

SENSOR PRODUCTS

2008-2009

www.bannerengineering.com



BANNER®

more sensors, more solutions

*From simple to advanced,
Banner solves more applications in your plant!*



Sensors

- Presence
- Absence
- Inspection
- Gating
- Counting
- Measurement



Vision

- Pattern Recognition
- Complex Part Inspection
- Multi-Component Gauging
- Part ID/Orientation
- Assembly Verification
- Print Verification



Wireless

- Process Control & Monitoring
- Factory Automation
- Agriculture & Water Management
- Traffic Monitoring & Control
- Commercial & Consumer Monitoring



Indicator Lights

- Bin & Part Picking
- Error/Mistake Proofing
- Pick-to-Light
- Operator Guidance
- Call for Parts
- Incorrect Pick Signal



Machine Safety

- Safety Light Screens
- Optical Safety Systems
- Safety Modules
- Emergency Stop Devices
- Safety Interlocking
- Ergonomic Two-hand Control

The Most Preferred Sensor Supplier.

- More sensing innovations than any other manufacturer.
- Choice of more than 20,000 photoelectric, ultrasonic and vision sensors, wireless networks and safety products available worldwide.
- Experienced factory application engineers to solve your most advanced sensing challenges.
- More than 3,000 factory and field representatives worldwide.
- Complete factory training, field training and online training.
- Commitment to 100% quality inspection and zero defect manufacturing.

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Catalogs



Industry/
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Software &
Data Sheets



Training



Product
Specifier



Drawings



Banner Beam
Newsletter



Reference

Banner has the sensors you need— here's how to find them.

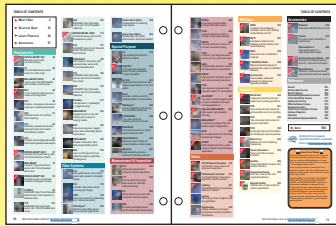
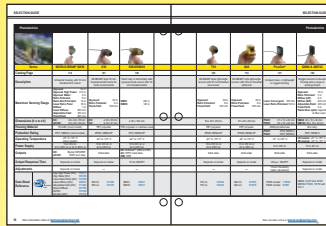
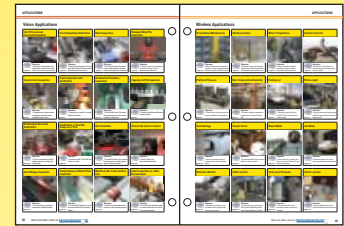


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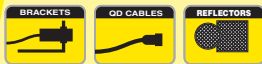
Selection Guide page 12



Applications page 37



Available Sensing Modes



Related Accessories

Detailed Dimensions available online



Simple Dimensions

PHOTOELECTRICS

WORLD-BEAM® QS18 Series Universal Sensors

- Features a universal housing with an 18 mm threaded lens or side mounts
- Meets IP67 and NEMA 6 standards for harsh environments
- Replaces hundreds of other sensors
- Available in opposed, polarized and non-polarized retroreflective, convergent, regular and wide-angle diffuse, laser, ultrasonic, plastic or glass fiber optic, fixed-field and adjustable-field sensing modes
- Offers easy push-button TEACH-mode setup in Expert™
- QS18C and ultrasonic models
- Ranges up to 20 m

QS18 Laser page 71

QS18 Laser page 72 & 73

QS18 Background Suppression page 73 & 74

QS18 Expert™ page 76

QS18 Ultrasonic page 77

QS18

- Light sensing modes for solving most applications: opposed, retroreflective, convergent, diffuse, plastic and glass fiber optic, and adjustable field and fixed field
- High power, infrared or visible red sensing beam
- Highly visible diagnostics

QS18 Expert™

- Advanced teachable microprocessor
- Single push-button programming
- Instant learning of difficult sensing condition
- High power, infrared or visible red sensing beam
- Reliable detection of transparent and reflective objects

QS18 Laser

- Opposed, diffuse, retroreflective and adjustable-field models with visible Class 1 and 2 lasers
- High performance sensing with visible Class 1 and 2 lasers
- Long sensing ranges
- Instant learning of difficult sensing condition
- Ideal for confined areas
- Encoder models available with live beam shapes
- Accurate and reliable even with low-reflectivity targets
- Ideal for guard, off-shoot access areas

QS18 Background Suppression

- Adjustable field models with cutoff angle from 20 to 100 mm, 50 to 150 mm or 30 to 250 mm
- Fixed-field models sensing ranges 25 or 150 mm
- Visible red LED or laser sensing beam
- Accurate and reliable even with low-reflectivity targets
- Ideal for guard, off-shoot access areas

PHOTOELECTRICS

WORLD-BEAM® QS18 Sensors

- 18 mm threaded lens mount on some models
- A variety of cable and connector options
- Rugged sealed housing, protected circuitry
- Bright LED operating status indicators visible from 360°

Opposed, Retroreflective, Laser Retroreflective, Convergent, Diffuse, Laser Diffuse and Fixed-Field Models Suffixes E, R, LV, LP, LLP, CVL, CVL4, D, LD, LE and FF

Opposed, Diffuse and Adjustable-Field Models Suffixes EB, WB, DB, W and AF

Plastic Fiber Models Suffix F

Glass Fiber Models Suffix F

WORLD-BEAM® QS18, 10-30V dc

Models	Sensing Mode/LED	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
QS18E00 Emitter		20 m	2 m	—	EGCO-9 (p. 468)	BPO-9 (p. 452)	63008
QS18E02 Emitter	4-pin Euro QD						
QS18VNR	2 m						
QS18VNRQ8	4-pin Euro QD						
QS18VPR		3 m	2 m	PNP	EGCO-10 (p. 468)	BPO-10 (p. 452)	
QS18VPRQ8	4-pin Euro QD						
QS18E08 Emitter	2 m						
QS18E08R	4-pin Euro QD						
QS18VNRQ8		2 m	4-pin Euro QD	PNP			
QS18VPRQ8	4-pin Euro QD						

More information online at bannerengineering.com

Navigation Tabs

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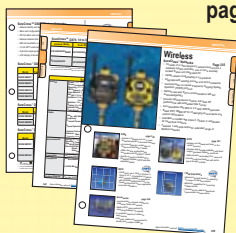
Data Sheet Reference

Data Sheet Online

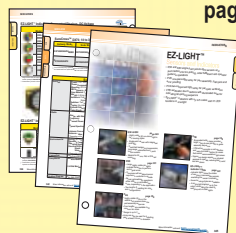
Model Selection

New features

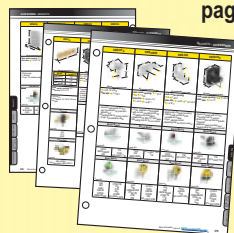
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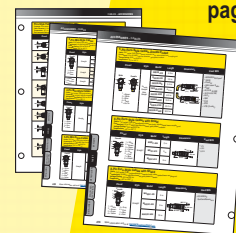
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What's New!



NEW M12



NEW Q20

New Cost-Effective Sensors with Compact Design and High Performance

High Performance in Worldwide Standard Rectangular Housing

WORLD-BEAM® Q20 Sensors

- Delivers cost-effective, rugged and powerful performance
- Features compact, rectangular housing with industry-standard mounting configuration
- Offers opposed, polarized and non-polarized retroreflective and diffuse
- Offers visible red beam for easy alignment on most models
- Offers bright LED indicators for easy operating status monitoring from 360°
- Features water-tight enclosure rated IP67/NEMA 6
- Delivers 1200 psi washdown rating
- Features versatile mounting options, including M3 (3 mm) threaded inserts with 25.4 mm hole spacing

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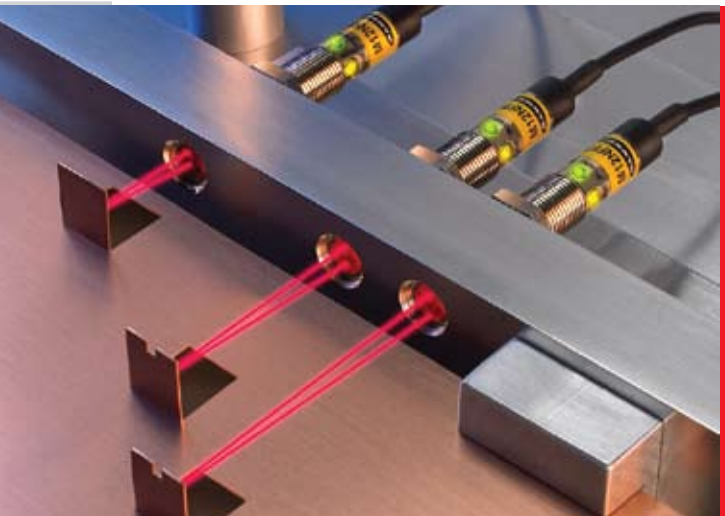


Barrel Sensor, an Ideal Replacement for Range Limited Proximity Sensors

M12 Sensors

- Features rugged 12 mm threaded metal barrel
- Combines compact design with high performance
- Offers fixed-field (25, 50 and 75 mm), opposed, polarized and non-polarized retroreflective, and diffuse models
- Features IP67/NEMA 6 rated housing for demanding environments
- Offers bright LED status indicators for easy operating status monitoring from any direction
- Features visible red sensing beam for easy alignment
- Offers fixed-field models with excellent background suppression and recessed mounting

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Chemical-Resistant Miniature Photoelectric Sensor

WORLD-BEAM® Q12 with PFA Jacket

- Features liquid-tight PFA jacket for use in wet and corrosive industrial environments
- Provides sensing up to 1.5 m in the opposed mode and 15, 30 and 50 mm fixed-field ranges
- Offers 1200 psi washdown rating
- Delivers rugged sensing performance in a compact, miniature sensor package
- Operates right out of the box—no field adjustments needed

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New Sensors. New Solutions.

New WORLD-BEAM® Sensors Provide Rugged, Reliable Solutions

Replace
hundreds of
other sensors!



Enhanced Interface and Two New Models

WORLD-BEAM® QS18 *Expert*™ Sensors

- Features enhanced *Expert*-style static and dynamic TEACH options, plus window, light and dark SET using push button or remote wire
- Provides push-button or remote Dark-Operate/Light-Operate select output
- Offers tough ABS housing; rated IP67/NEMA 6
- Delivers fast output for excellent sensing repeatability
- Includes new plastic fiber optic and visible red diffuse models
 - Fiber optic models for small part counting, machines with limited space and small conveyors
 - Visible diffuse models for easy and accurate alignment

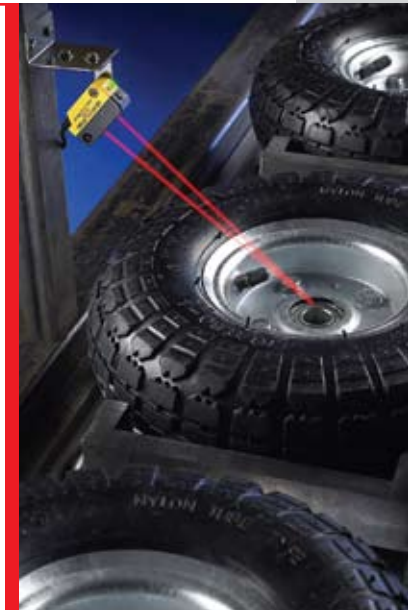
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Adjustable-Field Sensors with Visible Class 2 Laser

WORLD-BEAM® QS18LAF250

- Delivers extended sensing range—up to 250 mm
- Features reduced excess gain within 20 mm of the sensor for decreased susceptibility to lens contamination
- Offers narrow effective beam for precise sensing and small-object detection
- Features compact, rugged IP67-rated sealed housing
- Provides excellent optical performance throughout sensing range
- Offers crosstalk rejection algorithm for protection against optical disturbances from adjacent sensors

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High-Performance Sensors in Two New Models

WORLD-BEAM® QS30 Water and *Expert*™ Sensors

QS30 Water Sensor

- Includes opposed-mode sensors with 1450 nm infrared beam for detection of water and water-based material
- Provides choice of high-gain with a 4 m or low-gain models with a 2 m range
- Features bright status LEDs on top of sensor and large output indicator on receiver
- Offers 30 mm barrel and integral side mounting

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QS30 *Expert*™ Diffuse

- Provides visible red beam for high-performance in low-contrast applications
- Features *Expert*-style static and dynamic TEACH options, multiple single point set options and manual adjustment for fine tuning
- Includes crosstalk avoidance for multiple sensor use in close proximity
- Provides ability to see object brighter and darker than background

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What's New!

New Precise, Versatile Monitoring and Inspection Tools



Two-Piece Measuring Light Screen for Precise, High-Speed Sensing

A-GAGE® EZ-ARRAY™

- Offers two-piece measuring light screen for high-accuracy sensing
- Features controller functionality built into the receiver—basic setup requires no controller, software or PC
- Excels at high-speed, precise process monitoring and inspection, profiling and web-guiding applications
- Costs 50% less than comparable alternatives
- Provides quick and simple installation
- Uses closely spaced infrared beams to detect objects as small as 5 mm; edge resolution is 2.5 mm
- Offers emitters and receivers available in 10 lengths with 5 mm beam spacing for precise measuring at ranges to 4 m
- Delivers configuration options including 14 measurement modes, three scanning methods, two analog and two discrete outputs and a serial output
- Includes easy-to-use software for advanced configuration using a PC

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Reliable Sensing Using Cutting-Edge Radar Technology

R-GAGE™ QT50R Sensors

- Uses Frequency Modulated Continuous Wave (FMCW) radar to reliably detect moving or stationary objects, including cars, trains, trucks and cargo
- Features Weather Immunity to withstand extreme temperature conditions and exposure to strong wind
- Detects objects up to 15 m, ignoring objects and backgrounds beyond the setpoint
- Includes DIP switches for sensing distance, sensitivity and output configuration

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Cost-Efficient Pick-to-Light Solutions

EZ-LIGHT™ K50 and K80 Push-Button Sensors

- Delivers durable and low-cost sensing for harsh environments
- Features 50 mm dome with pressure-activated button
- Provides large dome with highly visible LED lights for optimal viewing
- Includes green pick light for all models, additional colors for misspick and sensing acknowledgement
- Offers rugged design with water and oil-tight sealing
- Offers choice of 30 mm, flat or DIN rail mounting
- Features quick-disconnect option for cost-efficient wiring

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New Sensors. New Solutions.

New Innovative EZ-LIGHT™ Models and Housing Options

Five-Color Indicators with Two Housing Styles

EZ-LIGHT™ K50L and K80L

- Offers choice of two housing styles
- Provides up to five colors in a single unit
- Offers indicators rated up to IP69K
- Features highly visible 50 mm dome indicator light
- Provides brightly colored solid or flashing LEDs for optimal viewing
- Mounts easily directly on a machine, elevated or flat-mounted to a wall or DIN rail
- Offers an alternative to cumbersome post and stack light
- Provides option of custom colors and configurations

See page 364



Daylight Visible Indicator

EZ-LIGHT™ K50L Daylight Visible

- Features high levels of light output for outdoor applications, areas of high ambient light and where reliable energy efficient LED indicators are needed
- Reliably performs in a variety of applications, including heavy equipment, off-road equipment, process equipment and signage
- Displays up to 3 colors in a single housing
- Features 50 mm diameter housing with flat profile and 30 mm mounting hub
- Offers accessory sun shield for enhanced visibility in desert sun brightness levels

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Visual and Audible Indication

EZ-LIGHT™ Audible Indicators

- Adds sound indication to the EZ-LIGHT K50L and K80L
- Offers choice of two decibel levels with steady or pulsed tone
- Available in an assortment of LED colors

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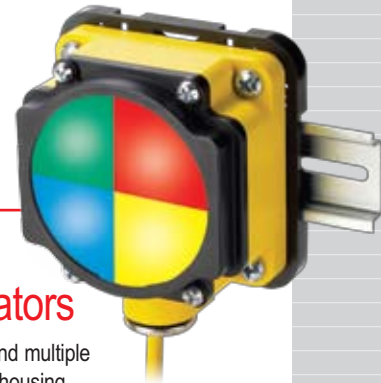
NOW AVAILABLE
ac power models
(page 367)

Four Colors in One Indicator

EZ-LIGHT™ Segmented Indicators

- Displays up to four light colors and multiple status configuration in the K80L housing
- Provides nonlingual message to operator
- Offers optional labels for enhanced segment identification
- Mounts easily directly on a machine, elevated or flat-mounted to a wall or DIN rail

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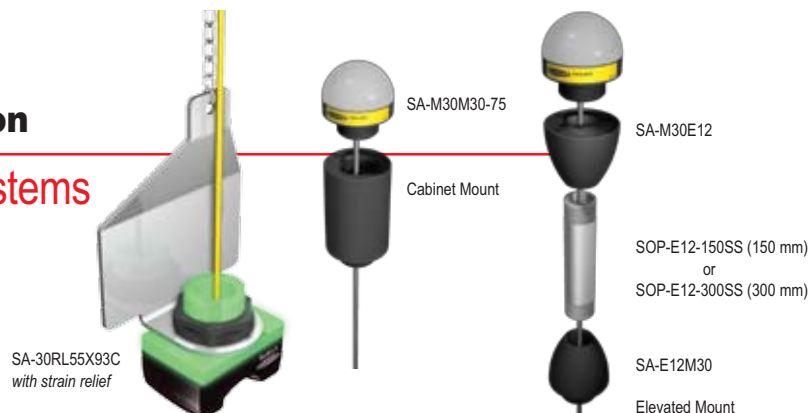


Simple Mounting Solution

EZ-LIGHT™ Mounting Systems

- Replaces elevated stack and tower lights
- Allows cabinet and flat surface mounting with single drilled hole
- Provides strain relief when hanging devices with 30 mm mounting hub

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More information online at bannerengineering.com

What's New!



NEW
PresencePLUS®
P4 COLOR OMNI



NEW
PresencePLUS®
Pro COLOR



NEW
PresencePLUS®
IP68 Pro

New Vision Sensors and Tools for Challenging Applications

Expanded Toolset and 1.3 Megapixel Cameras for Vision Sensors

PresencePLUS® Pro-PROII

- Provides expanded toolset for advanced operations using Banner's PresencePLUS Pro vision architecture
- Offers high-resolution 1.3 megapixel model, color camera and IP68-rated camera options
- Features universal PresencePLUS software with three-step point-and-click setup
- Provides Ethernet, serial and flexible discrete I/O in the same full-featured sensor
- Offers compact camera with separate DIN-mountable controller

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NEW TOOLS 

Add BEAD and OCR/OCV Tools to any PROII or P4 OMNI
See page 315



Powerful Color Vision Sensing with Full Suite of Gray Scale Tools in Two Convenient Packages

PresencePLUS® Pro COLOR and P4 COLOR OMNI

- Offers two convenient packages: the two-piece PresencePLUS Pro COLOR with separate DIN-mountable controller and the one-piece PresencePLUS P4 COLOR OMNI
- Color vision tools for matching, sorting and analyzing color
- Monitors color consistency within the taught range of acceptable color
- Includes free ActiveX utilities for exporting inspections and results
- Add Bar Code, OCR/OCV or Bead option to the full suite of color and gray scale tools

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Rugged, Compact, IP68 Vision Sensor

PresencePLUS® Pro with Washdown, Rugged Camera

- Delivers rugged sensing with compact, metal, IP68-rated camera
- Offers option of an integrated light or lens cover
- Pairs with a powerful controller featuring a comprehensive suite of inspection tools
- Provides choice of 316 stainless steel or nickel-plated aluminum housing

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New Sensors. New Solutions.

New Vision Lighting for Accurate Inspection



Dark-Field Lights for Enhanced Contrast Illumination

Low-Angle Ring Lights

- Enhances the contrast of surface features, emphasizing surface irregularities such as dust, dents and scratches
- Uses three tiers of bright LEDs for high-intensity, low-angle illumination
- Delivers choice of continuous or strobed operation
- Offers infrared or visible red LEDs

See page 331

Even, Diffused Lighting for Flat, Reflective Surfaces

On-Axis Lights

- Delivers even, diffused illumination of flat, reflective surfaces
- Offers standard sizes of 100 x 100 mm or 50 x 50 mm and a variety of specialty sizes
- Delivers collimated illumination in same optical path as camera
- Features models with infrared, visible red, white, green or blue LEDs
- Available in models with optical glass dust cover

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IP68-Rated Linear Lights for Illumination Over Long Distances

Sealed Linear Array Light

- Provides high-intensity, solid-state arrays for illuminating large areas or objects at long distances
- Offers choice of infrared or visible red, blue, green or white LEDs
- Available in 290 or 580 mm array lengths
- Features rugged, waterproof housing—rated IP68
- Delivers choice of 316 stainless steel or nickel-plated aluminum housing
- Available with clear acrylic, glass or acrylic diffusing windows
- Provides built-in current regulation and strobe control; no external controls needed

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High-Intensity Illumination in Two Lighting Styles

High-intensity Area Lights and Ring Lights

- Offers choice of models in anodized aluminum, nickel-plated aluminum or stainless steel
- Offers large illumination range for targets from .15 to beyond 2 m
- Features fixed or adjustable intensity, depending on the model
- Designed to withstand washdown and other challenging sensing environments (stainless steel and nickel-plated models)
- Provides built-in current regulation and strobe control; no external controls needed

See pages 324 and 327



What's New!

New SureCross™ Wireless Network Purpose-Built for Industry



Wireless Network with Superior Reliability and Deterministic Response

DX80 SureCross™ Wireless Network

- Features first wireless platform built from the ground up for industry
- Offers proprietary Radio Frequency (RF) design and robust communications integrity
- Consists of a Gateway system controller and one or more remotely located Nodes that bring monitoring and control capabilities to connected I/O
- Features bidirectional Rx/Tx communication
- Delivers an all-in-one packaged wireless solution with plug-and-play functionality
- Offers 900 MHz or 2.4 GHz models to meet global communications standards
- Provides IP67/NEMA 6 rating
- Features embedded Site Survey to ensure optimal device location and peak RF performance
- Offers flexible power options including 10 to 30V dc power, solar power or FlexPower™ battery module

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Low-Cost One-to-One Wireless Solution with High Performance

DX70 SureCross™ Wireless Network

- Delivers high performance sensing at an affordable price
- Offers compact, self-contained modules in a rugged, IP67/NEMA 6 design
- Provides binding feature to ensure enhanced security and reliable communications
- Offers simple installation with plug-and-play functionality
- Delivers up to three mile range, depending on the environment
- Features state-of-the-art FHSS wireless protocol and TDMA technology
- Provides bidirectional Rx/Tx communication for monitoring and control capabilities
- Features built-in signal strength indicator for real-time communications signal monitoring
- Includes DIP-switch-selectable default output conditions

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New Sensors. New Solutions.



Wireless Modules with Expandable Remote I/O

SureCross™ DX85 Modbus RTU Slave Expansion Module

- Adds I/O capacity to SureCross Gateways
- Offers models with discrete I/O, and analog and discrete I/O configurations
- Allows for easy access to wiring terminals without removal from mounting
- Provides IP67/NEMA 6 rated housing
- Features easy-to-use rotary switches for Modbus slave identification

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Wireless Accessories for Challenging Applications

SureCross™ Antennas, Cables and Accessories

- SureCross modules with internal or external antenna options
- Antennas in a variety of direct- and remote-mount and high-gain models
- Adapter cables for interfacing antennas and other accessories to SureCross devices
- Simple surge suppression devices

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Advanced Power Management Options

SureCross™ Power Supplies

- Provides power for Gateways, Nodes and sensors
- Features SureCross DX81 and DX81P6 FlexPower™ battery modules to supply power to FlexPower Nodes
- Offers EZAC IP67-rated boxes to convert 100-250V ac to 24V dc for powering devices














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




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


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Accessories

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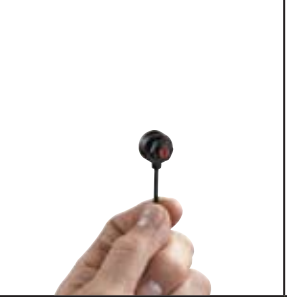


Anytime this icon appears, expanded information is available online at bannerengineering.com

▲ IMPORTANT SAFETY WARNING ▲






Sensors described in this catalog do NOT include the self-checking redundant circuitry necessary to allow their use in personnel safety applications. A sensor failure or malfunction can result in either an energized or a de-energized output condition.

Never use these products as sensing devices for personnel protection. Their use as safety devices may create an unsafe condition which could lead to serious bodily injury or death.

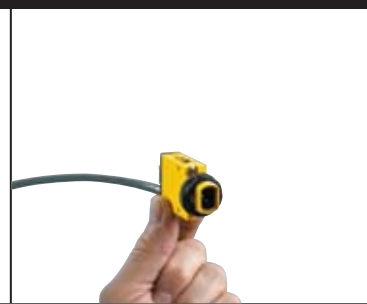
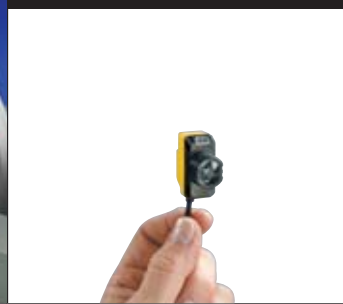
Only EZ-SCREEN®, PICO-GUARD™, MINI-SCREEN®, MULTI-SCREEN®, MICRO-SCREEN®, MACHINE-GUARD™ and PERIMETER-GUARD™ Systems, and other systems designated, are designed to meet OSHA and ANSI machine safety standards of point-of-operation guarding devices. No other Banner sensors or controls are designed to meet these standards, and they must NOT be used as sensing devices for personnel protection. See the Banner Machine Safety Products catalog for information on point-of-operation guarding devices.

Photoelectrics				
				
Series	WORLD-BEAM® Q12	T8	MINI-BEAM®2 QS12	
Catalog Page	46	49	52	
Description	Miniature sensor with universal housing	8 mm threaded barrel-mount sensor for small areas	1/3 the size of the MINI-BEAM, with versatile mounting style	
Maximum Sensing Range	Opposed: 2 m Retro Non-Polar: 1.5 m Retro Polarized: 1 m Fixed-Field: 50 mm	Opposed: 2 m Diffuse: 100 mm	Opposed: 4 m Retro Non-Polar: 2 m Retro Polarized: 1 m Diffuse: 180 mm Divergent: 50 mm Convergent: 20 mm	
Dimensions (h x w x d)	23 x 8 x 12 mm	19 x 16 x 16 mm	20 x 8 x 37 mm	
Housing Material	Thermoplastic elastomer	ABS	ABS	
Protection Rating	IP67	IP67; NEMA 6	IP67; NEMA 6	
Operating Temperature	-20° to +55° C	-20° to +55° C	-20° to +55° C	
Power Supply	10 to 30V dc	10 to 30V dc	10 to 30V dc	
Outputs	Bipolar NPN/PNP	Solid-state	Solid-state	
Output Response Time	Opposed: 1.3 ms ON/900 µs OFF All others: 700 µs ON/OFF	1 ms ON/0.5 ms OFF	Opposed: 8 ms ON/4 ms OFF All others: 1.5 ms ON/OFF	
Adjustments	—	—	One rubber-sealed push button	
Data Sheet Reference	 119223	T8 Opposed: 68669 T8 Diffuse: 67584	59040	

Photoelectrics

					
	M12	VS1	VS2	VS3	VS4
	55	58	61	64	67
	12 mm threaded metal barrel with visible red sensing beam	Miniature, convergent-mode sensor requiring no sensitivity adjustment	Ultra-thin sensor for confined flush-mounting	Extremely compact sensor with advanced optics and coaxial retroreflective models	Powerful, precise high-performance front-flush opposed-mode sensors
	Opposed: 5 m Retro Non-Polar: 1.5 m Retro Polarized: 2.5 m Diffuse: 400 mm Fixed-field: 75 mm	Convergent: 20 mm	Opposed: 3 m Convergent: 30 mm	Opposed: 1.2 m Retro Non-Polar: 250 mm Retro Polarized: 250 mm	Opposed: 1 m
	ø 12 x 67.5 mm	26 x 8 x 12 mm	25 x 12 x 4 mm	26 x 9 x 16 mm	25 x 5 x 13 mm
	Nickel-plated brass	ABS	ABS	ABS	Polycarbonate
	IP67; NEMA 6P	IP67; NEMA 6	IP67; NEMA 6	IP67; NEMA 6	IP67; NEMA 6
	-20° to +60° C	-20° to +55° C	-20° to +55° C	-20° to +55° C	-20° to +55° C
	10 to 30V dc	10 to 30V dc	10 to 30V dc	10 to 30V dc	10 to 30V dc
	Solid-state	Solid-state	Solid-state	Solid-state	Solid-state
	Opposed: 1 ms ON/OFF All others: 500 µs ON/OFF	1 ms ON/OFF	Opposed: 1 ms ON/0.5 ms OFF Convergent: 1 ms ON/OFF	Opposed: 1 ms ON/0.5 ms OFF Retro: 1 ms ON/OFF	1 ms ON/0.5 ms OFF
	—	—	—	—	—
	129721	56465	VS2 Opposed: 57248 VS2 Convergent: 65411	VS3 Opposed: 63227 VS3 Retro: 63226	69421





Photoelectrics



Series	WORLD-BEAM® QS18	MINI-BEAM®	
Catalog Page	70	79	
Description	Compact universal housing, with 18 mm threaded lens mount	Compact, high-performance sensor with 18 mm threaded lens mount	
Maximum Sensing Range	Opposed: 20 m Laser Emitter: 15 m Retro Non-Polarized: 6.5 m Retro Polarized: 3.5 m Laser Retro Polarized: 10 m Diffuse: 450 mm Laser Diffuse: 300 mm Convergent: 43 mm Adjustable-Field: 100 mm Laser Adjustable-Field: 250 mm Fixed-Field: 100 mm Glass & Plastic fiber optic: depends on fiber used Ultrasonic: 500 mm	Opposed: 30 m Retro Non-Polarized: 5 m Retro Polarized: 3 m Diffuse: 380 mm Divergent: 130 mm Convergent: 49 mm Glass & Plastic fiber optic: depends on fiber used	
Dimensions (h x w x d)	35 x 15 x 31 mm	see specifications	
Housing Material	ABS	PBT polyester	
Protection Rating	IP67; NEMA 6	IP67; NEMA 4X	
Operating Temperature	-20° to +70° C (most models)	-20° to +70° C	
Power Supply	10 to 30V dc	10 to 30V dc, 24 to 240V ac or 5 to 15V dc (NAMUR)	
Outputs	Solid-state	DC & Expert: Bipolar NPN/PNP AC: SPST SCR solid-state AC/DC: SPDT e/m relay NAMUR: Constant current	
Output Response Time	Depends on model	Depends on model	
Adjustments	Depends on sensing mode	Depends on model	
Data Sheet Reference	QS18: 63908 QS18 Expert: 136564 Laser Emitter: 109415 Laser Retro Polarized: 118900 Laser Diffuse: 118899 Adjustable-Field: 66981 Fixed-Field: 63908 Ultrasonic: 119287	DC: 69943 DC Expert: 55214 AC: 69942 AC/DC: 55230 Namur: 39616	







Photoelectrics

			
WORLD-BEAM® Q20	S18 & M18	T18	Q25
92	95	101	106
Compact sensor in worldwide standard rectangular housing	EZ-BEAM®-style 18 mm threaded barrel sensor in thermoplastic or stainless steel	EZ-BEAM®-style right-angle sensor with 18 mm threaded lens mount	EZ-BEAM®-style right-angle sensor with 18 mm threaded cable hub
Opposed: 15 m Retro Polarized: 4 m Retro Non-Polar: 6 m Diffuse: 1500 mm Fixed-Field: 150 mm	Opposed: 20 m Retro Polarized: 2 m Retro Non-Polar: 2 m Diffuse: 300 mm Fixed-Field: 100 mm	Opposed: 20 m Retro Polarized: 2 m Retro Non-Polar: 2 m Diffuse DC: 500 mm Diffuse AC: 300 mm Fixed-Field: 100 mm	Opposed: 20 m Retro Polarized: 2 m Fixed-Field: 100 mm
32 x 12 x 20 mm	∅ 18 x 59 mm	42 x 30 x 30 mm	50 x 25 x 30 mm
ABS	S18: PBT polyester M18: stainless steel	PBT polyester	PBT polyester
IP67; NEMA 6	IP69K; NEMA 6P	IP69K; NEMA 6P	IP69K; NEMA 6P
-20° to +60° C	-40° to +70° C	-40° to +70° C	-40° to +70° C
10 to 30V dc	10 to 30V dc or 20 to 250V ac	10 to 30V dc or 20 to 250V ac	10 to 30V dc or 20 to 250V ac
Solid-state	Solid-state	Solid-state	Solid-state
Depends on model	Depends on model	Depends on model	Depends on model
Depends on sensing mode	—	Depends on sensing mode	—
127816	S18 dc: 121522 S18 ac: 121521 M18: 49201	T18 dc: 121526 T18 ac: 121525	Q25 dc: 121518 Q25 ac: 121517





Photoelectrics

				
Series	WORLD-BEAM® QS30	S30	SM30/SMI30	
Catalog Page	112	121	125	
Description	Universal housing, with 30 mm threaded lens mount	EZ-BEAM®-style 30 mm threaded plastic barrel for harsh environments	Harsh duty or intrinsically safe opposed-mode sensor with 30 mm threaded barrel	
Maximum Sensing Range	Opposed: 60 m Opposed High Power: 213 m Opposed Water: 4 m Retro Polarized: 8 m Retro Non-Polarized: 12 m Laser Retro Polar: 18 m Diffuse: 1 m Laser Diffuse: 800 mm Adjustable-Field: 300 mm Fixed-Field: 600 mm	Opposed: 60 m Retro Polarized: 6 m Fixed-Field: 600 mm	SM30: 200 m SMI30: 140 m	
Dimensions (h x w x d)	DC: 44 x 22 x 35 mm AC/DC: 44 x 22 x 52 mm	DC: ø 30 x 69 mm AC: ø 30 x 81 mm	ø 30 x 102 mm	
Housing Material	PC/ABS (most models)	PBT polyester	PBT polyester or stainless steel	
Protection Rating	IP67; NEMA 6 (most models)	IP69K; NEMA 6P	IP67; NEMA 6P	
Operating Temperature	-20° to +70° C (most models)	-40° to +70° C	-40° to +70° C	
Power Supply	10 to 30V dc, 12 to 250V dc or 24 to 250V ac	10 to 30V dc or 20 to 250V ac	10 to 30V dc or 24 to 240V ac	
Outputs	DC: Bipolar NPN/PNP AC/DC: SPDT e/m relay	Solid-state	DC: Bi-Modal™ (NPN or PNP) AC: SPST solid-state SMI: NPN	
Output Response Time	Depends on model	Depends on model	10 ms ON/OFF	
Adjustments	Depends on model	—	—	
Data Sheet Reference 	Opp High Power (DC): 115011 Opp Water (DC): 136166 Laser Retro Polar (DC): 112355 Laser Diffuse (DC): 109027 Adjustable-Field (DC): 111384 Expert Diffuse: 127755 AC/DC: 119166 All other (DC): 119165	S30 dc: 121520 S30 ac: 121519	SM30: 03541 SMI30: 35331	

Photoelectrics






				
	T30	Q40	PicoDot®	QM42 & QMT42
	129	133	137	140
	EZ-BEAM®-style right-angle sensors with 30 mm threaded lens mount	EZ-BEAM®-style right-angle sensors with 30 mm threaded cable hub	Compact laser, in lightweight or rugged housing	Rugged sensors in die-cast housing with a range of sensing modes
	Opposed: 60 m Retro Polarized: 6 m Fixed-Field: 600 mm	Opposed: 60 m Retro Polarized: 6 m Fixed-Field: 600 mm	Laser Convergent: 305 mm Laser Retro Polarized: 10.6 m	Opposed: 10 m Retro Polarized: 3 m Diffuse (LR): 6 m Diffuse (SR): 400 mm Adjustable-Field: 400 mm Fixed-Field: 2 m Plastic fiber optics: depends on fiber used
	52 x 40 x 45 mm	70 x 40 x 46 mm	PD45: 41 x 13 x 46 mm PD49: 43 x 15 x 49 mm	QM42: 42 x 13 x 42 mm QMT42: 58 x 18 x 42 mm
	PBT polyester	PBT polyester	ABS/polycarbonate	Zinc alloy
	IP69K; NEMA 6P	IP69K; NEMA 6P	PD45: IP54; NEMA 3 PD49: IP67; NEMA 6	IP67; NEMA 6
	-40° to +70° C	-40° to +70° C	-10° to +45° C	LR models: -20° to +55° C SR models: -20° to +70° C
	10 to 30V dc or 20 to 250V ac	10 to 30V dc or 20 to 250V ac	10 to 30V dc	10 to 30V dc
	Solid-state	Solid-state	Solid-state	Solid-state
	Depends on model	Depends on model	200 µs ON/OFF	Depends on model
	—	—	12-turn Sensitivity (Gain) adjustment	Depends on model
	T30 dc: 121524 T30 ac: 121523	Q40 dc: 121516 Q40 ac: 121515	PD45 models: 115700 PD49 models: 67450	QM42: 44487 & 48363 QMT42: 57890, 50756 & 49211

Photoelectrics

			
Series	Q45	OMNI-BEAM™	Q60
Catalog Page	146	159	165
Description	Advanced one-piece, rugged sensor with outstanding optical performance	Modular, limit-switch style, field-programmable sensor	Laser or LED sensor for low reflectivity targets, regardless of background
Maximum Sensing Range	Opposed: 60 m Retro Laser: 70 m Retro Non-Polar: 9 m Retro Polarized: 6 m Diffuse: 3 m Convergent: 100 mm Glass & Plastic fiber optic: depends on fiber used	Opposed: 45 m Retro Non-Polar: 9 m Retro Polarized: 4.5 m Retro Clear Object: 4 m Diffuse: 2 m Convergent: 38 mm Glass & Plastic fiber optic: depends on fiber used	Adjustable-Field: 2 m
Dimensions (h x w x d)	88 x 45 x 55 mm	DC: 76 x 45 x 55 mm AC: 99 x 45 x 55 mm	67 x 25 x 52 mm
Housing Material	PBT polyester	PBT polyester	ABS/Polycarbonate
Protection Rating	IP67; NEMA 6P	IP66; NEMA 4	IP67; NEMA 6
Operating Temperature	DC: -40° to +70° C AC: -40° to +70° C AC/DC: -25° to +55° C	-40° to +70° C	-20° to +55° C (most models)
Power Supply	10 to 30V dc, 90 to 250V ac, 24 to 250V ac, 12 to 250V dc or 5 to 15V dc (NAMUR)	10 to 30V dc, 105 to 130V ac or 210 to 250V ac	10 to 30V dc, 12 to 250V dc or 24 to 250V ac
Outputs	DC: Bipolar NPN/PNP AC: SPST or SPDT Relay NAMUR: Constant current	DC: Bi-Modal™ AC: SPST relay	DC: Bipolar NPN/PNP AC/DC: SPST or SPDT Relay
Output Response Time	Depends on model	Depends on model	Depends on model
Adjustments	LO/DO switch, sensitivity adjustment control	Field-programmable for 4 operating parameters	2 momentary push buttons/ remote program wire
Data Sheet Reference	See product section for data sheet reference.	See product section for data sheet reference.	Adj.-Field Infrared: 67003 Adj.-Field Visible Red: 69622 Adj.-Field Laser: 114348



Fiber Systems

Series	D10	D12	R55F	FI22 Expert™
				
Catalog Page	172	178	183	186
Description	High-performance, low-contrast sensor with numeric or bargraph display	Versatile, high-power sensor with bargraph display	Fiber optic sensor for outstanding color contrast sensitivity	Machine-mount fiber sensor for low-contrast applications
Maximum Sensing Range	Range varies with power level/speed selection and with fiber optics used	Range varies depending on sensing mode and fiber optics used	Range varies depending on sensing mode and fiber optics used	Range varies depending on sensing mode and fiber optics used
Dimensions (h x w x d)	36 x 10 x 68 mm	Plastic Fibers: 30 x 12 x 64 mm Glass Fibers: 30 x 12 x 70 mm	25 x 30 x 85 mm	15 x 23 x 57 mm
Housing Material	ABS/Polycarbonate	ABS	ABS/Polycarbonate	ABS/Polycarbonate
Protection Rating	IP50; NEMA 1	IP66; NEMA 4	IP67; NEMA 6	IP67; NEMA 6
Operating Temperature	-20° to +55° C, depending on model	-40° to +70° C or -20° to +70° C depending on model	-30° to +70° C	-10° to +55° C
Power Supply	10 to 30V dc, 12 to 24V dc or 15 to 24V dc	10 to 30V dc	10 to 30V dc	10 to 30V dc
Outputs	Expert Numeric Discrete: Two solid-state Expert Numeric Analog/Discrete: 0 to 10V or 4 to 20 mA and Solid-state Expert Bargraph Discrete: Bipolar NPN/PNP Discrete: Bipolar NPN/PNP	Expert: Solid-state Standard: Solid-state AC Coupled: Bipolar NPN/PNP	Bipolar NPN/PNP	Bipolar NPN/PNP
Output Response Time	Depends on model	Expert: 200 µs ON/OFF Standard: 50 or 500 µs ON/OFF AC Coupled: 50 µs ON/OFF	50 µs	500 µs
Data Sheet Reference	Numeric Discrete: 64154 Numeric Analog: 65448 Bargraph Discrete: 117830 Discrete: 118431	Expert: 41974 Standard: 32822 Std. High Power: 34970 AC Coupled: 38384	57945	108899

*Operating temperature range for plastic fiber optic assemblies is typically -30° to +70° C and -140° to +250° C for metal-sheathed glass fiber optic assemblies. See the Fiber Systems section (beginning on page 188) for specific fiber optic temperature information.

Special Purpose



Series	LX	R58 Expert™	QC50 & QCX50	QL50	QL55	
Catalog Page	212	225	228	230	232	
Description	High-speed light screens to detect tiny objects	High-performance color registration sensor with 3 light colors	True color sensor for detecting color and intensity	Compact luminescence sensor with an ultraviolet LED	Compact luminescence sensor with an ultraviolet LED	
Maximum Sensing Range	Standard Normal: 300 to 2 m Reduced: 150 to 600 mm Short-range Normal: 100 to 200 mm Reduced: 75 to 150 mm	10 mm	20 mm	40 mm	75 mm	
Dimensions (h x w x d)	25 x 32 mm x height Array heights: 113 mm 190 mm 342 mm	62 x 30 x 83 mm	50 x 25 x 50 mm	66 x 15 x 50 mm	87 x 31 x 81 mm	
Housing Material	Aluminum	Zinc alloy	ABS	ABS	Zinc, aluminum & magnesium alloy	
Protection Rating	IP65	IP67; NEMA 6	IP62	IP62	IP62	
Operating Temperature	-20° to +70° C	-10° to +55° C	-10° to +55° C	-25° to +55° C	-10° to +55° C	
Power Supply	10 to 30V dc	10 to 30V dc	10 to 30V dc	10 to 30V dc	10 to 30V dc	
Outputs	Bipolar NPN/PNP	Bipolar NPN/PNP	NPN or PNP, 3 channel	Discrete PNP or NPN	Discrete PNP or NPN & analog	
Output Response Time	0.8 to 3.2 ms(ON-time) 6 to 8.5 ms(OFF-time)	50 µs	QC50: 335 µs QCX50: Selectable 5 ms or 1 ms	250 µs	250 µs	
Adjustments	—	Push button and remote TEACH	2 push buttons program teach, delay and tolerance level	1 push button and remote program wire	2 push buttons/2 selector switches	
Data Sheet Reference	108865	122928	111523	112151	112153	



Special Purpose

					
	SLM	SL Series	C-GAGE® SLC1	Optical Buttons	M-GAGE™
	216	219	222	234	241
	Fixed opposed-mode slot sensor for easy installation, in six slot widths	Opposed-mode slot sensor with multiple setup options, in two slot widths	Accurate, reliable sensor for detecting labels on web backing	Ergonomic touch buttons to prevent repetitive motion stress	Magnetostrictive passive sensors for detecting vehicles
	10, 20, 30, 50, 80, 120, 180 or 220 mm	10 or 30 mm	1 mm	—	Range varies, depending on application and target being sensed.
	12 x 252 x 140 mm	72 x 52 x 19 mm	41 x 23 x 89 mm	57 x 60 x 43 mm	S18M: ∅ 18 x 67 mm Q7M: 19 x 17 x 7.5 mm
	Zinc and ABS	ABS	Aluminum with black anodized finish	Black polysulfone or red polycarbonate with polyester or polycarbonate base	S18M: Thermoplastic polyester Q7M: Anodized aluminum
	IP67; NEMA 6	IP67; NEMA 6	IP67; NEMA 6	IP66; NEMA 4X	IP67; NEMA 6P
	-20° to +60° C	-40° to +70° C	+5° to 50° C	OTB/LTB/VTB: -20° to +50° C STB: 0° to +50° C	-40° to +70° C
	10 to 30V dc	10 to 30V dc	10 to 30V dc	10 to 30V dc, 20 to 30V ac/dc, 120V ac, 220/240V ac or 12 to 30V dc	10 to 30V dc
	Bipolar NPN/PNP, PNP or NPN	Bipolar NPN/PNP	Bipolar NPN/PNP	Depends on model	Solid-state
	500 μs	150, 300 or 500 μs or 1 ms, depending on model	100 μs	OTB/LTB/VTB: 100 ms STB: 20 ms	20 ms
	One-turn sensitivity potentiometer	Depends on model	—	—	Push button or via remote programming box
	122703	SL30: 56407 SL10: 58341 SL030: 60073 SLE30: 58338 SLE10: 60378	59369	OTB: 28436 LTB: 28437 VTB: 67570 STB: 64136	S18M: 114430 Q7M: 117172



Measurement & Inspection



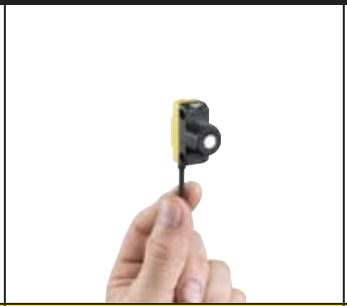
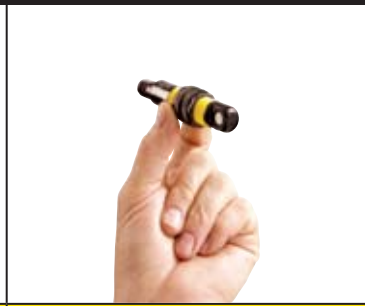
Series	LT3	LT7	
Catalog Page	244	248	
Description	Advanced measurement sensor for precise inspections	Self-contained long-range laser sensor for accurate distance sensing	
Technology	Time-of-Flight Laser	Time-of-Flight Laser	
Maximum Sensing Range	Retro: 50 m Diffuse: 5 m	Retro: 250 m Diffuse: 10 m	
Dimensions (h x w x d)	69 x 35 x 87 mm	93 x 42 x 95 mm	
Light Source	Class 1 and 2 laser	Class 1	
Housing Material	ABS/polycarbonate	ABS	
Protection Rating	IP67; NEMA 6	IP67	
Operating Temperature	0° to +50° C	-30° to +75° C	
Power Supply	12 to 24V dc	18 to 30V dc	
Outputs	Analog and discrete, or Dual discrete	Analog and discrete, or Dual discrete	
Discrete Outputs	One NPN or PNP or Dual NPN or PNP, depending on model	2 PNP	
Analog Outputs	0 to 10V dc or 4 to 20 mA	4 to 20 mA	
Analog Resolution or Discrete Repeatability	Retro: 5 or 10 mm Diffuse: 1 or 3.2 mm	Retro: ±2 mm Diffuse: ±4 mm	
Response Speed	1 to 192 ms, depending on model and setting	12 ms	
Adjustments	Window limits, response speed	See Specifications	
Data Sheet Reference	Dual-Discrete: 68503 Retro: 68504 Diffuse: 65742	120244	



Measurement & Inspection

		
	LG	Q50
	252	256
	Ultra-precise laser sensor with analog and discrete outputs	Compact linear displacement sensor with scalable analog output
	Laser/PSD triangulation	LED-PSD triangulation
	LG5: 60 mm LG10: 125 mm	Q50A Analog: 200 mm Q50A Discrete: 200 mm Q50B: 400 mm
	55 x 20 x 82 mm	60 x 20 x 50 mm
	Class 2 laser	Visible red and Infrared LEDs
	Zinc alloy die-cast; black painted finish	ABS/polycarbonate
	IP67; NEMA 6	IP67; NEMA 6P
	-10° to +50° C	-10° to +55° C
	12 to 30V dc	Analog: 15 to 30V dc Discrete: 12 to 30V dc
	Analog and discrete	Analog or discrete
	One NPN or PNP	Complementary NPN or PNP
	0 to 10V dc or 4 to 20 mA	0 to 10V dc or 4 to 20 mA
	LG5: 3 μm @ 50 mm LG10: 10 μm @ 100 mm	0.5 to 4 mm, depending on model
	2, 10 or 100 ms, depending on setting	4 to 64 ms, depending on model
	Window limits, response speed	Window limits, response speed
	59786	Q50A Analog: 67416 Q50A Discrete: 67417 Q50B Analog: 64323 Q50B Discrete: 65741





Measurement & Inspection








Series	QT50U	S18U	QS18U	
Catalog Page	262	266	269	
Description	Long-range programmable, precision ultrasonic sensor	Compact ultrasonic sensor in straight or right-angle housing	Low-cost ultrasonic sensor in a compact universal housing	
Outputs	Analog or Dual discrete	Analog or Discrete	Discrete	
Maximum Sensing Range	Proximity mode 200 mm to 8 m	Proximity mode 30 to 300 mm	500 mm	
Dimensions (h x w x d)	DC & AC/DC: 84 x 74 x 67 mm Teflon® Protected: 85 x 74 x 73 mm	Straight: ø 18 x 81 mm Right-angle: ø 18 x 85 mm	41 x 15 x 33 mm	
Housing Material	ABS/Polycarbonate	PBT polyester, ABS/polycarbonate	ABS	
Protection Rating	IP67; NEMA 6P	IP67; NEMA 6P	Push button: IP67; NEMA 6P Remote TEACH: IP68, NEMA 6P	
Operating Temperature	-20° to +70° C	-20° to +60° C	-20° to +60° C	
Power Supply	10 to 30V dc or 85 to 250V ac / 24 to 250V dc	10 to 30V dc	12 to 30V dc	
Discrete Outputs (when available)	DC: Selectable Dual NPN or PNP AC/DC: SPDT e/m Relay	Bipolar NPN/PNP	Solid-state, NPN or PNP	
Analog Resolution or Discrete repeatability	1.0 mm	0.5 mm	0.7 mm	
Analog Output (when available)	0 to 10V dc or 4 to 20 mA, Selectable	0 to 10V dc or 4 to 20 mA, depending on model	—	
High/low Limit Control (pump control)	Yes	—	—	
Adjustments	Window limits, DIP switch functions	Near & far window limits	Near & far window limits	
Data Sheet Reference	Analog: 70137 Dual discrete: 110112 Universal Voltage: 117764 Teflon® Protected: 122155	Analog: 110738 Discrete: 108964	199287	

Teflon® is a registered trademark of Dupont™.

Measurement & Inspection

				
	T30U	Q45U	Q45UR	T18U
	272	276	280	284
	Compact, right-angle ultrasonic sensors in long- and short-range	Programmable ultrasonic sensor with temperature compensation	High-precision ultrasonic sensor with remote sensing transducer	Fast response opposed-mode ultrasonic sensor, for clear objects
	Analog and discrete or Dual discrete	Analog or Discrete	Analog or Discrete	Complementary discrete
	Proximity mode 0.15 to 1.0 m or 0.3 to 2.0 m	Proximity mode 0.1 to 1.4 m or 0.25 to 3.0 m	Proximity mode 50 to 250 mm	Opposed mode 0.6 m
	Short- & Long-Range: 52 x 40 x 45 mm Teflon® Protected: 64 x 40 x 48 mm	Short range: 88 x 45 x 61 mm Long range: 88 x 45 x 79 mm	∅ 18 x 45 mm remote transducer or 28 x 28 x 12 mm flat	52 x 40 x 30 mm
	PBT polyester	PBT polyester	PBT polyester or stainless steel	PBT polyester
	IP67; NEMA 6P	IP67; NEMA 6P	Sensor: IP65; NEMA 4 Controller: IP67; NEMA 6P	IP67; NEMA 6P
	-20° to +70° C	-25° to +70° C	-25° to +70° C	-40° to +70° C
	12 to 24V dc or 15 to 24V dc, depending on model	12 to 24V dc or 15 to 24V dc, depending on model	12 to 24V dc or 15 to 24V dc, depending on model	12 to 30V dc
	NPN or PNP, depending on model	Bipolar NPN/PNP	Bipolar NPN/PNP	Complementary NPN or PNP, depending on model
	0.25% of sensing distance	0.1% of sensing distance (0.25 or 0.5 mm min.)	0.2% of sensing distance	1 or 2 mm, depending on resolution
	0 to 10V dc or 4 to 20 mA, depending on model	Selectable 0 to 10V dc or 4 to 20 mA	Selectable 0 to 10V dc or 4 to 20 mA	—
	Yes	Yes	—	—
	Window limits, analog output slope	Near & far window limits; DIP Switch functions	Near & far window limits; DIP Switch functions	—
	Discrete/analog: 57438 Dual discrete: 59200 Pump level: 63974 Teflon® Protected: 122155	Discrete SR: 44177 Discrete LR: 48454 Analog SR: 47818 Analog LR: 48456	Discrete: 59321 Analog: 59323	40124

Measurement & Inspection

				
Series		EZ-ARRAY™	High-Resolution MINI-ARRAY®	MINI-ARRAY®
Catalog Page		288	291	296
Description		Cost-effective light curtains for quick installation and tough sensing application	High-speed, high-resolution scanning	Compact long-range array with flexible output configurations
Minimum Object Detection Size		5 mm	2.5 mm	19 mm for arrays/ 9.5 mm beam spacing 38 mm for arrays/ 19 mm beam spacing
Maximum Sensing Range		4 m	380 mm to 1.8 m	0.6 to 17 m, depending on model
Emitters and Receivers	Dimensions (h x w x d)	36.0 x 45.2 x height Array heights: 227 mm 828 mm 1578 mm 379 mm 978 mm 1878 mm 529 mm 1128 mm 2178 mm 678 mm 1278 mm 2478 mm	38.1 x 38.1 x height Array heights: 233 mm 884 mm 1537 mm 396 mm 1046 mm 1700 mm 559 mm 1212 mm 1862 mm 721 mm 1374 mm 2025 mm	38.1 x 38.1 x height Approximate array heights: 201 mm 810 mm 1572 mm 356 mm 963 mm 1877 mm 505 mm 1115 mm 659 mm 1267 mm
	Power Supply	12 to 30V dc	Supplied by controller	Supplied by controller
	Construction	Anodized aluminum	Black anodized aluminum	Black anodized aluminum
	Protection Rating	IP65	IP65; NEMA 4, 13	IP65; NEMA 4, 13
	Operating Temperature	-40° to +70° C	0° to +50° C	-20° to +70° C
Controllers	Power Supply	—	16 to 30V dc	16 to 30V dc
	Output Configuration	—	MAHCVP-1: Two analog 0 to 10V sourcing + two PNP MAHCVN-1: Two analog 0 to 10V sourcing + two NPN MAHCIP-1: Two analog 4 to 20 mA sinking + two PNP MAHCIN-1: Two analog 4 to 20 mA sinking + two NPN Serial RS-232 & RS-485	MAC-1: One reed relay & one NPN MACN-1: Two NPN MAC16N-1: 16 NPN MACP-1: Two PNP MAC16P-1: 16 PNP MACV-1: Two 0-10V dc sourcing analog + one NPN MACI-1: Two 4-20 mA sinking analog + one NPN Serial RS-232 and/or RS-485, depending on model MACNXDN-1: 2 NPN (DeviceNet) MACPXDN-1: 2 PNP (DeviceNet)
	Protection Rating	—	IP20; NEMA 1	IP20; NEMA 1
	Operating Temperature	—	0° to +50° C	-20° to +70° C
Data Sheet Reference		126701	64118	Standard: 43298 DeviceNet™: 59437

Measurement & Inspection





Series	T-GAGE®
Catalog Page	303
Description	Non-contact sensor for monitoring temperature changes
Sensing Range	6:1, 8:1 or 14:1
Dimensions (h x w x d)	ø 18 x 97 mm
Power Supply	Discrete: 10 to 30V dc Analog: 12 to 30V dc
Housing Material	Stainless steel
Protection Rating	IP67; NEMA 6
Operating Temperature	-20° to +70° C
Output Configuration	Discrete: Bipolar NPN/PNP Analog: 0 to 10V dc plus 1 PNP alarm
Adjustments	One push button
Data Sheet Reference	Discrete: 120632 Analog: 123698



Series	R-GAGE™
Catalog Page	306
Description	Radar-based sensor for a wide variety of outdoor or challenging applications
Operating Principle	Frequency Modulated Continuous Wave (FMCW) radar
Detectable Objects	Objects containing metal or similar high-dielectric materials
Radio Frequency	24 GHz, ISM Band
Range	up to 15 m
Dimensions	100 x 74 x 46 mm
Power supply	12 to 30V dc
Housing Material	ABS/polycarbonate
Protection Rating	IP67
Operating Temperature	-40° to +65° C
Output Configuration	Bipolar NPN/PNP
Adjustments	DIP switch functions
Data Sheet Reference	135460







Vision Sensors—PresencePLUS® Pro & P4 General-Purpose

					
Series		PROII & PROII 1.3	IP68 PROII & PROII 1.3	OMNI & OMNI 1.3	
Catalog Page		312	312	312	
Description		Two-piece, all-purpose vision sensor with a full range of inspection tools	Two-piece, all-purpose vision sensor with a full range of inspection tools	One-piece, all-purpose vision sensor with a full range of inspection tools	
Hardware	Integrated I/O	14	14	7	
	Interchangeable Lenses	C-mount	C-mount	C-mount	
	Imager	PROII: CCD PROII 1.3: CMOS	IP68 PROII: CCD IP68 PROII 1.3: CMOS	OMNI: CCD OMNI 1.3: CMOS	
	Resolution	PROII: 640 X 480 PROII 1.3: 1280 X 1024	IP68 PROII: 640 X 480 IP68 PROII 1.3: 1280 X 1024	OMNI: 640 X 480 OMNI 1.3: 1280 X 1024	
	Imager Speed	PROII: 48 fps PROII 1.3: 18 fps	IP68 PROII: 48 fps IP68 PROII 1.3: 18 fps	OMNI: 48 fps OMNI 1.3: 48 fps	
	Color Models	752 X 480 resolution (CMOS)	752 X 480 resolution (CMOS)	752 X 480 resolution (CMOS)	
	Live Video Output	√	√	√	
	Memory	64 MB	64 MB	32 MB	
	Inspection Storage with Full Reference Image (Max)	PROII: 188 PROII 1.3: 44 COLOR PROII: 160	PROII: 188 PROII 1.3: 44 COLOR PROII: 160	OMNI: 85 OMNI 1.3: 44 COLOR OMNI: 72	
	Inspection Storage without Full Reference Image (Max)	999	999	999	
	Construction	Camera: Black anodized aluminum Controller: steel with zinc plating	Cameras: nickel-plated aluminum or 316 stainless steel Controller: steel with zinc plating	Black anodized aluminum	
	Environmental Rating	IP20; NEMA 1	Nickel-plated Camera: IP68; NEMA 6P Stainless Steel Camera: IP68; NEMA 6P & 4X Controller: IP20; NEMA 1	IP20; NEMA 1	
Communications	Ethernet	10/100	10/100	10/100	
	Serial	RS-232	RS-232	RS-232	
	Programmable Discrete I/O	6	6	4	
Programming/Interface	Industrial Ethernet Protocols	EtherNet/IP & Modbus TCP/IP	EtherNet/IP & Modbus TCP/IP	EtherNet/IP & Modbus TCP/IP	
	Software Upgrades	Free	Free	Free	
	Runs without a PC	Yes	Yes	Yes	
	ActiveX interface	√	√	√	
	Quick & Remote TEACH	√	√	√	

PresencePLUS P4 Dedicated-Function—Vision Sensors

				
	AREA & AREA 1.3	EDGE & EDGE 1.3	GEO & GEO 1.3	BCR & BCR 1.3
	313	313	313	313
	Application specific sensor for inspecting sizes, shapes and intensity	Application specific sensor for counting and measuring multiple edges and objects	Application specific sensor for pattern recognition, regardless of orientation	Application specific sensor for reading and grading 2D and 1D bar codes
	7	7	7	7
	C-mount	C-mount	C-mount	C-mount
	CMOS	CMOS	CMOS	BCR: CCD BCR 1.3: CMOS
	AREA: 128 X 100 AREA 1.3: 1280 X 1024	EDGE: 128 X 100 EDGE 1.3: 1280 X 1024	GEO: 128 X 100 GEO 1.3: 1280 X 1024	BCR: 640 X 480 BCR 1.3: 1280 X 1024
	AREA: 500 fps AREA 1.3: 27 fps	EDGE: 500 fps EDGE 1.3: 27 fps	GEO: 500 fps GEO 1.3: 27 fps	BCR: 48 fps BCR 1.3: 27 fps
	—	—	—	—
	√	√	√	√
	AREA: 8 MB AREA 1.3: 32 MB	EDGE: 8 MB EDGE 1.3: 32 MB	GEO: 8 MB GEO 1.3: 32 MB	BCR: 8 MB BCR 1.3: 32 MB
	AREA: 150 AREA 1.3: 20	EDGE: 150 EDGE 1.3: 20	GEO: 150 GEO 1.3: 20	BCR: 8 BCR 1.3: 20
	AREA: 500 AREA 1.3: 900	EDGE: 500 EDGE 1.3: 900	GEO: 500 GEO 1.3: 999	BCR: 400 BCR 1.3: 999
	Black anodized aluminum	Black anodized aluminum	Black anodized aluminum	Black anodized aluminum
	IP20; NEMA 1	IP20; NEMA 1	IP20; NEMA 1	IP20; NEMA 1
	10/100	10/100	10/100	10/100
	RS-232	RS-232	RS-232	RS-232
	4	4	4	4
	EtherNet/IP & Modbus TCP/IP	EtherNet/IP & Modbus TCP/IP	EtherNet/IP & Modbus TCP/IP	EtherNet/IP & Modbus TCP/IP
	Free	Free	Free	Free
	Yes	Yes	Yes	Yes
	√	√	√	√
	√	√	√	√

Wireless

		
Series	DX80	DX70
Catalog Page	336	341
Description	A Gateway and one or more Nodes in the same frequency	A Gateway and one Node in the same frequency
Inputs/Outputs (I/O)	Discrete, Analog, M-GAGE™ or Temperature	Analog or Discrete
Sensing Range	900 MHz: up to 4.8 km 2.4 GHz: up to 3.2 km	900 MHz: up to 4.8 km 2.4 GHz: up to 3.2 km
Radio Frequency	900 MHz or 2.4 GHz	900 MHz or 2.4 GHz
Dimensions (h x w x d)	127 x 81 x 60 mm	127 x 81 x 60 mm
Housing Material	Polycarbonate	Polycarbonate
Protection Rating	IP67; NEMA 6	IP67; NEMA 6
Operating Temperature	-40° to 80° C	-40° to 80° C
Power Supply	10 to 30V dc or <i>FlexPower</i> supply (battery or solar)	10 to 30V dc
Discrete I/O (when available)	Sinking, sourcing, M-GAGE™ or NMOS	Sourcing
Analog I/O (when available)	Current (0 to 20 mA) or Voltage (0-10V dc)	Current (0 to 20 mA)
Temperature	Thermocouple and Thermistor	—
Communications	Modbus TCP/IP Ethernet/IP	—
Antenna Options	External or Internal	External or Internal
Data Sheet Reference 	See product selection for data sheet reference	133214

Indicators

Series	K50 & K80	PVD	PVA	VTB
Catalog Page	346	351	354	358
Description	50 mm dome light with sensor in two housing styles	One-component light sensor for part assembly and error-proofing	Two-component light screen for part-pick verification	Ultra-bright optical touch buttons for indicating bin-picking sequences
Job Light Color	Green, Red, Yellow	Green, Red	Green	Green, Red, Blue
Maximum Sensing Range	Retroreflective: 2 m Fixed-Field: 100 mm Push button: —	Retroreflective: 2 m Diffuse: 400 mm	Opposed: 2 m	—
Minimum Object Detection Size	—	Retroreflective: 51 to 100 mm Diffuse: 55 mm	Opposed: 35 mm	—
Dimensions (h x w x d)	K50: \varnothing 50 x 57 mm K80: 110 x 81 x 66 mm	PVD100: 138 x 30 x 16 mm PVD225: 266 x 30 x 16 mm	30 x 15 mm x height Array heights: 138 mm 341 mm 264 mm 417 mm	57 x 60 x 43 mm
Construction	Polycarbonate & Nylon	Black painted aluminum	Black anodized aluminum	Black polysulfone or red polycarbonate with white polycarbonate base
Protection Rating	IP69K (depending on installation)	IP62; NEMA 2	IP62; NEMA 2	IP66; NEMA 4X
Operating Temperature	-20° to +50° C	0° to +50° C	0° to +50° C	-20° to +50° C
Power Supply	12 to 30V dc	12 to 30V dc	12 to 30V dc	12 to 30V dc
Output configuration	One NPN or PNP & NO or NC, depending on model	One user-selectable PNP or NPN	One NPN or PNP, depending on model; programmable for light or dark operate	One NPN or PNP, depending on model
Data Sheet Reference	2-Color: 126441 3-Color: 137551	113230	52088	67570



Indicators



Housing	K80L	K50L	T30
Catalog Page	362	362	362
Description	50 mm dome or flat profile thermoplastic polyester	50 mm dome or flat profile thermoplastic polyester	30 mm T-style thermoplastic polyester
Maximum Colors in One Housing	5	5	3
Indication	General-Purpose: Green, Red, Yellow Multi-Function: Green, Red, Yellow, Blue, White ON, flashing or alternating Sensor Emulator: Green, Yellow Audible: Green, Red, Yellow, Steady or Pulsed Tone Segmented: Green, Red, Yellow, Blue, White	General-Purpose: Green, Red, Yellow Multi-Function: Green, Red, Yellow, Blue, White ON, flashing or alternating Sensor Emulator: Green, Yellow Audible: Green, Red, Yellow, Steady or Pulsed Tone Daylight Visible: Green, Red, Yellow	General-Purpose: Green, Red, Yellow Multi-Function: Green, Red, Yellow ON, flashing or alternating Sensor Emulator: Green, Yellow
Dimensions	Segmented: 110 x 81 x 41mm All others: 110 x 81 x 66 mm	Daylight visible: 50 x ø 50 mm All others: 57 x ø 50 mm	64 x 40 x 45 mm
Mounting	Flat or DIN-rail	30 mm threaded lens mount	30 mm threaded lens mount
Construction	Thermoplastic	Thermoplastic	Thermoplastic
Protection	Audible: IP50 All others: IP67	Audible: IP50 All others: IP67	IP67
Operating Temperature	Audible: -20° to +50° C All others: -40° to +50° C	Audible: -20° to +50° C All others: -40° to +50° C	-40° to +50° C
Power Supply	18 to 30V dc or 85 to 130V ac	18 to 30V dc or 85 to 130V ac	10 to 30V dc
Data Sheet	General-Purpose (dc): 121899 General-Purpose (ac): 134548 Multi-Function Three-Color (dc): 121902 Multi-Function Four-Color (dc): 137329 Multi-Function Five-Color (dc): 131413 Sensor Emulator (dc): 121900 Audible (dc): 135242 Segmented (dc): 132728	General-Purpose (dc): 121899 General-Purpose (ac): 134548 Multi-Function Three-Color (dc): 121902 Multi-Function Four-Color (dc): 137329 Multi-Function Five-Color (dc): 131413 Sensor Emulator (dc): 121900 Audible (dc): 135242 Daylight Visible (dc): 137330	General-Purpose (dc): 121899 Multi-Function (dc): 121902 Sensor Emulator (dc): 121900



Indicators

				
	K30L	T18	M18	T8L
	362	362	362	362
	30 mm dome thermoplastic polyester	18 mm T-style thermoplastic polyester	18 mm barrel nickel-plated brass	8 mm T-style polycarbonate
	3	3	3	2
	General-Purpose: Green, Red, Yellow Sensor Emulator: Green, Yellow	General-Purpose: Green, Red, Yellow Sensor Emulator: Green, Yellow	General-Purpose: Green, Red, Yellow Multi-Function: Green, Red, Yellow ON, flashing or alternating Sensor Emulator: Green, Yellow	General-Purpose: Green, Red, Yellow Sensor Emulator: Green, Yellow
	58 x ø 30 mm	40 x 33 mm	51 x ø 17 mm	19 x 16 x 16 mm
	22 mm threaded mounting base	18 mm threaded lens mount	18 mm threaded barrel	8 mm threaded lens mount
	Thermoplastic	Thermoplastic	Nickel-plated brass	Polycarbonate
	IP67	IP67	IP67	IP67
	-40° to +50° C	-40° to +50° C	-40° to +50° C	-40° to +50° C
	10 to 30V dc	10 to 30V dc	10 to 30V dc	10 to 30V dc
	General-Purpose (dc): 121899 Sensor Emulator (dc): 121900	General-Purpose (dc): 121899 Sensor Emulator (dc): 121900	General-Purpose (dc): 121899 Multi-Function (dc): 121902 Sensor Emulator (dc): 121900	General-Purpose (dc): 121899 Sensor Emulator (dc): 121900

Established Sensing Solutions From Banner

The following standard products are still available from Banner.
Please go online to bannerengineering.com for full descriptions and technical references.



- Q08**
- Specially designed EZ-BEAM® style optics and electronics for reliable sensing without the need for adjustments
 - Opposed and diffuse sensing modes
 - Ultra thin: only 8 mm deep



- Q10/Q14**
- Economical opposed mode dc sensors in 75 to 10 mm thick right-angle housings
 - Opposed and diffuse sensing modes
 - Hermetically sealed optics



- D11/D11E**
- Economical, high-performance plastic fiber optic sensors
 - Red, green, blue or white light sources
 - Immune to subtle signal variations such as web flutter



- ECONO-BEAM®**
- Specially designed EZ-BEAM® style optics and electronics for reliable sensing without adjustments
 - Simple to install with no setup adjustments
 - ac and dc opposed, retroreflective, diffuse, divergent diffuse, convergent, and glass and plastic fiber optic models
 - 38 mm height



- S12**
- Opposed-mode sensor pairs in 12 mm barrel-style housings
 - Completely epoxy encapsulated for superior durability, even in harsh sensing environments
 - Innovative dual-indicator system to take the guesswork out of monitoring sensor performance and to warn of marginal sensing conditions or output overload



- M12 & S18 Laser Emitters**
- Rugged 12 mm diameter or 18 mm threaded barrel laser emitters
 - Low power Class 1 or Class 2 laser with visible red beam (670 nm)
 - M12 emitters: collimated, apertured beam 2 mm in diameter, divergence of less than 1 milliradian
 - Compatible with a variety of Banner modulated photoelectric receivers



- VALU-BEAM®**
- Economy, performance, and reliability in a rugged line of sensors with standard limit-switch mounting hole spacing
 - Wide choice of standard models for ac, dc or ac/dc operation
 - SM91EN/RN models: enhanced immunity to sunlight; SMA990 models: built-in 6-digit totalizing. SMI912 series: intrinsically safe sensors for use in hazardous locations



- Q85**
- Economical, rugged sensors
 - Wiring chamber with dual conduit entrances
 - Opposed, polarized retroreflective and diffuse sensing modes, available with programmable output timer
 - Models available for dc, ac or ac/dc universal power



- Analog OMNI-BEAM™**
- Sensor heads for diffuse, convergent, and glass and plastic fiber optic modes
 - Analog power blocks can be set for 0 to 10V dc
 - Ideal for applications requiring a continuously variable control voltage that is either directly or inversely related to sensing response

Established Sensing Solutions From Banner



MAXI-BEAM®

- Modular design for easy exchange of all sensing components and logic
- Opposed, polarized and non-polarized retroreflective, diffuse, convergent, fixed-field, and glass and plastic fiber optic modes
- Interchangeable heads with 90° increment rotation



MULTI-BEAM®

- Industry's most flexible modular sensor family with more than 5,000 custom configurations for ac or dc power
- Opposed, polarized and non-polarized retroreflective, convergent and glass fiber optic modes



PICO-AMP™

- Ideal for remote sensing in wafer handling, small-part sensing and pharmaceutical applications
- Three frequency selections to prevent multiple-sensor crosstalk
- Variety of sensing heads in opposed and diffuse mode



MAXI-AMP™

- CR, CM and CD series amplifier modules with or without output logic for use with specified remote photoelectric sensors
- Combines power supply, output circuitry and logic timing in CL series module for use with self-contained sensors
- Opposed, diffuse, divergent diffuse, retroreflective, convergent and adjustable-field proximity modes



MICRO-AMP® and Remote Sensors

- MA3, MA3-4, MA3AF and MA3P series amplifier modules for use with specific remote photoelectric sensors
- MA4 series add-on logic modules for output timing or multiple-sensor logic functions in component systems
- Miniature and ultra-miniature remote sensors for use with Banner PICO-AMP™, MAXI-AMP™ or MICRO-AMP® component sensing systems



SM512

- Rugged sensors in narrow 127 mm wide housings
- Easily stack for mounting in tight spaces
- Opposed, non-polarized retroreflective, diffuse, convergent and glass fiber optic modes
- DC operation only



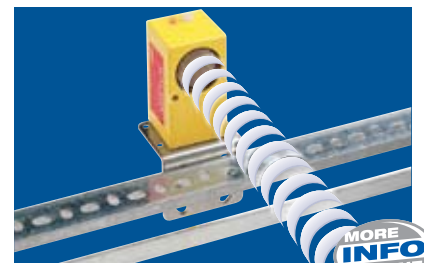
Bus-compatible Sensors

- Broad range of sensing and housing choices
- Solid-state outputs for connecting directly to "smart" bus system network junctions
- Compatible with DeviceNet™, SDS and ASI



Sonic OMNI-BEAM™ Sensors

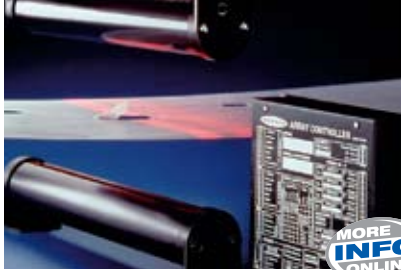
- 100 to 660 mm range modular ultrasonic sensor, with 80 to 560 mm window
- 10-element moving dot LED range indicator to simplify setup and monitoring
- Convenient modular ac, dc, discrete or analog design



ULTRA-BEAM™ Sensors

- Electrostatic ultrasonic sensor with sensing range to 6 m
- Range or NULL/SPAN adjustments on top of sensor
- Switched ac and dc electromechanical or analog outputs

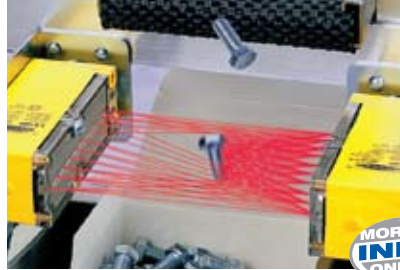
Established Sensing Solutions From Banner



BEAM-ARRAY

BEAM-ARRAY™

- Multiplexed emitter-receiver arrays for use in hostile industrial environments
- Three outputs offered; logic level “trip” output, dc sourcing analog or serial RS-232 data stream
- Optional controllers offer expanded sensing response options and outputs with sensor separation up to 3 m



LS

LS

- Simple, economical, reliable light screen senses small parts passing anywhere through the beams
- 3 ranges and resolutions
- Fast 1 millisecond response; built-in 5 millisecond output pulse stretcher



BMLV

BMLV

- An ideal system for sensing or counting large objects falling through a sensing area using a retroreflective target
- Minimum object size is 50 mm at 0.6 m from the sensor, and 125 mm at 21 m
- Light-operate or dark-operate output



R55

R55 and R55 Expert™

- Reliable color-mark sensors for outstanding detection and resolution
- Choice of two lens positions
- Expert™ model with easy push-button TEACH-mode setup and remote programming

Hundreds of solutions for your application needs.

The following pages feature a small selection of applications, with hundreds more available online.



Applications

- Area Guarding
- Area Sensing
- Clear Object Detection
- Color Mark Detection
- Detection
- Distance Measurement
- Fill-level
- Gate/Door Monitor
- Inspection
- Liquid Detection
- Orientation
- Perimeter Guarding
- Point-of-Operation Guarding
- Process Monitoring
- Profiling
- Roll Diameter
- Thickness Measurement
- Web Control

- Assembly/Manufacturing
- Automotive
- Electronic Assembly
- Food Processing
- Forest Products
- Generic - All Industry
- Material Handling
- Metallurgy
- Oil
- Packaging
- Pharmaceutical/Medical
- Printing
- Process
- Robotics
- Semiconductor
- Textile
- Toil Booth

- A-GAGE
- BEAM-ARRAY
- D10E
- D11
- D12
- F22
- LG Series
- LS10
- LTS Series
- LX Series
- M12 Lasers
- M18
- MICRO-SCREEN
- MINI-ROBOT
- MINI-BEAM
- MINI-BEAM Expert
- MINI-BEAM2
- MINI-SCREEN
- OMNI-BEAM

- Measurement & Inspection Products
- Machine Safety Products
- Protections Sensors
- Vision Sensors

Photoelectric Applications

Low-Profile Object Detection



Objective:
To detect the presence of integrated circuit chips in a confined space.

MORE INFO ONLINE
page 46

Reflective Object Counting



Objective:
To reliably count metal rings passing on a conveyor.

MORE INFO ONLINE
page 46


Part Presence



Objective:
To verify the presence of colored caps on bottles of children's medicine.

MORE INFO ONLINE
page 46

Precise Counting



Objective:
To count the narrow barrels of syringes.

MORE INFO ONLINE
page 70

Sorting



Objective:
To sort letters from packages, based on height.

MORE INFO ONLINE
page 70

Liquid Leak Detection



Objective:
To detect a hazardous fluid leaking from pipes inside a valve box.

MORE INFO ONLINE
page 70

Clear Bottle Detection



Objective:
To reliably count clear bottles moving on a high-speed conveyor line.

MORE INFO ONLINE
page 79

Tilt Tray Inspection



Objective:
To detect items in a tray for sorting.

MORE INFO ONLINE
page 92

Outsert Detection



Objective:
To ensure that a coupon is present before applying to a bottle cap.

MORE INFO ONLINE
page 92

Thread Hole Inspection



Objective:
To verify, from a distance, that threads have been cut into holes in a manifold.

MORE INFO ONLINE
page 112

Bottle Counting



Objective:
To count bottles on a conveyor, regardless of color.

MORE INFO ONLINE
page 112

Lumber Inspection



Objective:
To check lumber for warping.

MORE INFO ONLINE
page 112

Vehicle Detection



Objective:
To verify that a vehicle is in position in a car wash.

MORE INFO ONLINE
page 112

Liquid Detection



Objective:
To detect water or liquid containing water, regardless of bottle color.

MORE INFO ONLINE
page 112

Long-distance Feature Detection



Objective:
To detect a small flange from a long distance.

MORE INFO ONLINE
page 165

Product Flow Control



Objective:
To signal the machine control when cans are absent, using a time delay to filter out gaps between the cans.

MORE INFO ONLINE
page 165

Photoelectric Applications

Edge Guiding



Objective:
To keep a roll of plastic in the correct position by monitoring the edge.

MORE INFO ONLINE
page 172

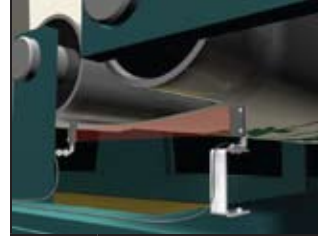
Lead Frame Presence Detection



Objective:
To detect the presence of an IC lead frame.

MORE INFO ONLINE
page 172

Loop Tension Monitoring



Objective:
To control the speed of a web using a loop control system.

MORE INFO ONLINE
page 172

Wafer Mapping



Objective:
To map the presence of wafers in a cassette.

MORE INFO ONLINE
page 172

Poly Bag Seal Detection



Objective:
To locate the perforations between bags on a web.

MORE INFO ONLINE
page 172

Counting



Objective:
To count bolts dispensed from a feeder bowl.

MORE INFO ONLINE
page 172

Thread Break Detection



Objective:
To detect broken threads on a loom.

MORE INFO ONLINE
page 172

Color Sorting



Objective:
To sort gum packets by label color.

MORE INFO ONLINE
page 172

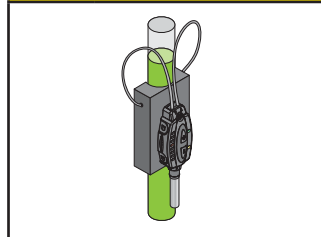
Equipment Inspection



Objective:
To check whether the weld tips of an automotive welder are within specifications.

MORE INFO ONLINE
page 183

Non-contact liquid Detection



Objective:
To detect the presence or absence of liquid in a transparent tube, without touching the liquid.

MORE INFO ONLINE
page 186

Splice Detection



Objective:
To identify splices on a roll of paper.

MORE INFO ONLINE
page 225

Registration Mark Detection



Objective:
To detect registration marks on food packages.

MORE INFO ONLINE
page 225

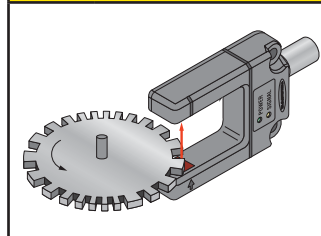
Counting



Objective:
To count syringe barrels in an assembly line.

MORE INFO ONLINE
page 216

Gear Tooth Sensing



Objective:
To reliably sense the teeth of a timing gear to produce pulses used in automated production machinery.

MORE INFO ONLINE
page 219

Vehicle Presence



Objective:
To detect when a truck backs up to a dock, triggering a light inside the warehouse that signals the truck's arrival.

MORE INFO ONLINE
page 241

Vehicle Detection

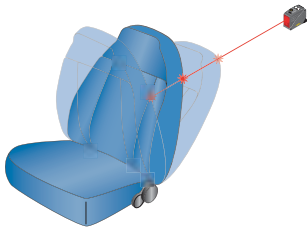


Objective:
To ascertain when a car or truck enters or leaves a car wash.

MORE INFO ONLINE
page 241

Measurement & Inspection Applications

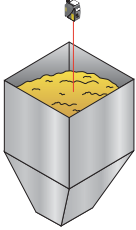
Range of Motion



Objective:
To confirm that each bottle of water is capped completely before it is packaged.

MORE INFO ONLINE
page 243

Dry Fill Level



Objective:
To accurately determine the level of dry bulk material in a bin hopper, despite the material's uneven surface.

MORE INFO ONLINE
page 243

Extremely Long-Range Sensing



Objective:
To instantly measure the location of an automated storage and retrieval shuttle, to track its position.

MORE INFO ONLINE
page 248

Long-Range Sensing



Objective:
To detect the presence and position of a car seat on an automotive assembly line.

MORE INFO ONLINE
page 248

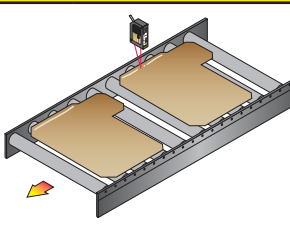
Roll Diameter



Objective:
To monitor the changing diameter of a roll of material.

MORE INFO ONLINE
page 248

Glue Bead Continuity



Objective:
To detect gaps in a row of glue that a robot applied to a panel.

MORE INFO ONLINE
page 252

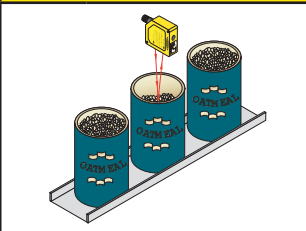
Board Warping



Objective:
To detect boards warped beyond a specified tolerance.

MORE INFO ONLINE
page 252

Dry Fill Level



Objective:
To ensure that a dry food package is not overfilled or underfilled.

MORE INFO ONLINE
page 256

Liquid Level Monitoring



Objective:
To monitor the level of liquid in a tank by sending a continuous signal that represents the current depth.

MORE INFO ONLINE
page 262

Roll Size



Objective:
To monitor the decreasing size of a roll of material, so it can be replaced when empty.

MORE INFO ONLINE
page 262

Pallet Load



Objective:
To detect that a pallet with packages stacked at different heights is loaded and ready for wrapping.

MORE INFO ONLINE
page 262

Loop Control



Objective:
To control the amount of play in a loop of clear plastic within a set range.

MORE INFO ONLINE
page 266

Liquid Level Detection



Objective:
To accurately determine the level of liquid in a narrow tube.

MORE INFO ONLINE
page 266


Bottle Counting



Objective:
To count tinted glass bottles on a conveyor in a soft drink bottling operation.

MORE INFO ONLINE
page 269

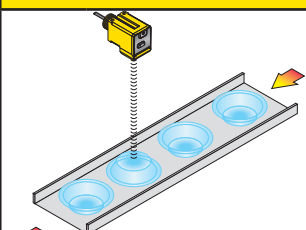
Liquid Level Detection



Objective:
To monitor the level of soap in a reservoir in a car wash.

MORE INFO ONLINE
page 269

Inverted Object Detection

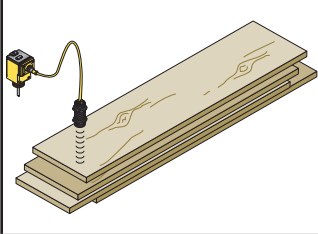


Objective:
To detect a product that has flipped over by measuring small differences in height.

MORE INFO ONLINE
page 276

Measurement & Inspection Applications

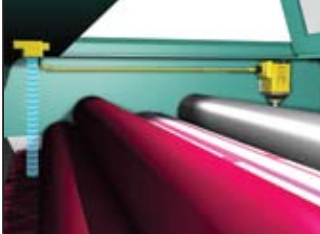
Height Measurement



Objective:
To verify that a stack of boards has the correct number of boards, by measuring the stack's height.

page 280

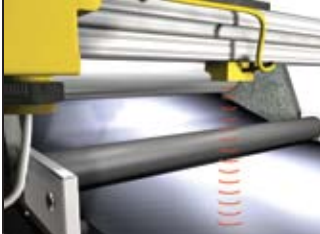
Ink Level



Objective:
To monitor the ink level in a printer tray.

page 280

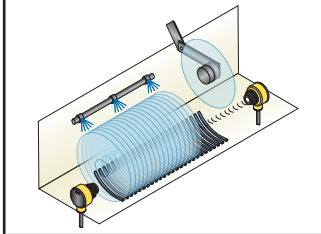
Web Thickness



Objective:
To measure the thickness of webbing.

page 280

Empty Rack Verification



Objective:
To verify that all glass hard disks are removed from the holding rack after the disks are missed.

page 284

Carton Sizing



Objective:
To measure height, length and width of cartons for storage or palletizing

page 288

Plastic Bottle Detection



Objective:
To ensure that clear bottles are properly placed on a conveyer.

page 288

Carpet Web Detection



Objective:
To determine the location of two edge transitions on carpet web; air to salvage and salvage to tufting.

page 288

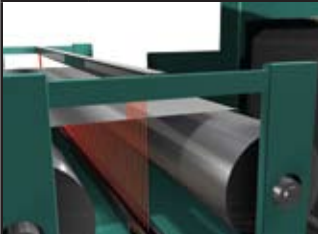
Vehicle Separation



Objective:
To detect vehicle separation in an Automated Vehicle Classification (AVC) system.

page 296

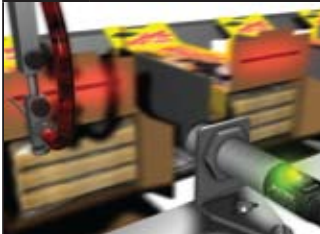
Edge Monitoring



Objective:
To track the edge of a web as it rolls, to make sure it stays aligned.

page 296

Hot Glue Detection



Objective:
To identify food packages missing hot sealing glue, before the flaps are closed.

page 303

Hot Part Detection



Objective:
To make sure that a waffle maker is hot before batter is poured into it.

page 303

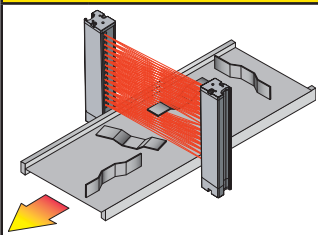
Small Part Detection



Objective:
To detect extremely small parts as they fall through a web of sensing beams.

page 212

Small Object Detection



Objective:
To accurately detect flat objects passing on a conveyor.

page 212

Train and Tram Detection



Objective:
To detect and locate a train or tram in a tunnel

page 306

Cargo Positioning



Objective:
To detect and position cargo on a truck bed

page 306

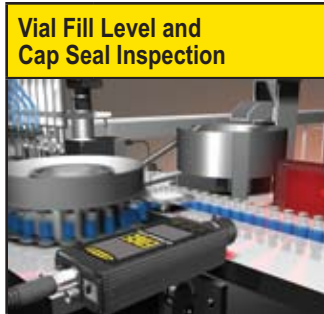
Truck Detection



Objective:
To detect a truck at a loading dock.

page 306

Vision Applications



Vial Fill Level and Cap Seal Inspection

Objective:
To rapidly verify that vials are filled to the correct level and that the vial caps are correctly aligned..

[MORE INFO ONLINE](#)
page 313



Food Assembly Verification

Objective:
To make sure that packets of frosting are included with each frozen pastry, before the pastries are boxed.

[MORE INFO ONLINE](#)
page 313



Rivet Inspection

Objective:
To verify that rivets are present and correctly placed in an automotive steering wheel component.

[MORE INFO ONLINE](#)
page 312



Stamped Metal Pin Inspection

Objective:
To check for correct count, straightness and pitch of connector pins on a stamped metal subassembly.

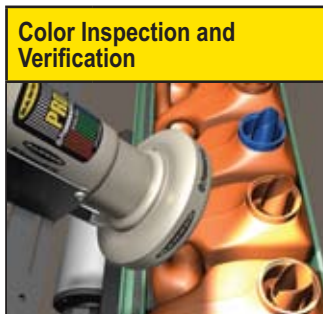
[MORE INFO ONLINE](#)
page 312



Candy Color Inspection

Objective:
To inspect boxes of candy to make sure that they contain the correct chocolates, based on color.

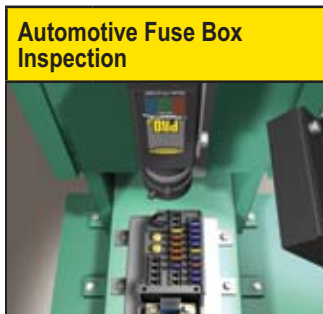
[MORE INFO ONLINE](#)
page 312



Color Inspection and Verification

Objective:
To inspect pour spouts for correct insertion and color.

[MORE INFO ONLINE](#)
page 312



Automotive Fuse Box Inspection

Objective:
To verify that fuses of the specified amperage are in the correct location in a fuse box.

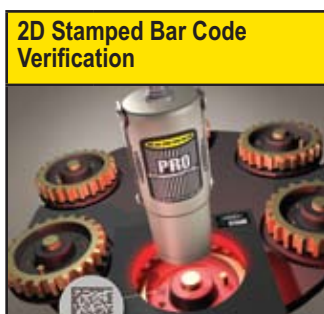
[MORE INFO ONLINE](#)
page 312



Capping and Fill Inspection

Objective:
To make sure bottles are filled and capped properly.

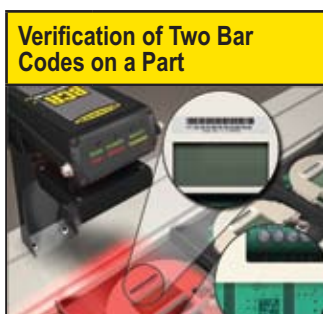
[MORE INFO ONLINE](#)
page 312



2D Stamped Bar Code Verification

Objective:
To track manufacturing lots for quality assurance, using a bar code reader

[MORE INFO ONLINE](#)
page 314



Verification of Two Bar Codes on a Part

Objective:
To read and verify 1D and 2D bar codes on a part.

[MORE INFO ONLINE](#)
page 314



Die Protection

Objective:
To protect the dies in tire presses from damage by directing green tires to the correct press.

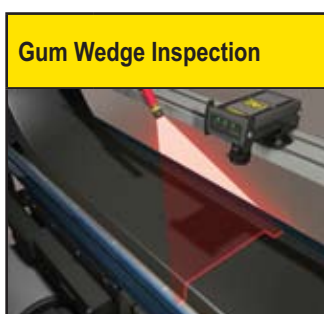
[MORE INFO ONLINE](#)
page 314



Product ID and Lot Control

Objective:
To track a batch of a pharmaceutical product.

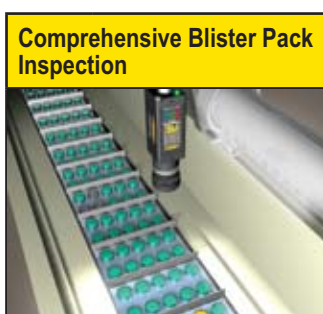
[MORE INFO ONLINE](#)
page 314



Gum Wedge Inspection

Objective:
To inspect the gum wedge of continuously extruded rubber.

[MORE INFO ONLINE](#)
page 313



Comprehensive Blister Pack Inspection

Objective:
To verify that all blisters in a pack have been filled with the correct, tablets.

[MORE INFO ONLINE](#)
page 312



Miniature Bar Code Verification

Objective:
To verify the 2-dimensional bar code on a cell phone component.

[MORE INFO ONLINE](#)
page 314



Label Inspection in a Wet Environment

Objective:
To confirm that each soda bottle in a wet environment has a label in the correct position.

[MORE INFO ONLINE](#)
page 312

Wireless Applications

Preventative Maintenance



Objective:
Gather I/O data such as temperature & vibration on a mobile Automated Storage and Retrieval System (AS/RS) crane motor.

MORE INFO ONLINE
page 336

Warehouse Door



Objective:
To control the routing of an Automated Guided Vehicle (AGV) through a facility a FlexNode is positioned at each door.

MORE INFO ONLINE
page 336

Motor Temperature



Objective:
To create a portable preventative maintenance solution to capture temperature data from the motor.

MORE INFO ONLINE
page 336

Camera Controls



Objective:
To control the X, Y and Z axis on a camera steering panel with the analog inputs on a Node.

MORE INFO ONLINE
page 336

Platform Fill Level



Objective:
To monitor tank level, pressure and flow rates from a difficult to access platform.

MORE INFO ONLINE
page 336

Barn Temperature/Humidity



Objective:
To maintain a healthy temperature and humidity level in a crowded livestock barn.

MORE INFO ONLINE
page 336

Parking Lot



Objective:
To manage parking at a facility an M-GAGE™ Node is used to detect a vehicle entering.

MORE INFO ONLINE
page 336

Pick-to-Light



Objective:
To deploy a wireless pick-to-light system a FlexNode equipped with low-power EZ Lights are used.

MORE INFO ONLINE
page 336

Cold Storage



Objective:
To ensure an optimal temperature is maintained in a large cold storage system.

MORE INFO ONLINE
page 336

People Count



Objective:
To understand traffic flow and consumer habits in a retail environment.

MORE INFO ONLINE
page 336

Waste Water



Objective:
To monitor level, pH, conductivity and flow using a single SureCross™ device with four analog inputs.

MORE INFO ONLINE
page 336

Car Wash



Objective:
To detect the presence of a vehicle entering an automated car wash system.

MORE INFO ONLINE
page 336

Robotics Retrofit



Objective:
To eliminate the need for slip rings a FlexNode is used to capture data onboard a moving robot.

MORE INFO ONLINE
page 336

HVAC Control



Objective:
To manage energy by monitoring the HVAC system and identifying areas where improved efficiency is possible.

MORE INFO ONLINE
page 335

Tank Level Pressure



Objective:
To maintain tank levels using a submersible pressure sensor and a FlexNode.

MORE INFO ONLINE
page 336

Call for service



Objective:
To create a portable call for service system with Nodes at each work station.

MORE INFO ONLINE
page 335

Indicator Applications

Call for Parts (Put-to-Light)



Objective:
Signal the destination for requested parts by pushing a button.

MORE INFO ONLINE
page 346

Incorrect Pick Signal



Objective:
To indicate whether the operator is picking from the correct bin or wrong bin.

MORE INFO ONLINE
page 346


Wide Bin Confirmation



Objective:
To provide compact part-pick confirmation for a shelf with a wide opening.

MORE INFO ONLINE
page 346

Call for Service



Objective:
To signal and indicate that service is required using a hanging indicator and push button.

MORE INFO ONLINE
page 346

Part Pick Indicator



Objective:
To signal to the assembler the next part to pick from a rack with small bins.

MORE INFO ONLINE
page 351


Order Fulfillment



Objective:
To indicate the shelf from which to pick a map for shipment to a customer.

MORE INFO ONLINE
page 351

Order Fulfillment



Objective:
To guide a book packer to the next title in an order and to confirm the pick.

MORE INFO ONLINE
page 353

Pick Sequence



Objective:
To show an assembler the pick order and verify that the correct part was picked.

MORE INFO ONLINE
page 354

Order Fulfillment



Objective:
To clearly show, from a distance what part to pick next.

MORE INFO ONLINE
page 354

Long Bin Pick-to-Light



Objective:
To provide pick-to-light sensing for bins that extend beyond the rack.

MORE INFO ONLINE
page 354

Part Pick Verification



Objective:
To indicate which part to pick for an assembly and to verify the pick is done.

MORE INFO ONLINE
page 358

Line Problem Call



Objective:
To trigger an audible alarm and andon board display to signal a problem on the line.

MORE INFO ONLINE
page 358


Part Loaded Indicator



Objective:
To signal to an operator that a part is placed correctly, without leaving the station.

MORE INFO ONLINE
page 361

Part Kitting



Objective:
To indicate on which illuminated spindle to place a shim.

MORE INFO ONLINE
page 361

Process Inspection Indicator



Objective:
To allow an inspector to monitor the pass/fail reading of several sensors at the same time..

MORE INFO ONLINE
page 361

Operator Indication



Objective:
To provide elevated viewing of operator indicator light using EMT tubing.

MORE INFO ONLINE
page 361

Miniature Sensors

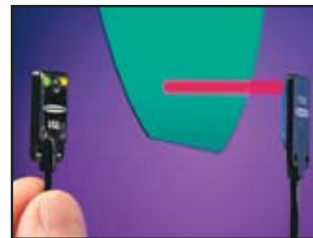
WORLD-BEAM® Q12 page 46

- Universal housing provides consistent mounting regardless of sensing modes.
- Powerful sensor fits extremely confined areas.
- Opposed, retroreflective and fixed-field sensing modes are available.
- Three fixed-field models offer precise cutoff background suppression.
- Overmolded design delivers enhanced durability and shielding.
- Solid-state outputs are bipolar (NPN and PNP).
- Models with PFA jacket are available for wet or corrosive environments.



VS1 page 58

- Convergent beam sensors
- 10 or 20 mm convergent point
- Repeatability of 250 microseconds



VS2 page 61

- Ultra-thin opposed and convergent
- Flat front mounting
- Range up to 3 m



VS3 page 64

- Advanced coaxial lens design
- Range up to 1200 mm
- Accurate detection of shiny objects
- Sensing up to the face of retroreflective models



VS4 page 67

- Low-profile, long-range sensing
- Unique, optically correct lens for narrow side light emission
- Opposed mode, 1000 mm range
- Rugged, overmolded housing
- Optional beam-shaping apertures



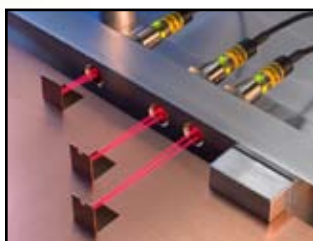
T8 page 49

- 8 mm thread ultra-miniature sensor
- Convenient T-shaped package
- 50 or 100 mm diffuse range
- Powerful 2 m opposed range



MINI-BEAM®2 page 52

- Single push-button programming
- Wrap-around status indicators
- 12 mm threaded barrel or side mount
- One-third the size of original MINI-BEAM®



M12 page 55

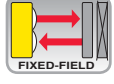
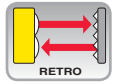
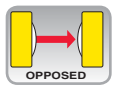
- 12 mm threaded metal barrel
- Ideal replacement for range limited proximity sensors
- Opposed, retroreflective, diffuse and fixed-field modes
- Excellent background suppression for fixed-field models

MINIATURE
COMPACT
MIDSIZE
FULLSIZE

WORLD-BEAM®

Q12 Series Universal Sensors

- Sets a new industry standard for ultra-miniature photoelectric sensors
- Features a housing as small as 22 by 8 by 12 mm with bipolar NPN/PNP outputs
- Delivers powerful sensing performance in extremely confined areas
- Rated IP67 for use in the widest range of locations and applications
- Mounts directly on or inside manufacturing equipment, with robust metal-lined mounting holes consistently located on all models
- Uses unique overmolded design for enhanced durability and shielding
- Available in dark- or light-operate models
- Features models with liquid-tight PFA jackets for use in wet and corrosive environments
- Provides excellent crosstalk avoidance circuitry for multiple sensor applications



Q12 Opposed

- 2 m range
- 1.3 millisecond response time
- Embedable in confined spaces



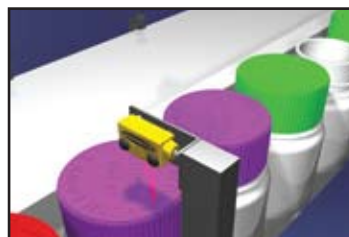
Q12 Retroreflective

- 700 microsecond response time
- Range of 1.5 m
- Ideal for difficult to access areas and detection of transparent objects (polarized retroreflective models)



Q12 Fixed-Field

- Range of 15, 30 or 50 mm, depending on model
- Excellent background cutoff
- Low color sensitivity



Bright LED operating status indicators visible from 360°

Rugged sealed housing, protected circuitry

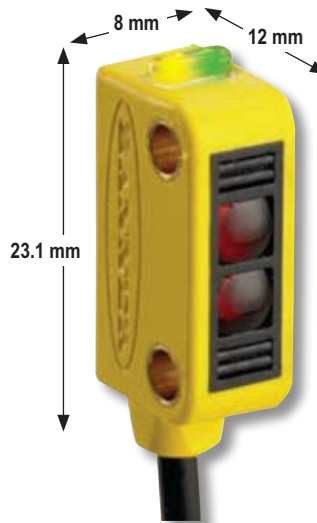
Variety of cable and connector options



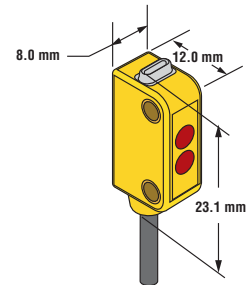
PFA-jacketed chemical-resistant models are ideal in a wide variety of level control, cleaning, etching and other chemical processes.

WORLD-BEAM® Q12 Sensors

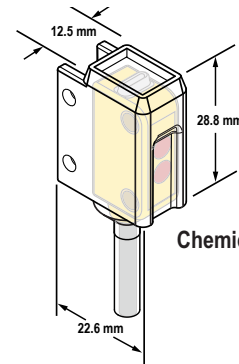
- Bright, visible red (640 nm) sensing beam
- Solid-state bipolar outputs: one current sourcing (PNP) and one current sinking (NPN)
- Integral cable or 150 mm pigtail with threaded Pico-style quick-disconnect
- Light operate (LO) or dark operate (DO) by model
- PFA-jacketed models for easy cleanup of the sensor optics



Opposed, Retroreflective and Fixed-field Models
Suffix E, R, LV and FF



Polarized Retroreflective Models
Suffix LP



Chemical-resistant Models
Suffix CR



- MINIATURE
- COMPACT
- MIDSIZE
- FULLSIZE

WORLD-BEAM® Q12, 10-30V dc

Models [†]	Sensing Mode/LED*	Range**	Cable***	Output Type	Excess Gain	Beam Pattern	Data Sheet
Q126E Emitter		2 m	2 m	Bipolar LO	EGCO-1 (p. 468)	BPO-1 (p. 492)	119223
Q126EQ Emitter			Threaded 4-Pin Pico Pigtail QD				
Q12AB6R			2 m				
Q12AB6RQ			Threaded 4-Pin Pico Pigtail QD				
Q12RB6R			2 m				
Q12RB6RQ			Threaded 4-Pin Pico Pigtail QD				
Q12AB6LV		1.5 m	2 m	Bipolar LO	EGCR-1 (p. 471)	BPR-1 (p. 495)	
Q12AB6LVQ			Threaded 4-Pin Pico Pigtail QD	Bipolar DO			
Q12RB6LV			2 m				
Q12RB6LVQ			Threaded 4-Pin Pico Pigtail QD				
Q12AB6LP		1 m	2 m	Bipolar LO	EGCR-2 (p. 471)	BPR-2 (p. 495)	
Q12AB6LPQ			Threaded 4-Pin Pico Pigtail QD	Bipolar DO			
Q12RB6LP			2 m				
Q12RB6LPQ			Threaded 4-Pin Pico Pigtail QD				
Q12AB6FF15		15 mm Cutoff	2 m	Bipolar LO	EGCF-1 (p. 482)	-	
Q12AB6FF15Q			Threaded 4-Pin Pico Pigtail QD	Bipolar DO			
Q12RB6FF15			2 m				
Q12RB6FF15Q			Threaded 4-Pin Pico Pigtail QD				

* Visible Red LED

** Retroreflective range is specified using one model BRT-60X40C retroreflector. Actual sensing range may differ, depending on efficiency and reflective area of the retroreflector in use. See Accessories for more information.

PFA chemical-resistant models provide a range of 1.5 m in opposed mode and 12, 28 or 48 mm in fixed-field mode, depending on model.

*** For 9 m cable, add suffix **W30** to the 2 m model number (example, **Q126E W30**). A model with a pigtail QD requires a mating cable (see pages 411 & 412).

Only 2 m cables are available for PFA chemical-resistant models.

QD models:

• For 4-pin 150 mm Euro-style pigtail, add suffix **Q5** (example, **Q126EQ5**). • For 3-pin 150 mm Pico-style pigtail, contact factory at 1-888-373-6767.

† For sensors with a PFA chemical-resistant jacket (opposed and fixed-field), add suffix **CR** to the 2 m model number (example, **Q12AB6FF15CR**).





MINIATURE
COMPACT
MIDSIZE
FULLSIZE

WORLD-BEAM® Q12, 10-30V dc (cont'd)

Models†	Sensing Mode/LED*	Range**	Cable***	Output Type	Excess Gain	Beam Pattern	Data Sheet
Q12AB6FF30		30 mm Cutoff	2 m	Bipolar LO	EGCF-2 (p. 482)	—	119223
Q12AB6FF30Q			Threaded 4-Pin Pico Pigtail QD				
Q12RB6FF30			2 m	Bipolar DO			
Q12RB6FF30Q			Threaded 4-Pin Pico Pigtail QD				
Q12AB6FF50		50 mm Cutoff	2 m	Bipolar LO	EGCF-3 (p. 482)	—	
Q12AB6FF50Q			Threaded 4-Pin Pico Pigtail QD				
Q12RB6FF50			2 m	Bipolar DO			
Q12RB6FF50Q			Threaded 4-Pin Pico Pigtail QD				

* → Visible Red LED

** PFA chemical-resistant models provide a range of 1.5 m in opposed mode and 12, 28 or 48 mm in fixed-field mode, depending on model.

*** For 9 m cable, add suffix **W/30** to the 2 m model number (example, **Q126E W/30**). A model with a pigtail QD requires a mating cable (see pages 411 & 412).

Only 2 m cables are available for PFA chemical-resistant models.

QD models:

• For 4-pin 150 mm Euro-style pigtail, add suffix **Q5** (example, **Q126EQ5**). • For 3-pin 150 mm Pico-style pigtail, contact factory at 1-888-373-6767.

† For sensors with a PFA chemical-resistant jacket (opposed and fixed-field), add suffix **CR** to the 2 m model number (example, **Q12AB6FF30CR**).

WORLD-BEAM® Q12 Specifications

Sensing Beam	640 nm visible red
Supply Voltage and Current	10 to 30V dc (10% max. ripple) @ 20 mA max. current
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	Bipolar: One NPN (current sinking) and one PNP (current sourcing); light operate (LO) or dark operate (DO), depending on model
Output Rating	50 mA total across both outputs with overload and short circuit protection OFF-state leakage current: NPN: 200 µA PNP: 10 µA ON-state saturation voltage: NPN: 1.25V @ 50 mA PNP: 1.45V @ 50 mA
Output Protection Circuitry	Protected against false pulse on power-up; short-circuit protected.
Output Response Time	Opposed: 1.3 milliseconds ON; 900 microseconds OFF All others: 700 microseconds ON/OFF NOTE: 120 milliseconds delay on power-up; outputs do not conduct during this time.
Repeatability	175 microseconds
Switching Frequency	Opposed models: 385 Hz All other models: 715 Hz
Indicators	2 LED indicators (Emitters-Green only): Green ON steady—power ON Green flashing—output overloaded Yellow ON steady—light sensed Yellow flashing—marginal signal
Construction	Polarized Retroreflective: Thermoplastic elastomer housing with glass lens Standard: Thermoplastic elastomer housing with polycarbonate lens Chemical-resistant: Housing encased in PFA jacket; cable encased in 3/16" O.D. PFA tubing.
Environmental Rating	Standard: IEC IP67 Chemical-resistant: IEC IP67 and 1200 psi washdown NEMA ICS 5, Annex F-2002
Connections	Standard: 2 m or 9 m attached PVC cable, or 150 mm pigtail with threaded 4-pin Pico-style (Q) or 4-pin Euro-style (Q5) quick-disconnect fitting. QD cables are ordered separately. See pages 411 & 412. Contact factory for 150 mm pigtail with threaded 3-pin Pico QD. Chemical-resistant: 2 m attached cable encased in 3/16" O.D. PFA tubing
Operating Conditions	Temperature: -20° to +55° C Storage temperature: -30° to +75° C Relative humidity: 95% max. @ 50° C (non-condensing)
Certifications	
Hookup Diagrams	Emitters: DC02 (p. 520) All others: DC04 (p. 520)

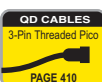
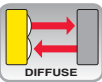
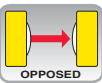


T8

8 mm Threaded-Mount Right-Angle Sensors

- Features EZ-BEAM® technology, with specially designed optics and electronics for reliable sensing without adjustments
- Ideal for presence sensing in small areas previously accessible only to remote sensors and fiber optic cable
- Can replace range-limited 8 mm threaded-mount inductive proximity sensors
- Offers visible sensing beam
- Available in dark- or light-operate models
- Available with integral cable or 150 mm pigtail quick-disconnect
- Offered in opposed mode with 2 m range or diffuse mode with 50 and 100 mm ranges

MINIATURE
COMPACT
MIDSIZE
FULLSIZE



T8 Sensors

- Visible red sensing beam
- Integral cable or 150 mm pigtail with threaded Pico-style quick-disconnect
- Bright LED output indicator on backside of housing



Opposed and Diffuse Models
Suffix E, R and D



T8, 10-30V dc

- MINIATURE
- COMPACT
- MIDSIZE
- FULLSIZE


Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
T86EV Emitter		2 m	2 m	—	EGCO-2 (p. 468)	BPO-2 (p. 492)	68669
T86EVQ Emitter			Threaded 3-Pin Pico Pigtail QD				
T8AN6R			2 m	NPN/LO			
T8AN6RQ			Threaded 3-Pin Pico Pigtail QD				
T8RN6R			2 m	NPN/DO			
T8RN6RQ			Threaded 3-Pin Pico Pigtail QD				
T8AP6R			2 m	PNP/LO			
T8AP6RQ			Threaded 3-Pin Pico Pigtail QD				
T8RP6R			2 m	PNP/DO			
T8RP6RQ			Threaded 3-Pin Pico Pigtail QD				
T8AN6D50				50 mm			
T8AN6D50Q	Threaded 3-Pin Pico Pigtail QD						
T8RN6D50	2 m	NPN/DO					
T8RN6D50Q	Threaded 3-Pin Pico Pigtail QD						
T8AP6D50	2 m	PNP/LO					
T8AP6D50Q	Threaded 3-Pin Pico Pigtail QD						
T8RP6D50	2 m	PNP/DO					
T8RP6D50Q	Threaded 3-Pin Pico Pigtail QD						
T8AN6D100	100 mm	2 m		NPN/LO	EGCD-2 (p. 475)	BPD-2 (p. 498)	
T8AN6D100Q		Threaded 3-Pin Pico Pigtail QD					
T8RN6D100		2 m		NPN/DO			
T8RN6D100Q		Threaded 3-Pin Pico Pigtail QD					
T8AP6D100		2 m		PNP/LO			
T8AP6D100Q		Threaded 3-Pin Pico Pigtail QD					
T8RP6D100		2 m		PNP/DO			
T8RP6D100Q		Threaded 3-Pin Pico Pigtail QD					

* Visible Red LED

** For 9 m cable, add suffix **W/30** to the 2 m model number (example, **T8AN6D50 W/30**). A model with a pigtail QD requires a mating cable (see page 410).

T8 Specifications	
Supply Voltage and Current	10 to 30V dc (10% max. ripple) at less than 25 mA (exclusive of load)
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	Solid-state switch NPN (current sinking) or PNP (current sourcing), depending on model. Light Operate (LO) or Dark Operate (DO), depending on model.
Output Rating	50 mA max. OFF-state leakage current: less than 1 µA at 24V dc ON-state saturation voltage: less than 0.25V at 10 mA dc; less than 0.5V at 50 mA dc
Output Protection Circuitry	Protected against false pulse on power-up and continuous overload or short circuit of outputs Overload trip point ≥ 100 mA
Output Response Time	1 millisecond ON; 0.5 milliseconds OFF NOTE: Maximum 100 milliseconds (150 milliseconds for Diffuse) delay on power-up; output does not conduct during this time.
Repeatability	Opposed: 100 microseconds Diffuse: 160 microseconds



T8 Specifications (cont'd)	
Indicators	<p>Opposed: Receiver has Green and Red LED Emitter has one Green LED Green ON steady: power ON Green flashing: output overloaded Red ON steady: light sensed Red flashing: marginal excess gain (1-1.5x) in light condition</p> <p>Diffuse: Red ON steady: light is sensed</p>
Construction	Reinforced polycarbonate/ABS alloy housing, acrylic window with 8 mm ABS nut
Environmental Rating	IEC IP67; NEMA 6
Connections	2 m or 9 m attached cable, 3-wire with PVC outer cable jacket; or 150 mm pigtail with threaded 3-pin Pico-style quick-disconnect fitting. QD cables are ordered separately. See page 410.
Operating Conditions	Temperature: -20° to +55° C Relative humidity: 80% at 50° C (non-condensing)
Vibration and Mechanical Shock	<p>Vibration: All models meet IEC 60068-2-6, IEC 60947-5-2, UL491 Section 40, MIL-STD-202F Method 201A; 10 to 60 Hz, 0.5 mm peak to peak</p> <p>Shock: All models meet IEC 60068-2-27, IEC 60947-5-2; 30g peak acceleration, 11 millisecond pulse duration, half-sine wave pulse shape</p>
Certifications	
Hookup Diagrams	Emitters: DC02 (p. 520) All others: DC01 (p. 520)









MINIATURE
COMPACT
MIDSIZE
FULLSIZE

MINI-BEAM[®]2

12 mm Threaded-Barrel Right-Angle Sensors

- Delivers MINI-BEAM[®] performance in a package 66% smaller than the original
- Available in opposed, polarized and non-polarized retroreflective, diffuse and divergent diffuse, and convergent modes
- Features easy push-button setup
- Solid-state complementary outputs



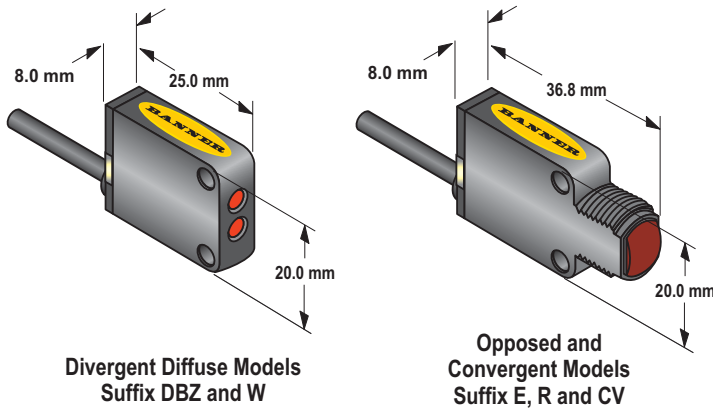
-  OPPOSED
-  RETRO
-  POLAR RETRO
-  CONVERGENT
-  DIFFUSE
-  BRACKETS
PAGE 370
-  OD CABLES
4-Pin Pico
PAGE 410
-  REFLECTORS
PAGE 425

MINI-BEAM[®]2 Sensors

- Incremental Gain control push button
- Dual-LED multi-function indicators
- 2 m or 9 m attached cable, or 150 mm Pico-style quick-disconnect pigtail
- 12 mm threaded lens or flush mounting



Retroreflective and Diffuse Models
Suffix LV, LP and D



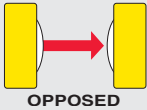
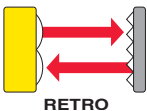

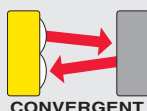
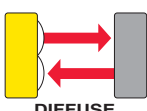
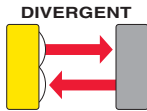
Divergent Diffuse Models
Suffix DBZ and W

Opposed and
Convergent Models
Suffix E, R and CV





MINI-BEAM®2, 10-30V dc

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet		
QS126E Emitter	 OPPOSED	4 m	2 m	—	EGCO-3 (p. 468)	BPO-3 (p. 492)	59040		
QS126EQ Emitter			4-pin Pico Pigtail QD						
QS12VN6R			2 m	NPN					
QS12VN6RQ			4-pin Pico Pigtail QD						
QS12VP6R			2 m	PNP					
QS12VP6RQ			4-pin Pico Pigtail QD						
QS12VN6LV	 RETRO	2 m†	2 m	NPN	EGCR-3 (p. 471)	BPR-3 (p.495)	59040		
QS12VN6LVQ			4-pin Pico Pigtail QD						
QS12VP6LV			2 m	PNP					
QS12VP6LVQ			4-pin Pico Pigtail QD						
QS12VN6LP	 POLAR RETRO	1 m†	2 m	NPN	EGCR-4 (p. 471)	BPR-4 (p. 495)	59040		
QS12VN6LPQ			4-pin Pico Pigtail QD						
QS12VP6LP			2 m	PNP					
QS12VP6LPQ			4-pin Pico Pigtail QD						
QS12VN6CV10	 CONVERGENT	10 mm	2 m	NPN	EGCC-1 (p. 478)	BPC-1 (p. 501)	59040		
QS12VN6CV10Q			4-pin Pico Pigtail QD						
QS12VP6CV10			2 m	PNP					
QS12VP6CV10Q			4-pin Pico Pigtail QD						
QS12VN6CV20		20 mm	2 m	NPN				EGCC-2 (p. 478)	BPC-2 (p. 501)
QS12VN6CV20Q			4-pin Pico Pigtail QD						
QS12VP6CV20			2 m	PNP					
QS12VP6CV20Q			4-pin Pico Pigtail QD						
QS12VN6D	 DIFFUSE	180 mm	2 m	NPN	EGCD-3 (p. 475)	BPD-3 (p. 498)	59040		
QS12VN6DQ			4-pin Pico Pigtail QD						
QS12VP6D			2 m	PNP					
QS12VP6DQ			4-pin Pico Pigtail QD						
QS12VN6DBZ			2 m	NPN				EGCD-4 (p. 475)	BPD-4 (p. 498)
QS12VN6DBZQ			4-pin Pico Pigtail QD						
QS12VP6DBZ			2 m	PNP					
QS12VP6DBZQ			4-pin Pico Pigtail QD						
QS12VN6W	 DIVERGENT DIFFUSE	50 mm	2 m	NPN	EGCD-5 (p. 475)	BPD-5 (p. 498)	59040		
QS12VN6WQ			4-pin Pico Pigtail QD						
QS12VP6W			2 m	PNP					
QS12VP6WQ			4-pin Pico Pigtail QD						


*  Visible Red LED

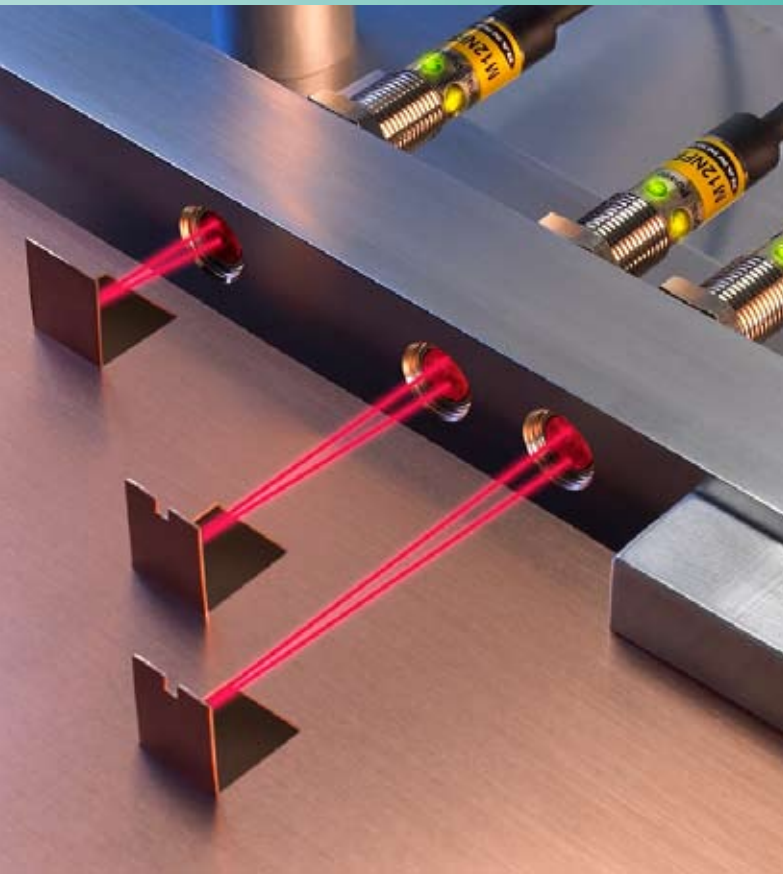
** For 9 m cable, add suffix **W30** to the 2 m model number (example, **QS12VN6D W30**). A model with a pigtail QD requires a mating cable (see page 410).

† Retroreflective range is specified using a BRT-50 retroreflector. Actual sensing range may differ depending on efficiency and reflective area of the retroreflector in use. See Accessories section for more information on reflectors.



MINIATURE
COMPACT
MIDSIZE
FULLSIZE

MINI-BEAM [®] 2 Specifications	
Supply Voltage and Current	10 to 30V dc (10% max. ripple) at less than 25 mA (exclusive of load)
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	Solid state complementary: NPN or PNP (current sinking or sourcing) output models available
Output Rating	150 mA max. each output at 25° C OFF-state leakage current: less than 10 µA @ 30V dc ON-state saturation voltage: less than 1V @ 10 mA; less than 2.0V @ 150 mA
Output Protection Circuitry	Protected against false pulse on power-up and continuous overload or short circuit of outputs
Output Response Time	Opposed: 8 milliseconds ON; 4 milliseconds OFF All others: 1.5 milliseconds NOTE: 500 millisecond delay on power-up, outputs do not conduct during this time
Repeatability	Opposed: 1 millisecond All others: 175 microseconds
Adjustments	One rubber-sealed push button Hold: max. gain Click: reduce gain one increment
Indicators	2 LEDs, visible from back and side of sensor: 1 Green, 1 Yellow Green ON steady: power ON Amber steady: light sensed Green flashing rapidly 5 times: max. gain Green single flash: click registered, gain reduced by one increment Yellow/Green alternating: minimum gain (can not reduce further)
Construction	Black polycarbonate/ABS alloy housing; totally encapsulated circuitry
Environmental Rating	IEC IP67; NEMA 6
Connections	2 m or 9 m PVC cable, or 4-pin Pico-style 150 mm pigtail QD. QD cables are ordered separately. See page 410.
Operating Conditions	Temperature: -20° to +55° C Relative humidity: 90% at 50° C (non-condensing)
Certifications	
Hookup Diagrams	Emitters: DC02 (p. 520) All others: DC03 (p. 520)



M12

12 mm Threaded-Barrel Sensors

- Features compact 12 mm threaded metal barrel
- Available in opposed, polarized and non-polarized retroreflective, diffuse and fixed-field modes
- Provides single-turn sensitivity adjustment on opposed, retroreflective and diffuse models
- Features fixed-field models with excellent background suppression and recessed mounting
- Fully encapsulated electronics-rated IP67
- Provides excellent crosstalk avoidance circuitry for diffuse, retroreflective and fixed-field models

MINIATURE
COMPACT
MIDSIZE
FULLSIZE



M12 Sensors

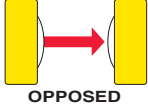
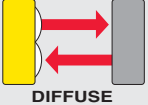
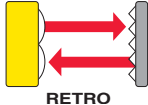


- Visible red sensing beam for easy alignment
- 12 mm threaded barrel
- 10 to 30V dc with NPN or PNP output, depending on model
- Dual-LED multi-function indicator system
- 2 m or 9 m attached cable, or Euro-style quick-disconnect fitting



Opposed, Retroreflective
Diffuse and Fixed-field Models
Suffix E, R, LP, LV, D and FF

M12, 10-30V dc

MINIATURE
COMPACT
MIDSIZE
FULLSIZE

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
M12E Emitter	 OPPOSED	5 m	2 m	—	EGCO-4 (p. 468)	BPO-4 (p. 492)	
M12EQ8 Emitter			4-pin Euro QD				
M12NR			2 m	NPN			
M12NRQ8			4-pin Euro QD				
M12PR			2 m	PNP			
M12PRQ8			4-pin Euro QD				
M12ND	 DIFFUSE	400 mm	2 m	NPN	EGCD-6 (p. 475)	BPD-6 (p. 498)	
M12NDQ8			4-pin Euro QD				
M12PD			2 m	PNP			
M12PDQ8			4-pin Euro QD				
M12NLV	 RETRO	2.5 m†	2 m	NPN	EGCR-5 (p. 471)	BPR-5 (p. 495)	
M12NLVQ8			4-pin Euro QD				
M12PLV			2 m	PNP			
M12PLVQ8			4-pin Euro QD				
M12NLP	 POLAR RETRO	1.5 m†	2 m	NPN	EGCR-6 (p. 471)	BPR-6 (p. 495)	129721
M12NLPQ8			4-pin Euro QD				
M12PLP			2 m	PNP			
M12PLPQ8			4-pin Euro QD				
M12NFF25	 FIXED-FIELD	25 mm Cutoff	2 m	NPN	EGCF-4 (p. 482)	—	
M12NFF25Q8			4-pin Euro QD				
M12PFF25			2 m	PNP			
M12PFF25Q8			4-pin Euro QD				
M12NFF50		50 mm Cutoff	2 m	NPN	EGCF-5 (p. 482)	—	
M12NFF50Q8			4-pin Euro QD				
M12PFF50			2 m	PNP			
M12PFF50Q8			4-pin Euro QD				
M12NFF75		75 mm Cutoff	2 m	NPN	EGCF-6 (p. 482)	—	
M12NFF75Q8			4-pin Euro QD				
M12PFF75			2 m	PNP			
M12PFF75Q8			4-pin Euro QD				

*  Visible red LED

** Cabled models: For 9 m cable, add suffix W/30 to the 2 m model number (example, M12PD W/30).

QD models: For a 4-pin 150 mm Euro-style pigtail, add suffix Q5 (example, M12PDQ5). A model with a QD requires a mating cable (see page 412).

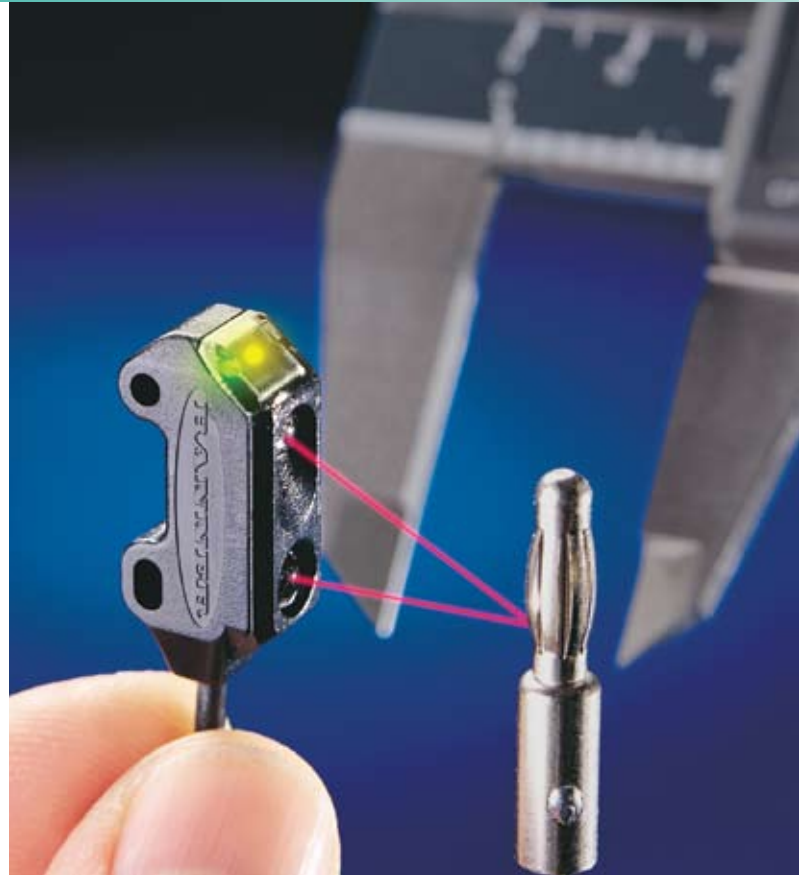
† Retroreflective range is specified using one model BRT-84 retroreflector. Actual sensing range may differ, depending on the efficiency and reflective area of the reflector used. See Accessories for more information.

M12 Specifications	
Sensing Beam	Fixed-field: 680 nm visible red All others: 660 nm visible red
Supply Voltage and Current	10 to 30V dc (10% max. ripple) @ 20 mA max current (exclusive of load)
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	Complementary (1 normally open and 1 normally closed) solid-state, NPN or PNP, depending on model
Output Ratings	100 mA total across both outputs with overload and short circuit protection OFF-state leakage current: ON-state saturation voltage: NPN: 200 μ A NPN: 1.6V @ 100 mA PNP: 10 μ A PNP: 3.0V @ 100 mA
Output Protection Circuitry	Protected against false pulse on power-up, short-circuit protected
Output Response Time	Opposed: 625 microseconds ON/375 microseconds OFF All others: 500 microseconds ON/OFF NOTE: 100 milliseconds delay on power-up; outputs do not conduct during this time.
Repeatability	Opposed: 85 microseconds All others: 95 microseconds
Indicators	2 LED indicators: Green ON steady —power ON Green flashing —output overload Yellow ON steady —light sensed Yellow flashing —marginal signal
Adjustments	Fixed-field: none All others: single-turn Gain (sensitivity) potentiometer
Construction	Housing: Nickel-plated brass Lenses: PMMA Cable endcap and Gain potentiometer adjuster: PBT
Environmental Rating	IEC IP67; NEMA 6
Connections	2 m or 9 m 4-wire PVC-jacketed cable, 4-pin integral Euro-style QD (Q8), or 150 mm pigtail with threaded 4-pin Euro-style quick-disconnect fitting (Q5), depending on model. See page 412
Operating Conditions	Operating temperature: -20° to +60° C Relative humidity: 90% max @ +50° C
Certifications	Approvals are pending, contact factory for status at 1-888-373-6767.
Hookup Diagrams	Emitters: DC02 (p. 520) All others: DC03 (p. 520)

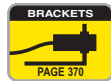
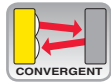
VS1

Miniature Convergent-Mode Sensors

- Features EZ-BEAM® technology, with specially designed optics and electronics for reliable sensing without adjustments
- Available with 10 or 20 mm focal length
- Available in dark- or light-operate models
- Provides high-quality, low-cost replacement for competitive miniature sensors
- Available with integral cable or 150 mm pigtail quick-disconnect
- Includes M2 stainless steel mounting hardware; optional mounting brackets available

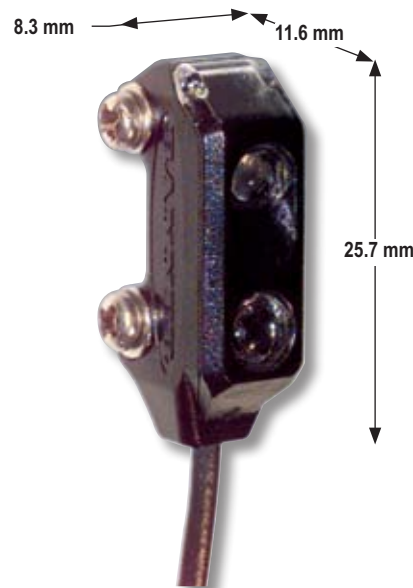


MINIATURE
COMPACT
MIDSIZE
FULLSIZE



VS1 Sensors

- Dual-LED multi-function indicators
- Visible red or infrared convergent sensing beam
- 2 m or 9 m attached cable, or 150 mm pigtail with threaded 3-pin Pico-style quick-disconnect



Convergent Models Suffix CV, C1 and C2



VS1, 10-30V dc


MINIATURE
COMPACT
MIDSIZE
FULLSIZE

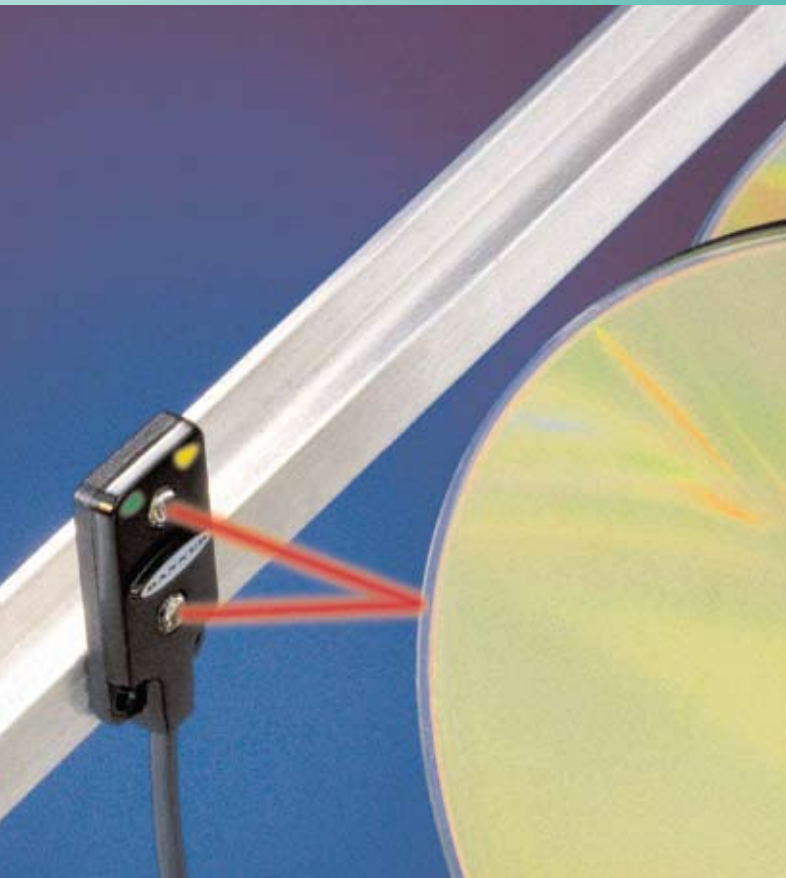
Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet	
VS1AN5CV10	 CONVERGENT	10 mm ±5 mm	2 m	NPN/LO	EGCC-3 (p. 478)	BPC-3 (p. 501)	56465	
VS1AN5CV10Q			Threaded 3-Pin Pico Pigtail QD					
VS1RN5CV10			2 m	NPN/DO				
VS1RN5CV10Q			Threaded 3-Pin Pico Pigtail QD					
VS1AP5CV10			2 m	PNP/LO				
VS1AP5CV10Q			Threaded 3-Pin Pico Pigtail QD					
VS1RP5CV10		2 m	PNP/DO					
VS1RP5CV10Q		Threaded 3-Pin Pico Pigtail QD						
VS1AN5CV20		 CONVERGENT	20 mm ±10 mm	2 m	NPN/LO	EGCC-4 (p. 478)		BPC-4 (p. 501)
VS1AN5CV20Q				Threaded 3-Pin Pico Pigtail QD				
VS1RN5CV20				2 m	NPN/DO			
VS1RN5CV20Q				Threaded 3-Pin Pico Pigtail QD				
VS1AP5CV20				2 m	PNP/LO			
VS1AP5CV20Q				Threaded 3-Pin Pico Pigtail QD				
VS1RP5CV20			2 m	PNP/DO				
VS1RP5CV20Q			Threaded 3-Pin Pico Pigtail QD					
VS1AN5C10	 CONVERGENT		10 mm ±5 mm	2 m	NPN/LO	EGCC-5 (p. 478)	BPC-5 (p. 501)	56465
VS1AN5C10Q				Threaded 3-Pin Pico Pigtail QD				
VS1RN5C10				2 m	NPN/DO			
VS1RN5C10Q				Threaded 3-Pin Pico Pigtail QD				
VS1AP5C10				2 m	PNP/LO			
VS1AP5C10Q				Threaded 3-Pin Pico Pigtail QD				
VS1RP5C10		2 m	PNP/DO					
VS1RP5C10Q		Threaded 3-Pin Pico Pigtail QD						
VS1AN5C20		 CONVERGENT	20 mm ±10 mm	2 m	NPN/LO	EGCC-6 (p. 478)	BPC-6 (p. 501)	
VS1AN5C20Q				Threaded 3-Pin Pico Pigtail QD				
VS1RN5C20				2 m	NPN/DO			
VS1RN5C20Q				Threaded 3-Pin Pico Pigtail QD				
VS1AP5C20				2 m	PNP/LO			
VS1AP5C20Q				Threaded 3-Pin Pico Pigtail QD				
VS1RP5C20			2 m	PNP/DO				
VS1RP5C20Q			Threaded 3-Pin Pico Pigtail QD					

* Infrared LED Visible Red LED

** For 9 m cable, add suffix W30 to the 2 m model number (example, VS1AN5CV10 W30). A model with a pigtail QD requires a mating cable (see page 410).

- MINIATURE
- COMPACT
- MIDSIZE
- FULLSIZE

VS1 Specifications	
Supply Voltage and Current	10 to 30V dc (10% max. ripple) at less than 25 mA (exclusive of load)
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	Solid-state switch NPN (current sinking) or PNP (current sourcing), depending on model Light Operate (LO) or Dark Operate (DO) models
Output Rating	50 mA max. OFF-state leakage current: less than 1 μ A at 24V dc ON-state saturation voltage: less than 0.25V at 10 mA dc; less than 0.5V at 50 mA dc
Output Protection Circuitry	Protected against false pulse on power-up and continuous overload or short circuit of outputs Overload trip point \geq 100 mA
Output Response Time	1 millisecond ON/OFF
Repeatability	250 microseconds
Indicators	Two LEDs: Green and Yellow Green ON steady: power ON Green flashing: output overloaded Yellow ON steady: light sensed Yellow flashing: marginal excess gain (1-1.5x) in light condition
Construction	Black ABS/polycarbonate housing with clear acrylic lens
Environmental Rating	IP54; NEMA 3
Connections	2 m or 9 m attached cable, 3-wire with PVC outer cable jacket; or 150 mm pigtail with threaded 3-pin Pico-style quick-disconnect fitting. QD cables are ordered separately. See page 410.
Operating Conditions	Temperature: -20° to +55° C Relative humidity: 80% at 50° C (non-condensing)
Application Notes	M2 stainless steel mounting hardware is included. Optional mounting brackets are available. See page 370.
Certifications	
Hookup Diagrams	DC01 (p. 520)



VS2

Ultra-Thin Miniature Sensors

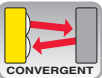
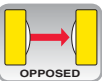
- Features EZ-BEAM® technology, with specially designed optics and electronics for reliable sensing without adjustments
- Available in opposed and convergent modes
- Ideal as a low-cost, high-quality miniaturized solution for confined areas
- Available with integral cable or 150 mm pigtail with threaded Pico-style quick-disconnect
- Available in dark- or light-operate models
- Includes M2 stainless steel mounting hardware; optional mounting brackets available

MINIATURE

COMPACT

MIDSIZE

FULLSIZE



VS2 Sensors

- Dual-LED multi-function indicators
- 8 mm mounting centers
- Visible or infrared sensing beam
- 2 m or 9 m attached cable, or 150 mm pigtail with threaded 3-pin Pico-style quick-disconnect



Opposed Models
Suffix E and R



Convergent Models
Suffix C



VS2, 10-30V dc


- MINIATURE
- COMPACT
- MIDSIZE
- FULLSIZE

Models [†]	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet					
VS25EV Emitter		Optimum up to 600 mm, 1.2 m max.	2 m	—	EGCO-5 (p. 468)	BPO-5 (p. 492)	57248					
VS25EVQ Emitter			Threaded 3-Pin Pico Pigtail QD									
VS2AN5R			2 m	NPN/LO								
VS2AN5RQ			Threaded 3-Pin Pico Pigtail QD									
VS2RN5R			2 m	NPN/DO								
VS2RN5RQ			Threaded 3-Pin Pico Pigtail QD									
VS2AP5R			2 m	PNP/LO								
VS2AP5RQ			Threaded 3-Pin Pico Pigtail QD									
VS2RP5R			2 m	PNP/DO								
VS2RP5RQ			Threaded 3-Pin Pico Pigtail QD									
VS25E Emitter				3.0 m				2 m	—	EGCO-6 (p. 468)	BPO-6 (p. 492)	57248
VS25EQ Emitter								Threaded 3-Pin Pico Pigtail QD				
VS2AN5R	2 m	NPN/LO										
VS2AN5RQ	Threaded 3-Pin Pico Pigtail QD											
VS2RN5R	2 m	NPN/DO										
VS2RN5RQ	Threaded 3-Pin Pico Pigtail QD											
VS2AP5R	2 m	PNP/LO										
VS2AP5RQ	Threaded 3-Pin Pico Pigtail QD											
VS2RP5R	2 m	PNP/DO										
VS2RP5RQ	Threaded 3-Pin Pico Pigtail QD											
VS2AN5CV15		15 mm ±5 mm			2 m	NPN/LO	EGCC-7 (p. 478)	BPC-7 (p. 501)	65411			
VS2AN5CV15Q					Threaded 3-Pin Pico Pigtail QD							
VS2RN5CV15			2 m	NPN/DO								
VS2RN5CV15Q			Threaded 3-Pin Pico Pigtail QD									
VS2AP5CV15			2 m	PNP/LO								
VS2AP5CV15Q			Threaded 3-Pin Pico Pigtail QD									
VS2RP5CV15			2 m	PNP/DO								
VS2RP5CV15Q			Threaded 3-Pin Pico Pigtail QD									
VS2AN5CV30			30 mm ±10 mm	2 m	NPN/LO	EGCC-8 (p. 478)				BPC-8 (p. 501)		
VS2AN5CV30Q				Threaded 3-Pin Pico Pigtail QD								
VS2RN5CV30				2 m	NPN/DO							
VS2RN5CV30Q				Threaded 3-Pin Pico Pigtail QD								
VS2AP5CV30	2 m	PNP/LO										
VS2AP5CV30Q	Threaded 3-Pin Pico Pigtail QD											
VS2RP5CV30	2 m	PNP/DO										
VS2RP5CV30Q	Threaded 3-Pin Pico Pigtail QD											

* Infrared LED Visible Red LED

** For 9 m cable, add suffix **W/30** to the 2 m model number (example, **VS2RP5R W/30**). A model with a pigtail QD requires a mating cable (see page 410).

† Opposed-mode models also sold as pairs. Contact factory for more information.

VS2 Specifications	
Supply Voltage and Current	10 to 30V dc (10% max. ripple) at less than 25 mA (exclusive of load)
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	Solid-state switch: NPN (current sinking) or PNP (current sourcing), depending on model Light Operate (LO) or Dark Operate (DO), depending on model
Output Rating	50 mA max. OFF-state leakage current: less than 1 μ A at 24V dc ON-state saturation voltage: less than 0.25V at 10 mA dc; less than 0.5V at 50 mA dc
Output Protection Circuitry	Protected against false pulse on power-up and continuous overload or short circuit of outputs Overload trip point \geq 100 mA
Output Response Time	Opposed: 1 millisecond ON; 0.5 millisecond OFF Convergent: 1 millisecond ON; OFF NOTE: Maximum 100 millisecond (opposed) and 150 millisecond (convergent) delay on power-up; output does not conduct during this time.
Repeatability	Opposed: 100 microseconds Convergent: 160 microseconds
Indicators	Two LEDs: Green and Yellow Green ON steady: power ON Green flashing: output overloaded Yellow ON steady: light sensed Yellow flashing: marginal excess gain (1-1.5x) in light condition (opposed mode only)
Construction	Opposed: Black ABS housing with clear MABS lens Convergent: Black ABS housing with acrylic lens
Environmental Rating	IEC IP67; NEMA 6
Connections	2 m or 9 m attached cable, 3-wire with PVC outer cable jacket; or 150 mm pigtail with threaded 3-pin Pico-style quick-disconnect fitting. QD cables are ordered separately. See page 410.
Operating Conditions	Temperature: -20° to +55° C Relative humidity: 80% at 50° C (non-condensing)
Vibration and Mechanical Shock	Vibration: All models meet IEC 60068-2-6, IEC 60947-5-2, UL491 Section 40, MIL-STD-202F Method 201A; 10 to 60 Hz, 0.5 mm peak to peak Shock: All models meet IEC 60068-2-27, IEC 60947-5-2; 30g peak acceleration, 11 millisecond pulse duration, half-sine wave pulse shape
Application Notes	M2 stainless steel mounting hardware is included. Optional mounting brackets are available. See page 370.
Certifications	
Hookup Diagrams	Emitters: DC02 (p. 520) All others: DC01 (p. 520)

MINIATURE

COMPACT

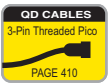
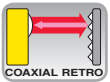
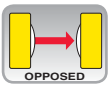
MIDSIZE

FULLSIZE

VS3

Miniature Sensors with Advanced Optics

- Features EZ-BEAM® technology, with specially designed optics and electronics for reliable sensing without adjustments
- Offers extremely compact self-contained miniature design
- Available in opposed and retroreflective sensing modes
- Uses coaxial optics on retroreflective models to eliminate blind areas at close range
- Features visible sensing beam for easy alignment
- Available in dark- or light-operate models
- Available with integral cable or threaded Pico-style quick-disconnect

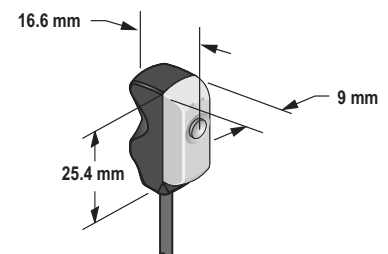


VS3 Sensors

- Dual-LED multi-function indicators
- 2 m or 9 m integral cable, or 3-pin threaded Pico-style quick-disconnect
- Extremely compact housing



Opposed, Non-Polarized Retroreflective Models
Suffix R, EV and LV



Polarized Retroreflective Models
Suffix LP



VS3, 10-30V dc

Models†	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
VS35EV Emitter		1.2 m	2 m	—	EGCO-7 (p. 468)	BPO-7 (p. 492)	63227
VS35EVQ Emitter			Threaded 3-Pin Pico QD				
VS3AN5R			2 m	NPN/LO			
VS3AN5RQ			Threaded 3-Pin Pico QD				
VS3RN5R			2 m	NPN/DO			
VS3RN5RQ			Threaded 3-Pin Pico QD				
VS3AP5R			2 m	PNP/LO			
VS3AP5RQ			Threaded 3-Pin Pico QD				
VS3RP5R			2 m	PNP/DO			
VS3RP5RQ			Threaded 3-Pin Pico QD				
VS3AN5XLV				250 mm††			
VS3AN5XLVQ	Threaded 3-Pin Pico QD						
VS3RN5XLV	2 m	NPN/DO					
VS3RN5XLVQ	Threaded 3-Pin Pico QD						
VS3AP5XLV	2 m	PNP/LO					
VS3AP5XLVQ	Threaded 3-Pin Pico QD						
VS3RP5XLV	2 m	PNP/DO					
VS3RP5XLVQ	Threaded 3-Pin Pico QD						
VS3AN5XLP		250 mm††	2 m	NPN/LO	EGCR-8 (p. 471)	BPR-8 (p. 495)	
VS3AN5XLPQ			Threaded 3-Pin Pico QD				
VS3RN5XLP			2 m	NPN/DO			
VS3RN5XLPQ			Threaded 3-Pin Pico QD				
VS3AP5XLP			2 m	PNP/LO			
VS3AP5XLPQ			Threaded 3-Pin Pico QD				
VS3RP5XLP			2 m	PNP/DO			
VS3RP5XLPQ			Threaded 3-Pin Pico QD				

* Visible Red LED


** For 9 m cable, add suffix **W/30** to the 2 m model number (example, **VS3AN5XLV W/30**). A model with a QD requires a mating cable (see page 410).

† Opposed-mode models also sold as pairs. Contact factory for more information.

†† Retroreflective range is specified using one model BRT-32X20AM retroreflector. Actual sensing range may differ, depending on efficiency and reflective area of the retroreflector in use. See Accessories for more information.



MINIATURE
COMPACT
MIDSIZE
FULLSIZE

VS3 Specifications	
Supply Voltage and Current	10 to 30V dc (10% max. ripple) at less than 25 mA (exclusive of load)
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	Solid-state switch NPN (current sinking) or PNP (current sourcing), depending on model Light Operate (LO) or Dark Operate (DO), depending on model
Output Protection Circuitry	Protected against false pulse on power-up and continuous overload or short circuit of outputs. Overload trip point \geq 100 mA
Output Rating	50 mA max. OFF-state leakage current: less than 1 μ A at 24V dc ON-state saturation voltage: less than 0.25V at 10 mA dc; less than 0.5V at 50 mA dc
Output Response Time	Opposed: 1 millisecond ON; 0.5 millisecond OFF Retroreflective: 1 millisecond ON/OFF NOTE: Maximum 100 millisecond (opposed mode) and 150 millisecond (retroreflective) delay on power-up; output does not conduct during this time.
Repeatability	Opposed: 100 microseconds Retroreflective: 160 microseconds
Indicators	Two LEDs: Green and Yellow Green ON steady: power ON Green flashing: output overloaded Yellow ON steady: light sensed Yellow flashing: marginal excess gain (1-1.5x) in light condition (opposed mode only)
Construction	Opposed and Non-polarized Retroreflective: Black ABS housing with acrylic lens Polarized Retroreflective: Black ABS housing with glass lens and acrylic cover
Environmental Rating	IEC IP67; NEMA 6
Connections	2 m or 9 m attached cable, 3-wire with PVC outer cable jacket; or 3-pin Pico-style threaded quick-disconnect fitting. QD cables are ordered separately. See page 410.
Operating Conditions	Temperature: -20° to +55° C Relative humidity: 80% at 50° C (non-condensing)
Vibration and Mechanical Shock	Vibration: All models meet IEC 60068-2-6, IEC 60947-5-2, UL491 Section 40, MIL-STD-202F Method 201A; 10 to 60 Hz, 0.5 mm peak to peak Shock: All models meet IEC 60068-2-27, IEC 60947-5-2; 30g peak acceleration, 11 millisecond pulse duration, half-sine wave pulse shape
Application Notes	M3 stainless steel mounting hardware is included. Optional mounting brackets are available. See page 370.
Certifications	
Hookup Diagrams	Emitters: DC02 (p. 520) All others: DC01 (p. 520)



VS4

Ultra-Thin Right-Angle Miniature Sensors

- Features EZ-BEAM® technology, with specially designed optics and electronics for reliable sensing without adjustments
- Features totally self-contained opposed-mode miniature design
- Offers advanced sensing circuitry for powerful, precise sensing
- Features bright visible red sensing beam for easy alignment
- Delivers powerful 1.0 m sensing range
- Available in dark- or light-operate models
- Provides horizontal mounting capability and extremely small size for mounting in narrow confines

MINIATURE

COMPACT

MIDSIZE

FULLSIZE



VS4 Sensors

- Two bright LED indicators
- Visible red sensing beam
- 2 m or 9 m attached cable, or 150 mm pigtail with threaded 3-pin Pico-style quick-disconnect
- Low-profile housing—only 4.75 mm thick



Opposed Models
Suffix E and R





VS4, 10-30V dc

MINIATURE
COMPACT
MIDSIZE
FULLSIZE

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
VS4EV Emitter		1 m	2 m	—	EGCO-8 (p. 468)	BPO-8 (p. 492)	69421
VS4EVQ Emitter			Threaded 3-pin Pico Pigtail QD				
VS4AN5R			2 m	NPN/LO			
VS4AN5RQ			Threaded 3-pin Pico Pigtail QD				
VS4RN5R			2 m	NPN/DO			
VS4RN5RQ			Threaded 3-pin Pico Pigtail QD				
VS4AP5R			2 m	PNP/LO			
VS4AP5RQ			Threaded 3-pin Pico Pigtail QD				
VS4RP5R			2 m	PNP/DO			
VS4RP5RQ			Threaded 3-pin Pico Pigtail QD				

* Visible Red LED

** For 9 m cable, add suffix W30 to the 2 m model number (example, VS4RP5R W30). A model with a pigtail QD requires a mating cable (see page 410).

VS4 Specifications	
Supply Voltage and Current	10 to 30V dc (10% max. ripple) Emitter: 25 mA Receiver: 25 mA (exclusive of load)
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	Solid-state switch NPN (current sinking) or PNP (current sourcing), depending on model Light Operate (LO) or Dark Operate (DO), depending on model
Output Rating	50 mA max. OFF-state leakage current: less than 1 µA at 24V dc ON-state saturation voltage: less than 0.25V at 10 mA dc; less than 0.5V at 50 mA dc
Output Protection Circuitry	Protected against false pulse on power-up and continuous overload or short circuit of outputs Overload trip point ≥ 100 mA
Output Response Time	1 millisecond ON; 0.5 milliseconds OFF NOTE: 100 millisecond delay on power-up; output does not conduct during this time.
Repeatability	100 microseconds
Indicators	Two LEDs: Green and Yellow Green ON steady: power ON Yellow ON steady: light sensed Green flashing: output overloaded Yellow flashing: marginal excess gain (1 to 1.5x) in light condition
Construction	Polycarbonate mounting holes and lens. Low pressure molded thermoplastic housing (UL 94-V0)
Environmental Rating	IP67; NEMA 6
Connections	2 m or 9 m attached cable, 3-wire with PVC outer cable jacket; or 150 mm pigtail with threaded 3-pin Pico-style quick-disconnect fitting. QD cables are ordered separately. See page 410.
Operating Conditions	Temperature: -20° to +55° C Relative humidity: 80% at 50° C (non-condensing)
Vibration and Mechanical Shock	Vibration: All models meet IEC 60068-2-6, IEC 60947-5-2, UL491 Section 40, MIL-STD-202F Method 201A; 10 to 60 Hz, 0.5 mm peak to peak Shock: All models meet IEC 60068-2-27, IEC 60947-5-2; 30g peak acceleration, 11 millisecond pulse duration, half-sine wave pulse shape
Application Notes	M2 stainless steel mounting hardware is included. Optional mounting bracket available.
Certifications	
Hookup Diagrams	Emitters: DC02 (p. 520) All others: DC01 (p. 520)

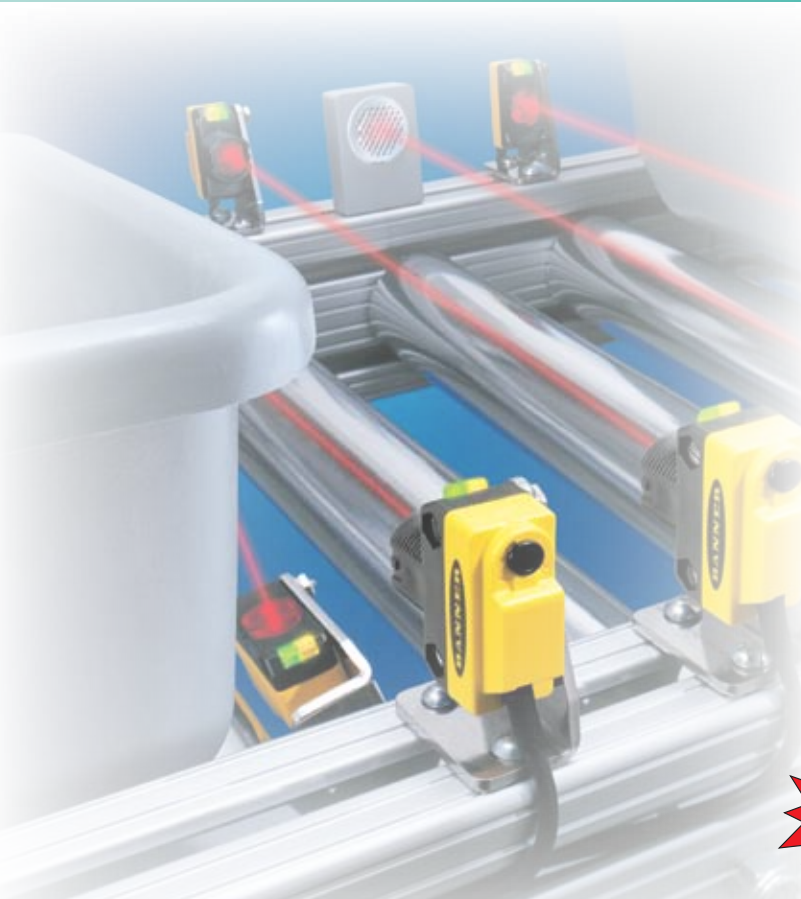
Compact Sensors

WORLD-BEAM® QS18 page 70

- Universal photoelectric family offers 18 mm threaded lens or side mounts.
- One sensor family replaces hundreds of other sensor styles.
- One housing design fulfills all mounting requirements.
- All sensing modes are available including laser, fiber optic and ultrasonic.
- *Expert™* models offer push-button TEACH-mode setup.
- Ranges are up to 30 m.
- A wide variety of connecting options are available.



QS18 ac/dc universal power models will be available soon—contact factory or visit www.bannerengineering.com for more information.



MINI-BEAM® page 79

- Extensive family in all sensing modes and ranges to 30 m
- *Expert™* push-button teachable models
- Models for special needs—clear plastic detection, NAMUR outputs
- World's most popular photoelectric



M18 page 95

- Rugged 18 mm stainless steel threaded barrels
- Opposed, polarized and non-polarized retroreflective, diffuse and fixed-field modes
- Dual LED indicators
- Specially designed EZ-BEAM® style optics and electronics for reliable sensing without adjustments



WORLD-BEAM® Q20 page 92

- High power in a small package
- Rugged overmolded design for enhanced durability
- Ranges to 15 m
- Four sensing modes
- Universal threaded inserts with 25.4 mm hole spacing



T18 page 101

- Completely epoxy encapsulated Right-angle, T-shaped package
- Specialized fixed-field and polarized retroreflective models
- Specially designed EZ-BEAM® style optics and electronics for reliable sensing without adjustments
- Models for ac or dc power



S18 page 95

- Completely epoxy encapsulated 18 mm threaded plastic barrels
- Specialized laser diode emitter models
- Specially designed EZ-BEAM® style optics and electronics for reliable sensing without adjustments
- Models for ac or dc power



Q25 page 106

- Compact rectangular 25 mm right-angle housing with 18 mm threaded mounting base
- Completely epoxy encapsulated
- Specially designed EZ-BEAM® style optics and electronics for reliable sensing without adjustments
- Models for ac or dc power

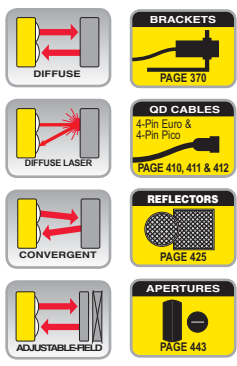
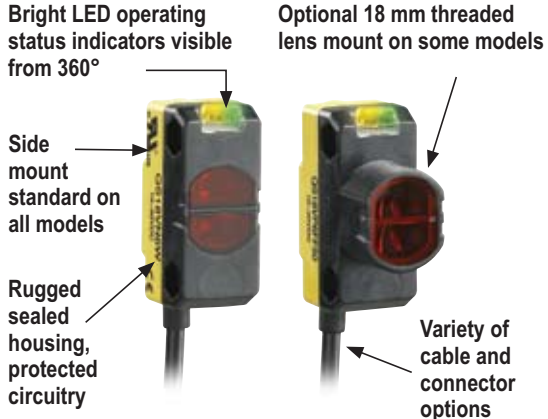
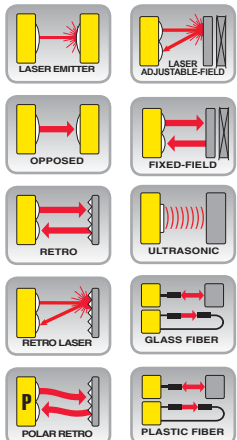
WORLD-BEAM®

QS18 Series Universal Sensors

- Features a universal housing with an 18 mm threaded lens or side mounts
- Replaces hundreds of other sensors
- Meets IP67 and NEMA 6 standards for harsh environments
- Available in opposed, polarized and non-polarized retroreflective, convergent, regular and wide-angle diffuse, laser, ultrasonic, plastic or glass fiber optic, fixed-field and adjustable-field sensing modes
- Offers easy push-button TEACH-mode setup in *Expert™* QS18E and ultrasonic models
- Ranges up to 20 m

Coming Soon! ac/dc universal power models

MINIATURE
COMPACT
MIDSIZE
FULLSIZE



QS18

- Eight sensing modes for solving most applications: opposed, retroreflective, convergent, diffuse, plastic and glass fiber optic, and adjustable field and fixed field
- High power, infrared or visible red sensing beam
- Highly visible diagnostics



QS18 Expert™

- Advanced teachable microprocessor
- Single push-button programming
- Instant learning of difficult sensing condition
- Reliable detection of transparent and reflective objects

QS18	page 71
QS18 Laser	72 & 73
QS18 Background Suppression	73 & 74
QS18 Expert™	76
QS18 Ultrasonic	77



QS18 Laser

- Opposed, diffuse, retroreflective and adjustable-field models
- High-performance sensing with visible Class 1 and 2 lasers
- Long sensing ranges
- Ideal for confined areas
- Emitter models available with five beam shapes



QS18 Background Suppression

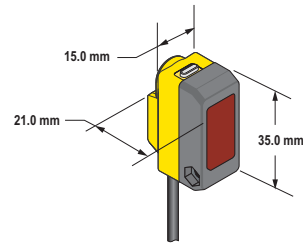
- Adjustable-field models with cutoff point from 20 to 100 mm, 30 to 150 mm or 50 to 250 mm
- Fixed-field models sensing range of 50 or 100 mm
- Visible red LED or laser sensing beam
- Accurate and reliable even with low-reflectivity targets
- Ideal for small, difficult-to-access areas

WORLD-BEAM® QS18 Sensors

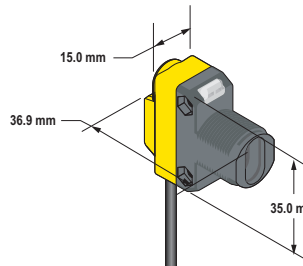
- 18 mm threaded lens mount on some models
- A variety of cable and connector options
- Rugged sealed housing, protected circuitry
- Bright LED operating status indicators visible from 360°



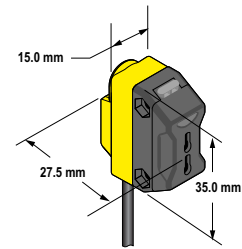
Opposed, Retroreflective, Laser Retroreflective, Convergent, Diffuse, Laser Diffuse and Fixed-field Models
Suffix E, R, LV, LP, LLP, CV15, CV45, D, LD, LE and FF



Opposed, Diffuse and Adjustable-field Models
Suffix EB, RB, DB, W and AF



Glass Fiber Models
Suffix F



Plastic Fiber Models
Suffix FP

- MINIATURE
- COMPACT
- MIDSIZE
- FULLSIZE

WORLD-BEAM® QS18, 10-30V dc



Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
QS186E Emitter	<p>OPPOSED</p>	20 m	2 m	—	EGCO-9 (p. 468)	BPO-9 (p. 492)	63908
QS186EQ8 Emitter			4-pin Euro QD				
QS18VN6R			2 m	NPN			
QS18VN6RQ8			4-pin Euro QD				
QS18VP6R			2 m	PNP			
QS18VP6RQ8			4-pin Euro QD				
QS186EB Emitter		3 m	2 m	—	EGCO-10 (p. 468)	BPO-10 (p. 492)	
QS186EBQ8 Emitter			4-pin Euro QD				
QS18VN6RB			2 m	NPN			
QS18VN6RBQ8			4-pin Euro QD				
QS18VP6RB			2 m	PNP			
QS18VP6RBQ8			4-pin Euro QD				

* Infrared LED

** For 9 m cable, add suffix **W/30** to the 2 m model number (example, **QS186E W/30**). A model with a QD requires a mating cable (see pages 410 & 412).

QD models:

- For 4-pin integral Euro-style QD, add suffix **Q8** (example, **QS186EQ8**).
- For 4-pin integral Pico-style QD, add suffix **Q7** (example, **QS186EQ7**).
- For 4-pin 150 mm Euro-style pigtail QD, add suffix **Q5** (example, **QS186EQ5**).
- For 4-pin 150 mm Pico-style pigtail QD, add suffix **Q** (example, **QS186EQ**).





WORLD-BEAM® QS18, 10-30V dc (cont'd)

MINIATURE
COMPACT
MIDSIZE
FULLSIZE

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet	
QS186LE***	Class 1 LASER EMITTER	15 m (4500 X excess gain) See Data sheet for more information.	2 m	—	See Data sheet for more information.		109415	
QS186LEQ8***			4-pin Euro QD					
QS186LE10	LASER SPOT 		2 m					
QS186LE10Q8			4-pin Euro QD					
QS186LE11	LASER SPOT 		2 m					
QS186LE11Q8			4-pin Euro QD					
QS186LE12	LASER SPOT 		2 m					
QS186LE12Q8			4-pin Euro QD					
QS186LE14	LASER SPOT 		2 m					
QS186LE14Q8			4-pin Euro QD					
QS18VN6LV	RETRO	6.5 m†	2 m	NPN	EGCR-9 (p. 471)	BPR-9 (p. 495)	63908	
QS18VN6LVQ8			4-pin Euro QD					
QS18VP6LV			2 m	PNP				
QS18VP6LVQ8			4-pin Euro QD					
QS18VN6LP	POLAR RETRO	3.5 m†	2 m	NPN	EGCR-10 (p. 471)	BPR-10 (p. 495)		
QS18VN6LPQ8			4-pin Euro QD					
QS18VP6LP			2 m	PNP				
QS18VP6LPQ8			4-pin Euro QD					
QS18VN6LLP	LASER POLAR RETRO	10 m††	2 m	NPN	EGCR-11 (p. 471)	—		
QS18VN6LLPQ8			4-pin Euro QD					
QS18VP6LLP			2 m	PNP				
QS18VP6LLPQ8			4-pin Euro QD					
QS18VN6CV15	CONVERGENT	16 mm	2 m	NPN	EGCC-9 (p. 478)	BPC-9 (p. 501)	63908	
QS18VN6CV15Q8			4-pin Euro QD					
QS18VP6CV15			2 m	PNP				
QS18VP6CV15Q8			4-pin Euro QD					
QS18VN6CV45		43 mm		2 m	NPN	EGCC-10 (p. 478)		BPC-10 (p. 501)
QS18VN6CV45Q8				4-pin Euro QD				
QS18VP6CV45				2 m	PNP			
QS18VP6CV45Q8				4-pin Euro QD				

* Visible Red LED Visible Red Laser

** For 9 m cable, add suffix **W/30** to the 2 m model number (example, **QS18VN6LV W/30**). A model with a QD requires a mating cable (see pages 410 & 412).
QD models (except Laser Emitters):

- For 4-pin integral Euro-style QD, add suffix **Q8** (example, **QS18VN6LVQ8**). • For 4-pin 150 mm Euro-style pigtail QD, add suffix **Q5** (example, **QS18VN6LVQ5**).
- For 4-pin integral Pico-style QD, add suffix **Q7** (example, **QS18VN6LVQ7**). • For 4-pin 150 mm Pico-style pigtail QD, add suffix **Q** (example, **QS18VN6LVQ**).

*** Specified with QS18 threaded lens receiver. Not recommended for dusty or dirty environments; the scattered light would greatly reduce excess gain.

† Retroreflective range is specified using one model BRT-84 retroreflector. Actual sensing range may differ, depending on the efficiency and reflective area of the retroreflector used. See Accessories for more information.

†† Retroreflective range is specified using one model BRT-51X51BM or BRT-TVHG-2X2 retroreflector. Actual sensing range may differ, depending on the efficiency and reflective area of the retroreflector used. See Accessories for more information.





WORLD-BEAM® QS18, 10-30V dc (cont'd)

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Models	Sensing Mode/LED*	Range	Laser Class	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet		
QS18VN6D		450 mm	—	2 m	NPN	EGCD-7 (p. 475)	BPD-7 (p. 498)	63908		
QS18VN6DQ8				4-pin Euro QD						
QS18VP6D				2 m	PNP					
QS18VP6DQ8				4-pin Euro QD						
QS18VN6DB				2 m	NPN				EGCD-8 (p. 475)	BPD-8 (p. 498)
QS18VN6DBQ8				4-pin Euro QD						
QS18VP6DB				2 m	PNP					
QS18VP6DBQ8				4-pin Euro QD						
QS18VN6W		100 mm	—	2 m	NPN	EGCD-9 (p. 475)	BPD-9 (p. 498)	63908		
QS18VN6WQ8				4-pin Euro QD						
QS18VP6W				2 m	PNP					
QS18VP6WQ8				4-pin Euro QD						
QS18VN6LD		300 mm	Class 1	2 m	NPN	EGCD-10 (p. 475)	BPD-10 (p. 498)	118899		
QS18VN6LDQ8				4-pin Euro QD						
QS18VP6LD				2 m	PNP					
QS18VP6LDQ8				4-pin Euro QD						
QS18VN6AF100		1 mm to cutoff point (adjustable between 20-100 mm)	—	2 m	NPN	EGCA-1 (p. 481) Cutoff Point Deviation Curve CPDC-1 (p. 517)	—			
QS18VN6AF100Q5				4-pin Euro Pigtail QD						
QS18VP6AF100				2 m	PNP					
QS18VP6AF100Q5				4-pin Euro Pigtail QD						
QS18VN6LAF		1 mm to cutoff point (adjustable between 30-150 mm)	Class 1	2 m	NPN	EGCA-2 (p. 481) Cutoff Point Deviation Curve CPDC-2 (p. 517)	—	66981		
QS18VN6LAFQ5				4-pin Euro Pigtail QD						
QS18VP6LAF				2 m	PNP					
QS18VP6LAFQ5				4-pin Euro Pigtail QD						
QS18VN6LAF250		20 mm to cutoff point (adjustable between 50-250 mm)	Class 2	2 m	NPN	EGCA-3 (p. 481) Cutoff Point Deviation Curve CPDC-3 (p. 517)	—			
QS18VN6LAF250Q5				4-pin Euro Pigtail QD						
QS18VP6LAF250				2 m	PNP					
QS18VP6LAF250Q5				4-pin Euro Pigtail QD						
QS18VN6FF50		0-50 mm Cutoff	—	2 m	NPN	EGCF-7 (p. 482)	—	63908		
QS18VN6FF50Q8				4-pin Euro Pigtail QD						
QS18VP6FF50				2 m	PNP					
QS18VP6FF50Q8				4-pin Euro Pigtail QD						

* Infrared LED Visible Red LED Visible Red Laser

** For 9 m cable, add suffix **W30** to the 2 m model number (example, **QS18VN6W W30**). A model with a QD requires a mating cable (see pages 410 and 412)

QD models (except Adjustable-field):

• For 4-pin integral Euro-style QD, add suffix **Q8** (example, **QS18VN6WQ8**)

• For 4-pin integral Pico-style QD, add suffix **Q7** (example, **QS18VN6WQ7**)

QD models (Adjustable-field only):

• For 4-pin 150 mm Pico-style pigtail QD, add suffix **Q** (example, **QS18VP6AF100Q**)

• For 4-pin 150 mm Euro-style pigtail QD, add suffix **Q5** (example, **QS18VN6WQ5**)

• For 4-pin 150 mm Pico-style pigtail QD, add suffix **Q** (example, **QS18VN6WQ**)

• For 4-pin 150 mm Euro-style pigtail QD, add suffix **Q5** (example, **QS18VP6AF100Q5**)

More on next page



WORLD-BEAM® QS18, 10-30V dc (cont'd)

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Models	Sensing Mode/LED*	Range	Laser Class	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
QS18VN6FF100	 FIXED-FIELD	0-100 mm Cutoff	—	2 m	NPN	EGCF-8 (p. 482)	—	63908
QS18VN6FF100Q8				4-pin Euro QD				
QS18VP6FF100				2 m	PNP			
QS18VP6FF100Q8				4-pin Euro QD				
QS18VN6F	 GLASS FIBER	Range varies by sensing mode and fiber optics used	—	2 m	NPN	EGCG-1 & EGCG-2 (p. 485)	BPG-1 & BPG-2 (p. 504)	63908
QS18VN6FQ8				4-pin Euro QD				
QS18VP6F				2 m	PNP			
QS18VP6FQ8				4-pin Euro QD				
QS18VN6FP	 PLASTIC FIBER	Range varies by sensing mode and fiber optics used	—	2 m	NPN	EGCP-1 & EGCP-2 (p. 488)	BPP-1 & BPP-2 (p. 507)	63908
QS18VN6FPQ8				4-pin Euro QD				
QS18VP6FP				2 m	PNP			
QS18VP6FPQ8				4-pin Euro QD				

* Infrared LED Visible Red LED

** For 9 m cable, add suffix **W30** to the 2 m model number (example, **QS18VN6F W30**). A model with a QD requires a mating cable (see pages 410 & 412).

QD models:

- For 4-pin integral Euro-style QD, add suffix **Q8** (example, **QS18VN6FQ8**).
- For 4-pin 150 mm Euro-style pigtail QD, add suffix **Q5** (example, **QS18VN6FQ5**).
- For 4-pin integral Pico-style QD, add suffix **Q7** (example, **QS18VN6FQ7**).
- For 4-pin 150 mm Pico-style pigtail QD, add suffix **Q** (example, **QS18VN6FQ**).




WORLD-BEAM® QS18 Specifications

Supply Voltage	Retroreflective, Diffuse and Adjustable-field Laser: 10 to 30V dc (10% max. ripple) at less than 15 mA, exclusive of load Laser Emitters: 10 to 30V dc (10% max. ripple) at less than 35 mA, exclusive of load All others: 10 to 30V dc (10% max. ripple) at less than 25 mA, exclusive of load
Laser Characteristics (Laser models only)	Wavelength: Class 1: 650 nm visible red Class 2: 658 nm visible red Pulse width: 7 microseconds (Laser Emitter: 5 microseconds) Rep rate: 130 microseconds (Laser Emitter: 27 microseconds) Average output power: Adjustable-field laser (Class 2): 0.2 mW Laser Emitters: less than 1.8 mW All others: 0.065 mW
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Laser Control	Enable beam by applying 0V dc to white wire; apply +10 to 30V dc to white wire to inhibit (extinguish) beam
Output Configuration*	Solid-state complementary; NPN (current sinking) or PNP (current sourcing), depending on model Rating: 100 mA max. each output at 25° C OFF-state leakage current: Retroreflective, Diffuse and Adjustable-field Laser: NPN: less than 200 µA @ 30V dc PNP: less than 10 µA @ 30V dc Fixed-field: less than 200 µA @ 30V dc All others: less than 50 µA @ 30V dc ON-state saturation voltage: Retroreflective, Diffuse and Adjustable-field Laser: NPN: less than 1.6V @ 100 mA PNP: less than 2.0V @ 100 mA All others: less than 1V @ 10 mA; less than 1.5V @ 100 mA Protected against false pulse on power-up and continuous overload or short circuit of outputs
Output Response Time*	Opposed: 750 microseconds ON; 375 microseconds OFF Retroreflective Laser, Diffuse Laser and Adjustable-field: 700 microseconds ON/OFF Fixed-field: 850 microseconds ON/OFF All others: 600 microseconds ON/OFF
Delay at Power-up	Laser Emitters: 1.5 seconds Retroreflective, Diffuse and Adjustable-field Laser: 200 milliseconds; outputs do not conduct during this time. All others: 100 milliseconds; outputs do not conduct during this time.

* Does not apply to laser emitter models.



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WORLD-BEAM® QS18 Specifications (cont'd)			
Repeatability*	Opposed: 100 microseconds Retroreflective Laser, Diffuse Laser and Adjustable-field Laser: 130 microseconds Adjustable-field: 175 microseconds Fixed-field: 160 microseconds All others: 150 microseconds		
Sensing Hysteresis*	Retroreflective Laser: 12% of range typical Diffuse Laser: 15% of range typical Adjustable-field: 0.5% of range typical at 20 mm cutoff 1% of range typical at 50 mm cutoff 3% of range typical at 100 mm cutoff Adjustable-field Laser (Class 1): 1% range typical at 30 mm cutoff 2% range typical at 75 mm cutoff 5% range typical at 150 mm cutoff Adjustable-field Laser (Class 2): 1% range typical at 50 mm cutoff 2% range typical at 150 mm cutoff 5% range typical at 250 mm cutoff		
Adjustments*	Retroreflective, Retroreflective Laser, Convergent, Diffuse, Diffuse Laser and Glass & Plastic Fiber Optic: Single-turn sensitivity (Gain) adjustment potentiometer Adjustable-field: Five-turn adjustment screw sets cutoff distance between min. and max. position, clutched at both ends of travel		
Indicators	Laser Emitters: Green LED: Power applied All others, 2 LED indicators: Green ON steady: Power ON Green flashing: Output overloaded Yellow† ON steady: Light sensed Yellow† flashing: Marginal excess gain (1.0 to 1.5x excess gain) in the light condition †NOTE: Prior to date code 0223, the output indicator was red instead of yellow.		
Construction	ABS housing, rated IEC IP67; NEMA 6; acrylic lens cover (Laser Emitter models have PMMA window) 2.5 mm (adjustable-field only) and 3 mm mounting hardware included		
Connections	2 m or 9 m 4-wire PVC cable, or 4-pin 150 mm pigtail Pico-style QD (Q), or 4-pin 150 mm pigtail Euro-style QD (Q5), or 4-pin Integral Pico-style QD (Q7), or 4-pin Integral Euro-style QD (Q8), depending on model. See pages 410 and 412.		
Operating Conditions	Laser Temperature: -10° to +50° C Relative humidity: 95% @ 50° C (non-condensing)	Adjustable-field Temperature: 0° to +55° C	All others Temperature: -20° to +70° C
Laser Classification (Laser models only)	Class 1 and Class 2 laser product; complies with EN60825-1: 2001 and 21 CFR 1040.10, except deviations pursuant to Laser Notice 50, dated 7-26-01.		
Certifications	Ultrasonic: 	All others:  	
Hookup Diagrams	Emitters: DC02 (p. 520) Laser Emitters: DC20 (p. 524)	All others: DC03 (p. 520)	

* Does not apply to laser emitter models.

Class 1 Laser Sensors

Lasers that are safe under reasonably foreseeable conditions of operation, including the use of optical instruments for intrabeam viewing. Reference 60825-1 Amend. 2 © IEC:2001(E), section 8.2.

Class 2 Lasers

Lasers that emit visible radiation in the wavelength range from 400 nm to 700 nm, where eye protection is normally afforded by aversion responses, including the blink reflex. This reaction may be expected to provide adequate protection under reasonably foreseeable conditions of operation, including the use of optical instruments for intrabeam viewing. Reference IEC 60825-1:2001, section 8.2.

For safe laser use (Class 1 or Class 2):

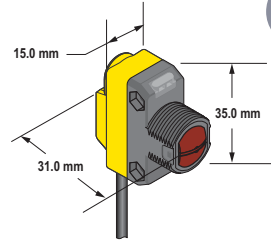
- Do not permit a person to stare at the laser from within the beam.
- Do not point the laser at a person's eye at close range.
- Terminate the beam emitted by a Class 2 laser product at the end of its useful path. Locate open laser beam paths either above or below eye level, where practical.



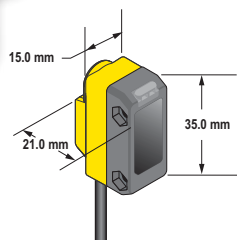
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WORLD-BEAM® QS18 Expert™ and Ultrasonic Sensors

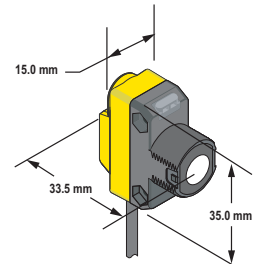
- Bright LED status indicators visible from 360°
- Simple push-button programming
- 18 mm threaded lens mount on some models



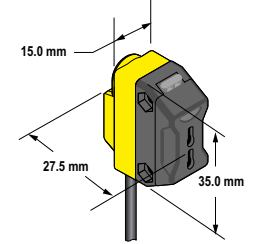
Retroreflective, Convergent and Diffuse Models
Suffix LP, CV15, CV45, D and DV



Diffuse Models
Suffix DB and W



Ultrasonic Models
Suffix NA and PA



Plastic Fiber Models
Suffix FP

WORLD-BEAM® QS18 Expert™, 10-30V dc



Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet				
QS18EN6LP	POLAR RETRO	3.5 m†	2 m	NPN	EGCR-12 (p. 471)	BPR-11 (p. 495)	136564				
QS18EN6LPQ8			4-pin Euro QD								
QS18EP6LP			2 m	PNP							
QS18EP6LPQ8			4-pin Euro QD								
QS18EN6CV15	CONVERGENT	16 mm	2 m	NPN	EGCC-11 (p. 478)	BPC-11 (p. 501)					
QS18EN6CV15Q8			4-pin Euro QD								
QS18EP6CV15			2 m	PNP							
QS18EP6CV15Q8			4-pin Euro QD								
QS18EN6CV45			43 mm	2 m				NPN	EGCC-12 (p. 478)	BPC-12 (p. 501)	
QS18EN6CV45Q8											4-pin Euro QD
QS18EP6CV45								2 m			PNP
QS18EP6CV45Q8								4-pin Euro QD			
QS18EN6D	DIFFUSE	800 mm	2 m	NPN	EGCD-11 (p. 475)	BPD-11 (p. 498)					
QS18EN6DQ8			4-pin Euro QD								
QS18EP6D			2 m	PNP							
QS18EP6DQ8			4-pin Euro QD								
QS18EN6DB			500 mm	2 m			NPN	EGCD-12 (p. 475)	BPD-12 (p. 498)		
QS18EN6DBQ8										4-pin Euro QD	
QS18EP6DB							2 m			PNP	
QS18EP6DBQ8							4-pin Euro QD				

* Infrared LED Visible Red LED

** For 9 m cable, add suffix W/30 to the 2 m model number (example, QS18EN6LP W/30). A model with a QD requires a mating cable (see pages 410 and 412).

QD models:

- For 4-pin integral Euro-style QD, add suffix Q8 (example, QS18EN6LPQ8).
- For 4-pin 150 mm Euro-style pigtail QD, add suffix Q5 (example, QS18EN6LPQ5).
- For 4-pin integral Pico-style QD, add suffix Q7 (example, QS18EN6LPQ7).
- For 4-pin 150 mm Pico-style pigtail QD, add suffix Q (example, QS18EN6LPQ).

† Retroreflective range is specified using one model BRT-84 retroreflector. Actual sensing range may differ, depending on the efficiency and reflective area of the retroreflector used. See Accessories for more information.





WORLD-BEAM® QS18 Expert™, 10-30V dc (cont'd)

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
QS18EN6W		300 mm	2 m	NPN	EGCD-13 (p. 475)	BPD-13 (p. 498)	136564
QS18EN6WQ8			4-pin Euro QD				
QS18EP6W			2 m	PNP			
QS18EP6WQ8			4-pin Euro QD				
QS18EN6DV		600 mm	2 m	NPN	EGCD-14 (p. 475)	BPD-14 (p. 498)	
QS18EN6DVQ8			4-pin Euro QD				
QS18EP6DV			2 m	PNP			
QS18EP6DVQ8			4-pin Euro QD				
QS18EN6FP		Range varies by sensing mode and fiber optics used	2 m	NPN	EGCP-3 & EGCP-4 (p. 488)	BPD-3 & BPD-4 (p. 507)	
QS18EN6FPQ8			4-pin Euro QD				
QS18EP6FP			2 m	PNP			
QS18EP6FPQ8			4-pin Euro QD				

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WORLD-BEAM® QS18 Ultrasonic, 12-30V dc

Models†	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
QS18UNA		50 - 500 mm	2 m	NPN	—	—	119287
QS18UNAQ8			4-pin Euro QD				
QS18UNAE††			2 m				
QS18UNAEQ8††			4-pin Euro QD				
QS18UPA			2 m	PNP			
QS18UPAQ8			4-pin Euro QD				
QS18UPAE††			2 m				
QS18UPAEQ8††			4-pin Euro QD				

* Visible Red LED Infrared LED Ultrasonic

** For 9 m cable, add suffix **W30** to the 2 m model number (example, **QS18EN6W W30**). A model with a QD requires a mating cable (see pages 410, 411 and 412).

QD models:


- For 4-pin integral Euro-style QD, add suffix **Q8** (example, **QS18EN6WQ8**).
- For 4-pin integral Pico-style QD, add suffix **Q7** (example, **QS18EN6WDQ7**).

- For 4-pin 150 mm Euro-style pigtail QD, add suffix **Q5** (example, **QS18EN6WQ5**).
- For 4-pin 150 mm Pico-style pigtail QD, add suffix **Q** (example, **QS18EN6WQ**).

† For complete information see QS18U Ultrasonic Sensors on page 269.

†† Models are epoxy-encapsulated, IP68; NEMA6P with remote TEACH programming.

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WORLD-BEAM® QS18 Expert™ Specifications	
Supply Voltage	10 to 30V dc (10% max. ripple) at less than 35 mA, exclusive of load; 10 to 24V dc @ greater than 55° C
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	Solid-state NPN (current sinking) or PNP (current sourcing), depending on model. Configuration in TEACH sequence for light operate (LO) or dark operate (DO). Rating: 100 mA max. OFF-state leakage current: less than 50 µA @ 30V dc ON-state saturation voltage: less than 1.5V (2 m cable); 1.7V (9 m cable) Protected against false pulse on power-up and continuous overload or short circuit of output
Output Response Time	600 microseconds ON/OFF
Delay at Power-up	Momentary delay on power-up; outputs do not conduct during this time
Repeatability	75 microseconds
Adjustments	<ul style="list-style-type: none"> • Thresholds: Push-button/remote-wire configurable • Five Expert™-style TEACH and SET options <ul style="list-style-type: none"> Static TEACH: locates a single switchpoint at the optimal location between two taught conditions. The first condition taught is the ON condition. Dynamic TEACH: configures sensor during actual sensing conditions, taking multiple samples of light and dark conditions and automatically setting the threshold at the optimal level. Window SET: sets a single sensing window that extend 12.5% above and below presented condition. Light SET: sets a threshold approximately 12.5% below the presented sensing condition. Dark SET: sets a threshold approximately 12.5% above the presented condition. • Light/dark operate: selectable by programming order (load output follows the first taught target condition) • Push-button enable/disable: (remote wire only)
Indicators	2 LED indicators: Green: RUN mode, output short-circuit Yellow: Output ON/marginal, TEACH mode
Construction	Polycarbonate/ABS housing rated IEC IP67; NEMA 6 3 mm mounting hardware included
Connections	2 m or 9 m 4-wire PVC cable, or 4-pin 150 mm pigtail Pico-style QD (Q), or 4-pin 150 mm pigtail Euro-style QD (Q5), or 4-pin Integral Pico-style QD (Q7), or 4-pin Integral Euro-style QD (Q8). QD cables are ordered separately. See pages 410 and 412.
Operating Conditions	Temperature: -20° to +70° C Relative humidity: 95% @ 50° C (non-condensing)
Certifications	
Hookup Diagrams	DC07 (p. 521)

WORLD-BEAM® QS18 Ultrasonic Specifications

See page 269.



MINI-BEAM®

Broad Family of Compact Sensors

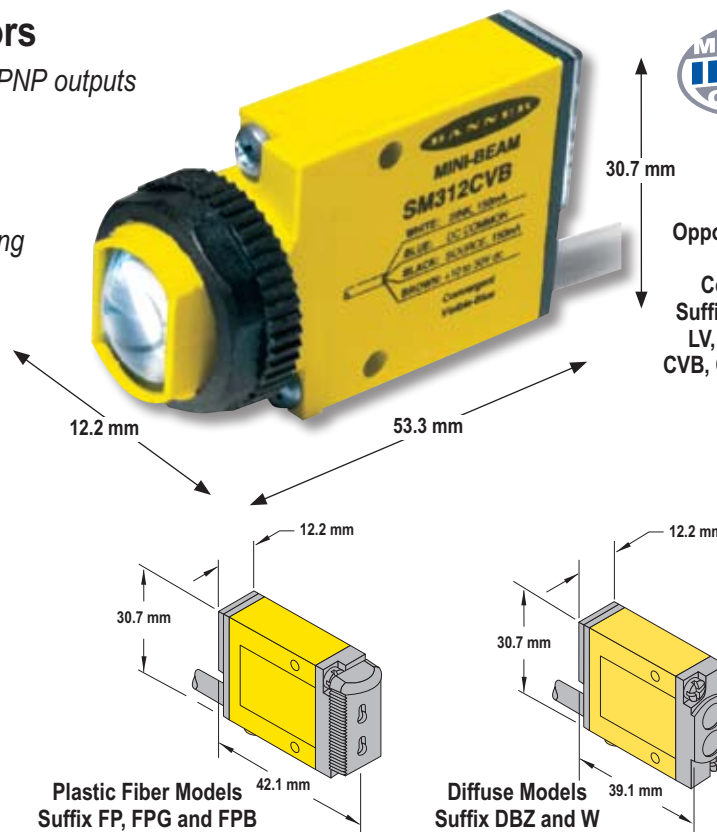
- Models are available for ac, dc or ac/dc universal voltage operation.
- Available models include opposed, opposed clear plastic detection, diffuse and divergent diffuse, polarized and non-polarized retroreflective, convergent, glass and plastic fiber optic.
- Convergent and fiber optic models offer infrared or visible red, blue, white, or green LED light source; select a color based on the application.
- SME312 Expert™ models offer easy, push-button TEACH-mode setup.
- MIAD9 series NAMUR models are for hazardous environments with approved switching amplifiers having intrinsically safe input circuits.
- MINI-BEAM models detect clear plastic; MINI-BEAM Expert™ models detect clear objects.

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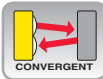
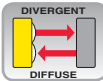
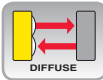
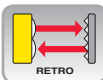
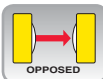
DC Models	page 80
AC Models	82
Expert™ Models	85
Universal Voltage Models	88
NAMUR Models	90

MINI-BEAM® DC Sensors

- 10 to 30V dc with bipolar NPN/PNP outputs
- Signal strength output indicator
- 2 m or 9 m integral cable, or Euro-style quick-disconnect fitting
- 18 mm threaded lens mount on some models



Opposed, Retroreflective, Diffuse and Convergent Models
 Suffix E, R, EPD, RPD, D, LV, LP, C, C2, CV, CV2, CVB, CV2B, CVG and CV2G



Glass Fiber Models
 Suffix F, FV, FVG and FVB

Plastic Fiber Models
 Suffix FP, FPG and FPB

Diffuse Models
 Suffix DBZ and W



MINI-BEAM®, 10-30V dc

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Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet	
SM31E Emitter		3 m	2 m	Bipolar NPN/PNP	EGCO-11 (p. 468)	BPO-11 (p. 492)	69943	
SM31EQD Emitter			4-Pin Euro QD					
SM31R			2 m					
SM31RQD			4-Pin Euro QD					
SM31EL Emitter	30 m	2 m	EGCO-12 (p. 468)		BPO-12 (p. 492)			
SM31ELQD Emitter		4-Pin Euro QD						
SM31RL		2 m						
SM31RLQD	4-Pin Euro QD							
SM31EPD Emitter		0.3 m	2 m		See Note Below***			
SM31RPD Emitter			4-Pin Euro QD					
SM31EPDQD								
SM31RPDQD								
SM312LV		5 m†	2 m		EGCR-13 (p. 471)	BPR-12 (p. 495)	69943	
SM312LVQD			4-Pin Euro QD					
SM312LVAG		50 mm - 2 m†	2 m		EGCR-14 (p. 471)	BPR-13 (p. 495)		
SM312LVAGQD			4-Pin Euro QD					
SM312LP		10 mm - 3 m†	2 m		EGCR-15 (p. 471)	BPR-14 (p. 495)		
SM312LPQD			4-Pin Euro QD					
SM312D		380 mm	2 m		EGCD-15 (p. 475)	BPD-15 (p. 498)	69943	
SM312DQD		300 mm	4-Pin Euro QD					
SM312DBZ			2 m					EGCD-16 (p. 475)
SM312DBZQD		4-Pin Euro QD						
SM312W		130 mm	2 m		EGCD-17 (p. 476)	BPD-17 (p. 499)		
SM312WQD			4-Pin Euro QD					
SM312C		16 mm	2 m		EGCC-13 (p. 478)	BPC-13 (p. 501)	69943	
SM312CQD		43 mm	4-Pin Euro QD					
SM312C2			2 m					EGCC-14 (p. 478)
SM312C2QD		4-Pin Euro QD						
SM312CV		16 mm	2 m	EGCC-15 (p. 478)	BPC-15 (p. 501)			
SM312CVQD		43 mm	4-Pin Euro QD					
SM312CV2			2 m			EGCC-16 (p. 478)		BPC-16 (p. 501)
SM312CV2QD		4-Pin Euro QD						
SM312CVG		16 mm	2 m	EGCC-17 (p. 479)	BPC-17 (p. 502)			
SM312CVGQD		49 mm	4-Pin Euro QD					
SM312CV2G			2 m			EGCC-18 (p. 479)		BPC-18 (p. 502)
SM312CV2GQD		4-Pin Euro QD						
SM312CVB		16 mm	2 m	EGCC-19 (p. 479)	BPC-19 (p. 502)			
SM312CVBQD		49 mm	4-Pin Euro QD					
SM312CV2B			2 m			EGCC-20 (p. 479)	BPC-20 (p. 502)	
SM312CV2BQD		4-Pin Euro QD						

* Infrared LED Visible Red LED Visible Green LED Visible Blue LED

** For 9 m cable, add suffix **W30** to the 2 m model number (example, **SM312D W30**). A model with a QD requires a mating cable (see page 412).

*** Actual range depends on light transmission through the plastic being sensed. Some clear plastic materials may not be detected. When in doubt, ask your Banner representative to evaluate material samples.

† Retroreflective range is specified using one model BRT-3 retroreflector. Actual sensing range may differ, depending on the efficiency and reflective area of the retroreflector used. See Accessories for more information.





MINI-BEAM®, 10-30V dc (cont'd)

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
SM312F		Range varies by sensing mode and fiber optics used	2 m	Bipolar NPN/PNP	EGCG-3 & EGCG-4 (p. 485)	BPG-3 & BPG-4 (p. 504)	69943
SM312FQD			4-Pin Euro QD				
SM312FV			2 m		EGCG-5 & EGCG-6 (p. 485)	BPG-5 & BPG-6 (p. 504)	
SM312FVQD			4-Pin Euro QD				
SM312FVG			2 m		EGCG-7 (p. 485)	BPG-7 (p. 504)	
SM312FVGQD			4-Pin Euro QD				
SM312FVB			2 m		EGCG-8 (p. 485)	BPG-8 (p. 504)	
SM312FVBQD			4-Pin Euro QD				
SM312FP			2 m		EGCP-5 & EGCP-6 (p. 488)	BPP-5 & BPP-6 (p. 507)	69943
SM312FPQD			4-Pin Euro QD				
SM312FPG			2 m		EGCP-7 (p. 488)	BPP-7 (p. 507)	
SM312FPGQD			4-Pin Euro QD				
SM312FPB			2 m		EGCP-8 (p. 488)	BPP-8 (p. 507)	
SM312FPBQD			4-Pin Euro QD				

* Infrared LED Visible Red LED Visible Green LED Visible Blue LED

** For 9 m cable, add suffix **W/30** to the 2 m model number (example, **SM312F W/30**). A model with a QD requires a mating cable (see page 412).

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MINI-BEAM® DC Specifications	
Supply Voltage and Current	10 to 30V dc (10% max. ripple) at less than 25 mA (exclusive of load)
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	Bipolar: One current sourcing (PNP) and one current sinking (NPN) open-collector transistor; light operate (LO) or dark operate (DO) selectable.
Output Rating	150 mA max. each output at 25° C, derated to 100 mA at 70° C (derate ≈ 1 mA per ° C) OFF-state leakage current: less than 1 µA Output saturation voltage (PNP output): less than 1 V @ 10 mA; less than 2 V @ 150 mA Output saturation voltage (NPN output): less than 200 mV @ 10mA; less than 1 V @ 150 mA
Output Protection Circuitry	Protected against false pulse on power-up and continuous overload or short-circuit of outputs
Output Response Time	Sensors will respond to either a "light" or a "dark" signal of 1 millisecond or longer duration, 500 Hz max. 0.3 millisecond response modification is available. See note below†. NOTE: 100 millisecond delay on power-up: outputs do not conduct during this time.
Repeatability	Opposed: 0.14 milliseconds Non-Polarized and Polarized Retroreflective, Diffuse, Convergent, and Glass and Plastic Fiber Optic: 0.3 milliseconds. Response time and repeatability specifications are independent of signal strength.
Adjustments	LIGHT/DARK OPERATE select switch, and 15-turn slotted brass screw GAIN (sensitivity) adjustment potentiometer (clutched at both ends of travel). Both controls are located on rear panel of sensor and protected by a gasketed, clear acrylic cover.
Indicators	Alignment Indicating Device system (AID) lights a rear-panel mounted red LED indicator whenever the sensor sees a "light" condition, with a superimposed pulse rate proportional to the light signal strength (the stronger the signal, the faster the pulse rate).
Construction	Reinforced thermoplastic polyester housing, totally encapsulated, o-ring sealing, acrylic lenses, and stainless steel screws.
Environmental Rating	Meets NEMA standards 1, 2, 3, 3S, 4, 4X, 6, 12, and 13; IEC IP67
Connections	PVC-jacketed 4-conductor 2 m or 9 m cables, or 4-pin Euro-style quick-disconnect (QD) fitting are available. QD cables are ordered separately. See page 412.
Operating Conditions	Temperature: -20° to +70° C Relative humidity: 90% at 50° C (non-condensing)
Certifications	
Hookup Diagrams	Emitters: DC02 (p. 520) Other Models: DC04 (p. 520)

† NOTE: DC MINI-BEAMS may be ordered with 0.3 millisecond ON/OFF response by adding suffix **MHS** to the model number (example, **SM312LVMHS**). This modification reduces sensing range (and excess gain).

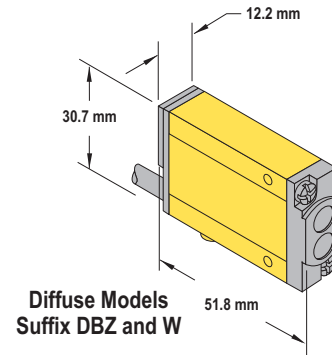
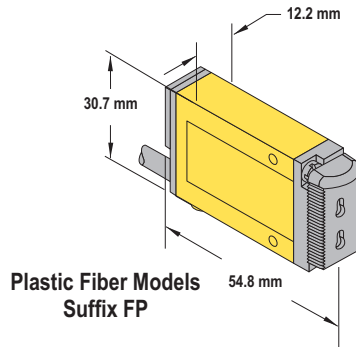
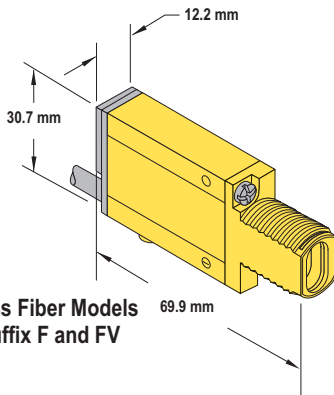
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MINI-BEAM® AC Sensors

- 24 to 240V ac with solid-state outputs
- Signal strength or output indicator
- 2 m or 9 m integral cable, Micro-style quick-disconnect fitting
- 18 mm threaded lens mount on some models



Opposed, Retroreflective, Diffuse and Convergent Models
Suffix E, R, EPD, RPD, D, LV, LP, C and CV



MINI-BEAM®, 24-240V ac



Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
SMA31E Emitter		3 m	2 m	SPST Solid-State 2-Wire	EGCO-11 (p. 468)	BPO-11 (p. 492)	69942
SMA31EQD Emitter			3-Pin Micro QD				
SM2A31R			2 m				
SM2A31RQD			3-Pin Micro QD				
SMA31EL Emitter		30 m	2 m		EGCO-12 (p. 468)	BPO-12 (p. 492)	
SMA31ELQD Emitter			3-Pin Micro QD				
SM2A31RL			2 m				
SM2A31RLQD			3-Pin Micro QD				
SMA31EPD Emitter		0.3 m	2 m		See Note Below***		
SMA31EPQD Emitter			3-Pin Micro QD				
SM2A31RPD			2 m				
SM2A31RPDQD			3-Pin Micro QD				
SM2A312D		380 mm	2 m	EGCD-15 (p. 475)	BPD-15 (p. 498)	69942	
SM2A312DQD			3-Pin Micro QD				
SM2A312DBZ		300 mm	2 m				
SM2A312DBZQD			3-Pin Micro QD				

* Infrared LED Visible Red LED

** For 9 m cable, add suffix **W30** to the 2 m model number (example, **SM2A312D W30**). A model with a QD requires a mating cable (see page 419).

*** Actual range depends on light transmission through the plastic being sensed. Some clear plastic materials may not be detected. When in doubt, ask your Banner representative to evaluate material samples.





MINI-BEAM®, 24-240V ac (cont'd)

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet	
SM2A312W	DIVERGENT DIFFUSE	130 mm	2 m	SPST Solid-state 2-Wire	EGCD-17 (p. 476)	BPD-17 (p. 499)	69942	
SM2A312WQD			3-Pin Micro QD					
SM2A312LV	RETRO	5 m†	2 m		EGCR-13 (p. 471)	BPR-12 (p. 495)	69942	
SM2A312LVQD			3-Pin Micro QD					
SM2A312LVAG	POLAR RETRO	50 mm - 2 m†	2 m		EGCR-14 (p. 471)	BPR-13 (p. 495)		
SM2A312LVAGQD			3-Pin Micro QD					
SM2A312LP	EXTENDED RANGE POLAR RETRO	10 mm - 3 m†	2 m		EGCR-15 (p. 471)	BPR-14 (p. 495)		
SM2A312LPQD			3-Pin Micro QD					
SM2A312C	CONVERGENT	16 mm	2 m		EGCC-13 (p. 478)	BPC-13 (p. 501)		69942
SM2A312CQD			3-Pin Micro QD					
SM2A312C2		43 mm	2 m		EGCC-14 (p. 478)	BPC-14 (p. 501)		
SM2A312C2QD			3-Pin Micro QD					
SM2A312CV	CONVERGENT	16 mm	2 m		EGCC-15 (p. 478)	BPC-15 (p. 501)		
SM2A312CVQD			3-Pin Micro QD					
SM2A312CV2		43 mm	2 m		EGCC-16 (p. 478)	BPC-16 (p. 502)		
SM2A312CV2QD			3-Pin Micro QD					
SM2A312CVG	CONVERGENT	16 mm	2 m	EGCC-17 (p. 479)	BPC-17 (p. 502)			
SM2A312CVGQD			3-Pin Micro QD					
SM2A312F	GLASS FIBER	Range varies by sensing mode and fiber optics used	2 m	EGCG-3 & EGCG-4 (p. 485)	BPG-3 & BPG-4 (p. 504)	69942		
SM2A312FQD			3-Pin Micro QD					
SM2A312FV			2 m				EGCG-5 & EGCG-6 (p. 485)	BPG-5 & BPG-6 (p. 504)
SM2A312FVQD			3-Pin Micro QD					
SM2A312FP	PLASTIC FIBER	Range varies by sensing mode and fiber optics used	2 m	EGCP-5 & EGCP-6 (p. 488)	BPP-5 & BPP-6 (p. 507)	69942		
SM2A312FPQD			3-Pin Micro QD					


* Infrared LED Visible Red LED Visible Green LED

** For 9 m cable, add suffix **W/30** to the 2 m model number (example, **SM2A312LP W/30**). A model with a QD requires a mating cable (see page 419).

† Retroreflective range is specified using one model BRT-3 retroreflector. Actual sensing range may differ, depending on the efficiency and reflective area of the retroreflector used. See Accessories for more information.

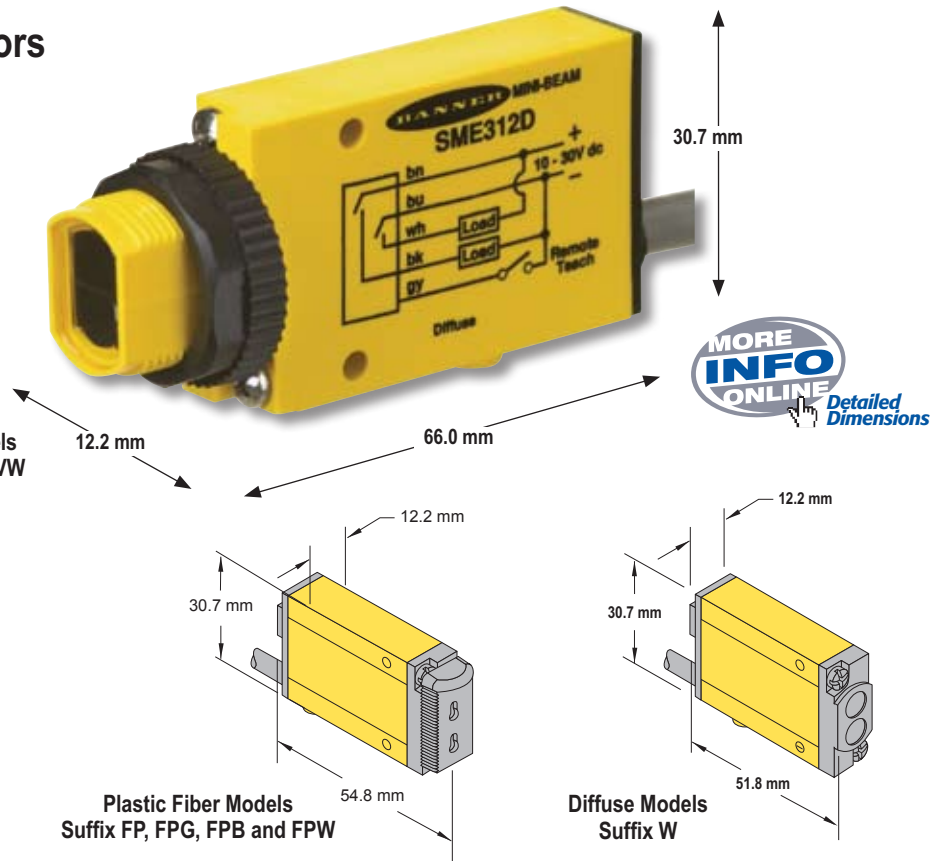


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MINI-BEAM® AC Specifications	
Supply Voltage and Current	24 to 240V ac (50/60 Hz), 250V ac max
Supply Protection Circuitry	Protected against transient voltages
Output Configuration	SPST SCR solid-state relay (light/dark operate selectable); 2-wire hookup
Output Rating	Min. load current 5 mA max. steady-state load capability 300 mA to 50° C ambient 100 mA to 70° C ambient Inrush capability: 3 amps for 1 second (non repetitive); 10 amps for 1 cycle (non repetitive) OFF-state leakage current: less than 1.7 mA rms ON-state voltage drop: ≤ 5 volts at 300 mA load, ≤ 10 volts at 15 mA load
Output Protection Circuitry	Protected against false pulse on power-up
Output Response Time	Opposed: 2 milliseconds ON and 1 millisecond OFF Non-Polarized and Polarized Retroreflective, Convergent and Plastic Fiber Optic: 4 milliseconds ON and OFF Diffuse and Glass Fiber Optic: 8 milliseconds ON and OFF OFF response time specification does not include load response of up to ½ ac cycle (8.3 milliseconds). Response time specification of load should be considered when important. NOTE: 300 millisecond delay on power-up.
Repeatability	Opposed: 0.3 milliseconds Non-Polarized and Polarized Retroreflective, Convergent and Plastic Fiber Optic: 1.3 milliseconds Diffuse and Glass Fiber Optics: 2.6 milliseconds Response time and repeatability specifications are independent of signal strength.
Adjustments	LIGHT/DARK OPERATE select switch, and 15-turn slotted brass screw GAIN (sensitivity) adjustment potentiometer (clutched at both ends of travel). Both controls are located on rear panel of sensor and protected by a gasketed, clear acrylic cover.
Indicators	Red indicator LED on rear of sensor is "ON" when the load is energized
Construction	Reinforced thermoplastic polyester housing, totally encapsulated, o-ring sealing, acrylic lenses, and stainless steel screws
Environmental Rating	Meets NEMA standards 1, 2, 3, 3S, 4, 4X, 6, 12, and 13; IEC IP67
Connections	PVC-jacketed 2-conductor 2 m or 9 m cables, or 3-pin Micro-style quick-disconnect (QD) fitting are available. QD cables are ordered separately. See page 419.
Operating Conditions	Temperature: -20° to +70° C Relative humidity: 90% at 50° C (non-condensing)
Application Notes	i) Overload conditions can destroy ac MINI-BEAM sensors. Directly wiring sensor without load series across hot and neutral will damage sensor (except emitter models). ii) Low voltage use requires careful analysis of the load to determine if the leakage current or on-state voltage of the sensor will interfere with proper operation of the load. iii) The false-pulse protection feature may cause momentary drop-out of the load when the sensor is wired in series or parallel with mechanical switch contacts.
Certifications	
Hookup Diagrams	Cabled Emitters: AC03 (p. 525) All Other QD Models: AC02 (p. 525) QD Emitters: AC04 (p. 525) All Other Cabled Models: AC01 (p. 525)

MINI-BEAM® Expert™ Sensors

- Simple push-button programming or remote TEACH via wire
- Dual-LED multi-function indicators
- 2 m or 9 m integral cable, or Euro-style quick-disconnect fitting
- Popular 18 mm threaded lens mount



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Retroreflective, Diffuse and Convergent Models
Suffix LV, LP, D, DV, CV, CV2, CVG, CVB and CVW

Glass Fiber Models
Suffix F, FV, FVG, FVB and FVW

Plastic Fiber Models
Suffix FP, FPG, FPB and FPW

Diffuse Models
Suffix W

MINI-BEAM® Expert™, 10-30V dc



Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
SME312LV		5 m†	2 m	Bipolar NPN/PNP	EGCR-16 (p. 471)	BPR-15 (p. 495)	55214
SME312LVQD			5-Pin Euro QD				
SME312LP		10 mm - 3 m†	2 m		EGCR-17 (p. 472)	BPR-16 (p. 495)	55214
SME312LPQD			5-Pin Euro QD				
SME312LPC***		1 m	2 m		EGCR-18 (p. 472)	BPR-17 (p. 496)	55214
SME312LPCQD***			5-Pin Euro QD				
SME312D		380 mm	2 m		EGCD-18 (p. 476)	BPD-18 (p. 499)	55214
SME312DQD			5-Pin Euro QD				
SME312DV		1100 mm	2 m		EGCD-20 (p. 476)	BPD-20 (p. 499)	
SME312DVQD			5-Pin Euro QD				
SME312W		130 mm	2 m	EGCD-19 (p. 476)	BPD-19 (p. 499)		
SME312WQD			5-Pin Euro QD				

* Infrared LED Visible Red LED

** For 9 m cable, add suffix W30 to the 2 m model number (example, SME312D W30). A model with a QD requires a mating cable (see page 414).

*** NOTE: For clear object detection, sensing range varies, according to the efficiency and reflective area of the retroreflector(s) used.

For these low-contrast applications, the model BRT-2X2 reflector is recommended and is included with each SME312LPC(QD) sensor.

- For applications with high vibration, the model BRT-51X51BM, with its micro-prism geometry, is recommended.
- For long-range applications, the BRT-77X77C reflector provides a range up to 2 m.
- SME312LPC(QD) are for use with corner cube type reflectors only; reflective tape is not recommended. See page 425 for more information.

† NOTE: Retroreflective range is specified using one model BRT-3 retroreflector, unless otherwise noted. Actual sensing range may differ, depending on the efficiency and reflective area of the retroreflector used. See Accessories section for more information.






MINI-BEAM® Expert™, 10-30V dc (cont'd)

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Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet			
SME312CV		16 mm	2 m	Bipolar NPN/PNP	EGCC-21 (p. 479)	BPC-21 (p. 502)	55214			
SME312CVQD			5-Pin Euro QD							
SME312CV2		43 mm	2 m							
SME312CV2QD			5-Pin Euro QD							
SME312CVG		16 mm	2 m							
SME312CVGQD			5-Pin Euro QD							
SME312CVB		16 mm	2 m							
SME312CVBQD			5-Pin Euro QD							
SME312CVW		16 mm	2 m							
SME312CVWQD			5-Pin Euro QD							
SME312F		Range varies by sensing mode and fiber optics used	2 m		Bipolar NPN/PNP	EGCG-9 & EGCG-10 (p. 485)		BPG-9 & BPG-10 (p. 504)	55214	
SME312FQD			5-Pin Euro QD							
SME312FV			2 m							
SME312FVQD			5-Pin Euro QD							
SME312FVG			2 m							
SME312FVGQD			5-Pin Euro QD							
SME312FVB			2 m							
SME312FVBQD			5-Pin Euro QD							
SME312FVW			2 m							
SME312FVWQD			5-Pin Euro QD							
SME312FP			Range varies by sensing mode and fiber optics used	2 m		Bipolar NPN/PNP	EGCP-9 & EGCP-10 (p. 488)	BPP-9 & BPP-10 (p. 507)		55214
SME312FPQD				5-Pin Euro QD						
SME312FPG				2 m						
SME312FPGQD				5-Pin Euro QD						
SME312FPB				2 m						
SME312FPBQD				5-Pin Euro QD						
SME312FPW		2 m								
SME312FPWQD		5-Pin Euro QD								

* Infrared LED Visible Red LED Visible Green LED Visible Blue LED Visible White LED

** For 9 m cable, add suffix W/30 to the 2 m model number (example, SME312CV W/30). A model with a QD requires a mating cable (see page 414).

MINI-BEAM® <i>Expert</i> ™ Specifications	
Supply Voltage and Current	10 to 30V dc (10% max. ripple) at less than 45 mA, exclusive of load
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	Bipolar: One current sourcing (PNP) and one current sinking (NPN) open-collector transistor. Configuration in TEACH sequence for Light Operate (LO) or Dark Operate (DO).
Output Rating	150 mA max. each output at 25° C, derated to 100 mA at 70° C (derate ≈ 1 mA per ° C) OFF-state leakage current: less than 5 µA @ 30V dc Output saturation voltage (PNP output): less than 1 V at 10 mA and less than 2 V at 150 mA Output saturation voltage (NPN output): less than 200 mV at 10 mA and less than 1 V at 150 mA
Output Protection Circuitry	Protected against false pulse on power-up and continuous overload or short-circuit of outputs
Output Response Time	Sensors will respond to either a “light” or a “dark” signal of 500 microseconds or longer duration, 1 kHz max. NOTE: 1 second delay on power-up; outputs do not conduct during this time.
Repeatability	100 microseconds (all models)
Adjustments	Push-button TEACH mode sensitivity setting; remote TEACH mode input is provided (gray wire)
Indicators	Two LEDs: Yellow and Bicolor Green/Red Green (RUN Mode): ON when power is applied Flashes when received light level approaches the switching threshold Red (TEACH Mode): OFF when no signal is received. Pulses to indicate signal strength (received light level). Rate is proportional to signal strength (the stronger the signal, the faster the pulse rate). This is a function of Banner’s Alignment Indicating Device (AID). Yellow (TEACH Mode): ON to indicate sensor is ready to learn output ON condition OFF to indicate sensor is ready to learn output OFF condition Yellow (RUN Mode): ON when outputs are conducting
Construction	Reinforced thermoplastic polyester housing, totally encapsulated, o-ring seal, acrylic lenses, and stainless steel screws.
Environmental Rating	Meets NEMA standards 1, 2, 3, 3S, 4, 4X, 6, 12, and 13; IEC IP67
Connections	PVC-jacketed 5-conductor 2 m or 9 m unterminated cable, or 5-pin Euro-style quick-disconnect (QD) fitting are available. QD cables are ordered separately. See page 414.
Operating Conditions	Temperature: -20° to +70° C Relative humidity: 90% at 50° C (non-condensing)
Application Notes	The first condition presented during TEACH mode becomes the output ON condition.
Certifications	
Hookup Diagrams	DC08 (p. 521)

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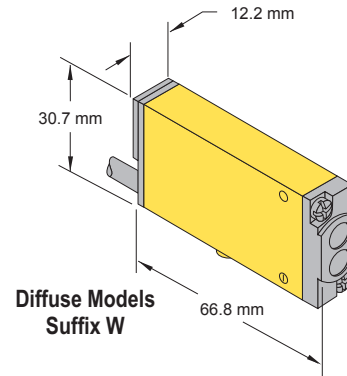
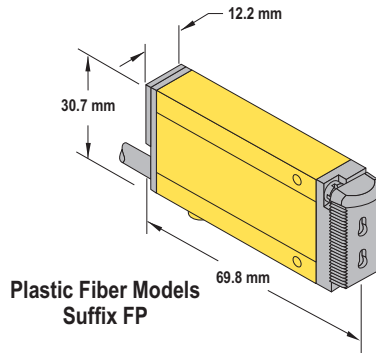
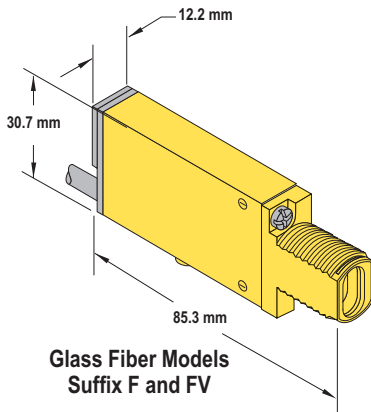
MINI-BEAM® Universal Voltage Sensors

- Popular, compact MINI-BEAM package with a SPDT electromechanical (E/M) relay
- Universal supply voltage: 24 to 240V ac, 50/60 Hz; 24 to 240V dc
- Easy-to-operate sensors with few required adjustments



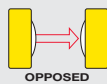
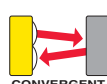
MORE INFO ONLINE
Detailed Dimensions

Opposed, Retroreflective, Diffuse and Convergent Models
Suffix E, EL, R, RL, LV, LP, D, CV and CV2



MINI-BEAM® Universal Voltage, 24-240V ac or dc

MORE INFO ONLINE
Download PDF

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet		
SMU31E Emitter	 OPPOSED	3 m	2 m	SPDT E/M Relay	EGCO-13 (p. 468)	BPO-13 (p. 492)	55230		
SMU31R		30 m	2 m		EGCO-14 (p. 468)	BPO-14 (p. 492)			
SMU31EL Emitter					5 m†	2 m		EGCR-19 (p. 472)	BPR-18 (p. 496)
SMU31RL								EGCR-20 (p. 472)	BPR-19 (p. 496)
SMU315LV	RETRO	10 mm - 3 m†	2 m		EGCD-21 (p. 476)	BPD-21 (p. 499)			
SMU315LP	POLAR RETRO	130 mm	2 m		EGCD-22 (p. 476)	BPD-22 (p. 499)			
SMU315D	DIFFUSE	16 mm	2 m		EGCC-26 (p. 479)	BPC-26 (p. 502)			
SMU315W	DIVERGENT DIFFUSE	43 mm	2 m		EGCC-27 (p. 479)	BPC-27 (p. 502)			
SMU315CV	 CONVERGENT	16 mm	2 m						
SMU315CV2		43 mm	2 m						

*  Infrared LED  Visible Red LED

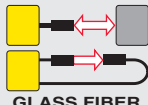

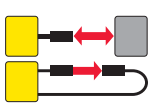
** For 9 m cable, add suffix W/30 to the 2 m model number (example, SMU315D W/30).



† Retroreflective range is specified using one model BRT-3 retroreflector. Actual sensing range may differ, depending on the efficiency and reflective area of the retroreflector used. See Accessories for more information.

More on next page




MINI-BEAM® Universal Voltage, 24-240V ac or dc (cont'd)

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
SMU315F	 GLASS FIBER	Range varies by sensing mode and fiber optics used	2 m	SPDT E/M Relay	EGCG-16 (p. 485) & EGCG-17 (p. 486)	BPG-16 (p. 504) & BPG-17 (p. 505)	55230
SMU315FV	 GLASS FIBER		2 m		EGCG-18 & EGCG-19 (p. 486)	BPG-18 & BPG-19 (p. 505)	
SMU315FP	 PLASTIC FIBER	2 m	EGCP-14 & EGCP-15 (p. 488)		BPP-14 & BPP-15 (p. 507)		

*  Infrared LED  Visible Red LED
 ** For 9 m cable, add suffix W/30 to the 2 m model number (example, SMU315F W/30).

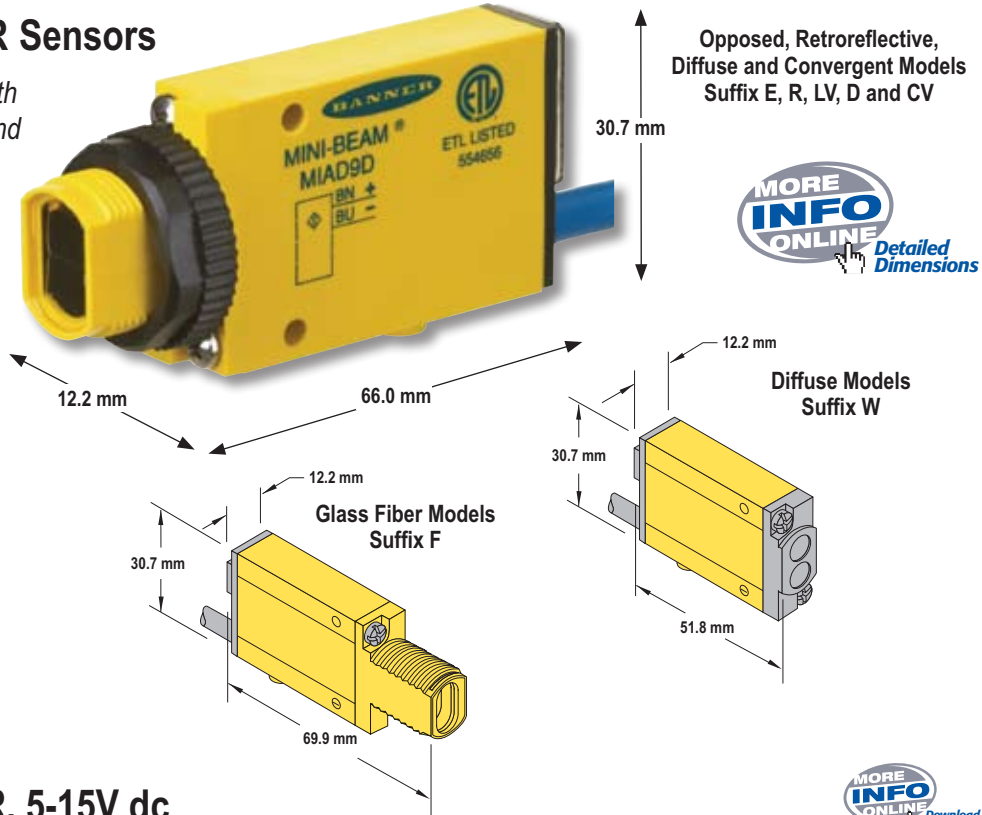
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MINI-BEAM® Universal Voltage Specifications	
Supply Voltage	Universal voltage: 24 to 240V ac, 50/60Hz or 24 to 240V dc (1.5 watts or 2.5 VA max.)
Supply Protection Circuitry	Protected against transient voltages. DC hookup is without regard to polarity.
Output Configuration	SPDT (Single-Pole, Double Throw) (form C) electromechanical relay, ON/OFF output.
Output Rating	Max. switching power (resistive load): 90W, 250VA Max. switching voltage (resistive load): 250V ac or 30V dc Max. switching current (resistive load): 3A Min. voltage and current: 5V dc, 10 mA Mechanical life: 20,000,000 operations Electrical life at full resistive load: 100,000 operations
Output Protection Circuitry	Protected against false pulse on power-up.
Output Response Time	Closure time: 20 milliseconds max. Release time: 20 milliseconds max. Max. switching speed: 25 operations per second
Repeatability	1 millisecond
Adjustments	Light/Dark Operate select switch, and 15-turn slotted brass screw Gain (sensitivity) adjustment potentiometer (clutched at both ends of travel). Both controls are located on rear panel of sensor and are protected by a gasketed, clear acrylic cover.
Indicators	Alignment Indicator Device system (AID) lights a rear-panel-mounted LED indicator whenever the sensor sees a "light" condition, with a superimposed pulse rate proportional to the light signal strength (the stronger the signal, the faster the pulse rate).
Construction	Reinforced thermoplastic polyester housing, totally encapsulated, o-ring seal, acrylic lenses, and stainless steel screws.
Environmental Rating	Meets NEMA standards 1, 2, 3, 3S, 4, 4X, 6, 12, and 13; IEC IP67.
Connections	PVC-jacketed 5-conductor 2 m or 9 m unterminated cable. Opposed mode emitter cables are 2-conductor.
Operating Conditions	Temperature: -20° to +55° C Relative humidity: 90% at 50° C (non-condensing)
Application Notes	Install transient suppressor (MOV) across contacts switching inductive loads.
Certifications	
Hookup Diagrams	Emitters: UN02 (p. 528) Other AC/DC Models: UN01 (p. 528)

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MINI-BEAM® NAMUR Sensors

- Intrinsically safe sensors with MINI-BEAM performance and small size
- For use with approved switching amplifiers with intrinsically safe input circuits
- Output 1 mA or less in dark conditions and 2 mA or more in light conditions
- Models with integral cable or quick-disconnect



MINI-BEAM® NAMUR, 5-15V dc








Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
MI9E Emitter		6 m	2 m	Constant Current ≤1.2 mA dark ≥2.1 mA light	EGCO-15 (p. 468)	BPO-15 (p. 492)	39616
MI9EQ Emitter			4-Pin Euro QD				
MIAD9R			2 m				
MIAD9RQ			4-Pin Euro QD				
MIAD9LV		5 m †	2 m		EGCR-21 (p. 472)	BPR-20 (p. 496)	
MIAD9LVQ			4-Pin Euro QD				
MIAD9LVAG		50 mm - 2 m †	2 m		EGCR-22 (p. 472)	BPR-21 (p. 496)	
MIAD9LVAGQ			4-Pin Euro QD				
MIAD9D		380 mm	2 m		EGCD-23 (p. 476)	BPD-23 (p. 499)	
MIAD9DQ			4-Pin Euro QD				
MIAD9W		75 mm	2 m		EGCD-24 (p. 476)	BPD-24 (p. 499)	
MIAD9WQ			4-Pin Euro QD				
MIAD9CV		16 mm	2 m		EGCC-28 (p. 479)	BPC-28 (p. 502)	
MIAD9CVQ			4-Pin Euro QD				
MIAD9CV2		43 mm	2 m				
MIAD9CV2Q			4-Pin Euro QD				
MIAD9F		Range varies by sensing mode and fiber optics used	2 m	EGCG-20 & EGCG-21 (p. 486)	BPG-20 & BPG-21 (p. 505)		
MIAD9FQ			4-Pin Euro QD				

* Infrared LED Visible Red LED

** For 9 m cable, add suffix W30 to the 2 m model number (example, MIAD9LV W/30). A model with a QD requires a special 4-pin Euro QD mating cable (see page 413).

† Retroreflective range is specified using one model BRT-3 retroreflector. Actual sensing range may differ, depending on the efficiency and reflective area of the retroreflector used. See Accessories for more information.

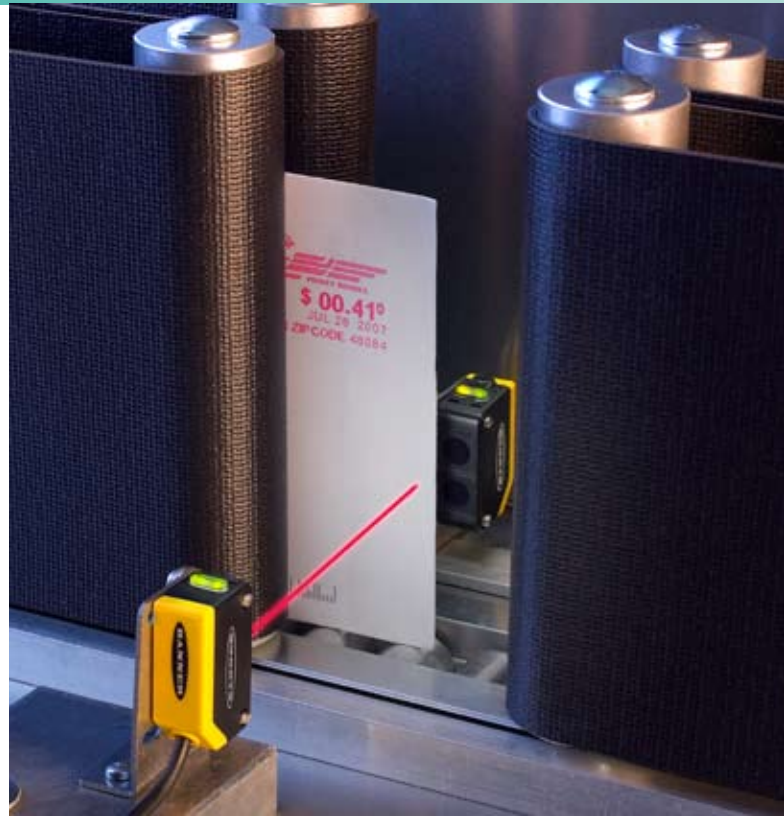
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MINI-BEAM® NAMUR Specifications	
Supply Voltage	5 to 15V dc (provided by the amplifier to which the sensor is connected)
Output	Constant current output: ≤ 1.2 mA in the “dark” condition and ≤ 2.1 mA in the “light” condition
Output Response Time	Opposed receiver: 2 milliseconds ON/400 microseconds OFF All others: 5 milliseconds ON/OFF (does not include amplifier response)
Adjustments	15-turn slotted brass screw GAIN (sensitivity) adjustment potentiometer (clutched at both ends of travel); located on rear panel and protected by a clear gasketed acrylic cover
Indicators	Red LED Alignment Indicator Device (AID) located on rear panel lights when the sensor sees a “light” condition; pulse rate is proportional to signal strength (the stronger the signal, the faster the pulse rate).
Construction	Reinforced thermoplastic polyester housing, totally encapsulated, o-ring sealing, acrylic lenses, and stainless steel screws
Environmental Rating	Meets NEMA standards 1, 2, 3, 3S, 4, 4X, 6, 12 and 13; IEC IP67
Connections	PVC-jacketed 2-conductor 2 m or 9 m cables, or special 4-pin Euro-style quick-disconnect (QD) fitting are available; QD cables are ordered separately. See page 413.
Operating Conditions	Temperature: -40° to +70° C Relative humidity: 90% at 50° C (non-condensing)
Design Standards	MIAD9 Series sensors comply with the following standards: DIN 19 234, EN 50 014 Part 1. 1977, EN50 020 Part 7. 1977, Factory Mutual #3610 and 3611, CSA 22.2 #157-92 and 22.2 #213-M1987
Certifications	    
Hookup Diagrams	SP01 (p. 530)

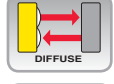
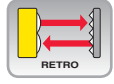
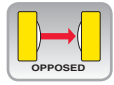
APPROVALS		
CSA:	#LR 41887	Intrinsically Safe, with Entity for Class I, Groups A-D Class I, Div. 2, Groups A-D
FM:	#J.I. 5Y3A4.AX	Intrinsically Safe, with Entity for Class I, II, III, Div. 1, Groups A-G Class I, II, III, Div. 2, Groups A-D and G
KEMA:	#03ATEX1441X	II IG EEx ia IIC T6
ETL:	#553868	

WORLD-BEAM® Q20 Series Rectangular Sensor

- Features compact, rectangular housing with industry-standard mounting configuration
- Available in opposed, polarized and non-polarized retroflective, and diffuse models
- Offers visible red beam for easy alignment on most models
- Provides water-tight, IP67 and NEMA 6 rated enclosure for rugged, reliable sensing
- Rated to 1200 psi for washdown environments
- Features ranges to 15 m
- Offers 10 to 30V dc supply voltage with complementary NPN or PNP outputs, depending on the model
- Provides versatile mounting options, including M3 (3 mm) inserts and 25.4 mm hole spacing
- Includes single-turn gain potentiometer for easy configuration, depending on model



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WORLD-BEAM® Q20 Sensors

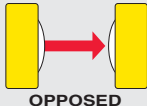
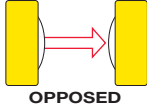
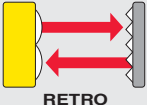

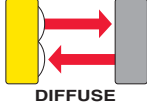
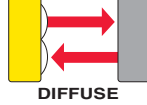
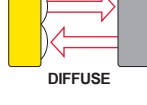
- Easy-to-see sensor LED
- 2 m or 9 m attached cable, or Pico- or Euro-style quick-disconnect
- Molded-in threaded mounting holes on standard 25.4 mm spacing
- Rugged overmolded housing
- Excellent optical crosstalk and electronic noise immunity



Opposed, Retroreflective and Diffuse Models
Suffix E, EL, R, RL, LP, LV,
D, DL and DXL



WORLD-BEAM® Q20, 10-30V dc

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet	
Q20E Emitter	 OPPOSED	10 m	2 m	—	EGCO-16 (p. 468)	BPO-16 (p. 492)	127816	
Q20EQ5 Emitter			4-pin Euro Pigtail QD	NPN				
Q20NR			2 m					
Q20NRQ5			4-pin Euro Pigtail QD					
Q20PR			2 m					PNP
Q20PRQ5			4-pin Euro Pigtail QD					
Q20EL Emitter	 OPPOSED	15 m	2 m	—	EGCO-17 (p. 469)	BPO-17 (p. 493)	127816	
Q20ELQ5 Emitter			4-pin Euro Pigtail QD	NPN				
Q20NRL			2 m					
Q20NRLQ5			4-pin Euro Pigtail QD					
Q20PRL			2 m					PNP
Q20PRLQ5			4-pin Euro Pigtail QD					
Q20NLV	 RETRO	6 m †	2 m	NPN	EGCR-23 (p. 472)	BPR-22 (p. 496)	127816	
Q20NLVQ5			4-pin Euro Pigtail QD					
Q20PLV			2 m	PNP				
Q20PLVQ5			4-pin Euro Pigtail QD					
Q20NLP	 POLAR RETRO	4 m †	2 m	NPN	EGCR-24 (p. 472)	BPR-23 (p. 496)	127816	
Q20NLPQ5			4-pin Euro Pigtail QD					
Q20PLP			2 m	PNP				
Q20PLPQ5			4-pin Euro Pigtail QD					
Q20ND	 DIFFUSE	250 mm	2 m	NPN	EGCD-25 (p. 476)	BPD-25 (p. 499)	127816	
Q20NDQ5			4-pin Euro Pigtail QD					
Q20PD			2 m	PNP				
Q20PDQ5			4-pin Euro Pigtail QD					
Q20NDL	 DIFFUSE	800 mm	2 m	NPN	EGCD-26 (p. 476)	BPD-26 (p. 499)	127816	
Q20NDLQ5			4-pin Euro Pigtail QD					
Q20PDL			2 m	PNP				
Q20PDLQ5			4-pin Euro Pigtail QD					
Q20NDXL	 DIFFUSE	1500 mm	2 m	NPN	EGCO-27 (p. 476)	BPO-22 (p. 499)	127816	
Q20NDXLQ5			4-pin Euro Pigtail QD					
Q20PDXL			2 m	PNP				
Q20PDXLQ5			4-pin Euro Pigtail QD					

*  Infrared LED  Visible Red LED

** For 9 m cable, add suffix **W30** to the 2 m model number (example, **Q20ND W30**). A model with a QD requires a mating cable (see pages 410 & 412).

QD models:

- For a 4-pin 150 mm Euro-style pigtail QD, add suffix **Q5** (example, **Q20NDQ5**).
- For a 4-pin 150 mm Pico-style pigtail QD, add suffix **Q** (example, **Q20NDQ**).
- For a 4-pin integral Pico-style QD, add suffix **Q7** (example, **Q20NDQ7**).

† Retroreflective range is specified using one model BRT-84 retroreflector. Actual sensing range may differ, depending on the efficiency and reflective area of the reflector used. See Accessories for more information.



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WORLD-BEAM® Q20 Specifications	
Supply Voltage	10 to 30V dc (10% maximum ripple) at less than 18 mA, exclusive of load
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	Solid-state complementary; PNP (sourcing) or NPN (sinking), depending on model
Output Rating	100 mA with short circuit protection OFF-state leakage current: NPN: less than 10 µA sinking PNP: less than 200 µA sourcing ON-state saturation voltage: NPN: less than 1.6V @ 100 mA PNP: less than 3.0V @ 100 mA
Output Response Time	Opposed: 1 millisecond; 600 microseconds OFF All others: 800 microseconds ON/OFF NOTE: 100 millisecond delay on power-up; outputs do not conduct during this time
Repeatability	Opposed: 140 microseconds All others: 155 microseconds
Adjustments	Diffuse, Retroreflective and Polarized Retroreflective: single-turn sensitivity (Gain) adjustment potentiometer
Indicators	Emitters: Green power ON only All others: Two LED Indicators: Green and Yellow Green ON: power ON Yellow ON: light sensed Green flashing: output overload Yellow flashing: marginal excess gain (1 x 1.5)
Construction	Housing: ABS Lenses: PPMA Gain Adjuster: PBT
Connections	2 m or 9 m 4-wire PVC cable, 4-pin 150 mm pigtail Pico-style QD (Q), or 4-pin 150 mm pigtail Euro-style QD (Q5), or 4-pin integral Pico-style QD (Q7), depending on model. QD cables are ordered separately. See pages 410 and 412.
Operating Conditions	Temperature: -20° to 60° C Relative humidity: 95% @ 50° C (non-condensing)
Environmental Rating	IEC IP67; NEMA 6 and 1200 psi washdown NEMA ICS 5, Annex F-2002
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements method 201A (vibration: 10 to 60 Hz max., double amplitude 0.06", maximum acceleration 10G). Also meets IEC 947-5-2: 30G 11 ms duration, half sine wave
Certification	Approvals pending, contact factory for status at 1-888-373-6767.
Hookup Diagram	Emitters: DC02 (p. 520) All others: DC03 (p. 520)



S18 and M18

18 mm Threaded-Barrel Sensors

- Features EZ-BEAM® technology, with specially designed optics and electronics for reliable sensing without adjustments
- Available in plastic threaded barrel sensor (S18) and stainless steel threaded barrel sensor (M18)
- Completely epoxy-encapsulated to provide superior durability, even in harsh sensing environments (S18)
- Uses innovative dual-indicator system to take the guesswork out of monitoring sensor performance
- Available in models for ac or dc power
- Includes advanced diagnostics to warn of marginal sensing conditions or output overload (dc models)
- Meets rigorous IP69K standards for use in washdown (S18) applications

S18 DC Models	page 96
M18 DC Models	97
S18 AC Models	99

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OPPOSED

RETRO

POLAR RETRO

DIFFUSE

FIXED-FIELD

BRACKETS
PAGE 370

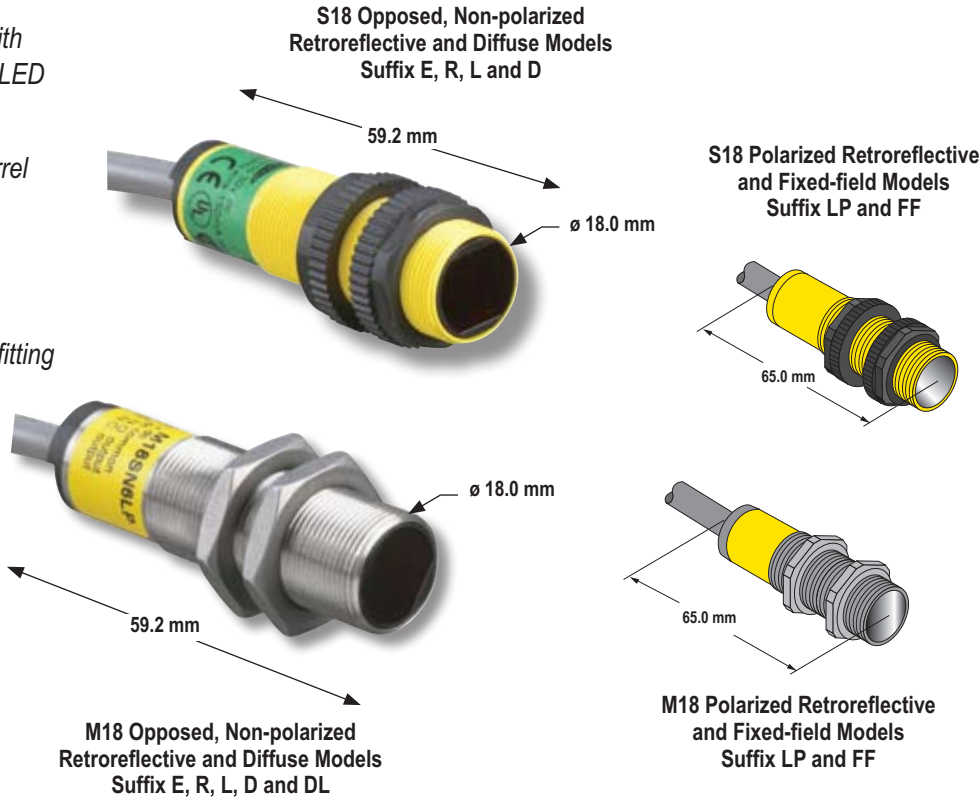
OD CABLES
4-Pin Euro + 4-Pin Micro
PAGE 412 & 419

REFLECTORS
PAGE 425

APERTURES
PAGE 443

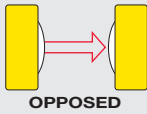
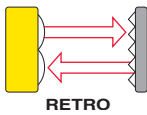

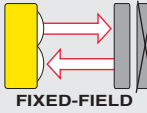
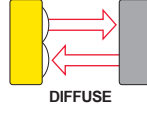
S18 and M18 DC Sensors

- Advanced self-diagnostics with separate alarm output; dual-LED multi-function indicators
- Popular 18 mm threaded barrel
- 10 to 30V dc with NPN or PNP outputs
- 2 m or 9 m integral cable, or Euro-style quick-disconnect fitting



S18, 10-30V dc

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Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
S186E Emitter	 OPPOSED	20 m	2 m	—	EGCO-18 (p. 469)	BPO-18 (p. 493)	
S186EQ Emitter			4-Pin Euro QD				
S18SN6R			2 m	NPN			
S18SN6RQ			4-Pin Euro QD				
S18SP6R			2 m	PNP			
S18SP6RQ			4-Pin Euro QD				
S18SN6L	 RETRO	2 m†	2 m	NPN	EGCR-25 (p. 472)	BPR-24 (p. 496)	
S18SN6LQ			4-Pin Euro QD				
S18SP6L			2 m	PNP			
S18SP6LQ			4-Pin Euro QD				
S18SN6LP	 POLAR RETRO	2 m†	2 m	NPN	EGCR-26 (p. 472)	BPR-25 (p. 496)	
S18SN6LPQ			4-Pin Euro QD				
S18SP6LP			2 m	PNP			
S18SP6LPQ			4-Pin Euro QD				
S18SN6FF25	 FIXED-FIELD	0 - 25 mm Cutoff	2 m	NPN	EGCF-9 (p. 482)	—	121522
S18SN6FF25Q			4-Pin Euro QD				
S18SP6FF25			2 m	PNP			
S18SP6FF25Q			4-Pin Euro QD				
S18SN6FF50		0 - 50 mm Cutoff	2 m	NPN	EGCF-10 (p. 482)	—	
S18SN6FF50Q			4-Pin Euro QD				
S18SP6FF50			2 m	PNP			
S18SP6FF50Q			4-Pin Euro QD				
S18SN6FF100		0 - 100 mm Cutoff	2 m	NPN	EGCF-11 (p. 482)	—	
S18SN6FF100Q			4-Pin Euro QD				
S18SP6FF100			2 m	PNP			
S18SP6FF100Q			4-Pin Euro QD				
S18SN6D	 DIFFUSE	100 mm	2 m	NPN	EGCD-28 (p. 476)	BPD-28 (p. 499)	
S18SN6DQ			4-Pin Euro QD				
S18SP6D			2 m	PNP			
S18SP6DQ			4-Pin Euro QD				
S18SN6DL		300 mm	2 m	NPN	EGCD-29 (p. 476)	BPD-29 (p. 499)	
S18SN6DLQ			4-Pin Euro QD				
S18SP6DL			2 m	PNP			
S18SP6DLQ			4-Pin Euro QD				

*  Infrared LED  Visible Red LED

** For 9 m cable, add suffix **W30** to the 2 m model number (example, **S18SP6D W30**). A model with a QD requires a mating cable (see page 412).

† Retroreflective range is specified using one model BRT-3 retroreflector. Actual sensing range may differ, depending on the efficiency and reflective area of the retroreflector used. See Accessories for more information.



M18, 10-30V dc

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
M186E Emitter	<p>OPPOSED</p>	20 m	2 m	-	EGCO-19 (p. 469)	BPO-19 (p.493)	49201
M186EQ Emitter			4-Pin Euro QD				
M18SN6R			2 m	NPN			
M18SN6RQ			4-Pin Euro QD				
M18SP6R			2 m	PNP			
M18SP6RQ			4-Pin Euro QD				
M18SN6L	<p>RETRO</p>	2 m†	2 m	NPN	EGCR-27 (p. 472)	BPR-26 (p. 496)	
M18SN6LQ			4-Pin Euro QD				
M18SP6L			2 m	PNP			
M18SP6LQ			4-Pin Euro QD				
M18SN6LP	<p>POLAR RETRO</p>	2 m†	2 m	NPN	EGCR-28 (p. 472)	BPR-27 (p. 496)	
M18SN6LPQ			4-Pin Euro QD				
M18SP6LP			2 m	PNP			
M18SP6LPQ			4-Pin Euro QD				
M18SN6FF25	<p>FIXED-FIELD</p>	0 - 25 mm Cutoff	2 m	NPN	EGCF-12 (p. 482)	—	
M18SN6FF25Q			4-Pin Euro QD				
M18SP6FF25			2 m	PNP			
M18SP6FF25Q			4-Pin Euro QD				
M18SN6FF50		0 - 50 mm Cutoff	2 m	NPN	EGCF-13 (p. 482)	—	
M18SN6FF50Q			4-Pin Euro QD				
M18SP6FF50			2 m	PNP			
M18SP6FF50Q			4-Pin Euro QD				
M18SN6FF100		0 - 100 mm Cutoff	2 m	NPN	EGCF-14 (p. 482)	—	
M18SN6FF100Q			4-Pin Euro QD				
M18SP6FF100			2 m	PNP			
M18SP6FF100Q			4-Pin Euro QD				
M18SN6D		<p>DIFFUSE</p>	100 mm	2 m	NPN	EGCD-30 (p. 476)	BPD-30 (p. 499)
M18SN6DQ				4-Pin Euro QD			
M18SP6D				2 m	PNP		
M18SP6DQ				4-Pin Euro QD			
M18SN6DL	300 mm		2 m	NPN	EGCD-31 (p. 476)	BPD-31 (p. 499)	
M18SN6DLQ			4-Pin Euro QD				
M18SP6DL			2 m	PNP			
M18SP6DLQ			4-Pin Euro QD				




* Infrared LED Visible Red LED

** For 9 m cable, add suffix **W30** to the 2 m model number (example, **M18SN6D W30**). A model with a QD requires a mating cable (see page 412).

† Retroreflective range is specified using one model BRT-3 retroreflector. Actual sensing range may differ, depending on the efficiency and reflective area of the retroreflector used. See Accessories for more information.

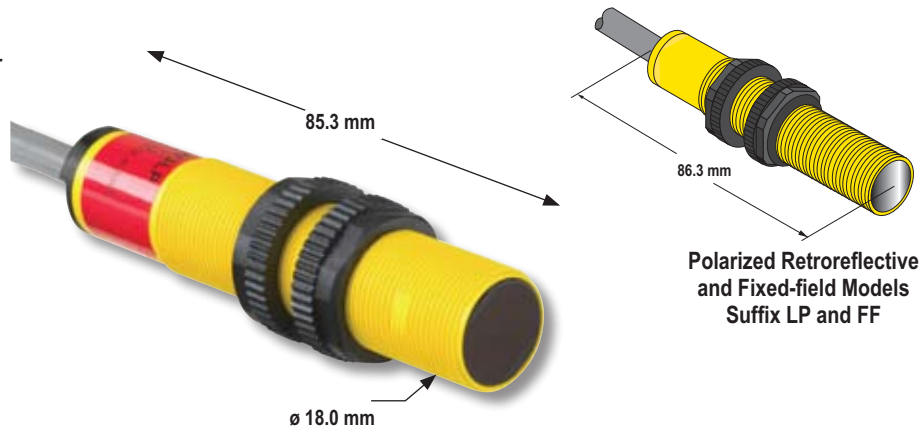
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S18 and M18 DC Specifications	
Supply Voltage and Current	10 to 30V dc (10% max. ripple); Supply current (exclusive of load current): Opposed Emitters: 25 mA Opposed Receivers: 20 mA Polarized Retroreflective: 30 mA Non-polarized Retroreflective: 25 mA Fixed-field: 35 mA Diffuse: 25 mA
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	Solid-state complementary dc switch; NPN (current sinking) or PNP (current sourcing), depending on model. The Dark Operate (DO) output may be wired as a normally open marginal signal alarm output, depending upon hookup to the power supply.
Output Rating	150 mA max. (each) in standard hookup. When wired for alarm output, the total load may not exceed 150 mA OFF-state leakage current: less than 1 µA at 30V dc ON-state saturation voltage: less than 1V at 10 mA dc; less than 1.5V at 150 mA dc
Output Protection Circuitry	Protected against false pulse on power-up and continuous overload or short circuit of outputs
Output Response Time	Opposed: 3 milliseconds ON, 1.5 milliseconds OFF Polarized Retroreflective, Non-polarized Retroreflective, Fixed-field and Diffuse: 3 milliseconds ON/OFF NOTE: 100 millisecond delay on power-up; outputs are non-conducting during this time
Repeatability	Opposed: 375 microseconds Polarized Retroreflective, Non-polarized Retroreflective, Fixed-field and Diffuse: 750 microseconds. Repeatability and response are independent of signal strength.
Indicators	Two LEDs: Green and Yellow Green ON steady: power is ON Green flashing: output overloaded Yellow ON steady: Light Operate (LO) output is energized Yellow flashing: excess gain marginal (1-1.5x) in light condition, LO output energized
Construction	M18 models: stainless steel housing S18 models: thermoplastic polyester housing Lenses are polycarbonate or acrylic; S18 and M18 models come with two jam nuts.
Environmental Rating	Leakproof design rated NEMA 6P; DIN 40050 (IP69K)
Connections	2 m or 9 m attached cable, or 4-pin Euro-style quick-disconnect fitting. QD cables are ordered separately. See page 412.
Operating Conditions	Temperature: -40° to +70° C Relative humidity: 90% at 50° C (non-condensing)
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements. Method 201A (Vibration; frequency 10 to 60 Hz, max., double amplitude 0.06-inch acceleration 10G). Method 213B conditions H&I (Shock: 75G with unit operating; 100G for non-operation)
Certifications	S18 and M18 models:  S18 models:  
Hookup Diagrams	Emitters: DC02 (p. 520) NPN Models: DC05 (p. 521) PNP Models: DC06 (p. 521)

S18 AC Sensors

- 18 mm thermoplastic polyester threaded barrel sensor
- Dual LED indicators
- 20 to 250V ac (3-wire hookup)
- Solid-state switch output, maximum load 300 mA



Polarized Retroreflective and Fixed-field Models
Suffix LP and FF

Opposed, Non-polarized
Retroreflective and Diffuse Models
Suffix E, R, L and D



S18, 20-250V ac

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
S183E Emitter		20 m	2 m	—	EGCO-18 (p. 469)	BPO-18 (p. 493)	121521
S183EQ1 Emitter			4-Pin Micro QD				
S18AW3R			2 m	LO			
S18AW3RQ1			4-Pin Micro QD				
S18RW3R			2 m	DO			
S18RW3RQ1			4-Pin Micro QD				
S18AW3L		2 m†	2 m	LO	EGCR-25 (p. 472)	BPR-24 (p. 496)	
S18AW3LQ1			4-Pin Micro QD				
S18RW3L			2 m	DO			
S18RW3LQ1			4-Pin Micro QD				
S18AW3LP		2 m†	2 m	LO	EGCR-26 (p. 472)	BPR-25 (p. 496)	
S18AW3LPQ1			4-Pin Micro QD				
S18RW3LP			2 m	DO			
S18RW3LPQ1			4-Pin Micro QD				
S18AW3FF25		0 - 25 mm Cutoff	2 m	LO	EGCF-9 (p. 482)	—	
S18AW3FF25Q1			4-Pin Micro QD				
S18RW3FF25			2 m	DO			
S18RW3FF25Q1			4-Pin Micro QD				
S18AW3FF50		0 - 50 mm Cutoff	2 m	LO	EGCF-10 (p. 482)	—	
S18AW3FF50Q1			4-Pin Micro QD				
S18RW3FF50			2 m	DO			
S18RW3FF50Q1			4-Pin Micro QD				
S18AW3FF100		0 - 100 mm Cutoff	2 m	LO	EGCF-11 (p. 482)	—	
S18AW3FF100Q1			4-Pin Micro QD				
S18RW3FF100			2 m	DO			
S18RW3FF100Q1			4-Pin Micro QD				

* Infrared LED Visible Red LED

** For 9 m cable, add suffix **W30** to the 2 m model number (example, **S18AW3LP W30**). A model with a QD requires a mating cable (see page 419).

† Retroreflective range is specified using one model BRT-3 retroreflector. Actual sensing range may differ, depending on the efficiency and reflective area of the retroreflector used. See Accessories for more information.



S18, 20-250V ac (cont'd)

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
S18AW3D		100 mm	2 m	LO	EGCD-28 (p. 476)	BPD-28 (p. 499)	121521
S18AW3DQ1			4-Pin Micro QD				
S18RW3D			2 m	DO			
S18RW3DQ1			4-Pin Micro QD				
S18AW3DL		300 mm	2 m	LO	EGCD-29 (p. 476)	BPD-29 (p. 499)	
S18AW3DLQ1			4-Pin Micro QD				
S18RW3DL			2 m	DO			
S18RW3DLQ1			4-Pin Micro QD				

* Infrared LED

** For 9 m cable, add suffix W30 to the 2 m model number (example, S18AW3D W30). A model with a QD requires a mating cable (see page 419).

S18 AC Specifications

Supply Voltage and Current	20 to 250V ac (50/60 Hz). Average current: 20 mA. Peak current: 200 mA at 20V ac, 500 mA at 120V ac, 750 mA at 250V ac
Supply Protection Circuitry	Protected against transient voltages
Output Configuration	Solid-state ac switch; three-wire hookup; Light Operate (LO) or Dark Operate (DO), depending on model. Light operate: Output conducts when the sensor sees its own (or the emitter's) modulated light Dark operate: Output conducts when sensor sees dark
Output Rating	300 mA max. (continuous) Fixed-field: derate 5 mA/° C above +50° C Inrush capability: 1 amp for 20 milliseconds, non-repetitive OFF-state leakage current: less than 100 µA ON-state voltage drop: 3V at 300 mA ac; 2V at 15 mA ac
Output Protection Circuitry	Protected against false pulse on power-up
Output Response Time	Opposed: 16 milliseconds ON, 8 milliseconds OFF Polarized Retroreflective, Non-polarized Retroreflective, Fixed-field and Diffuse: 16 milliseconds ON/OFF NOTE: 100 millisecond delay on power-up
Repeatability	Opposed: 2 milliseconds Polarized Retroreflective, Non-polarized Retroreflective, Fixed-field and Diffuse: 4 milliseconds Repeatability and response are independent of signal strength.
Indicators	Two LEDs: Green and Yellow Green ON steady: power ON Yellow ON steady: light sensed Yellow flashing: excess gain marginal (1-1.5x) in light condition
Construction	Housings are thermoplastic polyester. Lenses are polycarbonate or acrylic; two jam nuts included.
Environmental Rating	Leakproof design rated NEMA 6P; DIN 40050 (IP69K)
Connections	2 m or 9 m attached cable, or 4-pin Micro-style quick-disconnect fitting. QD cables are ordered separately. See page 419.
Operating Conditions	Temperature: -40° to +70° C Relative humidity: 90% at 50° C (non-condensing)
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements. Method 201A (Vibration; frequency 10 to 60 Hz, max, double amplitude 0.06-inch acceleration 10G). Method 213B conditions H&I (Shock: 75G with unit operating; 100G for non-operation)
Certifications	
Hookup Diagrams	Cabled Emitters: AC03 (p. 525) Other Cabled Models: AC05 (p. 526) QD Emitters: AC07 (p. 526) Other QD Models: AC06 (p. 526)



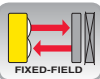
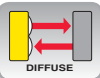
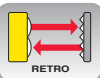
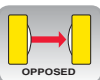
T18

18 mm Threaded Right-Angle Sensors

- Features EZ-BEAM® technology, with specially designed optics and electronics for reliable sensing without adjustments on most models
- T-style plastic housing with 18 mm threaded lens mount
- Available in opposed, retroreflective, diffuse and fixed-field modes
- Completely epoxy-encapsulated to provide superior durability, even in harsh sensing environments
- Uses innovative dual-indicator system to take the guesswork out of monitoring sensor performance
- Includes advanced diagnostics to warn of marginal sensing conditions or output overload (dc models)

DC Models	page 102
AC Models	104

- MINIATURE
- COMPACT
- MIDSIZE
- FULLSIZE



T18 DC Sensors

- Dual-LED multi-function indicators
- Popular 18 mm threaded lens mount
- 10 to 30V dc with NPN or PNP outputs
- 2 m or 9 m attached cable, or Euro-style quick-disconnect

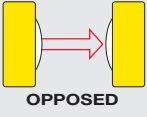
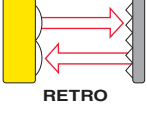

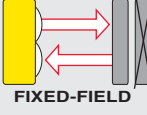
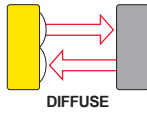


DC Sensors (all models)



T18, 10-30V dc




- MINIATURE
- COMPACT
- MIDSIZE
- FULLSIZE

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet		
T186E Emitter	 OPPOSED	20 m	2 m	-	EGCO-20 (p. 469)	BPO-20 (p. 493)			
T186EQ Emitter			4-Pin Euro QD						
T18SN6R			2 m	NPN					
T18SN6RQ			4-Pin Euro QD						
T18SP6R			2 m	PNP					
T18SP6RQ			4-Pin Euro QD						
T18SN6L	 RETRO	2 m†	2 m	NPN	EGCR-29 (p. 472)	BPR-28 (p. 496)			
T18SN6LQ			4-Pin Euro QD						
T18SP6L			2 m	PNP					
T18SP6LQ			4-Pin Euro QD						
T18SN6LP	 POLAR RETRO	2 m†	2 m	NPN	EGCR-30 (p. 472)	BPR-29 (p. 496)			
T18SN6LPQ			4-Pin Euro QD						
T18SP6LP			2 m	PNP					
T18SP6LPQ			4-Pin Euro QD						
T18SN6FF25	 FIXED-FIELD	0 - 25 mm Cutoff	2 m	NPN	EGCF-15 (p. 482)	-	121526		
T18SN6FF25Q			4-Pin Euro QD						
T18SP6FF25			2 m	PNP					
T18SP6FF25Q			4-Pin Euro QD						
T18SN6FF50		0 - 50 mm Cutoff	2 m	NPN	EGCF-16 (p. 482)	-			
T18SN6FF50Q			4-Pin Euro QD						
T18SP6FF50			2 m	PNP					
T18SP6FF50Q			4-Pin Euro QD						
T18SN6FF100		0 - 100 mm Cutoff	2 m	NPN	EGCF-17 (p. 483)	-			
T18SN6FF100Q			4-Pin Euro QD						
T18SP6FF100			2 m	PNP					
T18SP6FF100Q			4-Pin Euro QD						
T18SN6D		 DIFFUSE	500 mm	2 m	NPN	EGCD-32 (p. 476)		BPD-32 (p. 499)	
T18SN6DQ				4-Pin Euro QD					
T18SP6D				2 m	PNP				
T18SP6DQ				4-Pin Euro QD					

* Infrared LED Visible Red LED

** For 9 m cable, add suffix **W30** to the 2 m model number (example, **T18SN6L W30**). A model with a QD requires a mating cable (see page 412).

† Retroreflective range is specified using one model BRT-3 retroreflector. Actual sensing range may differ, depending on the efficiency and reflective area of the retroreflector used. See Accessories for more information.

T18 DC Specifications	
Supply Voltage and Current	10 to 30V dc (10% max. ripple); Supply current (exclusive of load current): Opposed Emitters: 25 mA Opposed Receivers: 20 mA Polarized Retroreflective: 30 mA Non-polarized Retroreflective: 25 mA Diffuse: 25 mA Fixed-field: 35 mA
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	Solid-state complementary dc switch; NPN (current sinking) or PNP (current sourcing), depending on model. The Dark Operate (DO) output may be wired as a normally open marginal signal alarm output, depending upon hookup to the power supply.
Output Rating	150 mA max. (each) in standard hookup. When wired for alarm output, the total load may not exceed 150 mA OFF-state leakage current: less than 1 μ A at 30V dc ON-state saturation voltage: less than 1V at 10 mA dc; less than 1.5V at 150 mA dc
Output Protection Circuitry	Protected against false pulse on power-up and continuous overload or short circuit of outputs
Output Response Time	Opposed: 3 milliseconds ON, 1.5 milliseconds OFF Polarized Retroreflective, Non-polarized Retroreflective, Fixed-field and Diffuse: 3 milliseconds ON/OFF NOTE: 100 millisecond delay on power-up; outputs are non-conducting during this time
Adjustments	T18 Series infrared non-polarized retroreflective and diffuse mode models (only) have a single-turn rear-panel SENSITIVITY control for adjustment of system gain (turn clockwise to increase)
Repeatability	Opposed: 375 microseconds Polarized Retroreflective, Non-polarized Retroreflective, Fixed-field and Diffuse: 750 microseconds Repeatability and response are independent of signal strength.
Indicators	Two LEDs: Green and Yellow Green ON steady: power ON Green flashing: output overloaded Yellow ON steady: Light Operate (LO) output energized Yellow flashing: excess gain marginal (1-1.5x) in light condition, LO output energized
Construction	Housings are thermoplastic polyester. Lenses are polycarbonate or acrylic; one jam nut included
Environmental Rating	Leakproof design rated NEMA 6P; DIN 40050 (IP69K)
Connections	2 m or 9 m attached cable, or 4-pin Euro-style quick-disconnect fitting. QD cables are ordered separately. See page 412.
Operating Conditions	Temperature: -40° to +70° C Relative humidity: 90% at 50° C (non-condensing)
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements. Method 201A (Vibration; frequency 10 to 60 Hz, max., double amplitude 0.06-inch acceleration 10G). Method 213B conditions H&I (Shock: 75G with unit operating; 100G for non-operation)
Certifications	  
Hookup Diagrams	Emitters: DC02 (p. 520) NPN Models: DC05 (p. 521) PNP Models: DC06 (p. 521)

T18 AC Sensors

- Dual-LED multi-function indicators
- Popular 18 mm threaded barrel
- 20 to 250V ac with solid-state outputs
- 2 m or 9 m attached cable, or Micro-style quick-disconnect



MORE INFO ONLINE
[Detailed Dimensions](#)

AC Sensors (all models)

T18, 20-250V ac

MORE INFO ONLINE
[Download PDF](#)

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
T183E Emitter		20 m	2 m	-	EGCO-20 (p. 469)	BPO-20 (p. 493)	121525
T183EQ1 Emitter			4-Pin Micro QD				
T18AW3R			2 m	LO			
T18AW3RQ1			4-Pin Micro QD				
T18RW3R			2 m	DO			
T18RW3RQ1			4-Pin Micro QD				
T18AW3L		2 m†	2 m	LO	EGCR-29 (p. 472)	BPR-28 (p. 496)	
T18AW3LQ1			4-Pin Micro QD				
T18RW3L			2 m	DO			
T18RW3LQ1			4-Pin Micro QD				
T18AW3LP		2 m†	2 m	LO	EGCR-30 (p. 472)	BPR-29 (p. 496)	
T18AW3LPQ1			4-Pin Micro QD				
T18RW3LP			2 m	DO			
T18RW3LPQ1			4-Pin Micro QD				
T18AW3D		300 mm	2 m	LO	EGCD-33 (p. 477)	BPD-33 (p. 500)	
T18AW3DQ1			4-Pin Micro QD				
T18RW3D			2 m	DO			
T18RW3DQ1			4-Pin Micro QD				

* Infrared LED Visible Red LED

** For 9 m cable, add suffix **W30** to the 2 m model number (example, **T18AW3L W30**). A model with a QD requires a mating cable (see page 419).

† Retroreflective range is specified using one model BRT-3 retroreflector. Actual sensing range may differ, depending on the efficiency and reflective area of the retroreflector used. See Accessories for more information.

More on next page



T18, 20-250V ac (cont'd)

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet	
T18AW3FF25	<p>FIXED-FIELD</p>	0 - 25 mm Cutoff	2 m	LO	EGCF-15 (p. 482)	—	121525	
T18AW3FF25Q1			4-Pin Micro QD					
T18RW3FF25			2 m	DO				
T18RW3FF25Q1			4-Pin Micro QD					
T18AW3FF50		0 - 50 mm Cutoff	0 - 50 mm Cutoff	2 m	LO	EGCF-16 (p. 482)		—
T18AW3FF50Q1				4-Pin Micro QD				
T18RW3FF50				2 m	DO			
T18RW3FF50Q1				4-Pin Micro QD				
T18AW3FF100		0 - 100 mm Cutoff	0 - 100 mm Cutoff	2 m	LO	EGCF-17 (p. 483)		—
T18AW3FF100Q1				4-Pin Micro QD				
T18RW3FF100				2 m	DO			
T18RW3FF100Q1				4-Pin Micro QD				

* Infrared LED

** For 9 m cable, add suffix W/30 to the 2 m model number (example, T18AW3FF25 W/30). A model with a QD requires a mating cable (see page 419).

T18 AC Specifications	
Supply Voltage and Current	20 to 250V ac (50/60 Hz) Average current: 20 mA Peak current: 200 mA at 20V ac, 500 mA at 120V ac, 750 mA at 250V ac
Supply Protection Circuitry	Protected against transient voltages
Output Configuration	Solid-state ac switch; three-wire hookup; Light Operate (LO) or Dark Operate (DO), depending on model. Light operate: Output conducts when the sensor sees its own (or the emitter's) modulated light Dark operate: Output conducts when sensor sees dark
Output Rating	300 mA max. (continuous) Fixed-field: derate 5 mA/° C above +50° C Inrush capability: 1 amp for 20 milliseconds, non-repetitive OFF-state leakage current: less than 100 µA ON-state voltage drop: 3V at 300 mA ac; 2V at 15 mA ac
Output Protection Circuitry	Protected against false pulse on power-up
Output Response Time	Opposed: 16 milliseconds ON, 8 milliseconds OFF Polarized Retroreflective, Non-polarized Retroreflective, Fixed-field and Diffuse: 16 milliseconds ON/OFF NOTE: 100 millisecond delay on power-up
Repeatability	Opposed: 2 milliseconds Polarized Retroreflective, Non-polarized Retroreflective, Fixed-field and Diffuse: 4 milliseconds Repeatability and response are independent of signal strength.
Adjustments	T18 Series infrared non-polarized retroreflective and diffuse mode models (only) have a single-turn rear-panel SENSITIVITY control for adjustment of system gain (turn clockwise to increase)
Indicators	Two LEDs: Green and Yellow Green ON steady: power ON Yellow ON steady: light sensed Yellow flashing: excess gain marginal (1-1.5x) in light condition
Construction	Housings are thermoplastic polyester. Lenses are polycarbonate or acrylic; one jam nut included.
Environmental Rating	Leakproof design rated NEMA 6P; DIN 40050 (IP69K)
Connections	2 m or 9 m attached cable, or 4 pin Micro-style quick-disconnect fitting. QD cables are ordered separately. See page 419.
Operating Conditions	Temperature: -40° to +70° C Relative humidity: 90% at 50° C (non-condensing)
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements. Method 201A (Vibration; frequency 10 to 60 Hz, max, double amplitude 0.06-inch acceleration 10G). Method 213B conditions H&I (Shock: 75G with unit operating; 100G for non-operation)
Certifications	
Hookup Diagrams	Cabled Emitters: AC03 (p. 525) Other cabled Models: AC05 (p. 526) QD Emitters: AC07 (p. 526) Other QD Models: AC06 (p. 526)

MINIATURE
COMPACT
MIDSIZE
FULLSIZE

MINIATURE

COMPACT

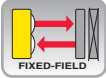
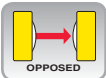
MIDSIZE

FULLSIZE

Q25

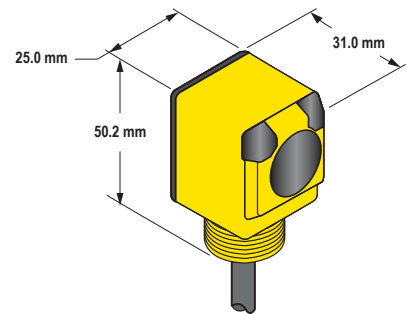
Right-Angle Rectangular Sensors

- Features EZ-BEAM® technology, with specially designed optics and electronics for reliable sensing without adjustments
- Available in opposed, retroreflective or fixed-field modes in rectangular 25 mm plastic housing with 18 mm threaded mounting base
- Completely epoxy-encapsulated for superior durability, even in harsh sensing environments
- Uses an innovative dual-indicator system to take the guesswork out of monitoring sensor performance
- Available in models for ac or dc power
- Includes advanced diagnostics to warn of marginal sensing conditions or output overload (dc models)



Q25 Sensors

- Yellow LED output indicator
- 18 mm threaded mounting base
- 2 m or 9 m attached cable, or Euro- or Micro-style quick-disconnect
- Green LED power indicator

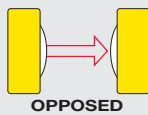

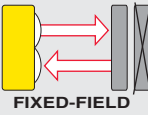


Fixed-field Models
Suffix FF

Opposed and Retroreflective Models
Suffix E, R and LP



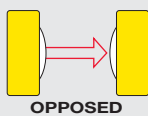

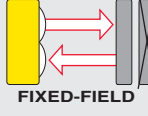
Q25, 10-30V dc

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
Q256E Emitter	 OPPOSED	20 m	2 m	-	EGCO-21 (p. 469)	BPO-21 (p. 493)	121518
Q256EQ Emitter			4-Pin Euro QD				
Q25SN6R			2 m	NPN			
Q25SN6RQ			4-Pin Euro QD				
Q25SP6R			2 m	PNP			
Q25SP6RQ			4-Pin Euro QD				
Q25SN6LP	 POLAR RETRO	2 m†	2 m	NPN	EGCR-31 (p. 472)	BPR-30 (p. 496)	
Q25SN6LPQ			4-Pin Euro QD				
Q25SP6LP			2 m	PNP			
Q25SP6LPQ			4-Pin Euro QD				
Q25SN6FF25	 FIXED-FIELD	0 - 25 mm Cutoff	2 m	NPN	EGCF-18 (p. 483)	-	
Q25SN6FF25Q			4-Pin Euro QD				
Q25SP6FF25			2 m	PNP			
Q25SP6FF25Q			4-Pin Euro QD				
Q25SN6FF50		0 - 50 mm Cutoff	2 m	NPN	EGCF-19 (p. 483)	-	
Q25SN6FF50Q			4-Pin Euro QD				
Q25SP6FF50			2 m	PNP			
Q25SP6FF50Q			4-Pin Euro QD				
Q25SN6FF100		0 - 100 mm Cutoff	2 m	NPN	EGCF-20 (p. 483)	-	
Q25SN6FF100Q			4-Pin Euro QD				
Q25SP6FF100			2 m	PNP			
Q25SP6FF100Q			4-Pin Euro QD				

- MINIATURE
- COMPACT
- MIDSIZE
- FULLSIZE

Q25, 20-250V ac



Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
Q253E Emitter	 OPPOSED	20 m	2 m	-	EGCO-21 (p. 469)	BPO-21 (p. 493)	121517
Q253EQ1 Emitter			4-Pin Micro QD				
Q25AW3R			2 m	LO			
Q25AW3RQ1			4-Pin Micro QD				
Q25RW3R			2 m	DO			
Q25RW3RQ1			4-Pin Micro QD				
Q25AW3LP	 POLAR RETRO	2 m†	2 m	LO	EGCR-31 (p. 472)	BPR-30 (p. 496)	
Q25AW3LPQ1			4-Pin Micro QD				
Q25RW3LP			2 m	DO			
Q25RW3LPQ1			4-Pin Micro QD				
Q25AW3FF25	 FIXED-FIELD	0 - 25 mm Cutoff	2 m	LO	EGCF-18 (p. 483)	-	
Q25AW3FF25Q1			4-Pin Micro QD				
Q25RW3FF25			2 m	DO			
Q25RW3FF25Q1			4-Pin Micro QD				

*  Infrared LED  Visible Red LED

** For 9 m cable, add suffix **W/30** to the 2 m model number (example, **Q25AW3LP W/30**). A model with a QD requires a mating cable (see pages 412 and 419).

† Retroreflective range is specified using one model BRT-3 retroreflector. Actual sensing range may differ, depending on the efficiency and reflective area of the retroreflector used. See Accessories for more information.



More on next page



Q25, 20-250V ac (cont'd)

- MINIATURE
- COMPACT
- MIDSIZE
- FULLSIZE




Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
Q25AW3FF50	 FIXED-FIELD	0 - 50 mm Cutoff	2 m	LO	EGCF-19 (p. 483)	—	121517
Q25AW3FF50Q1			4-Pin Micro QD				
Q25RW3FF50			2 m	DO			
Q25RW3FF50Q1			4-Pin Micro QD				
Q25AW3FF100	 FIXED-FIELD	0 - 100 mm Cutoff	2 m	LO	EGCF-20 (p. 483)		
Q25AW3FF100Q1			4-Pin Micro QD				
Q25RW3FF100			2 m	DO			
Q25RW3FF100Q1			4-Pin Micro QD				

* Infrared LED

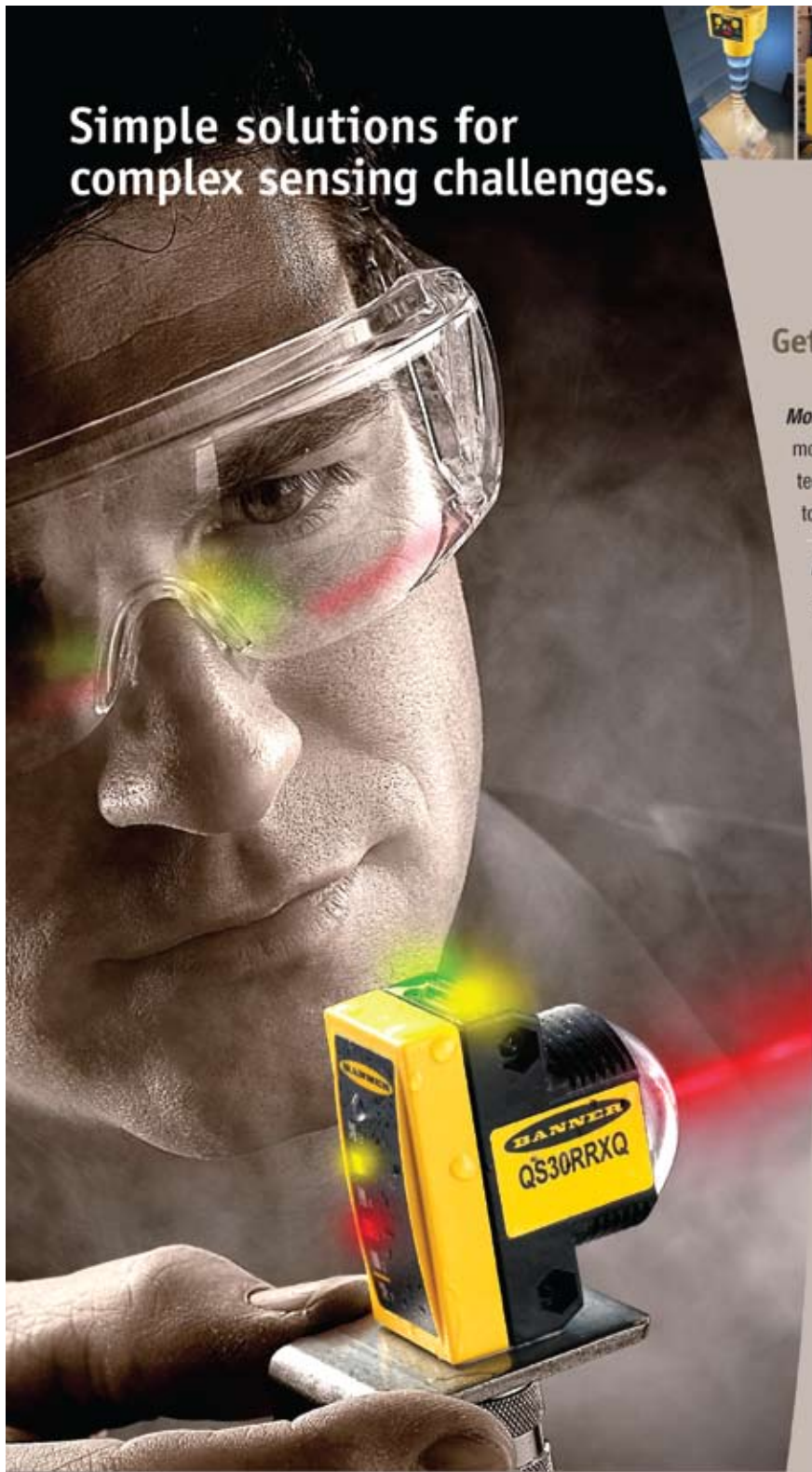
** For 9 m cable, add suffix W30 to the 2 m model number (example, Q25AW3FF50 W30). A model with a QD requires a mating cable (see page 419).

Q25 DC Specifications

Supply Voltage and Current	10 to 30V dc (10% max. ripple); Supply current (exclusive of load current): Opposed Emitters: 25 mA Opposed Receivers: 20 mA Polarized Retroreflective: 30 mA Fixed-field: 35 mA
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	Solid-state complementary dc switch; NPN (current sinking) or PNP (current sourcing), depending on model. The Dark Operate (DO) output may be wired as a normally open marginal signal alarm output, depending upon hookup to the power supply.
Output Rating	150 mA max. (each) in standard hookup. When wired for alarm output, the total load may not exceed 150 mA OFF-state leakage current: less than 1 µA at 30V dc ON-state saturation voltage: less than 1V at 10 mA dc; less than 1.5V at 150 mA dc
Output Protection Circuitry	Protected against false pulse on power-up and continuous overload or short circuit of outputs
Output Response Time	Opposed: 3 milliseconds ON, 1.5 milliseconds OFF Polarized Retroreflective and Fixed-field: 3 milliseconds ON/OFF NOTE: 100 millisecond delay on power-up; outputs do not conduct during this time
Repeatability	Opposed: 375 microseconds Polarized Retroreflective and Fixed-field: 750 microseconds Repeatability and response are independent of signal strength.
Indicators	Two LEDs: Green and Yellow Green ON steady: power ON Green flashing: output overloaded Yellow ON steady: Light Operate (LO) output energized Yellow flashing: excess gain marginal (1-1.5x) in light condition, LO output energized
Construction	Housings are thermoplastic polyester. Lenses are polycarbonate or acrylic; one jam nut included.
Environmental Rating	Leakproof design rated NEMA 6P; DIN 40050 (IP69K)
Connections	2 m or 9 m attached cable, or 4-pin Euro-style quick-disconnect fitting. QD cables are ordered separately. See page 412.
Operating Conditions	Temperature: -40° to +70° C Relative humidity: 90% at 50° C (non-condensing)
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements. Method 201A (Vibration; frequency 10 to 60 Hz, max., double amplitude 0.06-inch acceleration 10G). Method 213B conditions H&I (Shock: 75G with unit operating; 100G for non-operation)
Certifications	
Hookup Diagrams	Emitters: DC02 (p. 520) NPN Models: DC05 (p. 521) PNP Models: DC06 (p. 521)

Q25 AC Specifications	
Supply Voltage and Current	20 to 250V ac (50/60 Hz). Average current: 20 mA Peak current: 200 mA at 20V ac, 500 mA at 120V ac, 750 mA at 250V ac
Supply Protection Circuitry	Protected against transient voltages
Output Configuration	Solid-state ac switch; three-wire hookup; Choose Light Operate (LO) or Dark Operate (DO), depending on model. Light operate: Output conducts when the sensor sees its own (or the emitter's) modulated light Dark operate: Output conducts when sensor sees dark
Output Rating	300 mA max. (continuous) Fixed-field: derate 5 mA/° C above +50° C Inrush capability: 1 amp for 20 milliseconds, non-repetitive Off-state leakage current: less than 100 mA On-state voltage drop: 3V at 300 mA ac; 2V at 15 mA ac
Output Protection Circuitry	Protected against false pulse on power-up
Output Response Time	Opposed: 16 milliseconds ON, 8 milliseconds OFF Polarized Retroreflective and Fixed-field: 16 milliseconds ON/OFF NOTE: 100 millisecond delay on power-up
Repeatability	Opposed: 2 milliseconds; Polarized Retroreflective and Fixed-field: 4 milliseconds Repeatability and response are independent of signal strength.
Indicators	Two LEDs: Green and Yellow Green ON steady: power ON Yellow ON steady: light sensed Yellow flashing: excess gain marginal (1-1.5x) in light condition
Construction	Housings are thermoplastic polyester. Lenses are polycarbonate or acrylic; one jam nut included.
Environmental Rating	Leakproof design rated NEMA 6P, DIN 40050 (IP69K)
Connections	2 m or 9 m attached cable, or 4-pin Micro-style quick-disconnect fitting. QD cables are ordered separately. See page 419.
Operating Conditions	Temperature: -40° to +70° C Relative humidity: 90% at 50° C (non-condensing)
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements. Method 201A (Vibration; frequency 10 to 60 Hz, max, double amplitude 0.06-inch acceleration 10G). Method 213B conditions H&I (Shock: 75G with unit operating; 100G for non-operation)
Certifications	  
Hookup Diagrams	Cabled Emitters: AC03 (p. 525) Other Cabled Models: AC05 (p. 526) QD Emitters: AC07 (p. 526) Other QD Models: AC06 (p. 526)

- MINIATURE
- COMPACT
- MIDSIZE
- FULLSIZE



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Vision



Sensing



Safety



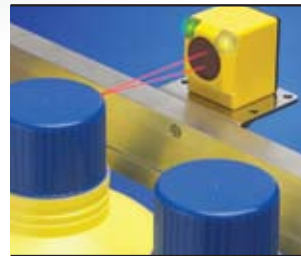
Midsized Sensors

WORLD-BEAM® QS30 page 112

- Universal housing offers 30 mm threaded lens or side mount.
- Opposed, retroreflective, diffuse, fixed-field and adjustable-field modes are available.
- High-power opposed sensing is available with some models.
- Popular supply options include dc or ac/dc universal power.
- *Expert™* models offer push-button TEACH-mode setup.
- New models to detect water, or liquids that contain water.
- Cable choice is 2 m integral or Euro-style quick-disconnect.
- Two bright LED indicators are visible from 360 degrees.



- S30 page 121**
- EZ-BEAM® technology for reliable sensing without adjustments
 - 30 mm plastic threaded barrel sensor in opposed, retroreflective and fixed-field modes
 - Completely epoxy encapsulated
 - Models for ac or dc power



- Q40 page 133**
- Rectangular 40 mm plastic housing with 30 mm threaded mounting base in opposed, retroreflective and fixed-field modes
 - Models for ac or dc power
 - Completely epoxy encapsulated
 - Specially designed EZ-BEAM® style optics and electronics for reliable sensing without adjustments



- SM30/SMI30 page 125**
- Economical, easy-to-use opposed mode barrel sensors
 - Models certified as intrinsically safe for use in hazardous atmospheres
 - Quad-ring sealed lens to eliminate capillary leakage
 - Very high excess gain; 200 m sensing range



- PicoDot® page 137**
- Convergent and retroreflective mode laser sensors for accurate position detection, inspection or counting
 - Convergent models with precise 0.25 mm focus point beam width
 - Retroreflective models for sensing small objects at close range or larger objects to 10.6 m



- T30 page 129**
- Right-angle T-style housing with 30 mm threaded lens
 - Completely epoxy encapsulated
 - Models for ac or dc power and bus network compatible connection
 - Specially designed EZ-BEAM® style optics and electronics for reliable sensing without adjustments



- QM42/QMT42 page 140**
- Rugged low-cost dc sensor in die-cast housing
 - Outstanding immunity to noise
 - Opposed, retroreflective, diffuse, fixed-field, adjustable-field and plastic fiber models

WORLD-BEAM®

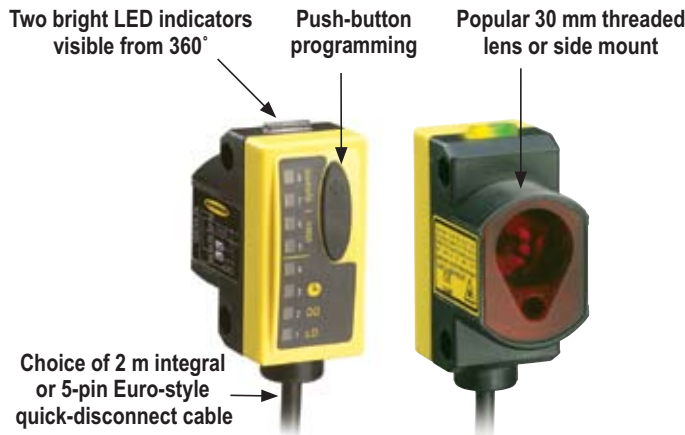
QS30 Series

Universal Sensors

- Features compact universal housing with 30 mm threaded lens or side mounts
- Available with Class 1 visible laser in diffuse and retroreflective models, and Class 2 in diffuse models, and high-power infrared in opposed mode and adjustable-field background suppression
- Offers easy push-button *Expert™* configuration in laser, adjustable-field and visible red diffuse models
- Available in models for detecting water
- Features easy-to-read operating status indicators
- Provides bipolar discrete NPN or PNP outputs



MINIATURE
COMPACT
MIDSIZE
FULLSIZE



- OPPOSED WATER DETECTION
- OPPOSED
- RETRO
- POLAR RETRO
- LASER POLAR RETRO
- DIFFUSE
- DIFFUSE LASER
- FIXED-FIELD
- ADJUSTABLE-FIELD
- BRACKETS PAGE 371
- GD CABLES 5-Pin Euro PAGE 414
- REFLECTORS PAGE 425
- APERTURES PAGE 444

QS30	page 113
QS30 Expert™	116
QS30 Laser	116
QS30 Background Suppression	116
QS30 Universal Voltage	119



QS30

- Large bright output state indicator
- Power and signal indicators visible from 360°
- Precise fixed-field background suppression
- High-power opposed and water detecting models
- Configurable for LO/DO through hookup

QS30 Expert™

- Visible red LED or laser for easy alignment
- Adjustable-field, visible red diffuse and laser models
- Push-button configuration
- 8-segment LED display for easy setup

QS30 Laser Diffuse and Retroreflective

- High-performance sensing with visible Class 1 and Class 2 lasers
- 8-segment LED display for easy setup
- Convenient push-button TEACH for fine tuning

QS30 Background Suppression

- Push-button SET adjustable-field background suppression
- Fixed-field model sensing range of 200, 400 or 600 mm
- Accurate and reliable even with low reflectivity targets

QS30 Universal Voltage

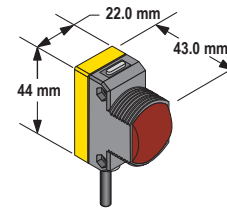
- Universal voltage for use anywhere regardless of supply voltage
- Operation from 12 to 250V dc or 24 to 250V ac
- Convenient SPDT electromechanical relay to switch up to 5 A

WORLD-BEAM® QS30 DC Sensors

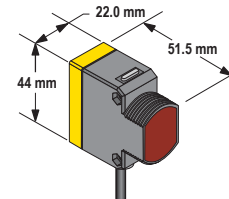
- Popular 30 mm threaded lens or side mount
- Two bright LED indicators visible from 360°
- Extra-large Output indicator on some models
- IP67 or IP69K environmental rating, depending on model
- Choice of 2 or 9 m integral, or 5-pin Euro-style quick-disconnect cable



Opposed, Retroreflective, Diffuse and Fixed-field Models
Suffix E, R, LP, LV, D and FF



Opposed High-Power Models
Suffix EX and RX



Opposed Water Detector Models
Suffix H2O



WORLD-BEAM® QS30, 10-30V dc



Model	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
QS30E Emitter		60 m	2 m	Bipolar NPN/PNP	EGCO-22 (p. 469)	BPO-22 (p. 493)	119165
QS30EQ Emitter			5-pin Euro QD				
QS30R			2 m				
QS30RQ			5-pin Euro QD				
QS30EX Emitter		213 m	2 m	Bipolar NPN/PNP LO	EGCO-23 (p. 469)	BPO-23 (p. 493)	115011
QS30EXQ Emitter			5-pin Euro QD				
QS30ARX			2 m				
QS30ARXQ			5-pin Euro QD				
QS30RRX			2 m				
QS30RRXQ			5-pin Euro QD				
QS30EXH2O		4 m	2 m	Bipolar NPN/PNP LO	EGCO-25 (p. 469)	BPO-25 (p. 493)	136166
QS30EXH2OQ5			5-pin Euro Pigtail QD				
QS30ARXH2O			2 m				
QS30ARXH2OQ5			5-pin Euro Pigtail QD				
QS30RRXH2O			2 m				
QS30RRXH2OQ5			5-pin Euro Pigtail QD				

* Visible Red LED Infrared LED

** For 9 m cable, add W/30 to the 2 m model number (example, QS30EX W/30). A QD model requires a mating cable (see page 414).

More on next page

WORLD-BEAM® QS30, 10-30V dc (cont'd)

MINIATURE
 COMPACT
 MIDSIZE
 FULLSIZE

Model	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
QS30ARH2O	 OPPOSED WATER DETECTION	2 m	2 m	Bipolar NPN/PNP LO	EGCO-25 (p. 469)	BPO-25 (p. 493)	136166
QS30ARH2OQ5			5-pin Euro Pigtail QD				
QS30RRH2O			2 m	Bipolar NPN/PNP DO			
QS30RRH2OQ5			5-pin Euro Pigtail QD QD				
QS30LV	 RETRO	12 m†	2 m	Bipolar NPN/PNP	EGCR-32 (p. 472)	BPR-31 (p. 496)	119165
QS30LVQ			5-pin Euro QD				
QS30LP	 POLAR RETRO	8 m†	2 m		EGCR-33 (p. 473)	BPR-32 (p. 496)	119165
QS30LPQ			5-pin Euro QD				
QS30D	 DIFFUSE	1 m	2 m		EGCD-34 (p. 477)	BPD-34 (p. 500)	119165
QS30DQ			5-pin Euro QD				
QS30FF200	 FIXED-FIELD	200 mm Cutoff	2 m		EGCF-21 (p. 483)	—	119165
QS30FF200Q			5-pin Euro QD				
QS30FF400		400 mm Cutoff	2 m				
QS30FF400Q			5-pin Euro QD				
QS30FF600		600 mm Cutoff	2 m				
QS30FF600Q			5-pin Euro QD				


* Visible Red LED Infrared LED
 ** For 9 m cable, add W/30 to the 2 m model number (example, QS30FF200 W/30). A QD model requires a mating cable (see page 414).
 † Retroreflective range is specified using one model BRT-84 retroreflector. Actual sensing range may differ, depending on efficiency and reflective area of the retroreflector in use. See Accessories for more information.

WORLD-BEAM® QS30 DC Specifications

Supply Voltage	Emitters (High-Powered): 10 to 30V dc (10% max. ripple) at less than 70 mA Receivers (High-Powered and water): 10 to 30V dc (10% max. ripple) at less than 22 mA Receivers (Water): 10 to 30V dc (10% max. ripple) at less than 50 mA (exclusive of load) All others: 10 to 30V dc (10% max. ripple) at 45 mA, (exclusive of load)
Supply Protection Circuitry	Protected against reverse polarity, over voltage, and transient voltages
Delay at Power-Up	100 milliseconds; outputs do not conduct during this time (except Opposed High-Powered)
Output Configuration	Bipolar: One PNP (current sourcing) and one NPN (current sinking); light operate (LO) or dark operate (DO) selectable or configurable (depending on model).
Output Rating	Opposed (High-Power): 100 mA max. load OFF-state leakage current: less than 200 µA ON-state saturation voltage: less than 1.5V at 100 mA; less than 900 mV at 10 mA All others: 100 mA max. each output at 25° C OFF-state leakage current: NPN: less than 200 µA @ 30V dc PNP: less than 10 µA ON-state saturation voltage: NPN: less than 1.6V @ 100 mA PNP: less than 2.0V @ 100 mA
Output Protection	Protected against output short-circuit, continuous overload, transient over-voltages, and false pulse on power-up

More on next page

WORLD-BEAM® QS30 DC Specifications (cont'd)

Output Response Time	Opposed: 5 milliseconds ON/OFF Opposed (High-Power): 30 milliseconds ON/OFF Opposed (Water): less than 1 millisecond Fixed-field: 2 milliseconds ON/OFF All others: 2 milliseconds ON/OFF
Repeatability	Opposed: not applicable Fixed-field models: 500 microseconds Opposed (High-Power): 5 milliseconds All others: 500 microseconds
Adjustments	Opposed (High-Power and Water): Light Operate/Dark Operate—dependent on model selected Frequency via gray wire: A: Gray (+) B: Gray (-) Emitter only: LED inhibit, via white wire White (-) turns emitter LED OFF (to allow verification of sensor operation) Opposed, Retroreflective, and Polarized Retroreflective: Selectable Light/Dark Operate is achieved via the gray wire. Light Operate - Low (0 to 3V)* Dark Operate - High (open or 5 to 30V)* Diffuse and Fixed-field: Light Operate - High (open or 5 to 30V)* Dark Operate - Low (0 to 3V)* Diffuse, Retroreflective, and Polarized Retroreflective (only): Single-turn sensitivity (Gain) adjustment potentiometer * Input impedance 10 kΩ
Indicators	Opposed (High-Power)*: 4-LED Signal Strength light bar Green LED: Power ON Frequency indicator: (A or B) Receiver only: Yellow LED: Output conducting All others (except emitters): Large, oval LED indicator on sensor back Yellow ON steady: Output conducting 2 indicators on top Green ON Steady: Power ON Green Flashing: Output overloaded (except receivers) Yellow ON steady: Light sensed Yellow Flashing: Marginal excess gain (1.0 to 1.5x excess gain) *See data sheets for more detailed information
Construction	PC/ABS blend plastic housing; acrylic lens cover
Environmental Rating	Opposed (High-Power): Cabled: IP67; NEMA 6P QD: IP69K; DIN 40050-9 Opposed (Water): IEC IP67 (NEMA 6) and 1200 PSI washdown NEMA ICS 5, Annex F-2002 All others: IP67; NEMA 6
Connections	5-conductor 2 or 9 m PVC cable, or 5-pin integral Euro-style quick-disconnect fitting. QD cables are ordered separately. See page 414.
Operating Conditions	Opposed (High-Power and Water): -20° to +60° C Relative humidity: 95% (non-condensing) All others: -20° to +70° C Relative humidity: 95% (non-condensing)
Vibration and Mechanical Shock	All models (except Opposed High-Power) meet Mil. Std. 202F requirements. Method 201A (Vibration: 10 to 60Hz max. double amplitude 0.06", max. acceleration 10G). Also meets IEC 947-5-2 requirements: 30G, 11 milliseconds duration, half sine wave.
Certifications	
Hookup Diagrams	High-Powered and Water models: Emitters: DC09 (p. 522) Receivers: DC10 (p. 522) All other models: Emitters: DC02 (p. 520) Bipolar NPN/PNP: DC08 (p. 521)

MINIATURE

COMPACT

MIDSIZE

FULLSIZE

MINIATURE
COMPACT
MIDSIZE
FULLSIZE

WORLD-BEAM® QS30 Expert™ Sensors

- Popular 30 mm lens or side mount
- Two bright LED indicators visible from 360°
- 8-segment LED display for easy setup
- Simple push-button programming
- Choice of 2 or 9 m integral, or 5-pin Euro-style quick-disconnect cable
- High-performance sensor with red laser or LED
- Laser polarized retroreflective models with high gain or high sensitivity



Laser Retroreflective, LED Diffuse, Laser Diffuse and Adjustable-field Models
Suffix LLP, LLPC, EDV, LD, LDL, and AF

WORLD-BEAM® QS30 Expert™, 10-30V dc



Model	Sensing Mode/LED*	Laser Class	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
QS30LLP	<p>LASER POLAR RETRO</p>	Class 1	0.2-18 m†	2 m	Bipolar NPN/PNP	EGCR-34 & EGCR-35 (p. 473)	—	112355
QS30LLPQ				5-pin Euro QD				
QS30LLPC				2 m				
QS30LLPCQ				5-pin Euro QD				
QS30EDV	<p>DIFFUSE</p>	—	High-Speed: 1100 mm Normal: 1400 mm	2 m		EGCD-37 (p. 477)	BPD-37 (p. 500)	127755
QS30EDVQ				5-pin Euro QD				
QS30LD	<p>DIFFUSE LASER</p>	Class 1	400 mm	2 m		EGCD-35 (p. 477)	BPD-35 (p. 500)	109027
QS30LDQ				5-pin Euro QD				
QS30LDL		Class 2	800 mm	2 m				
QS30LDLQ				5-pin Euro QD				
QS30AF	<p>ADJUSTABLE-FIELD</p>	—	50-300 mm Cutoff	2 m	ECGA-4 (p. 481) Cutoff Point Deviation CPDC-4 & CPDC-5 (p. 517)	—	111384	
QS30AFQ				5-pin Euro QD				

* → Visible Red LED → Visible Red Laser

** For 9 m cable, add W/30 to the 2 m model number (example, QS30LLP W/30). A QD model requires a mating cable (see page 414).

† Retroreflective range is specified using one model BRT-36X40BM retroreflector. Actual sensing range may differ, depending on efficiency and reflective area of the retroreflector in use. BRT-TVHG-2X2 and BRT-36X40BM are included. See Accessories for more information.

WORLD-BEAM® QS30 Expert™ Specifications

Supply Voltage and Current	Adjustable-field LED: 10 to 30V dc (10% max. ripple) at less than 45 mA, exclusive of load Diffuse LED: 10 to 30V dc (10% max. ripple) at less than 25 mA, exclusive of load Diffuse Laser and Retroreflective Laser: 10 to 30V dc (10% max. ripple @ 10% duty cycle) @ 35 mA max current, exclusive of load
Sensing Beam	LED models: 660 nm visible Red Laser models: Class 1: 650 nm visible Red Class 2: 658 nm visible Red
Beam size at Aperture	Diffuse Laser: Approx. 2 mm Retroreflective Laser: Approx. 3 mm
Supply Protection Circuitry	Protected against reverse polarity, over voltage and transient voltages
Output Configuration	Bipolar: One NPN (current sinking) and one PNP (current sourcing); light operate (LO) or dark operate (DO) configurable
Output Rating	Adjustable-field LED and Diffuse LED: 150 mA max. load (derate ~ 1 mA/° C above 25° C) OFF-state leakage current: less than 50 µA @ 30V dc ON-state saturation voltage: NPN: less than 200 mV @ 10 mA; less than 1V @ 150 mA PNP: less than 1.25V @ 10 mA; less than 2V @ 150 mA Diffuse Laser and Retroreflective Laser: 150 mA max. load OFF-state leakage current: less than 10 µA at 30V dc ON-state saturation voltage: NPN: less than 1.0V @ 150 mA load PNP: less than 2.0V @ 150 mA load
Output Protection Circuitry	Protected against output short-circuit, continuous overload, transient over-voltages and false pulse on power-up
Output Response Time	Adjustable-field LED: 1 millisecond Diffuse LED: High-speed mode: 300 microseconds Normal mode: 1.8 milliseconds Diffuse Laser and Retroreflective Laser: 500 microseconds
Delay at Power-up	Adjustable-field LED and Diffuse LED: 250 milliseconds; outputs do not conduct during this time. Diffuse Laser and Retroreflective Laser: 1 second max.; outputs do not conduct during this time.
Repeatability	Adjustable-field LED: 170 microseconds Diffuse LED: High-speed mode: 100 microseconds Normal mode: 150 microseconds Diffuse Laser and Retroreflective Laser: 75 microseconds
Hysteresis	See chart HC-1 on page 512.
Adjustments	2 push buttons and remote wire • Push-button SET programming; manually adjust (+/-) cutoff (Adjustable-field LED and Retroreflective Laser models) • Expert™ TEACH programming (two-point static, dynamic and single-point static) for Diffuse Laser and Diffuse LED models • Manually adjust (+/-) cutoff (push buttons only) • NO/NC or LO/DO and OFF-delay configuration options (push buttons only) • Push-button lockout (from remote wire only)
Indicators	8-segment Red bargraph*: distance relative to cutoff point 2 LED indicators on top: Green and Yellow Green: Power ON Yellow: Output conducting * See data sheets for more detailed information.
Construction	PC/ABS housing with acrylic lens cover
Environmental Rating	IP67; NEMA 6




MINIATURE

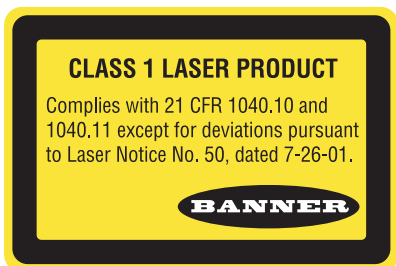
COMPACT

MIDSIZE

FULLSIZE

- MINIATURE
- COMPACT
- MIDSIZE
- FULLSIZE

WORLD-BEAM® QS30 Expert™ Specifications (cont'd)	
Connections	5-conductor 2 m or 9 m attached PVC cable, or 5-pin Euro-style quick-disconnect fitting. QD cables are ordered separately. See page 414.
Operating Conditions	Adjustable-field LED and Diffuse LED: Temperature: -10° to +55° C Relative humidity: 95% @ 55° C (non-condensing) Diffuse Laser and Retroreflective Laser: Temperature: -10° to +50° C Relative humidity: 95% @ 50° C (non-condensing)
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements. Method 201A (Vibration; frequency 10 to 60 Hz max., double amplitude 0.06-inch acceleration 10G). Also meets IEC 947-5-2 requirements: 30G, 11 milliseconds duration, half-sine wave.
Certification	
Hookup Diagrams	DC08: (p.521)



Class 1 Lasers

Lasers that are safe under reasonably foreseeable conditions of operation, including the use of optical instruments for intrabeam viewing. Reference 60825-1 Amend. 2 © IEC:2001(E), section 8.2.

For safe laser use:

- Do not permit a person to stare at the laser from within the beam.
- Do not point the laser at a person's eye at close range.
- Locate open laser beam paths either above or below eye level, where practical.

Class 2 Lasers

Lasers that emit visible radiation in the wavelength range from 400 to 700 nm where eye protection is normally afforded by aversion responses, including the blink reflex. This reaction may be expected to provide adequate protection under reasonably foreseeable conditions of operation, including the use of optical instruments for intrabeam viewing. Reference 60825-1 Amend. 2 © IEC:2001(E), section 8.2.

For safe laser use:

- Do not permit a person to stare at the laser from within the beam.
- Do not point the laser at a person's eye at close range.
- Locate open laser beam paths either above or below eye level, where practical.

WORLD-BEAM® QS30 Universal Voltage Sensors

- Popular 30 mm threaded lens or side mount
- Two bright LED indicators visible from 360°
- Extra-large Output indicator on some models
- IP67 environmental rating
- SPDT e/m relay output



Opposed, Retroreflective and Fixed-field Models
Suffix R, E, LP and FF



WORLD-BEAM® QS30 Universal Voltage, 12-250V dc or 24-250V ac



Model	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
QS303E Emitter	 OPPOSED	60 m	2 m	SPDT e/m Relay	EGCO-24 (p. 469)	BPO-24 (p. 493)	119166
QS30VR3R			2 m				
QS30VR3LP	 POLAR RETRO	8 m†	2 m		EGCR-36 (p. 473)	BPR-33 (p. 497)	
QS30VR3FF200	 FIXED-FIELD	200 mm Cutoff	2 m		EGCF-24 (p. 483)	—	
QS30VR3FF400		400 mm Cutoff	2 m		EGCF-25 (p. 483)	—	
QS30VR3FF600		600 mm Cutoff	2 m		EGCF-26 (p. 483)	—	

* Infrared LED Visible Red LED


** Connection Options:

Cabled models: For 9 m cable, add **W/30** to the 2 m model number (example, **QS303E W/30**).

QD models: Available with modified specification, contact factory at 1-888-373-6767.

† Retroreflective range is specified using model BRT-84 retroreflector. Actual sensing range may differ, depending on efficiency and reflective area of the retroreflector in use. See Accessories for more information.

WORLD-BEAM® QS30 Universal Voltage Specifications

Supply Voltage	24 to 250V ac, 50/60 Hz or 12 to 250V dc (1.0 watt max.)
Supply Protection Circuitry	Protected against transient voltages
Output Configuration	SPDT (Single-Pole Double-Throw) electromechanical relay output (all models except emitters)
Output Rating	Max. Switching Power (resistive load): 150 W, 1250 VA Max. Switching Voltage (resistive load): 250V ac; 125V dc Max. Switching Current (resistive load): 5 A @ 250V ac; 5 A @ 30V dc derated to 200 mA @ 125V dc Min. Voltage and Current: 5V dc, 10 mA Mechanical life of relay: 50 million operations Electrical life of relay at full resistive load: 100,000 operations
Output Response	15 milliseconds ON/OFF
Delay at Power-Up	100 millisecond delay; output does not conduct during this time.
Indicators	2 LED indicators on sensor top: Green ON steady: Power ON Yellow ON steady: Light sensed Yellow flashing: Marginal excess gain (1.0 to 1.5X excess gain) Large, oval LED indicator on sensor back (except emitters): Yellow ON steady: Output conducting
Construction	ABS housing; Acrylic lens cover
Environmental Rating	IEC IP67; NEMA 6
Connections	2 m or 9 m 5-wire PVC cable
Operating Conditions	Temperature: -20° to +70° C Relative humidity: 95% @ 50° C (non-condensing)
Certifications	
Hookup Diagrams	Emitters: UN02 (p. 528) All other models: UN01 (p. 528)

MINIATURE

COMPACT

MIDSIZE

FULLSIZE

S30

30 mm Threaded-Barrel Sensors

- Features EZ-BEAM® technology, with specially designed optics and electronics for reliable sensing without adjustments
- Available in 30 mm plastic threaded barrel sensor in opposed, retroreflective and fixed-field modes
- Completely epoxy-encapsulated to provide superior durability, even in harsh environments
- Uses innovative dual-indicator system to take the guesswork out of monitoring sensor performance
- Available in models for ac or dc power
- Includes advanced diagnostics to warn of marginal sensing conditions or output overload (dc models)

DC Models page 122

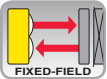
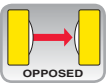
AC Models 123

MINIATURE

COMPACT

MIDSIZE

FULLSIZE



S30 DC Sensors

- Dual-LED multi-function indicators
- Popular 30 mm threaded barrel
- 10 to 30V dc with NPN or PNP outputs
- 2 m or 9 m attached cable, or Euro-style quick-disconnect

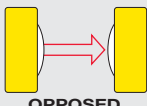

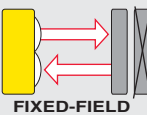
MORE INFO ONLINE
Detailed Dimensions



Opposed, Polarized Retroreflective and Fixed-field Models
Suffix E, R, LP and FF

S30, 10-30V dc

- MINIATURE
- COMPACT
- MIDSIZE
- FULLSIZE

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
S306E Emitter	 OPPOSED	60 m	2 m	-	EGCO-26 (p. 469)	BPO-26 (p. 493)	121520
S306EQ Emitter			4-Pin Euro QD				
S30SN6R			2 m	NPN			
S30SN6RQ			4-Pin Euro QD				
S30SP6R			2 m	PNP			
S30SP6RQ			4-Pin Euro QD				
S30SN6LP	 POLAR RETRO	6 m†	2 m	NPN	EGCR-37 (p. 473)	BPR-34 (p. 497)	
S30SN6LPQ			4-Pin Euro QD				
S30SP6LP			2 m	PNP			
S30SP6LPQ			4-Pin Euro QD				
S30SN6FF200	 FIXED-FIELD	0 - 200 mm Cutoff	2 m	NPN	EGCF-27 (p. 483)	—	
S30SN6FF200Q			4-Pin Euro QD				
S30SP6FF200			2 m	PNP			
S30SP6FF200Q			4-Pin Euro QD				
S30SN6FF400		0 - 400 mm Cutoff	2 m	NPN	EGCF-28 (p. 483)	—	
S30SN6FF400Q			4-Pin Euro QD				
S30SP6FF400			2 m	PNP			
S30SP6FF400Q			4-Pin Euro QD				
S30SN6FF600	0 - 600 mm Cutoff	2 m	NPN	EGCF-29 (p. 483)	—		
S30SN6FF600Q		4-Pin Euro QD					
S30SP6FF600		2 m	PNP				
S30SP6FF600Q		4-Pin Euro QD					

* Infrared LED Visible Red LED

** For 9 m cable, add W/30 to the 2 m model number (example, S30SP6LP W/30). A QD model requires a mating cable (see page 412).

† Retroreflective range is specified using one model BRT-3 retroreflector. Actual sensing range may differ, depending on efficiency and reflective area of the retroreflector in use. See Accessories for more information.

S30 DC Specifications	
Supply Voltage and Current	10 to 30V dc (10% max. ripple); Supply current (exclusive of load current): Opposed Emitters: 25 mA Opposed Receivers: 20 mA Polarized Retroreflective: 30 mA Fixed-field: 35 mA
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	Solid-state complementary; choose NPN (current sinking) or PNP (current sourcing) models. The Dark Operate (DO) output may be wired as a normally open marginal signal alarm output, depending upon hookup to the power supply.
Output Rating	150 mA max. (each) in standard hookup; When wired for alarm output, the total load may not exceed 150 mA OFF-state leakage current: less than 1 µA at 30V dc ON-state saturation voltage: less than 1V at 10 mA dc; less than 1.5V at 150 mA dc
Output Protection Circuitry	Protected against false pulse on power-up and continuous overload or short circuit of outputs
Output Response Time	Opposed: 3 milliseconds ON; 1.5 milliseconds OFF Polarized Retroreflective and Fixed-field: 3 milliseconds ON/OFF NOTE: 100 millisecond delay on power-up; outputs are non-conducting during this time
Repeatability	Opposed: 375 microseconds Polarized Retroreflective and Fixed-field: 750 microseconds Repeatability and response are independent of signal strength.
Indicators	Two LEDs: Green and Yellow Green ON steady: power ON Green flashing: output overloaded Yellow ON steady: Light Operate (LO) energized Yellow flashing: excess gain marginal (1-1.5x) in light condition, LO energized
Construction	Housings are thermoplastic polyester. Lenses are polycarbonate or acrylic; two jam nuts included.



S30 DC Specifications (cont'd)	
Environmental Rating	Leakproof design rated NEMA 6P; DIN 40050 (IP69K)
Connections	2 m or 9 m attached cable, or 4-pin Euro-style quick-disconnect fitting. QD cables are ordered separately. See page 412.
Operating Conditions	Temperature: -40° to +70° C Relative humidity: 90% at 50° C (non-condensing)
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements. Method 201A (Vibration; frequency 10 to 60 Hz, max., double amplitude 0.06-inch acceleration 10G). Method 213B conditions H&I (Shock: 75G with unit operating; 100G for non-operation)
Certifications	
Hookup Diagrams	Emitters: DC02 (p. 520) NPN Models: DC05 (p. 521) PNP Models: DC06 (p. 521)

S30 AC Sensors

- Dual-LED multi-function indicators
- Popular 30 mm threaded barrel
- 20 to 250V ac with solid-state outputs
- 2 m or 9 m attached cable, or Micro-style quick-disconnect



Opposed, Polarized Retroreflective and Fixed-field Models
Suffix E, R, LP and FF

S30, 20-250V ac

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
S303E Emitter	<p>OPPOSED</p>	60 m	2 m	-	EGCO-26 (p. 469)	BPO-26 (p. 493)	121519
S303EQ1 Emitter			4-Pin Micro QD				
S30AW3R			2 m	LO			
S30AW3RQ1			4-Pin Micro QD				
S30RW3R			2 m	DO			
S30RW3RQ1			4-Pin Micro QD				
S30AW3LP	<p>POLAR RETRO</p>	6 m†	2 m	LO	EGCR-37 (p. 473)	BPR-34 (p. 497)	
S30AW3LPQ1			4-Pin Micro QD				
S30RW3LP			2 m	DO			
S30RW3LPQ1			4-Pin Micro QD				

* Infrared LED Visible Red LED
 ** For 9 m cable, add W/30 to the 2 m model number (example, S30AW3LP W/30). A QD model requires a mating cable (see page 419).
 † Retroreflective range is specified using one model BRT-3 retroreflector. Actual sensing range may differ, depending on efficiency and reflective area of the retroreflector in use. See Accessories for more information.





S30, 20-250V ac (cont'd)

MINIATURE
 COMPACT
 MIDSIZE
 FULLSIZE

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet					
S30AW3FF200		0 - 200 mm Cutoff	2 m	LO	EGCF-27 (p. 483)	—	121519					
S30AW3FF200Q1			4-Pin Micro QD									
S30RW3FF200			2 m	DO								
S30RW3FF200Q1			4-Pin Micro QD									
S30AW3FF400		0 - 400 mm Cutoff	0 - 400 mm Cutoff	2 m	LO	EGCF-28 (p. 483)		—				
S30AW3FF400Q1				4-Pin Micro QD								
S30RW3FF400				2 m	DO							
S30RW3FF400Q1				4-Pin Micro QD								
S30AW3FF600				0 - 600 mm Cutoff	0 - 600 mm Cutoff				2 m	LO	EGCF-29 (p. 483)	—
S30AW3FF600Q1									4-Pin Micro QD			
S30RW3FF600		2 m	DO									
S30RW3FF600Q1		4-Pin Micro QD										

* Infrared LED

** For 9 m cable, add W/30 to the 2 m model number (example, S30AW3FF200 W/30). A QD model requires a mating cable (see page 419).

S30 AC Specifications	
Supply Voltage and Current	20 to 250V ac (50/60 Hz). Average current: 20 mA Peak current: 200 mA at 20V ac, 500 mA at 120V ac, 750 mA at 250V ac
Supply Protection Circuitry	Protected against transient voltages
Output Configuration	Solid-state ac switch; three-wire hookup; choose light operate (LO) or dark operate (DO) models; Light operate: Output conducts when the sensor sees its own (or the emitter's) modulated light Dark operate: Output conducts when sensor sees dark
Output Rating	300 mA max. (continuous) Fixed-field: derate 5 mA/° C above +50° C Inrush capability: 1 amp for 20 milliseconds, non-repetitive OFF-state leakage current: less than 100 µA ON-state voltage drop: 3V at 300 mA ac; 2V at 15 mA ac
Output Protection Circuitry	Protected against false pulse on power-up
Output Response Time	Opposed: 16 milliseconds ON; 8 milliseconds OFF Polarized Retroreflective and Fixed-field: 16 milliseconds ON/OFF NOTE: 100 millisecond delay on power-up
Repeatability	Opposed: 2 milliseconds Polarized Retroreflective and Fixed-field: 4 milliseconds Repeatability and response are independent of signal strength.
Indicators	Two LEDs: Green and Yellow Green ON steady: power ON Yellow steady: light sensed Yellow flashing: excess gain marginal (1-1.5x) in light condition
Construction	Housings are thermoplastic polyester. Lenses are polycarbonate or acrylic; two jam nuts included
Environmental Rating	Leakproof design rated NEMA 6P; DIN 40050 (IP69K)
Connections	2 m or 9 m attached cable, or 4-pin Micro-style quick-disconnect fitting. QD cables are ordered separately. See page 419.
Operating Conditions	Temperature: -40° to +70° C Relative humidity: 90% at 50° C (non-condensing)
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements. Method 201A (Vibration; frequency 10 to 60 Hz, max, double amplitude 0.06-inch acceleration 10G). Method 213B conditions H&I (Shock: 75G with unit operating; 100G for non-operation)
Certifications	
Hookup Diagrams	Cabled Emitters: AC03 (p. 525) Cabled Models: AC05 (p. 526) QD Emitters: AC07 (p. 526) QD Models: AC06 (p. 526)



SM30 and SMI30

High-Power, Opposed-Mode Barrel Sensors

- Features EZ-BEAM® technology, with specially designed optics and electronics for reliable sensing without adjustments
- Operates in opposed mode with very high excess gain
- Available in models for either ac or dc operation (standard SM30 Series)
- Certified as intrinsically safe for use in hazardous atmospheres (SMI30 Series)
- Uses positive sealing to eliminate even capillary leakage, with quad-ring-sealed lens
- Exceeds IEC IP67 (NEMA 6P) ratings; ideal in equipment washdown environments

SM30

page 126

SMI30 Intrinsically Safe

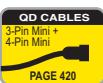
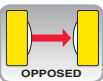
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MINIATURE

COMPACT

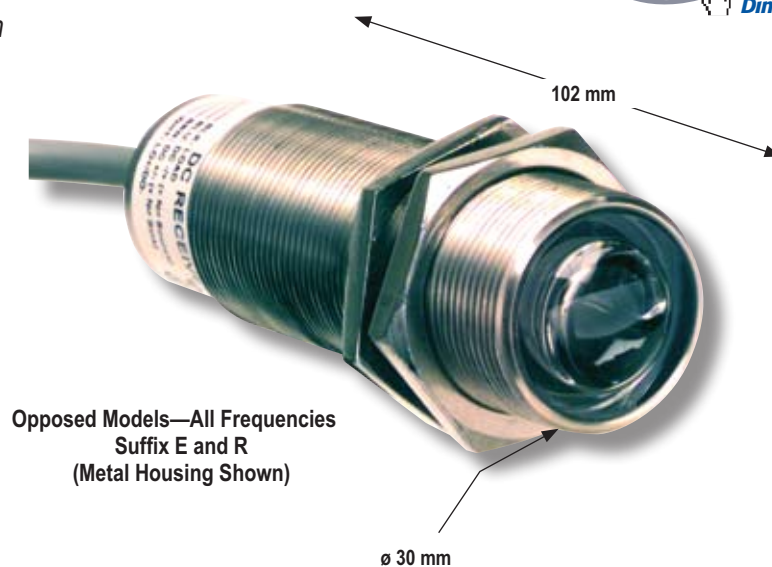
MIDSIZE

FULLSIZE



SM30 Sensors

- LED alignment indicator visible from side and through lens
- Popular 30 mm threaded barrel
- Metal or plastic housing
- 2 m or 9 m attached cable, or Mini-style quick-disconnect fitting



Opposed Models—All Frequencies
Suffix E and R
(Metal Housing Shown)

MINIATURE
COMPACT
MIDSIZE
FULLSIZE



SM30 Emitters, 10-30V dc or 12-240V ac, Frequency A†

Models	Sensing Mode/LED*	Housing	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
SMA30PEL		Plastic	200 m	2 m	N/A	EGCO-27 (p. 469)	BPO-27 (p. 493)	03541
SMA30PELQD				3-Pin Mini QD				
SMA30SEL		Stainless Steel		2 m				
SMA30SELQD				3-Pin Mini QD				



SM30 Receivers, 10-30V dc, Frequency A†

Models	Sensing Mode/LED*	Housing	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
SM30PRL		Plastic	200 m	2 m	Bi-Modal™ NPN or PNP	EGCO-27 (p. 469)	BPO-27 (p. 493)	03541
SM30PRLQD				4-Pin Mini QD				
SM30SRL		Stainless Steel		2 m				
SM30SRLQD				4-Pin Mini QD				



SM30 Receivers, 24-240V ac, Frequency A†

Models	Sensing Mode/LED*	Housing	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
SM2A30PRL		Plastic	200 m	2 m	LO	EGCO-27 (p. 469)	BPO-27 (p. 493)	03541
SM2A30PRLQD				3-Pin Mini QD				
SM2A30SRL		Stainless Steel		2 m				
SM2A30SRLQD				3-Pin Mini QD				
SM2A30PRLNC		Plastic		2 m	DO			
SM2A30PRLNCQD				3-Pin Mini QD				
SM2A30SRLNC		Stainless Steel		2 m				
SM2A30SRLNCQD				3-Pin Mini QD				

* Infrared LED

** For 9 m cable, add W/30 to the 2 m model number (example, SM30PRL W/30). A QD model requires a mating cable (see page 420).


† Modulation frequency "A" is standard; frequencies "B" and "C" are also available to minimize optical crosstalk potential between adjacent pairs and are specified by adding "B" or "C" at the end of the standard model number (example, SM30PRLB or SM30PRLC).

SM30 Specifications

Supply Voltage and Current	Emitters: 12 to 240V ac (50/60 Hz) or 10 to 30V dc (10% max. ripple) at 20 mA DC Receivers: 10 to 30V dc (10% max. ripple) at 10 mA max, exclusive of load AC Receivers: 24 to 240V ac (50/60 Hz)
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	DC Receivers: Bi-Modal™ output (PNP sourcing or NPN sinking). Selection of sourcing or sinking configuration depends upon receiver's power supply hookup polarity. Once wired, the unit performs as a solid-state switch. AC Receivers: Solid-state switch offer light operate (LO) or dark operate (DO) by model



SM30 Specifications (cont'd)

Output Rating	DC Receivers: 250 mA continuous Output saturation voltage: (PNP & NPN configuration) less than 1 volt at 10 mA; less than 2 volts at 250 mA OFF-state leakage current: less than 10 μ A AC Receivers: Max. steady-state load capability is 500 mA Inrush capability: 10 amps for 1 second (non-repeating) OFF-state leakage: current less than 1.7 mA rms ON-state voltage drop: less than 3.5 volts rms across a 500 mA load; less than 5 volts rms across a 15 mA load
Output Protection Circuitry	Outputs of dc receivers are short circuit protected
Output Response Time	10 milliseconds ON/OFF
Repeatability	"A" frequency units: 1 millisecond "B" frequency units: 1.5 milliseconds "C" frequency units: 2.3 milliseconds
Indicators	Internal Red LED, visible through the lens or from side of the sensor. Emitters: Red "Power ON" indicator LED DC Receivers: Lights whenever receiver sees its modulated light source AC Receivers: Lights whenever receiver's output is conducting
Construction	Fully epoxy-encapsulated tubular threaded housing, positive sealed at both ends, quad-ring sealed acrylic lens. Plastic models: 30 mm diameter thermoplastic polyester housing and jam nuts Stainless Steel models: 30 mm diameter 303 stainless steel housing and jam nuts
Environmental Rating	Exceeds NEMA 6P; IEC IP67 standards
Connections	PVC-jacketed 2 m or 9 m cables or Mini-style quick-disconnect (QD) fitting are available. QD cables are ordered separately. See page 420.
Operating Conditions	Temperature: -40° to +70° C Relative humidity: 90% at 50° C (non-condensing)
Certifications	
Hookup Diagrams	Cabled Emitters: UN06 (p. 529) QD Emitters: AC04 (p. 525) AC Cabled Receivers: AC10 (p. 527) AC QD Receivers: AC11 (p. 527) DC Receivers: DC18 (p. 524)

MINIATURE

COMPACT

MIDSIZE

FULLSIZE

SMI30 Intrinsically Safe DC Sensors

- *Extremely rugged and powerful opposed-mode intrinsically safe barrel sensors are designed for the most demanding hazardous area sensing applications.*
- *Sensor is certified as intrinsically safe for use in all hazardous atmospheres as defined by Article 500 of the National Electrical Code, when used with approved "positive input" intrinsic safety barriers.*
- *Sensor is certified by Factory Mutual and CSA as non-incendive devices when used in Division 2 locations (except Groups E and F) without intrinsic safety barriers.*
- *10 millisecond sensor pairs have a 140 m range; 1 millisecond pairs have a 60 m range.*
- *Use each sensor pair with model CI3RC2 current trip point amplifier and dual-channel intrinsic safety barrier for a complete intrinsically safe sensing system (components available as a kit).*





SMI30, 10-30V dc, Frequency A[†]

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Response Time	Excess Gain	Beam Pattern	Data Sheet
SMI306EQ	<p>OPPOSED</p>	140 m	3-Pin Mini QD	—	10 ms	Frequency: A: EGCO-28 B: EGCO-29 C: EGCO-30 (p. 469)	BPO-28 (p. 493)	35331
SMI30AN6RQ				NPN/LO				
SMI30RN6RQ				NPN/DO				
SMI306EYQ		—		1 ms	BPO-29 (p. 493)			
SMI30AN6RYQ		NPN/LO						
SMI30RN6RYQ		NPN/DO						

* Infrared LED

** A model with a QD requires a special Mini-style mating cable (see page 420).

† Modulation frequency "A" is standard; frequencies "B" and "C" are also available to minimize optical crosstalk potential between adjacent pairs and are specified by adding "B" or "C" in the standard model number (example, SMI306EBQ or SMI306EQC).

Intrinsic Safety Kits for Use with SMI30 Intrinsically Safe Sensors

Model	Description
C12BK-1	Includes a CI3RC2 current amplifier, one RS-11 socket, one DIN-rail mount and one single-channel intrinsically safe barrier
C12BK-2	Includes a CI3RC2 current amplifier, one RS-11 socket, one DIN-rail mount and one dual-channel intrinsically safe barrier
CI3RC2	Current trip point amplifier
CIB-1	Single channel intrinsic safety barrier
CI2B-1	Dual channel intrinsic safety barrier

SMI30 Specifications

Supply Voltage and Current	Emitters: 10 to 30V dc at 25 mA Receivers: 10 to 30V dc at 15 mA max. Division 1 use, with barriers, requires minimum system supply voltage of 10V.
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	Receivers: Current sinking NPN open-collector transistor
Output Rating	Three-wire hookup sinks 15 mA max. continuous, 10 to 30V dc. Two-wire hookup sinks ≤10 mA
Output Protection Circuitry	Outputs are short circuit protected
Output Response Time	10 milliseconds or 1 millisecond ON/OFF, depending on models; independent of signal strength
Repeatability	"A" frequency units: 10 millisecond receiver is 1 milliseconds and 1 millisecond receiver is 360 microseconds "B" frequency units: 1.6 milliseconds "C" frequency units: 10 millisecond receiver is 2.3 milliseconds and 1 millisecond receiver is 210 microseconds Repeatability is independent of signal strength
Indicators	Internal Red LED lights whenever the receiver sees the emitter's modulated light source. Emitters have Red "power on" indicator LED. All indicators are visible through the lens or from side of the sensor.
Construction	30 mm diameter tubular threaded thermoplastic polyester housing, fully epoxy-encapsulated, positive sealing at both ends, quad-ring sealed acrylic lens. Two thermoplastic polyester jam nuts provided.
Environmental Rating	IP67; NEMA 6P
Connections	3-wire Mini-style quick-disconnect (QD) fitting. Use cable models SMICC-3xx (p. 420). Cable electric properties: 40 pf/ft; 20 μH/ft. Order cable separately from sensor.
Operating Conditions	Temperature: -40° to +70° C Relative humidity: 90% at 50° C (non-condensing)
Certifications	
Hookup Diagrams	See data sheet (p/n 35331) for detailed Hookup Diagrams.



T30

30 mm Threaded Nose Right-Angle Sensors

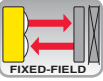
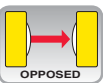
- Features EZ-BEAM® technology, with specially designed optics and electronics for reliable sensing without adjustments
- Features T-style plastic housing with 30 mm threaded lens in opposed, retroreflective and fixed-field modes
- Completely epoxy-encapsulated to provide superior durability, even in harsh sensing environments
- Uses an innovative dual-indicator system to take the guesswork out of monitoring sensor performance
- Available in models for ac or dc power
- Includes advanced diagnostics to warn of marginal sensing conditions or output overload (dc models)

MINIATURE

COMPACT

MIDSIZE

FULLSIZE



T30 AC and DC Sensor

- Dual-LED multi-function indicators
- Popular 30 mm threaded lens
- 2 m or 9 m attached cable, or Euro- or Micro-style quick-disconnect



Opposed, Polarized Retroreflective and Fixed-field Models
Suffix E, R, LP and FF



T30, 10-30V dc

MINIATURE
 COMPACT
 MIDSIZE
 FULLSIZE

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
T306E Emitter	 OPPOSED	60 m	2 m	-	EGCO-31 (p. 469)	BPO-30 (p. 493)	121524
T306EQ Emitter			4-Pin Euro QD				
T30SN6R			2 m	NPN			
T30SN6RQ			4-Pin Euro QD				
T30SP6R			2 m	PNP			
T30SP6RQ			4-Pin Euro QD				
T30SN6LP	 POLAR RETRO	6 m†	2 m	NPN	EGCR-38 (p. 473)	BPR-35 (p. 497)	
T30SN6LPQ			4-Pin Euro QD				
T30SP6LP			2 m	PNP			
T30SP6LPQ			4-Pin Euro QD				
T30SN6FF200	 FIXED-FIELD	0 - 200 mm Cutoff	2 m	NPN	EGCF-30 (p. 483)	-	
T30SN6FF200Q			4-Pin Euro QD				
T30SP6FF200			2 m	PNP			
T30SP6FF200Q			4-Pin Euro QD				
T30SN6FF400		0 - 400 mm Cutoff	2 m	NPN	EGCF-31 (p. 483)	-	
T30SN6FF400Q			4-Pin Euro QD				
T30SP6FF400			2 m	PNP			
T30SP6FF400Q			4-Pin Euro QD				
T30SN6FF600		0 - 600 mm Cutoff	2 m	NPN	EGCF-32 (p. 483)	-	
T30SN6FF600Q			4-Pin Euro QD				
T30SP6FF600			2 m	PNP			
T30SP6FF600Q			4-Pin Euro QD				

T30, 20-250V ac



Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
T303E Emitter	 OPPOSED	60 m	2 m	-	EGCO-31 (p. 469)	BPO-30 (p. 493)	121523
T303EQ1 Emitter			4-Pin Micro QD				
T30AW3R			2 m	LO			
T30AW3RQ1			4-Pin Micro QD				
T30RW3R			2 m	DO			
T30RW3RQ1			4-Pin Micro QD				
T30AW3LP	 POLAR RETRO	6 m†	2 m	LO	EGCR-38 (p. 473)	BPR-35 (p. 497)	
T30AW3LPQ1			4-Pin Micro QD				
T30RW3LP			2 m	DO			
T30RW3LPQ1			4-Pin Micro QD				

* Infrared LED Visible Red LED

** For 9 m cable, add W/30 to the 2 m model number (example, T30SN6LP W/30). A QD model requires a mating cable (see pages 412 and 419).

† Retroreflective range is specified using one model BRT-3 retroreflector. Actual sensing range may differ, depending on efficiency and reflective area of the retroreflector in use. See Accessories for more information.



More on next page



T30, 20-250V ac (cont'd)

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet	
T30AW3FF200	<p>FIXED-FIELD</p>	0 - 200 mm Cutoff	2 m	LO	EGCF-30 (p. 483)	—	121523	
T30AW3FF200Q1			4-Pin Micro QD					
T30RW3FF200			2 m	DO				
T30RW3FF200Q1			4-Pin Micro QD					
T30AW3FF400		0 - 400 mm Cutoff	0 - 400 mm Cutoff	2 m	LO	EGCF-31 (p. 483)		—
T30AW3FF400Q1				4-Pin Micro QD				
T30RW3FF400				2 m	DO			
T30RW3FF400Q1				4-Pin Micro QD				
T30AW3FF600		0 - 600 mm Cutoff	0 - 600 mm Cutoff	2 m	LO	EGCF-32 (p. 483)		—
T30AW3FF600Q1				4-Pin Micro QD				
T30RW3FF600				2 m	DO			
T30RW3FF600Q1				4-Pin Micro QD				

* Infrared LED



** For 9 m cable, add W/30 to the 2 m model number (example, T30AW3FF200 W/30). A QD model requires a mating cable (see page 419).

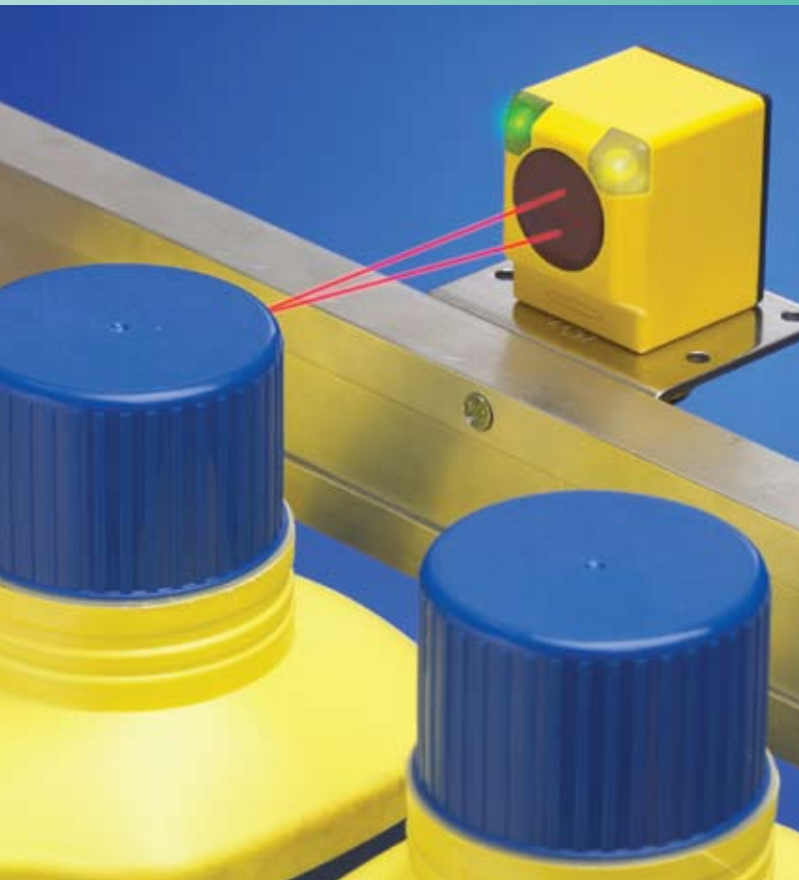
T30 DC Specifications

Supply Voltage and Current	10 to 30V dc (10% max. ripple); Supply current (exclusive of load current): Opposed Emitters: 25 mA Opposed Receivers: 20 mA Polarized Retroreflective: 30 mA Fixed-field: 35 mA
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	Solid-state dc switch; three-wire hookup; choose light operate (LO) or dark operate (DO) models Light operate: Output conducts when the sensor sees its own (or the emitter's) modulated light Dark operate: Output conducts when sensor sees dark
Output Rating	150 mA max. (each) in standard hookup; When wired for alarm output, the total load may not exceed 150 mA OFF-state leakage current: less than 1 µA at 30V dc ON-state saturation voltage: less than 1V at 10 mA dc; less than 1.5V at 150 mA dc
Output Protection Circuitry	Protected against false pulse on power-up and continuous overload or short circuit of outputs
Output Response Time	Opposed: 3 milliseconds ON; 1.5 milliseconds OFF Polarized Retroreflective and Fixed-field: 3 milliseconds ON/OFF NOTE: 100 millisecond delay on power-up; outputs are non-conducting during this time
Repeatability	Opposed: 375 microseconds Polarized Retroreflective, Non-polarized Retroreflective, Fixed-field and Diffuse: 750 microseconds Repeatability and response are independent of signal strength.
Indicators	Two LEDs: Green and Yellow Green ON steady: power ON Green flashing: output overloaded Yellow ON steady: light operate (LO) output energized Yellow flashing: excess gain marginal (1-1.5x) in light condition, LO output energized
Construction	Housings are thermoplastic polyester. Lenses are polycarbonate or acrylic; one jam nut included.
Environmental Rating	Leakproof design rated NEMA 6P; DIN 40050 (IP69K)
Connections	2 m or 9 m attached cable, or 4-pin Euro-style quick-disconnect fitting. QD cables are ordered separately. See page 412.
Operating Conditions	Temperature: -40° to +70° C Relative humidity: 90% at 50° C (non-condensing)
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements. Method 201A (Vibration; frequency 10 to 60 Hz, max., double amplitude 0.06-inch acceleration 10G). Method 213B conditions H&I (Shock: 75G with unit operating; 100G for non-operation)
Certifications	
Hookup Diagrams	Emitters: DC02 (p. 520) NPN Models: DC05 (p. 521) PNP Models: DC06 (p. 521)



MINIATURE
COMPACT
MIDSIZE
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T30 AC Specifications	
Supply Voltage and Current	20 to 250V ac (50/60 Hz). Average current: 20 mA Peak current: 200 mA at 20V ac, 500 mA at 120V ac, 750 mA at 250V ac
Supply Protection Circuitry	Protected against transient voltages
Output Configuration	Solid-state ac switch; three-wire hookup; choose light operate (LO) or dark operate (DO) models Light operate: Output conducts when the sensor sees its own (or the emitter's) modulated light Dark operate: Output conducts when sensor sees dark
Output Rating	300 mA max. (continuous) Fixed-field: derate 5 mA/° C above +50° C Inrush capability: 1 amp for 20 milliseconds, non-repetitive OFF-state leakage current: less than 100 µA ON-state voltage drop: 3V at 300 mA ac; 2V at 15 mA ac
Output Protection Circuitry	Protected against false pulse on power-up
Output Response Time	Opposed: 16 milliseconds ON; 8 milliseconds OFF Polarized Retroreflective and Fixed-field: 16 milliseconds ON/OFF NOTE: 100 millisecond delay on power-up
Repeatability	Opposed: 2 milliseconds Polarized Retroreflective and Fixed-field: 4 milliseconds Repeatability and response are independent of signal strength.
Indicators	Two LEDs: Green and Yellow Green ON steady: power ON Yellow ON steady: light sensed Yellow flashing: excess gain marginal (1-1.5x) in light condition
Construction	Housings are thermoplastic polyester. Lenses are polycarbonate or acrylic; one jam nut included.
Environmental Rating	Leakproof design rated NEMA 6P; DIN 40050 (IP69K)
Connections	2 m or 9 m attached cable, or 4-pin Micro-style quick-disconnect fitting. QD cables are ordered separately. See page 419.
Operating Conditions	Temperature: -40° to +70° C Relative humidity: 90% at 50° C (non-condensing)
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements. Method 201A (Vibration; frequency 10 to 60 Hz, max, double amplitude 0.06-inch acceleration 10G). Method 213B conditions H&I (Shock: 75G with unit operating; 100G for non-operation)
Certifications	 
Hookup Diagrams	Cabled Emitters: AC03 (p. 525) Cabled Models: AC05 (p. 526) QD Emitters: AC07 (p. 526) QD Models: AC06 (p. 526)

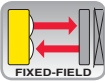
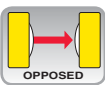


Q40

Right-Angle Rectangular Sensors

- Features EZ-BEAM® technology, with specially designed optics and electronics for reliable sensing without adjustments
- Features rectangular 40 mm plastic housing with 30 mm threaded mounting base in opposed, retroreflective and fixed-field modes
- Completely epoxy-encapsulated to provide superior durability, even in harsh sensing environments rated to IP69K
- Uses an innovative dual-indicator system to take the guesswork out of monitoring sensor performance
- Available in models for ac or dc power
- Uses advanced diagnostics to warn of marginal sensing conditions or output overload (dc models)

MINIATURE
COMPACT
MIDSIZE
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Q40 AC and DC Sensors

- Dual LED multi-function indicators
- 30 mm threaded mounting base
- 2 or 9 m attached cable, or Euro- or Micro-style quick-disconnect
- Green LED Power indicator

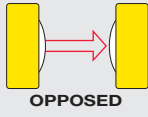

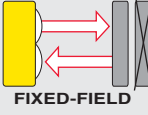


Opposed, Polarized Retroreflective and Fixed-field Models
Suffix E, R, LP and FF



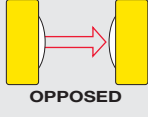

Q40, 10-30V dc

MINIATURE
COMPACT
MIDSIZE
FULLSIZE

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
Q406E Emitter	 OPPOSED	60 m	2 m	-	EGCO-32 (p. 469)	BP0-31 (p. 493)	121516
Q406EQ Emitter			4-Pin Euro QD				
Q40SN6R			2 m	NPN			
Q40SN6RQ			4-Pin Euro QD				
Q40SP6R			2 m	PNP			
Q40SP6RQ			4-Pin Euro QD				
Q40SN6LP	 POLAR RETRO	6 m†	2 m	NPN	EGCR-39 (p. 473)	BPR-36 (p. 497)	
Q40SN6LPQ			4-Pin Euro QD				
Q40SP6LP			2 m	PNP			
Q40SP6LPQ			4-Pin Euro QD				
Q40SN6FF200	 FIXED-FIELD	0 - 200 mm Cutoff	2 m	NPN	EGCF-33 (p. 484)	-	
Q40SN6FF200Q			4-Pin Euro QD				
Q40SP6FF200			2 m	PNP			
Q40SP6FF200Q			4-Pin Euro QD				
Q40SN6FF400		0 - 400 mm Cutoff	-	2 m	NPN	EGCF-34 (p. 484)	
Q40SN6FF400Q				4-Pin Euro QD			
Q40SP6FF400				2 m	PNP		
Q40SP6FF400Q				4-Pin Euro QD			
Q40SN6FF600		0 - 600 mm Cutoff	-	2 m	NPN	EGCF-35 (p. 484)	
Q40SN6FF600Q				4-Pin Euro QD			
Q40SP6FF600				2 m	PNP		
Q40SP6FF600Q				4-Pin Euro QD			

Q40, 20-250V ac



Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
Q403E Emitter	 OPPOSED	60 m	2 m	-	EGCO-32 (p. 469)	BP0-31 (p. 493)	121515
Q403EQ1 Emitter			4-Pin Micro QD				
Q40AW3R			2 m	LO			
Q40AW3RQ1			4-Pin Micro QD				
Q40RW3R			2 m	DO			
Q40RW3RQ1			4-Pin Micro QD				
Q40AW3LP	 POLAR RETRO	6 m†	2 m	LO	EGCR-39 (p. 473)	BPR-36 (p. 497)	
Q40AW3LPQ1			4-Pin Micro QD				
Q40RW3LP			2 m	DO			
Q40RW3LPQ1			4-Pin Micro QD				

*  Infrared LED  Visible Red LED

** For 9 m cable, add W/30 to the 2 m model number (example, Q40SN6LP W/30). A QD model requires a mating cable (see pages 412 and 419).

† Retroreflective range is specified using one model BRT-3 retroreflector. Actual sensing range may differ, depending on efficiency and reflective area of the retroreflector in use. See Accessories for more information.



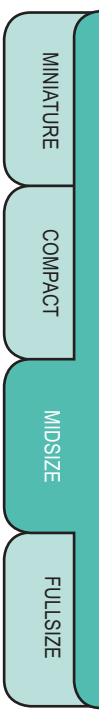


Q40, 20-250V ac (cont'd)

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet	
Q40AW3FF200		0 - 200 mm Cutoff	2 m	LO	EGCF-33 (p. 484)	—	121515	
Q40AW3FF200Q1			4-Pin Micro QD					
Q40RW3FF200			2 m	DO				
Q40RW3FF200Q1			4-Pin Micro QD					
Q40AW3FF400		0 - 400 mm Cutoff	0 - 400 mm Cutoff	2 m	LO	EGCF-34 (p. 484)		—
Q40AW3FF400Q1				4-Pin Micro QD				
Q40RW3FF400				2 m	DO			
Q40RW3FF400Q1				4-Pin Micro QD				
Q40AW3FF600		0 - 600 mm Cutoff	0 - 600 mm Cutoff	2 m	LO	EGCF-35 (p. 484)		—
Q40AW3FF600Q1				4-Pin Micro QD				
Q40RW3FF600				2 m	DO			
Q40RW3FF600Q1				4-Pin Micro QD				




* Infrared LED

** For 9 m cable, add W/30 to the 2 m model number (example, Q40AW3FF200 W/30). A QD model requires a mating cable (see page 419).



Q40 DC Specifications	
Supply Voltage and Current	10 to 30V dc (10% max. ripple); Supply current (exclusive of load current): Opposed Emitters: 25 mA Opposed Receivers: 20 mA Polarized Retroreflective: 30 mA Fixed-field: 35 mA
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	Solid-state complementary; choose NPN (current sinking) or PNP (current sourcing) models. The Dark Operate (DO) output may be wired as a normally open marginal signal alarm output, depending upon hookup to the power supply.
Output Rating	150 mA max. (each) in standard hookup; When wired for alarm output, the total load may not exceed 150 mA OFF-state leakage current: less than 1 µA at 30V dc ON-state saturation voltage: less than 1V at 10 mA dc; less than 1.5V at 150 mA dc
Output Protection Circuitry	Protected against false pulse on power-up and continuous overload or short circuit of outputs
Output Response Time	Opposed: 3 milliseconds ON; 1.5 milliseconds OFF Polarized Retroreflective and Fixed-field: 3 milliseconds ON/OFF NOTE: 100 millisecond delay on power-up; outputs are non-conducting during this time
Repeatability	Opposed: 375 microseconds Polarized Retroreflective, Non-Polarized Retroreflective, Fixed-field and Diffuse: 750 microseconds. Repeatability and response are independent of signal strength.
Indicators	Two LEDs: Green and Yellow Green ON steady: power ON Green flashing: output overloaded Yellow ON steady: Light Operate (LO) output energized Yellow flashing: excess gain marginal (1-1.5x) in light condition, LO output energized
Construction	Housings are thermoplastic polyester. Lenses are polycarbonate or acrylic; one jam nut included.
Environmental Rating	Leakproof design rated NEMA 6P; DIN 40050 (IP69K)
Connections	2 m or 9 m attached cable, or 4-pin Euro-style quick-disconnect fitting. QD cables are ordered separately. See page 412.
Operating Conditions	Temperature: -40° to +70° C Relative humidity: 90% at 50° C (non-condensing)
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements. Method 201A (Vibration; frequency 10 to 60 Hz, max., double amplitude 0.06-inch acceleration 10G). Method 213B conditions H&I (Shock: 75G with unit operating; 100G for non-operation)
Certifications	
Hookup Diagrams	Emitters: DC02 (p. 520) NPN Models: DC05 (p. 521) PNP Models: DC06 (p. 521)

MINIATURE
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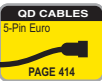
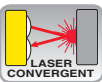
Q40 AC Specifications	
Supply Voltage and Current	20 to 250V ac (50/60 Hz) Average current: 20 mA Peak current: 200 mA at 20V ac, 500 mA at 120V ac, 750 mA at 250V ac
Supply Protection Circuitry	Protected against transient voltages
Output Configuration	Solid-state ac switch; three-wire hookup; choose light operate (LO) or dark operate (DO) models Light operate: Output conducts when the sensor sees its own (or the emitter's) modulated light Dark operate: Output conducts when sensor sees dark
Output Rating	300 mA max. (continuous) Fixed-field: derate 5 mA/° C above +50° C Inrush capability: 1 amp for 20 milliseconds, non-repetitive OFF-state leakage current: less than 100 µA ON-state voltage drop: 3V at 300 mA ac; 2V at 15 mA ac
Output Protection Circuitry	Protected against false pulse on power-up
Output Response Time	Opposed: 16 milliseconds ON; 8 milliseconds OFF Polarized Retroreflective and Fixed-field: 16 milliseconds ON/OFF NOTE: 100 millisecond delay on power-up
Repeatability	Opposed: 2 milliseconds Polarized Retroreflective and Fixed-field: 4 milliseconds Repeatability and response are independent of signal strength.
Indicators	Two LEDs: Green and Yellow Green ON steady: power ON Yellow ON steady: light sensed Yellow flashing: excess gain marginal (1-1.5x) in light condition
Construction	Housings are thermoplastic polyester. Lenses are polycarbonate or acrylic; one jam nut included.
Environmental Rating	Leakproof design rated NEMA 6P; DIN 40050 (IP69K)
Connections	2 m or 9 m attached cable, or 4-pin Micro-style quick-disconnect fitting. QD cables are ordered separately. See page 419.
Operating Conditions	Temperature: -40° to +70° C Relative humidity: 90% at 50° C (non-condensing)
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements. Method 201A (Vibration; frequency 10 to 60 Hz, max, double amplitude 0.06-inch acceleration 10G). Method 213B conditions H&I (Shock: 75G with unit operating; 100G for non-operation)
Certifications	  
Hookup Diagrams	Cabled Emitters: AC03 (p. 525) Cabled Models: AC05 (p. 526) QD Emitters: AC07 (p. 526) QD Models: AC06 (p. 526)



PicoDot[®] Laser Precision Sensors

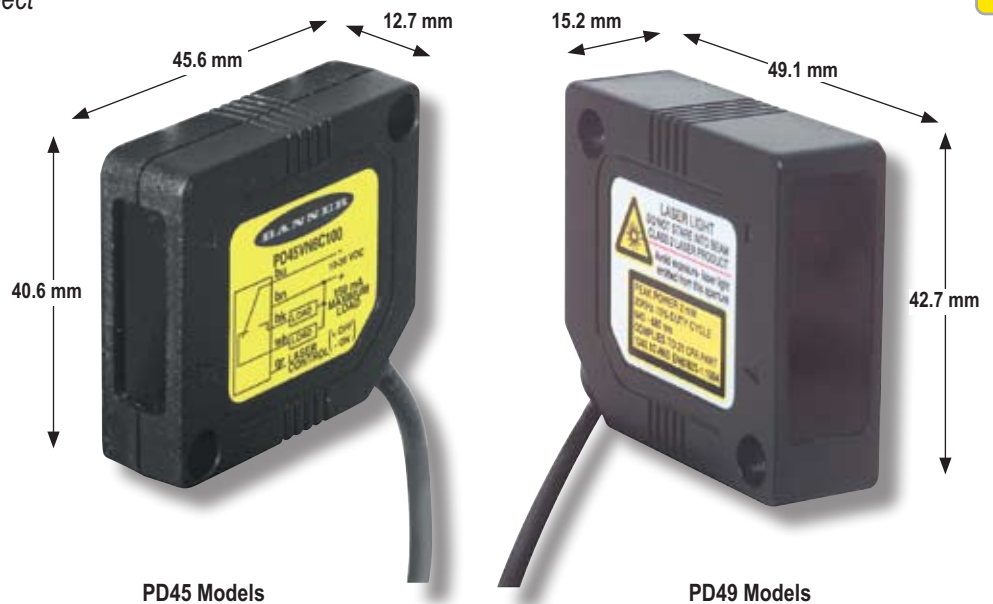
- Convergent mode laser sensor delivers precise position detection, inspection and counting.
- Powerful retroreflective models offer long-range retroreflective sensing.
- Fixed-field technology in the convergent-mode models ignores objects beyond the maximum sensing distance.
- Convergent models have precise 0.25 mm beam width at the convergent focus point.
- Retroreflective models have a precise, narrow beam to sense small objects at close range or larger objects to 10.6 m.
- All models have a gain sensitivity potentiometer for fine tuning sensor performance.
- Models are available with compact lightweight housing (PD45 models) or with environmentally sealed housing (PD49 models).

- MINIATURE
- COMPACT
- MIDSIZE
- FULLSIZE




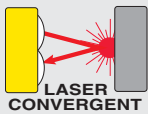
PicoDot[®] Sensors

- Dual-LED multifunction indicator and gain adjustment
- 2 m or 9 m attached cable, or 150 mm Euro-style pigtail quick-disconnect
- PD45 lightweight housings; IP54, NEMA 3
- PD49 ruggedized housing; IP67, NEMA 6
- Visible red Class 2 lasers



PicoDot®, 10-30V dc


- MINIATURE
- COMPACT
- MIDSIZE
- FULLSIZE

Models	Sensing Mode/LED*	Range or Focus	Cable**	Output Type	Housing Rating	Excess Gain	Beam Pattern	Data Sheet
PD45VN6LLP		0.2 m - 10.6 m†	2 m	NPN	IP54, NEMA 3	EGCR-40, EGCR-41 & EGCR-42 (p. 473)	—	115700
PD45VN6LLPQ			5-pin Euro Pigtail QD					
PD49VN6LLP			2 m	NPN	IP67, NEMA 6			
PD49VN6LLPQ			5-pin Euro Pigtail QD					
PD45VP6LLP			2 m	PNP	IP54, NEMA 3			
PD45VP6LLPQ			5-pin Euro Pigtail QD					
PD49VP6LLP			2 m	PNP	IP67, NEMA 6			
PD49VP6LLPQ			5-pin Euro Pigtail QD					
PD45VN6C50				50 mm	2 m			
PD45VN6C50Q	5-pin Euro Pigtail QD							
PD49VN6C50	2 m	NPN			IP67, NEMA 6			
PD49VN6C50Q	5-pin Euro Pigtail QD							
PD45VP6C50	2 m	PNP			IP54, NEMA 3			
PD45VP6C50Q	5-pin Euro Pigtail QD							
PD49VP6C50	2 m	PNP			IP67, NEMA 6			
PD49VP6C50Q	5-pin Euro Pigtail QD							
PD45VN6C100	102 mm	2 m		NPN	IP54, NEMA 3	EGCC-31 (p. 479)	BPC-31 (p. 502)	115700
PD45VN6C100Q		5-pin Euro Pigtail QD						
PD49VN6C100		2 m		NPN	IP67, NEMA 6			
PD49VN6C100Q		5-pin Euro Pigtail QD						
PD45VP6C100		2 m		PNP	IP54, NEMA 3			
PD45VP6C100Q		5-pin Euro Pigtail QD						
PD49VP6C100		2 m		PNP	IP67, NEMA 6			
PD49VP6C100Q		5-pin Euro Pigtail QD						
PD45VN6C200	203 mm	2 m		NPN	IP54, NEMA 3	EGCC-32 (p. 479)	BPC-32 (p. 502)	115700
PD45VN6C200Q		5-pin Euro Pigtail QD						
PD49VN6C200		2 m		NPN	IP67, NEMA 6			
PD49VN6C200Q		5-pin Euro Pigtail QD						
PD45VP6C200		2 m		PNP	IP54, NEMA 3			
PD45VP6C200Q		5-pin Euro Pigtail QD						
PD49VP6C200		2 m		PNP	IP67, NEMA 6			
PD49VP6C200Q		5-pin Euro Pigtail QD						
PD45VN6C300	305 mm	2 m	NPN	IP54, NEMA 3	EGCC-33 (p. 480)	BPC-33 (p. 503)	115700	
PD45VN6C300Q		5-pin Euro Pigtail QD						
PD49VN6C300		2 m	NPN	IP67, NEMA 6				
PD49VN6C300Q		5-pin Euro Pigtail QD						
PD45VP6C300		2 m	PNP	IP54, NEMA 3				
PD45VP6C300Q		5-pin Euro Pigtail QD						
PD49VP6C300		2 m	PNP	IP67, NEMA 6				
PD49VP6C300Q		5-pin Euro Pigtail QD						

* Visible Red Laser

** For 9 m cable, add W/30 to the 2 m model number (example, PD45VN6LLP W/30). A QD model requires a mating cable (see page 414).

† Tested using a BRT-36X40BM retro target (included with each sensor). Actual range depends on the efficiency and size of the retroreflective target. Some targets have produced ranges up to 40 m.

PicoDot® Specifications	
Supply Voltage	10 to 30V dc (10% max ripple) at less than 20 mA, exclusive of load
Beam Size at Aperture	3.75 x 1.85 mm (Retroreflective Models)
Beam Divergence	Approx. 1 milliradian (Retroreflective Models)
Laser Classification	Class 2 safety (CDRH (FDA) 1040.10 and IEC 60875-1)
Supply Protection Circuitry	Protected against reverse polarity, over voltage, and transient voltages
Delay at Power-up	< 1 second
Output Configuration	Solid-state complementary; choose NPN (current sinking) or PNP (current sourcing) models
Output Rating	150 mA max. (each output) OFF-state leakage current: less than μ A at 30V dc ON-state saturation voltage: less than 0.3V at 10 mA dc; less than 0.8V at 150 mA dc
Output Protection	Protected against continuous overload or short-circuit of outputs; Overload trip point \geq 220 milliamps
Output Response Time	0.2 milliseconds (200 microseconds) ON/OFF
Repeatability	50 microseconds; Rep Rate 20 KHz
Spot Size at Focus	0.25 mm
Range	C50 models: 25 to 58 mm; focus at 50 mm \pm 5 mm C100 models: 25 to 115 mm; focus at 102 mm \pm 5 mm C200 models: 25 to 216 mm; focus at 203 mm \pm 5 mm C300 models: 25 to 317 mm; focus at 305 mm \pm 5 mm LLP models: 0.2 to 10.6 m, using supplied retroreflective target
Adjustments	12-turn slotted brass Gain (sensitivity) adjustment potentiometer (clutched at both ends of travel)
Extinguishing Wire	Gray wire held "low" for laser operation; "high" to turn laser OFF; Low \leq 1.0V dc; High \geq Vsupply - 4.0V dc (< 30V dc) or disconnect wire; 100 milliseconds delay upon enable
Indicators	Two LEDs: Green and Yellow Green ON steady: power ON Yellow ON steady: light sensed; light operate (LO) output conducting Green flashing: output overloaded Yellow flashing: marginal excess gain
Construction	PD45 models: Housings are heat-resistant ABS, UL94-VO rated; acrylic lens cover PD49 models: Housings are sealed, heat-resistant ABS/polycarbonate alloy, UL94-VO rated, acrylic lens cover
Environmental Rating	PD45: IP54; NEMA 3 PD49: IP67; NEMA 6
Connections	2 m or 9 m attached cable, or 5-pin Euro-style 150 mm pigtail quick-disconnect fitting; mating cables for QD models are ordered separately. See page 414.
Operating Conditions	Temperature: -10° to +45° C Relative humidity: 90% at 50° C (non-condensing)
Weight	PD45 models: PD49 models: Sensor only: 22 g Sensor only: 28 g Sensor plus 2 m cable: 62 g Sensor plus 2 m cable: 68 g
Application Notes	False pulse may occur less than 1 second after power-up
Certifications	
Hookup Diagrams	DC11 (p. 522)

MINIATURE

COMPACT

MIDSIZE

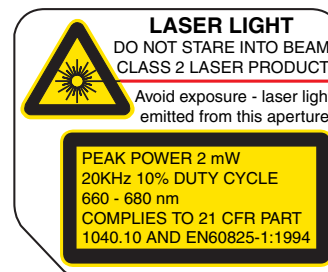
FULLSIZE

Class 2 Laser Safety Notes

Low-power lasers are by definition incapable of causing eye injury within the duration of the blink (aversion response) of 0.25 seconds. They also must emit only visible wavelengths (400 - 700 nm). Therefore, an ocular hazard can exist only if an individual overcomes their natural aversion to bright light and stares directly into the laser beam.

For safe laser use:

- Do not permit a person to stare at the laser from within the beam.
- Do not point the laser at a person's eye at close range.
- The beam emitted by a Class 2 laser product should be terminated at the end of its useful path. Open laser beam paths should be located above or below eye level where practical.



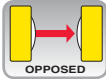

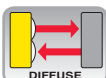
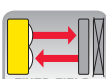
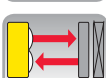
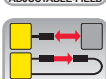
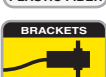


QM42 and QMT42

Rugged Die-Cast Family of Sensors

- Features compact, low-cost dc sensors in NEMA 6 (IEC IP67) die-cast housings
- Delivers outstanding immunity to electrical noise
- Includes marginal and Power ON gain indicator
- QM42 series: Available in opposed, polarized retroreflective, diffuse, short-range adjustable-field and plastic fiber optic modes
- QMT42 series (slightly larger): Available in fixed-field, diffuse and long-range adjustable-field modes

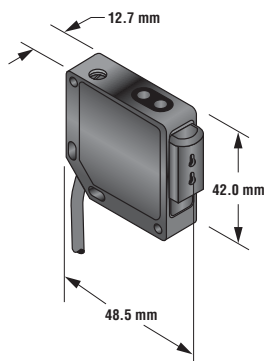


MINIATURE
COMPACT
MIDSIZE
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-  OPPOSED
-  POLAR RETRO
-  DIFFUSE
-  FIXED-FIELD
-  ADJUSTABLE-FIELD
-  PLASTIC FIBER
-  BRACKETS
PAGE 371
-  OD CABLES
4-Pin Euro
PAGE 412
-  REFLECTORS
PAGE 425

QM42 and QMT42 Sensors

- Sensitivity adjustment on top of QM42 models; rear panel on QMT42 models
- 2 m or 9 m attached cable, or Euro-style quick-disconnect
- Die-cast, leakproof NEMA 6 (IP67) housing
- Dual-LED multifunction indicators



QM42 Plastic Fiber Optic Models Suffix FP



QM42 Opposed, Retroreflective, Short-range Diffuse, and Short-range Adjustable-field Model Suffix E, R, LP, D, AFV150 and FP



QMT42 Long-range Diffuse, Fixed-field and Adjustable-field Model Suffix DX, FF and AFV400



QM42 and QMT42, 10-30V dc

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet					
QM426E Emitter	 OPPOSED	10 m	2 m	-	EGCO-33 (p. 470)	BPO-32 (p. 493)	44487					
QM426EQ Emitter			4-Pin Euro QD									
QM42VN6R			2 m	NPN								
QM42VN6RQ			4-Pin Euro QD									
QM42VP6R			2 m	PNP								
QM42VP6RQ			4-Pin Euro QD									
QM42VN6LP	 POLAR RETRO	3 m†	2 m	NPN	EGCR-43 (p. 473)	BPR-37 (p. 497)	44487					
QM42VN6LPQ			4-Pin Euro QD									
QM42VP6LP			2 m	PNP								
QM42VP6LPQ			4-Pin Euro QD									
QM42VN6D	 DIFFUSE	Short-Range 400 mm	2 m	NPN	EGCD-38 (p. 477)	BPD-38 (p. 500)	44487					
QM42VN6DQ			4-Pin Euro QD									
QM42VP6D			2 m	PNP								
QM42VP6DQ			4-Pin Euro QD									
QMT42VN6DX			Long-Range 10 mm - 6 m	2 m				NPN	EGCD-39 (p. 477)	BPD-39 (p. 500)	57890	
QMT42VN6DXQ				4-Pin Euro QD								
QMT42VP6DX		2 m		PNP								
QMT42VP6DXQ		4-Pin Euro QD										
QMT42VN6FF500		 FIXED-FIELD		50 - 500 mm Cutoff	2 m	NPN	EGCF-36 (p. 484)	—				50756
QMT42VN6FF500Q					4-Pin Euro QD							
QMT42VP6FF500			2 m		PNP							
QMT42VP6FF500Q			4-Pin Euro QD									
QMT42VN6FF750	50 - 750 mm Cutoff		2 m	NPN	EGCF-37 (p. 484)	—						
QMT42VN6FF750Q			4-Pin Euro QD									
QMT42VP6FF750			2 m	PNP								
QMT42VP6FF750Q			4-Pin Euro QD									
QMT42VN6FF1000	50 - 1000 mm Cutoff		2 m	NPN	EGCF-38 (p. 484)	—						
QMT42VN6FF1000Q			4-Pin Euro QD									
QMT42VP6FF1000			2 m	PNP								
QMT42VP6FF1000Q			4-Pin Euro QD									
QMT42VN6FF1500	50 - 1500 mm Cutoff		2 m	NPN	EGCF-39 (p. 484)	—						
QMT42VN6FF1500Q			4-Pin Euro QD									
QMT42VP6FF1500			2 m	PNP								
QMT42VP6FF1500Q			4-Pin Euro QD									
QMT42VN6FF2000	50 - 2000 mm Cutoff		2 m	NPN	EGCF-40 (p. 484)	—						
QMT42VN6FF2000Q			4-Pin Euro QD									
QMT42VP6FF2000			2 m	PNP								
QMT42VP6FF2000Q			4-Pin Euro QD									

* Infrared LED Visible Red LED

** For 9 m cable, add W/30 to the 2 m model number (example, QM42VN6LP W/30). A QD model requires a mating cable (see page 412).

† Retroreflective range is specified using one model BRT-3 retroreflector. Actual sensing range may differ, depending on efficiency and reflective area of the retroreflector in use. See Accessories for more information.



More on next page





QM42 and QMT42, 10-30V dc (cont'd)

MINIATURE
 COMPACT
 MIDSIZE
 FULLSIZE

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
QM42VN6AFV150		5 mm to Cutoff point (adjustable from 50 to 150 mm)	2 m	NPN	EGCA-5 (p. 481) Cutoff Point Deviation Curve CPDC-6 (p. 517)	—	48363
QM42VN6AFV150Q			4-Pin Euro QD				
QM42VP6AFV150			2 m	PNP			
QM42VP6AFV150Q			4-Pin Euro QD				
QMT42VN6AFV400		25 mm to Cutoff point (adjustable from 125 to 400 mm)	2 m	NPN	EGCA-6 (p. 481) Cutoff Point Deviation Curve CPDC-7 (p. 518)	—	49211
QMT42VN6AFV400Q			4-Pin Euro QD				
QMT42VP6AFV400			2 m	PNP			
QMT42VP6AFV400Q			4-Pin Euro QD				
QM42VN6FP		Range varies by sensing mode and fiber optics used	2 m	NPN	EGCP-16 (p. 488) & EGCP-17 (p. 489)	BPP-16 (p. 507) & BPP-17 (p. 508)	44487
QM42VN6FPQ			4-Pin Euro QD				
QM42VP6FP			2 m	PNP			
QM42VP6FPQ			4-Pin Euro QD				

* Visible Red LED


** For 9 m cable, add W/30 to the 2 m model number (example, QM42VN6AFV150 W/30). A QD model requires a mating cable (see page 412).

QM42 and QMT42 Specifications

Sensing Beam	Opposed, Diffuse, Retroreflective, Fixed-field and Fiber Optic: Infrared, 880 nm; Visible Red, 660 nm Adjustable-field: Visible Red, 680 nm
Supply Voltage and Current	10 to 30V dc (10% max. ripple) at less than: Opposed: 30 mA (emitter), 10 mA (receiver) Short-range diffuse and retroreflective: 20 mA Fiber optic: 30 mA Adjustable-field: 50 mA Fixed-field and long-range diffuse: 40 mA
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	Solid-state complementary; choose NPN (current sinking) or PNP (current sourcing) models
Output Rating	100 mA max. (each output) OFF-state leakage current: less than μ A at 30V dc ON-state saturation voltage: less than 1V at 10 mA dc; less than 1.5V at 100 mA dc
Output Protection Circuitry	Protected against false pulse on power-up and continuous overload or short circuit of outputs Overload trip point \geq 150 mA, typical at 20° C
Output Response Time	Opposed: 1 millisecond ON; 0.5 millisecond OFF Diffuse, Retroreflective, Adjustable-field and Fixed-field: 1 millisecond ON/OFF Plastic Fiber Optic: 0.25 millisecond ON/OFF NOTE: 100 millisecond delay on power-up; outputs are non-conducting during this time.
Repeatability	Opposed: 120 microseconds Diffuse, Retroreflective, Adjustable-field and Fixed-field: 250 microseconds Fiber Optic: 60 microseconds. Repeatability and response are independent of signal strength
Sensing Hysteresis	Long-range diffuse: less than 20% of set sensing distance Adjustable-field: less than 7% of set cutoff distance Fixed-field: 2000 mm models – less than 5% of set cutoff distance 1500 mm models – less than 4% of set cutoff distance 1000 mm models – less than 3% of set cutoff distance 750 mm models – less than 2% of set cutoff distance 500 mm models – less than 1% of set cutoff distance



QM42 and QMT42 Specifications (cont'd)

Cutoff Point Tolerance	Fixed-field: $\pm 10\%$ of nominal cutoff distance
Adjustments	All models (except emitters, Adjustable-field, Fixed-field and Long-range Diffuse): 15-turn slotted brass GAIN (sensitivity) adjustment potentiometer (clutched at both ends of travel) 150 mm Adjustable-field: 12-turn slotted brass cutoff distance adjustment potentiometer (clutched at both ends of travel) 400 mm Adjustable-field: 15-turn slotted brass cutoff distance adjustment potentiometer (clutched at both ends of travel) Long-range diffuse: 4-turn slotted GAIN (sensitivity) adjustment potentiometer (clutched at both ends of travel) Fixed-field: No adjustments
Indicators	Two LEDs: Green and Yellow Green ON steady: power ON; Opposed emitters: Green power ON Green flashing: output overloaded Yellow ON steady: light sensed; light operate (LO) Yellow flashing: marginal excess gain (1-1.5x) in light condition
Construction	Housings are die-cast zinc alloy with black acrylic polyurethane finish; lenses are acrylic
Environmental Rating	IP67; NEMA 6
Connections	2 m or 9 m attached cable, or 4-pin Euro-style quick-disconnect fitting. QD cables are ordered separately. See page 412.
Operating Conditions	Temperature: Long-range diffuse, Adjustable-field and Fixed-field: -20° to $+55^{\circ}$ C All others: -20° to $+70^{\circ}$ C Relative humidity: 90% at 50° C (non-condensing)
Certifications	
Hookup Diagrams	Emitters: DC02 (p. 520) All others: DC03 (p. 520)

MINIATURE

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MIDSIZE

FULLSIZE

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MIDSIZE
FULLSIZE



The most exciting new technologies in vehicle sensing are from Banner.



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Vehicle Placement Sensor

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- ▶ More powerful and reliable than remote amplified systems.
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- ▶ Ultra-compact, self-contained sensor eliminates control boxes.
- ▶ Rugged leakproof housing is rated IP69K for 1200 PSI washdown protection.



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Eliminate cumbersome, failure-prone inductive loops.

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- ▶ Versatile mounting includes above and below ground options.
- ▶ Installs in a fraction of time needed to repair or replace failed loops.
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Fullsize Sensors

Q45

page 146

- Extremely rugged design exceeds NEMA 6P and IEC IP67 standards; sensors withstand 1200 psi washdown.
- Power, Signal and Output indicator LEDs are highly visible.
- Standard models accommodate output timing logic or expansion for a 7-segment LED display of signal strength.
- Available modes include opposed, polarized and non-polarized retroreflective, diffuse, convergent, and glass and plastic fiber optic modes.
- Models are available for dc, ac or ac/dc universal voltage power.
- A laser retroreflective version is available for extended 70 m sensing range.



OMNI-BEAM™ page 159

- Advanced modular design for customized configuration at user level
- Sensor heads in opposed, retroreflective, diffuse, convergent, and glass and plastic fiber optic modes
- For use with analog ac or dc power blocks



Q60

page 165

- Available in both Class 1 or extended-range Class 2 laser and visible red or infrared LED formats
- Adjustable-field setpoints from 200 to 2000 mm
- Advanced background suppression technology to ignore objects beyond the setpoint

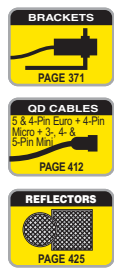
MINIATURE
COMPACT
MIDSIZE
FULLSIZE

Q45 Advanced One-Piece Sensors

- Uses extremely rugged design that exceeds NEMA 6P and IEC IP67 standards and withstands 1200 psi washdown
- Features highly visible Power, Signal and Output indicator LEDs
- Accommodates output timing logic or 7-segment LED signal strength display on standard models
- Available in opposed, polarized and non-polarized retroreflective, diffuse, convergent, and glass and plastic fiber optic modes
- Available in models for dc, ac or ac/dc universal voltage power
- Available in laser diode retroreflective and NAMUR models



Q45 DC Models	page 147
Q45 Laser Models	147
Q45 AC Models	148
Q45 Universal Voltage Models	150
Q45 NAMUR Models	157
Q45 Logic Modules	155



Q45

- Models for dc or ac power
- Opposed, retroreflective, diffuse, convergent, laser, and glass and plastic fiber optic modes
- Electromechanical or solid-state outputs



Q45 Universal Voltage

- Models for ac/dc power
- Opposed, retroreflective, diffuse, convergent, and glass and plastic fiber optic modes
- A variety of cable and connector options



Q45 Retroreflective Laser

- Extended 70 m sensing range
- Visible laser beam for easy target alignment
- Precision small object or edge detection



Q45 NAMUR

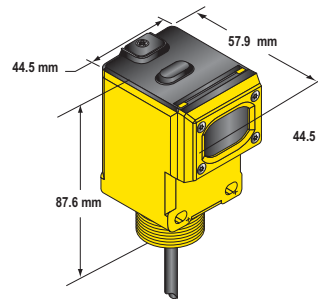
- Intrinsically safe dc models for potentially explosive environments
- 12 mA output or less in dark condition and 21 mA or more in light condition
- For use with approved DIN 19 234 switching amplifiers

Q45 Sensors

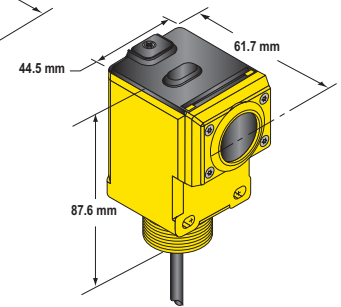
- Optional 7-element LED signal strength display and/or output switching logic
- 2 m or 9 m attached cable, or Mini-, Micro- and Euro-style quick-disconnect
- Gasketed transparent cover
- Triple-LED multi-function indicators



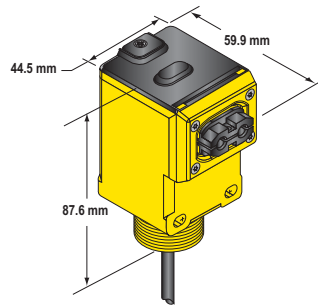
Opposed, Retroreflective and Diffuse Models
Suffix E, R, D, DL, DX, LV and LP



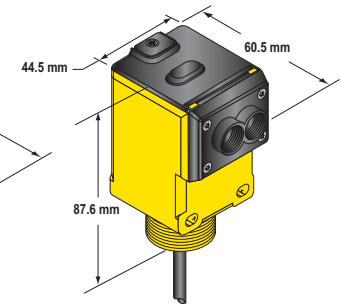
Retroreflective Laser Models
Suffix LL and LLP



Convergent Models
Suffix CV and CV4



Plastic Fiber Model
Suffix FP



Glass Fiber Models
Suffix F and FV



Q45, 10-30V dc

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet	
Q456E Emitter		60 m	2 m	Bipolar NPN/PNP	EGCO-34 (p. 470)	BPO-33 (p. 494)	36578	
Q456EQ Emitter			4-Pin Mini QD					
Q456EQ5 Emitter			4-Pin Euro QD					
Q45BB6R			2 m					
Q45BB6RQ	4-Pin Mini QD	0.08 - 9 m†	2 m		EGCR-44 (p. 473)	BPR-38 (p. 497)		
Q45BB6RQ5	4-Pin Euro QD							
Q45BB6LV	2 m							
Q45BB6LVQ		0.08 - 9 m†	4-Pin Mini QD		EGCR-45 (p. 473)	BPR-39 (p. 497)		
Q45BB6LVQ5			4-Pin Euro QD					
Q45BB6LP		0.15 - 6 m†	2 m		EGCR-46 (p. 473)	BPR-40 (p. 497)		38244
Q45BB6LPQ			4-Pin Mini QD					
Q45BB6LPQ5			4-Pin Euro QD					
Q45BB6LL		0.3 - 70 m†	2 m		EGCR-47 (p. 473)	BPR-40 (p. 497)		
Q45BB6LLQ			5-Pin Mini QD					
Q45BB6LLQ6			5-Pin Euro QD					
Q45BB6LLP		0.6 - 40 m†	2 m					
Q45BB6LLPQ			5-Pin Mini QD					
Q45BB6LLPQ6			5-Pin Euro QD					

* Infrared LED Visible Red LED Visible Red Laser

** For 9 m cable, add suffix **W30** to the 2 m model number (example, **Q45BB6LV W30**). A model with a QD requires a mating cable (see pages 412, 414 and 420).

† Retroreflective range is specified using one model BRT-3 retroreflector (BRT-2X2 for Q45BB6LL models). Actual sensing range may differ, depending on efficiency and reflective area of the retroreflector in use. See Accessories for more information.





Q45, 10-30V dc (cont'd)

MINIATURE
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Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet	
Q45BB6D	SHORT RANGE 	450 mm	2 m	Bipolar NPN/PNP	EGCD-40 (p. 477)	BPD-40 (p. 500)	36578	
Q45BB6DQ			4-Pin Mini QD					
Q45BB6DQ5			4-Pin Euro QD					
Q45BB6DL	LONG RANGE 	1.8 m	2 m		EGCD-41 (p. 477)	BPD-41 (p. 500)		
Q45BB6DLQ			4-Pin Mini QD					
Q45BB6DLQ5			4-Pin Euro QD					
Q45BB6DX	HIGH POWER 	3 m	2 m		EGCD-42 (p. 477)	BPD-42 (p. 500)		
Q45BB6DXQ			4-Pin Mini QD					
Q45BB6DXQ5			4-Pin Euro QD					
Q45BB6CV	CONVERGENT 	38 mm	2 m		EGCC-34 (p. 480)	BPC-34 (p. 503)	36578	
Q45BB6CVQ			4-Pin Mini QD					
Q45BB6CVQ5			4-Pin Euro QD					
Q45BB6CV4		100 mm	2 m			EGCC-35 (p. 480)		BPC-35 (p. 503)
Q45BB6CV4Q			4-Pin Mini QD					
Q45BB6CV4Q5			4-Pin Euro QD					
Q45BB6F	GLASS FIBER 	Range varies by sensing mode and fiber optics used	2 m	EGCG-22 & EGCG-23 (p. 486)	BPG-22 & BPG-23 (p. 505)	36578		
Q45BB6FQ			4-Pin Mini QD					
Q45BB6FQ5			4-Pin Euro QD					
Q45BB6FV			2 m		EGCG-24 & EGCG-25 (p. 486)		BPG-24 & BPG-25 (p. 505)	
Q45BB6FVQ								4-Pin Mini QD
Q45BB6FVQ5								4-Pin Euro QD
Q45BB6FP	PLASTIC FIBER 	Range varies by sensing mode and fiber optics used	2 m	EGCP-18 & EGCP-19 (p. 489)	BPP-18 & BPP-19 (p. 508)	36578		
Q45BB6FPQ			4-Pin Mini QD					
Q45BB6FPQ5			4-Pin Euro QD					

Q45, 90-250V ac



Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
Q452E Emitter	OPPOSED 	60 m	2 m	—	EGCO-34 (p. 470)	BPO-33 (p. 494)	36339 & 37209
Q452EQ Emitter			3-Pin Mini QD				
Q452EQ1 Emitter			4-Pin Micro QD				
Q45VR2R			2 m	SPDT e/m Relay			36339
Q45VR2RQ			5-Pin Mini QD				
Q45BW22R			2 m	SPST Solid-state Relay			37209
Q45BW22RQ			3-Pin Mini QD				
Q45BW22RQ1			4-Pin Micro QD				

* Infrared LED Visible Red LED

** For 9 m cable, add suffix W/30 to the 2 m model number (example, Q45BB6D W/30). A model with a QD requires a mating cable (see pages 412, 419 and 420).



More on next page



Q45, 90-250V ac (cont'd)

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet	
Q45VR2LV		0.08 - 9 m†	2 m	SPDT e/m Relay	EGCR-44 (p. 473)	BPR-38 (p. 497)	36339	
Q45VR2LVQ			5-Pin Mini QD					
Q45BW22LV			2 m	SPST Solid-state Relay			37209	
Q45BW22LVQ			3-Pin Mini QD					
Q45BW22LVQ1			4-Pin Micro QD					
Q45VR2LP		0.15 - 6 m†	2 m	SPDT e/m Relay	EGCR-45 (p. 473)	BPR-39 (p. 497)		36339
Q45VR2LPQ			5-Pin Mini QD					
Q45BW22LP			2 m	SPST Solid-state Relay			37209	
Q45BW22LPQ			3-Pin Mini QD					
Q45BW22LPQ1			4-Pin Micro QD					
Q45VR2D		450 mm	2 m	SPDT e/m Relay	EGCD-40 (p. 477)	BPD-40 (p. 500)		36339
Q45VR2DQ			5-Pin Mini QD					
Q45BW22D			2 m	SPST Solid-state Relay			37209	
Q45BW22DQ			3-Pin Mini QD					
Q45BW22DQ1			4-Pin Micro QD					
Q45VR2DL		1.8 m	2 m	SPDT e/m Relay	EGCD-41 (p. 477)	BPD-41 (p. 500)		36339
Q45VR2DLQ			5-Pin Mini QD					
Q45BW22DL			2 m	SPST Solid-state Relay			37209	
Q45BW22DLQ			3-Pin Mini QD					
Q45BW22DLQ1			4-Pin Micro QD					
Q45VR2DX		3 m	2 m	SPDT e/m Relay	EGCD-42 (p. 477)	BPD-42 (p. 500)		36339
Q45VR2DXQ			5-Pin Mini QD					
Q45BW22DX			2 m	SPST Solid-state Relay			37209	
Q45BW22DXQ			3-Pin Mini QD					
Q45BW22DXQ1			4-Pin Micro QD					
Q45VR2CV		38 mm	2 m	SPDT e/m Relay	EGCC-34 (p. 480)	BPC-34 (p. 503)		36339
Q45VR2CVQ			5-Pin Mini QD					
Q45BW22CV			2 m	SPST Solid-state Relay			37209	
Q45BW22CVQ			3-Pin Mini QD					
Q45BW22CVQ1			4-Pin Micro QD					
Q45VR2CV4		100 mm	2 m	SPDT e/m Relay	EGCC-35 (p. 480)	BPC-35 (p. 503)		36339
Q45VR2CV4Q			5-Pin Mini QD					
Q45BW22CV4			2 m	SPST Solid-state Relay			37209	
Q45BW22CV4Q			3-Pin Mini QD					
Q45BW22CV4Q1			4-Pin Micro QD					

MINIATURE
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MIDSIZE
FULLSIZE

* Infrared LED Visible Red LED

** For 9 m cable, add suffix W/30 to the 2 m model number (example, Q45VR2LV W/30). A model with a QD requires a mating cable (see pages 419 and 420).

† Retroreflective range is specified using one model BRT-3 retroreflector. Actual sensing range may differ, depending on efficiency and reflective area of the retroreflector in use. See Accessories for more information.



More on next page



Q45, 90-250V ac (cont'd)

MINIATURE
COMPACT
MIDSIZE
FULLSIZE

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
Q45VR2F	 GLASS FIBER	Range varies by sensing mode and fiber optics used	2 m	SPDT e/m Relay	EGCG-22 & EGCG-23 (p. 486)	BPG-22 & BPG-23 (p. 505)	36339
Q45VR2FQ			5-Pin Mini QD				
Q45BW22F			2 m	SPST Solid-state Relay			
Q45BW22FQ			3-Pin Mini QD				
Q45BW22FQ1			4-Pin Micro QD				
Q45VR2FV	 GLASS FIBER	Range varies by sensing mode and fiber optics used	2 m	SPDT e/m Relay	EGCG-24 & EGCG-25 (p. 486)	BPG-24 & BPG-25 (p. 505)	36339
Q45VR2FVQ			5-Pin Mini QD				
Q45BW22FV			2 m	SPST Solid-state Relay			
Q45BW22FVQ			3-Pin Mini QD				
Q45BW22FVQ1			4-Pin Micro QD				
Q45VR2FP	 PLASTIC FIBER	Range varies by sensing mode and fiber optics used	2 m	SPDT e/m Relay	EGCP-18 & EGCP-19 (p. 489)	BPP-18 & BPP-29 (p. 508)	36339
Q45VR2FPQ			5-Pin Mini QD				
Q45BW22FP			2 m	SPST Solid-state Relay			
Q45BW22FPQ			3-Pin Mini QD				
Q45BW22FPQ1			4-Pin Micro QD				

Q45 Universal Voltage, 12-250V dc or 24-250V ac



Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
Q453E	 OPPOSED	60 m	2 m	—	EGCO-34 (p. 470)	BPO-33 (p. 494)	53997
Q453EQ			3-Pin Mini QD				
Q45VR3R			2 m	SPDT e/m Relay			
Q45VR3RQ			5-Pin Mini QD				
Q45BW13R			2 m	SPST Solid-state Relay			
Q45BW13RQ			4-Pin Mini QD				
Q45VR3LV	 RETRO	0.08 - 9 m†	2 m	SPDT e/m Relay	EGCR-44 (p. 473)	BPR-38 (p. 497)	53997
Q45VR3LVQ			5-Pin Mini QD				
Q45BW13LV			2 m	SPST Solid-state Relay			
Q45BW13LVQ			4-Pin Mini QD				
Q45VR3LP	 POLAR RETRO	0.15 - 6 m†	2 m	SPDT e/m Relay	EGCR-45 (p. 473)	BPR-39 (p. 497)	53997
Q45VR3LPQ			5-Pin Mini QD				
Q45BW13LP			2 m	SPST Solid-state Relay			
Q45BW13LPQ			4-Pin Mini QD				

* Infrared LED Visible Red LED

** For 9 m cable, add suffix W/30 to the 2 m model number (example, Q45VR2F W/30). A model with a QD requires a mating cable (see pages 419 and 420).

† Retroreflective range is specified using one model BRT-3 retroreflector. Actual sensing range may differ, depending on efficiency and reflective area of the retroreflector in use. See Accessories for more information.

More on next page



Q45 Universal Voltage, 12-250V dc or 24-250V ac (cont'd)



Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet		
Q45VR3D		450 mm	2 m	SPDT e/m Relay	EGCD-40 (p. 477)	BPD-40 (p. 500)	53997		
Q45VR3DQ			5-Pin Mini QD						
Q45BW13D			2 m	SPST Solid-state Relay			EGCD-41 (p. 477)	BPD-41 (p. 500)	53999
Q45BW13DQ			4-Pin Mini QD						
Q45VR3DL		1.8 m	2 m	SPDT e/m Relay	EGCD-42 (p. 477)	BPD-42 (p. 500)			53997
Q45VR3DLQ			5-Pin Mini QD						
Q45BW13DL			2 m	SPST Solid-state Relay			EGCC-34 (p. 480)	BPC-35 (p. 503)	53999
Q45BW13DLQ			4-Pin Mini QD						
Q45VR3DX		3 m	2 m	SPDT e/m Relay	EGCC-35 (p. 480)	BPC-34 (p. 503)			53997
Q45VR3DXQ			5-Pin Mini QD						
Q45BW13DX			2 m	SPST Solid-state Relay			EGCC-34 (p. 480)	BPC-35 (p. 503)	53999
Q45BW13DXQ			4-Pin Mini QD						
Q45VR3CV		38 mm	2 m	SPDT e/m Relay	EGCC-34 (p. 480)	BPC-35 (p. 503)			53997
Q45VR3CVQ			5-Pin Mini QD						
Q45BW13CV			2 m	SPST Solid-state Relay			EGCC-35 (p. 480)	BPC-34 (p. 503)	53999
Q45BW13CVQ			4-Pin Mini QD						
Q45VR3CV4		100 mm	2 m	SPDT e/m Relay	EGCC-35 (p. 480)	BPC-34 (p. 503)			53997
Q45VR3CV4Q			5-Pin Mini QD						
Q45BW13CV4			2 m	SPST Solid-state Relay			EGCG-22 & EGCG-23 (p. 486)	BPG-22 & BPG-23 (p. 505)	53999
Q45BW13CV4Q			4-Pin Mini QD						
Q45VR3F		Range varies by sensing mode and fiber optics used	2 m	SPDT e/m Relay	EGCG-22 & EGCG-23 (p. 486)	BPG-22 & BPG-23 (p. 505)			53997
Q45VR3FQ			5-Pin Mini QD						
Q45BW13F			2 m	SPST Solid-state Relay			EGCG-24 & EGCG-25 (p. 486)	BPG-24 & BPG-25 (p. 505)	53999
Q45BW13FQ			4-Pin Mini QD						
Q45VR3FV			2 m	SPDT e/m Relay	EGCG-24 & EGCG-25 (p. 486)	BPG-24 & BPG-25 (p. 505)			53997
Q45VR3FVQ			5-Pin Mini QD						
Q45BW13FV			2 m	SPST Solid-state Relay			EGCP-18 & EGCP-19 (p. 489)	BPP-18 & BPP-19 (p. 508)	53999
Q45BW13FVQ			4-Pin Mini QD						
Q45VR3FP		Range varies by sensing mode and fiber optics used	2 m	SPDT e/m Relay	EGCP-18 & EGCP-19 (p. 489)	BPP-18 & BPP-19 (p. 508)			53997
Q45VR3FPQ			5-Pin Mini QD						
Q45BW13FP			2 m	SPST Solid-state Relay			EGCP-18 & EGCP-19 (p. 489)	BPP-18 & BPP-19 (p. 508)	53999
Q45BW13FPQ			4-Pin Mini QD						

* Infrared LED Visible Red LED

** For 9 m cable, add suffix **W/30** to the 2 m model number (example, **Q45VR3D W/30**). A model with a QD requires a mating cable (see page 420).

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Q45 DC Specifications	
Supply Voltage and Current	10 to 30V dc (10% max. ripple), at less than 50 mA (exclusive of load)
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	Bipolar: one current sourcing (PNP) and one current sinking (NPN) open-collector transistor
Output Rating	250 mA max. each output up to 50° C, derated to 150 mA at 70° C (derate 5 mA/° C) OFF-state leakage current: less than 1 µA Output saturation voltage (both outputs): less than 1 volt at 10 mA and less than 2 volts at 250 mA
Output Protection Circuitry	Protected against false pulse on power-up and continuous overload or short circuit of outputs
Output Response Time	Opposed: 2 milliseconds ON and 1 millisecond OFF Laser Retroreflective: less than 2 milliseconds All others: 2 milliseconds ON/OFF NOTE: 100 millisecond delay on power-up; output does not conduct during this time.
Repeatability	Opposed: 0.25 milliseconds All others: 0.5 milliseconds Response time and repeatability specifications are independent of signal strength.
Adjustments	Beneath sensor's transparent cover: Light Operate (LO) Dark Operate (DO) select switch and multi-turn sensitivity control on top of sensor, beneath a transparent polycarbonate o-ring sealed cover, allows precise sensitivity setting (turn clockwise to increase gain). Optional logic and logic/display modules have adjustable timing functions.
Indicators	Indicator LEDs are highly visible, located beneath a raised transparent polycarbonate dome on top of the sensor. Power (Green) LED lights whenever 10 to 30V dc power is applied, and flashes to indicate output overload or output short circuit Signal (Red) LED lights whenever the sensor sees its modulated light source, and pulses at a rate proportional to the strength of the received light signal Load (Yellow) LED lights whenever an output is conducting Optional 7-element LED signal strength display module
Construction	Molded reinforced thermoplastic polyester housing, o-ring sealed transparent polycarbonate cover, molded acrylic lenses, and stainless steel hardware. Q45s are designed to withstand 1200 psi washdown. The base of cabled models has a ½" NPS integral internal conduit thread.
Environmental Rating	IP67; NEMA 6P
Laser Classification (Laser Retroreflective models only)	Class II laser product. US Safety Standards 21 CFR 1040.10 and 1040.11; European Standards EN 60825 and IEC 60825
Connections	PVC-jacketed 4-wire (5-wire for Laser Retroreflective) 2 m or 9 m cables. For 4-pin Mini-style QD use "Q" suffix, (5-pin Mini-style QD for Laser Retroreflective use "Q" suffix) or for 4-pin Euro-style use "Q5" suffix (5-pin Euro-style QD for Laser Retroreflective use "Q6" suffix). QD cables are ordered separately. See page 412, 414 and 420.
Operating Conditions	Temperature: -40° to +70° C (-10° to +40° C for Retroreflective Laser models) Relative humidity: 90% at 50° C (non-condensing)
Application Notes	Optional logic timing modules are available. See page 155 for more information.
Certifications	Retroreflective Laser:  All others: 
Hookup Diagrams	Emitters: DC02 (p. 520) Laser Retroreflective Models: DC12 (p. 522) Other DC Models: DC04 (p. 520)



Q45 AC Specifications	
Supply Voltage and Current	90 to 250V ac (50 - 60 Hz) Average current: 20 mA. Peak current: 500 mA at 120V ac, 750 mA at 250V ac.
Supply Protection Circuitry	Protected against transient voltages
Output Configuration	Q45VR2 models: SPDT (single-pole double-throw) electromechanical relay output (except emitters) Q45BW22 models: Short circuit/overload protected FET solid-state relay
Output Rating	Q45VR2 models: Max. switching power (resistive load): 150W, 600 VA Max. switching voltage (resistive load): 250V ac or 30V dc Max. switching current (resistive load): 5A @ 250V ac Min. voltage and current: 5V dc, 0.1 mA Mechanical life of relay: 10,000,000 operations Electrical life of relay at full resistive load: 100,000 operations Q45BW22 models: Continuous current: 300 mA max. to 50° C (derate to 200 mA at 70° C, 5 mA/° C) Inrush current: 3A max. for 100 milliseconds, 5A max. for 1 millisecond OFF-state leakage current: less than 100 μA Saturation voltage: less than 3V at 200 mA
Output Protection Circuitry	Q45VR2 models: Protected against false pulse on power-up Q45BW22 models: Manually-resettable output latch-out trips in the event of an output overload or short circuit condition. The green Power LED flashes to indicate the latch-out. To reset the output, remove power to the sensor and load for 5 seconds, then restore power.
Output Response Time	Q45VR2 models: 15 milliseconds ON/OFF Q45BW22 models: Opposed: 2 milliseconds ON, 1 millisecond OFF All others: 2 milliseconds ON/OFF NOTE: 100 millisecond delay on power-up. Output does not conduct during this time.
Repeatability	Opposed: 0.25 milliseconds; All others: 0.5 milliseconds Response time and repeatability specifications are independent of signal strength.
Adjustments	Beneath sensor's transparent cover: Light Operate (LO), Dark Operate (DO) select switch, and multi-turn sensitivity control on top of sensor, allows precise sensitivity setting (turn clockwise to increase gain). Optional logic and logic/display modules have adjustable timing functions.
Indicators	Indicator LEDs are highly visible, located beneath a raised transparent polycarbonate dome on top of the sensor. Power (Green) LED lights whenever 90-250V ac power is applied, and flashes to indicate output overload or output short circuit. Signal (Red) LED lights whenever the sensor sees its modulated light source, and pulses at a rate proportional to the strength of the received light signal Load (Yellow) LED lights whenever an output relay is energized Optional 7-element LED signal strength display module
Construction	Molded reinforced thermoplastic polyester housing, o-ring sealed transparent polycarbonate cover, molded acrylic lenses, and stainless steel hardware. Q45s are designed to withstand 1200 psi washdown. The base of cabled models has a ½" NPS integral internal conduit thread.
Environmental Rating	NEMA 6P; IEC IP67
Connections	Q45VR2 models: PVC-jacketed 2-wire emitters or 5-wire (all others) 2 m or 9 m unterminated cables, or 3-pin (emitters) or 5-pin (all others) Mini-style quick-disconnect (QD) fittings are available ("Q"- suffix models). QD cables are ordered separately. See page 420. Q45BW22 models: PVC-jacketed 2 m or 9 m cables, or 3-pin Mini-style ("Q" suffix models) or 4-pin Micro-style ("Q1" suffix models) quick-disconnect (QD) fittings are available. QD cables are ordered separately. See pages 420 and 419.
Operating Conditions	Temperature: -40° to +70° C Relative humidity: 90% at 50° C (non-condensing)

 More on next page



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Q45 AC Specifications (cont'd)	
Application Notes	Transient suppression is recommended for contacts switching inductive loads. Optional logic timing modules are available. See page 155 for more information.
Certifications	Q45VR2 models:  Q45BW22 models: 
Hookup Diagrams	VR2 Models: Emitters: AC03 (p. 525) BW22 Models: Cabled & Mini QD: AC05 (p. 526) Cabled & Mini QD Emitters: AC03 (p. 525) Other AC Models: AC08 (p. 526) Micro QD: AC06 (p. 526) Micro QD Emitters: AC07 (p. 526)

Q45 Universal Voltage Specifications	
Supply Voltage and Current	24 to 250V ac, 50/60 Hz or 12 to 250V dc (1.5 watts max.)
Supply Protection Circuitry	Protected against transient voltages. DC hookup is without regard to polarity.
Output Configuration	Q45VR3 models: SPDT (Single-Pole, Double-Throw) electromechanical relay output. All models except emitters. Q45BW13 models: Optically isolated SPST solid-state switch. All models except emitters.
Output Rating	Q45VR3 models: Max. switching power (resistive load): 1250VA, 150W Max. switching voltage (resistive load): 250V ac, 125V dc Max. switching current (resistive load): 5A @ 250V ac, 5A @ 30V dc derated to 200 mA @ 125V dc Min. voltage and current: 5V dc, 10 mA Mechanical life of relay: 50,000,000 operations Electrical life of relay at full resistive load: 100,000 operations Q45BW13 models: 250V ac, 250V dc, 300 mA Output saturation voltage: 3V at 300 mA, 2V at 15 mA OFF-state leakage current: less than 50 µA Inrush current: 1 amp for 20 milliseconds, non-repetitive
Output Protection Circuitry	Protected against false pulse on power-up
Output Response Time	Q45VR3 models: 15 milliseconds ON/OFF NOTE: 100 millisecond delay on power-up. Relay is de-energized during this time. Q45BW13 models: Opposed: 2 milliseconds ON, 1 millisecond OFF All others: 2 milliseconds ON/OFF (NOTE: 100 millisecond delay on power-up. Output does not conduct during this time.)
Repeatability	Opposed: 0.25 milliseconds All others: 0.5 milliseconds Response time and repeatability specifications are independent of signal strength.
Adjustments	Beneath sensor's transparent cover: Light Operate (LO), Dark Operate (DO) select switch, and multi-turn sensitivity control on top of sensor, beneath a transparent polycarbonate o-ring sealed cover, allows precise sensitivity setting (turn clockwise to increase gain). Optional logic and logic/display modules have adjustable timing functions.
Indicators	Indicator LEDs are clearly visible beneath a raised transparent polycarbonate dome on top of the sensor. Power (Green) LED lights whenever 24 to 250V ac, or 12 to 250V dc power is applied Signal (Red) LED lights whenever the sensor sees its modulated light source, and pulses at a rate proportional to the strength of the received light signal Load (Yellow) LED lights whenever the output relay is energized Optional 7-element LED signal strength display module
Construction	Molded reinforced thermoplastic polyester housing, o-ring-sealed transparent polycarbonate cover, molded acrylic lenses, and stainless steel hardware. Q45s are designed to withstand 1200 psi washdown. The base of cabled models has a ½" NPS integral internal conduit thread.

 More on next page

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Q45 Universal Voltage Specifications (cont'd)	
Environmental Rating	IP67; NEMA 6P
Connections	<p>Q45VR3 models: PVC-jacketed 2 m or 9 m unterminated cables, or 5-pin Mini-style quick-disconnect (QD) fittings are available ("Q"- suffix models). QD cables are ordered separately. See page 520.</p> <p>Q45BW13 models: PVC-jacketed 2 m or 9 m unterminated cables, or 4-pin Mini-style quick-disconnect (QD) fittings are available ("Q"- suffix models). QD cables are ordered separately. See page 520.</p>
Operating Conditions	Temperature: -25° to +55° C Relative humidity: 90% at 50° C (non-condensing)
Application Notes	Transient suppression is recommended for contacts switching inductive loads. Optional output timing modules are available. See below for more information.
Certifications	<p>Q45VR3 models:  Q45BW13 models: </p>
Hookup Diagrams	<p>VR3 Models: Emitters: UN02 (p. 528) Other AC/DC Models: UN01 (p. 528)</p> <p>BW13 Models: Emitters: UN02 (p. 528) Other AC/DC Models: UN03 (p. 528)</p>

45LM Series Modules

Q45 sensors easily accept the addition of output timing logic and signal strength display functions. Display models have a 7-element display which gives a "finer" indication of excess gain than does the LED that is standard on most Q45 sensors. The modules listed below may be used with all Q45 sensors except NAMUR models.




Model	Function	Timing Logic Functions	Data Sheet
45LM58	Programmable output timing logic	<ul style="list-style-type: none"> Models with programmable output timing provide the following timing logic functions: <ul style="list-style-type: none"> - ON delay - OFF delay - ON/OFF delay - Retriggerable one-shot - Non-retriggerable one-shot - Delayed one-shot - ON delayed one-shot - Repeat cycle timer - Limit timer - Rate sensor - Flip-flop (alternate action) 	63416
45LM58D	Programmable output timing, plus signal strength display	<ul style="list-style-type: none"> Selectable timing ranges: 0.01 to 0.15 seconds 0.1 to 1.5 seconds 1 to 15 seconds Delay and hold time ranges may be individually selected and times precisely set using 15-turn adjustment potentiometers. Delay or hold time may also be displayed (zero seconds). 	
45LMD	Signal strength display, only (no programmable functions)	<ul style="list-style-type: none"> Module allows sensor output to be programmed for normally-open or normally-closed operation. Models with signal strength display gives precise indication of excess gain; see page 156 for more information. Valuable for sensor setup and alignment, critical evaluation of alternative sensing schemes and close monitoring of sensing performance over time (example, dirt build-up on lenses or progressive misalignment). 	

MINIATURE
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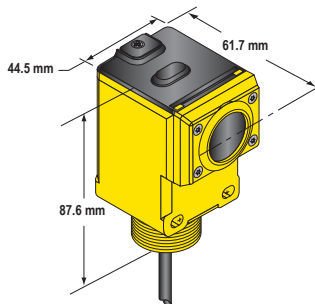
45LM Series Module Specifications	
Operating Temperature	-40° to +70° C
Timing Adjustments	Two 15-turn clutched potentiometers with brass elements, accessible from outside at the top of the sensor, beneath an o-ring sealed polycarbonate cover.
Timing Repeatability	Plus or minus 2% of the timing range (max.); assumes conditions of constant temperature and power supply.
Useful Time Range	Useful time range is from maximum time down to 5% of maximum. When the timing potentiometer is set fully counterclockwise, time will be approximately 5% of maximum.
Response Time	When the delay time is switched OFF, the card adds no measurable sensing response time.
LED Display	7-element LED display, visible through transparent top sensor cover. The more LEDs that are lit, the stronger is the received light signal; three LEDs lit is equivalent to an excess gain of about 1x.

Signal Strength Display

LED Number	Approximate Gain	Display
#1	0.25x	
#2	0.5x	
#3	1.0x	
#4	2.0x	
#5	4.0x	
#6	6.0x	
#7	8.0x	

Q45 NAMUR Sensors

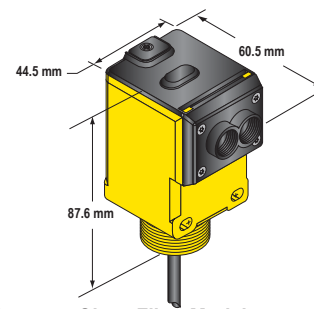
- NAMUR sensor in popular Q45 housing with Q45 proven performance
- For use with approved switching amplifiers with intrinsically safe input circuits
- Designed in accordance with DIN 19 234



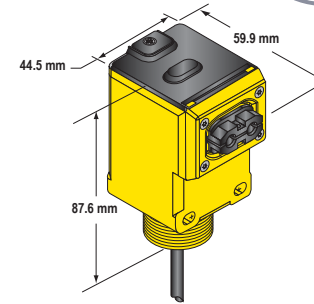
Convergent Models
Suffix CV and CV4



Opposed, Retroreflective and Diffuse Models
Suffix E, R, D, DL, LV and LP



Glass Fiber Models
Suffix F and FV

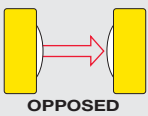


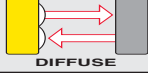
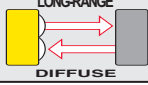
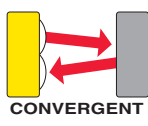


Plastic Fiber Model
Suffix FP



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- FULLSIZE

Q45 NAMUR, 5-15V dc

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
Q459E Emitter		6 m	2 m	Constant Current ≤1.2 mA dark ≥2.1 mA light	EGCO-35 (p. 470)	BPO-34 (p. 494)	38343
Q459EQ Emitter			4-Pin Euro QD				
Q45AD9R			2 m				
Q45AD9RQ			4-Pin Euro QD				
Q45AD9LV		9 m†	2 m		EGCR-48 (p. 473)	BPR-41 (p. 497)	
Q45AD9LVQ			4-Pin Euro QD				
Q45AD9LP		6 m†	2 m		EGCR-49 (p. 474)	BPR-42 (p. 497)	
Q45AD9LPQ			4-Pin Euro QD				
Q45AD9D		300 mm	2 m		EGCD-43 (p. 477)	BPD-43 (p. 500)	
Q45AD9DQ			4-Pin Euro QD				
Q45AD9DL		1 m	2 m		EGCD-44 (p. 477)	BPD-44 (p. 500)	
Q45AD9DLQ			4-Pin Euro QD				
Q45AD9CV		38 mm	2 m		EGCC-36 (p. 480)	BPC-36 (p. 503)	
Q45AD9CVQ			4-Pin Euro QD				
Q45AD9CV4		100 mm	2 m		EGCC-37 (p. 480)	BPC-37 (p. 503)	
Q45AD9CV4Q			4-Pin Euro QD				

*  Infrared LED  Visible Red LED

** For 9 m cable, add suffix **W/30** to the 2 m model number (example, **Q45AD9LV W/30**). A model with a QD requires a mating cable (see page 413).

† Retroreflective range is specified using one model BRT-3 retroreflector. Actual sensing range may differ, depending on efficiency and reflective area of the retroreflector in use. See Accessories for more information.





Q45 NAMUR, 5-15V dc (cont'd)

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
Q45AD9F		Range varies by sensing mode and fiber optics used	2 m	Constant Current ≤1.2 mA dark ≥2.1 mA light	EGCG-26 & EGCG-27 (p. 486)	BPG-26 & BPG-27 (p. 505)	38343
Q45AD9FQ			4-Pin Euro QD				
Q45AD9FV			2 m				
Q45AD9FVQ			4-Pin Euro QD				
Q45AD9FP		Range varies by sensing mode and fiber optics used	2 m				
Q45AD9FPQ			4-Pin Euro QD				

* Infrared LED Visible Red LED

** For 9 m cable, add suffix W/30 to the 2 m model number (example, Q45AD9F W/30). A model with a QD requires a mating cable (see page 413).

Q45 NAMUR Specifications

Supply Voltage and Current	5 to 15V dc. Supply voltage is provided by the amplifier to which the sensor is connected.
Output	Constant current output: ≤ 1.2 mA in the dark condition and ≥ 2.1 mA in the light condition
Output Response Time	Opposed receiver: 2 milliseconds ON/0.4 milliseconds OFF All others: 5 milliseconds ON/OFF (does not include amplifier response)
Adjustments	Multi-turn sensitivity control on top of sensor, beneath a transparent o-ring sealed Lexan® cover, allows precise sensitivity setting (turn clockwise to increase gain).
Indicators	Indicator LED's are highly visible, located beneath a raised transparent Lexan® dome on top of the sensor. Power (Red) LED (emitters only) lights whenever 5 - 15V dc power is applied Signal (Red) LED lights whenever the sensor sees its modulated light source
Construction	Molded thermoplastic polyester housing, o-ring sealed transparent Lexan® top cover, molded acrylic lenses, and stainless steel hardware. Q45s are designed to withstand 1200 psi washdown. The base of cabled models has a 1/2" NPS integral internal conduit thread.
Environmental Rating	IP67; NEMA 6P
Connections	PVC-jacketed 2 m or 9 m cables, or 4-pin Euro-style quick-disconnect (QD) fitting are available. QD cables are ordered separately. See page 413.
Operating Conditions	Temperature: -40° to +70° C Relative humidity: 90% at 50° C (non-condensing)
Design Standards	Q45AD9 Series sensors comply with the following standards: DIN 19234, EN 50 014: 1977, EN 50 020: 2002
Certifications	
Hookup Diagrams	SP01 (p. 530)

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APPROVALS

CSA: #LR 41887	Intrinsically Safe, with Entity for Class I, Groups A-D Class I, Div. 2, Groups A-D	KEMA: #03 ATEX 1441x	II IG EEx ia IICTC
FM: #J.I. 5Y3A4.AX	Intrinsically Safe, with Entity for Class I, II, III, Div. 1, Groups A-G Class I, II, III, Div. 2, Groups A-D and G	ETL: #558044	Tested per FM and CSA as shown above



OMNI-BEAM™

Modular Limit-Switch Style Sensors

- Modular self-contained photoelectric sensors that you can customize for a specific application.
- Includes a sensor head and a power block; timing logic module is optional
- Features exclusive multiple-LED system that displays received signal strength, sensing contrast and seven different warnings
- Easily field-programmable for sensing hysteresis, signal strength display scale factor and light/dark operate
- Available in opposed, retroreflective, diffuse, convergent and fiber optic modes
- Available in convergent and fiber optic models with choice of red, blue or green LED for color-differentiation applications

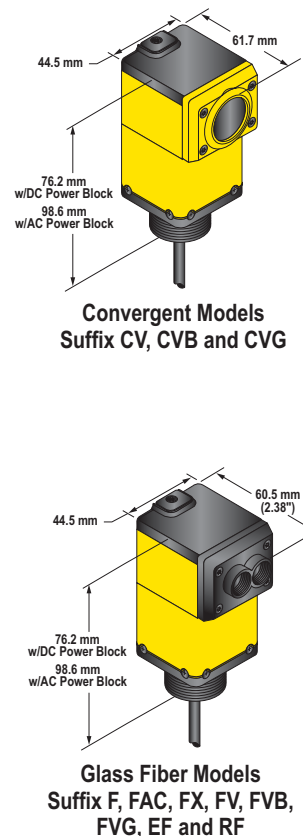
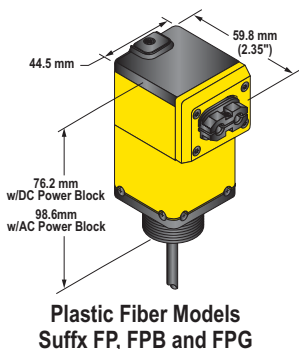
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- COMPACT
- MIDSIZE
- FULLSIZE

Sensor Heads	page 160
Timing Logic Modules	162
Power Blocks	162

- OPPOSED
- RETRO
- POLAR RETRO
- CLEAR OBJECT POLAR RETRO
- DIFFUSE
- CONVERGENT
- GLASS FIBER
- PLASTIC FIBER
- BRACKETS PAGE 371
- QD CABLES 4-Pin Euro 4- & 5-Pin Mini PAGE 412 & 420
- REFLECTORS PAGE 425

OMNI-BEAM™ Sensors

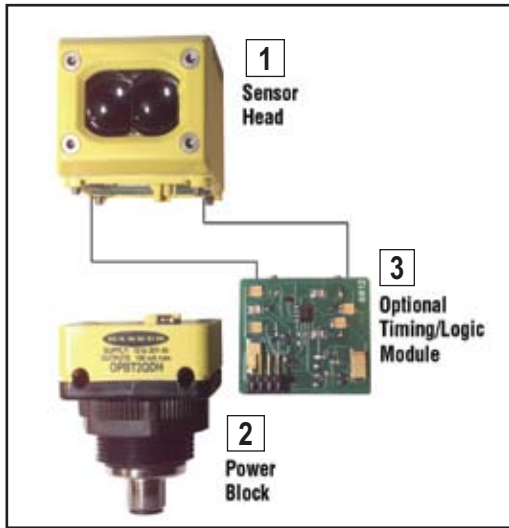
- Display and Alarm multiple-LED self-diagnostic system
- Interchangeable ac or dc power block (dc model shown in photo to right; ac model shown in drawings)
- Attached cable, or Mini- or Euro-style quick-disconnect
- Interchangeable sensor head
- Optional output logic module (inside)



MINIATURE
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Selecting Components for OMNI-BEAM™ Sensors

OMNI-BEAM™ sensors are modular self-contained photoelectric sensors that you can customize for a specific application.



STEP 1:
Choose a sensor head with the required sensing mode.

STEP 2:
Choose a power block for the required sensor power (ac or dc) and interface.

STEP 3:
Choose an optional timing logic module.

STEP 4:
Plug and bolt components together without interwiring.

OMNI-BEAM modular components are sold separately. The three modular components, and the lenses, can be replaced in the field.

OMNI-BEAM™ Sensor Heads



Models	Sensing Mode/LED*	Range	Supply Voltage	Response & Repeatability	Excess Gain	Beam Pattern	Data Sheet				
OSBE Emitter	OPPOSED	45 m	Provided by Power Block (see page 162)	Response: 2 ms Repeatability: 0.01 ms	EGCO-36 (p. 470)	BPO-35 (p. 494)	03522				
OSBR											
OSBLV	RETRO	0.15-9 m†		Response: 4 ms Repeatability: 0.2 ms	EGCR-50 (p. 474)	BPR-42 (p. 497)	03522				
OSBLVAG								POLAR RETRO CLEAR OBJECT	0.3-4.5 m†	EGCR-51 (p. 474)	BPR-44 (p. 497)
OSBLVAGC											
OSBD	HIGH-SPEED DIFFUSE	300 mm		Response: 2 ms Repeatability: 0.1 ms	EGCD-45 (p. 477)	BPD-45 (p. 500)	03522				
OSBDX								HIGH-POWER DIFFUSE	2 m	Response: 15 ms Repeatability: 1 ms	EGCD-46 (p. 477)

* Infrared LED Visible Red LED

† Retroreflective range is specified using one model BRT-3 retroreflector. Actual sensing range may differ, depending on efficiency and reflective area of the retroreflector in use. See Accessories for more information.

NOTE: Sensor heads require a power block. See page 162.



More on next page



OMNI-BEAM™ Sensor Heads (cont'd)

Models	Sensing Mode/LED*	Range	Supply Voltage	Response & Repeatability	Excess Gain	Beam Pattern	Data Sheet					
OSBCV	CONVERGENT	38 mm	Provided by Power Block (see page 162)	Response: 4 ms Repeatability: 0.2 ms	EGCC-38 (p. 480)	BPC-38 (p. 503)	03522					
OSBCVB	CONVERGENT				EGCC-39 (p. 480)	BPC-39 (p. 503)						
OSBCVG	CONVERGENT				EGCC-40 (p. 480)	BPC-40 (p. 503)						
OSBF	HIGH SPEED GLASS FIBER	Range varies by sensing mode and fiber optics used		Provided by Power Block (see page 162)	Response: 2 ms Repeatability: 0.1 ms	EGCG-30 & EGCG-31 (p. 486)	BPG-30 & BPG-31 (p. 505)	03522				
OSBFV	HIGH SPEED GLASS FIBER					EGCG-32 (p. 486) & EGCG-33 (p. 487)	BPG-32 (p. 505) & BPG-33 (p. 506)					
OSBFVB	HIGH SPEED GLASS FIBER					EGCG-34 (p. 487)	BPG-34 (p. 506)					
OSBFVG	HIGH SPEED GLASS FIBER					EGCG-35 (p. 487)	BPG-35 (p. 506)					
OSBFX	HIGH POWER GLASS FIBER					EGCG-36 & EGCG-37 (p. 487)	BPG-36 & BPG-37 (p. 506)					
OSBFAC	AC-COUPLED GLASS FIBER					Maximum Range: IT23S fibers, opposed mode: 180 mm			03553			
OSBEF	GLASS FIBER					EGCG-38 & EGCG-39 (p. 487)	BPG-38 & BPG-39 (p. 506)		03522			
OSBRF	GLASS FIBER											
OSBFP	PLASTIC FIBER					Range varies by sensing mode and fiber optics used	Provided by Power Block (see page 162)		Response: 2 ms Repeatability: 0.1 ms	EGCP-22 & EGCP-23 (p. 489)	BPP-22 & BPP-23 (p. 508)	03522
OSBFPB	PLASTIC FIBER									EGCP-24 (p. 489)	BPP-24 (p. 505)	
OSBFPG	PLASTIC FIBER	EGCP-25 (p. 489)	BPP-25 (p. 508)									

* Infrared LED Visible Red LED Visible Green LED Visible Blue LED
NOTE: Sensor heads require a power block. See page 162.

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OMNI-BEAM™ Timing Logic Modules



Models	Type	Logic Function	Timing Ranges	Timing Diagrams	Data Sheet
OLM5	Delay Timer Logic Module	ON-DELAY or OFF-DELAY or ON/OFF DELAY	ON-Delay: 0.01-1 sec., 0.15-15 sec., or none OFF-Delay: 0.01-1 sec., 0.15-15 sec., or none	For information on Timing Diagrams, see data sheets	03540 & 03522
OLM8	Pulse Timer Logic Module	ONE-SHOT pulse timer or DELAYED ONE-SHOT logic timer	Delay: 0.01-1 sec., 0.15-15 sec., or none Pulse: 0.01-1 sec., 0.15-15 sec.		
OLM8M1	Pulse Timer Logic Module	ONE-SHOT pulse timer or DELAYED ONE-SHOT logic timer	Delay: 0.002-0.1 sec., 0.03-1.5 sec., or none Pulse: 0.002-0.1 sec., 0.03-1.5 sec.		

OMNI-BEAM™ Power Blocks, DC Voltage






Models	Cable**	Supply Voltage	Output Type	Data Sheet
OPBT2	2 m	10-30V dc	Bi-Modal™ NPN or PNP Two outputs: Load and Alarm	03522
OPBT2QD	4-Pin Mini QD			
OPBT2QDH	4-Pin Euro QD			
OPBTE	2 m		No output: for powering emitter-only sensor heads	
OPBTEQD	4-Pin Mini QD			
OPBTEQDH	4-Pin Euro QD			




OMNI-BEAM™ Power Blocks, AC Voltage




Models	Cable**	Supply Voltage	Output Type	Data Sheet
OPBA2	2 m	105-130V ac	SPST solid-state ac relay Two outputs: Load and Alarm	03522
OPBA2QD	5-Pin Mini QD	210-250V ac		
OPBB2	2 m			
OPBB2QD	5-Pin Mini QD	105-130V ac	No output: for powering emitter only sensor heads	
OPBAE	2 m	210-250V ac		
OPBAEQD	5-Pin Mini QD			
OPBBE	2 m	210-250V ac		
OPBBEQD	5-Pin Mini QD			


** For 9 m cable, add suffix **W30** to the 2 m model number (example, **OPBT2 W30**). A model with a QD requires a mating cable (see pages 412 and 420).

OMNI-BEAM™ Sensor Head Specifications	
Supply Voltage and Current	Supplied by OMNI-BEAM power block. See page 162.
Output Response Time	See individual sensing heads for response times (see pages 160 and 161). 200 millisecond delay on power-up: outputs are non-conducting during this time.
Adjustments	OMNI-BEAM sensor heads are field-programmable for four operating parameters. A set of four programming DIP switches is located at the base of the sensor head and is accessible with the sensor head removed from the power block SWITCH #1 selects the amount of sensing hysteresis SWITCH #2 selects the alarm output configuration SWITCH #3 selects Light Operate (switch #3 OFF) or Dark Operate (switch #3 ON) SWITCH #4 selects the STANDARD (switch #4 OFF) or Fine (switch #4 ON) scale factor for the D.A.T.A. light signal strength indicator array Sensitivity: 15-turn slotted brass screw Gain (sensitivity) adjustment potentiometer (clutched at both ends of travel).
Indicators	Sense and Load indicator LEDs are located on the top of the sensor head on either side of the D.A.T.A. array. Sense LED indicates when a target has been sensed Load LED lights whenever the load (sensor output) is energized Also, Banner's exclusive, D.A.T.A. sensor self-diagnostic system located on the top of the sensor head warns of marginal sensing conditions usually before a sensing failure occurs (except on model OSBFAC)
Construction	Sensor heads are molded of rugged thermoplastic polyester; top view window is polycarbonate; acrylic lenses; stainless steel hardware.
Environmental Rating	Meets NEMA standards 1, 2, 3, 3S, 4, 12, and 13; IEC IP66 when assembled to power block.
Operating Conditions	Temperature: -40° to +70° C Relative humidity: 90% at 50° C (non-condensing)
Certifications	  

OMNI-BEAM™ Timing Logic Module Specifications	
Response Time	A disabled timing function adds no measurable sensing response time
Timing Adjustments	All logic modules feature 15-turn clutched potentiometers for accurate timing adjustments. The logic module slides into the sensor head housing and interconnects without wires. Timing adjustments are easily accessible at the top of the sensor head and are protected by the sensor's transparent cover.
Timing Repeatability	± 2% of timing range (max.); assumes conditions of constant temperature and power supply
Time Range	Useful range is from maximum time down to 10% of maximum (all models); when timing potentiometer is set fully counterclockwise, time will be approximately 1% of maximum for models OLM5 and OLM8, and 2% of maximum for model OLM8M1
Operating Conditions	Temperature: -40° to +70° C Relative humidity: 90% at 50° C (non-condensing)
Certifications	  

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OMNI-BEAM™ DC Power Block Specifications	
Supply Voltage and Current	10 to 30V dc (10% max. ripple) at less than 80 mA (exclusive of load)
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	OPBT2, OPBT2QD, OPBT2QDH: Bi-Modal™ NPN or PNP, depending upon hookup to power supply (see hookup diagrams) OPBTE, OPBTEQD, OPBTEQDH: No output - for use with emitters only
Output Rating	100 mA max. OFF-state leakage current: less than 100 µA Output saturation voltage (NPN or PNP outputs): less than 1 volt at 10 mA and less than 1.5 volts at 100 mA
Output Protection Circuitry	Protected against false pulse on power-up and continuous overload or short-circuit of outputs
Construction	Reinforced thermoplastic polyester housing with totally epoxy-encapsulated circuitry, and 30 mm threaded hub for swivel bracket or through-hole mounting
Environmental Rating	Meets NEMA standards 1, 2, 3, 3S, 4, 12, and 13; IEC IP66 when assembled to sensor head
Connections	PVC-jacketed 2 m or 9 m cables, or 4-pin Mini- or Euro-style quick-disconnect (QD) fitting are available. QD cables are ordered separately. See page 412.
Operating Conditions	Temperature: -40° to +70° C Relative humidity: 90% at 50° C (non-condensing)
Application Notes	Interface to TTL logic is not direct (contact factory). When the load and the OMNI-BEAM do not share a common power supply, load voltage must be ≤ the sensor supply voltage
Certifications	
Hookup Diagrams	Emitters: DC02 (p. 520) Other DC Models: DC13 (p. 523)

OMNI-BEAM™ AC Power Block Specifications	
Supply Voltage and Current	120V models: 105 to 130V ac, 50/60 Hz, 4 watts (excluding load) 220/240V models: 210 to 250V ac, 50/60 Hz, 4 watts (excluding load)
Supply Protection Circuitry	Protected against transient voltages
Output Configuration	OPBA2, OPBA2QD, OPBB2 and OPBB2QD: Isolated SPST solid-state ac relay OPBAE, OPBAEQD, OPBBE and OPBBEQD: No output - for use with emitter only
Load Output Rating	500 mA max to 25° C, derated 1% per ° C to 70° C; 7 amps max inrush for 1 second or 20 amps max for one cycle (non-repeating) OFF-state leakage current: less than 100 µA max. ON-state voltage drop: less than 3V ac at full load
Alarm Output Rating	200 mA max to 25° C, derated 2% per ° C to 70° C; 2 amps max inrush for 1 second or 3 amps max for 1 cycle (non-repeating) OFF-state leakage current: less than 100 µA max. ON-state voltage drop: less than 2.5V ac at full load
Output Protection Circuitry	Protected against false pulse on power-up
Construction	Reinforced thermoplastic polyester housing with totally epoxy-encapsulated circuitry, and 30 mm threaded hub for swivel bracket or through-hole mounting
Environmental Rating	Meets NEMA standards 1, 2, 3, 3S, 4, 12, and 13; IEC IP66 when assembled with sensor head
Connections	PVC-jacketed 2 m or 9 m cables, or 5-pin Mini-style quick-disconnect (QD) fitting are available. QD cables are ordered separately. See page 420.
Operating Conditions	Temperature: -40° to +70° C Relative humidity: 90% at 50° C (non-condensing)
Certifications	
Hookup Diagrams	Emitters: AC03 (p. 525) Other AC Models: AC09 (p. 527)



Q60

Long-Range Adjustable-Field Sensors

- Detects objects within a defined sensing field, ignoring objects located just beyond the sensing field cutoff
- Features two-turn, logarithmic adjustment of sensing field cutoff point from 0.2 to 2 m, to make it easy to set cutoff point
- Uses rotating pointer to indicate relative cutoff point setting within sensing range
- Features easy push-button or remote programming of light/dark operate and output timing
- Uses continuous status indicators to verify all settings at a glance
- Available in models for dc or ac/dc universal voltage operation
- Models with visible red lasers enable small part detection from long distances

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- LASER ADJUSTABLE-FIELD
- ADJUSTABLE-FIELD
- BRACKETS PAGE 371
- OD CABLES 5-Pin Euro + 4-Pin Micro PAGE 414 & 419

Q60 Sensors

- Two-turn, logarithmic adjustment of sensing cutoff point from 0.2 to 2 m
- Powerful infrared and visible LED, or laser (Class 1 and Class 2) light sources
- Integral cable, or rotating quick-disconnect fitting
- Output ON and/or OFF delays adjustable from 8 milliseconds to 16 seconds



Adjustable-field Models
Suffix AF, AFV and LAF



Q60, 10-30V dc

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain and Cutoff Point Deviation	Data Sheet
Q60BB6AFV1000	ADJUSTABLE-FIELD	Min.: 65 - 130 mm† Cutoff: 200 - 1000 mm	2 m	Bipolar NPN/ PNP	EGCA-7 (p. 481) Cutoff Point Deviation Curves CPDC-10 & CPDC-11 (p. 518)	69622
Q60BB6AFV1000Q			5-pin Euro QD			
Q60BB6AF2000	ADJUSTABLE-FIELD	Min.: 50 - 125 mm† Cutoff: 200 - 2000 mm	2 m		EGCA-8 (p. 481) Cutoff Point Deviation Curves CPDC-8 & CPDC-9 (p. 518)	67003
Q60BB6AF2000Q			5-pin Euro QD			
Q60BB6LAF1400	CLASS 1 LASER LASER ADJUSTABLE-FIELD	Min.: 100 - 260 mm† Cutoff: 200 - 1400 mm	2 m		EGCA-9 (p. 481) Cutoff Point Deviation Curves CPDC-12 (p. 518) & CPDC-13 (p. 518)	114348
Q60BB6LAF1400Q			5-pin Euro QD			
Q60BB6LAF2000	CLASS 2 LASER LASER ADJUSTABLE-FIELD	Min.: 75 - 240 mm† Cutoff: 200 - 2000 mm	2 m		EGCA-10 (p. 481) Cutoff Point Deviation Curves CPDC-12 (p. 518) & CPDC-13 (p. 519)	114348
Q60BB6LAF2000Q			5-pin Euro QD			

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Q60 Universal Voltage, 12-250V dc or 24-250V ac



Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain and Cutoff Point Deviation	Data Sheet
Q60VR3AFV1000	ADJUSTABLE-FIELD	Min.: 65 - 130 mm† Cutoff: 200 - 1000 mm	2 m	SPDT e/m Relay	EGCA-7 (p. 481) Cutoff Point Deviation Curves CPDC-10 & CPDC-11 (p. 518)	69622
Q60VR3AFV1000Q1			4-pin Micro QD	SPST e/m Relay		
Q60VR3AF2000	ADJUSTABLE-FIELD	Min.: 50 - 125 mm† Cutoff: 200 - 2000 mm	2 m	SPDT e/m Relay	EGCA-8 (p. 481) Cutoff Point Deviation Curves CPDC-8 & CPDC-9 (p. 518)	67003
Q60VR3AF2000Q1			4-pin Micro QD	SPST e/m Relay		
Q60VR3LAF1400	CLASS 1 LASER LASER ADJUSTABLE-FIELD	Min.: 100 - 260 mm† Cutoff: 200 - 1400 mm	2 m	SPDT e/m Relay	EGCA-9 (p. 481) Cutoff Point Deviation Curves CPDC-12 & CPDC-13 (p. 518)	114348
Q60VR3LAF1400Q1			4-pin Micro QD	SPST e/m Relay		
Q60VR3LAF2000	CLASS 2 LASER LASER ADJUSTABLE-FIELD	Min.: 75 - 240 mm† Cutoff: 200 - 2000 mm	2 m	SPDT e/m Relay	EGCA-10 (p. 481) Cutoff Point Deviation Curves CPDC-12 (p. 518) & CPDC-13 (p. 519)	114348
Q60VR3LAF2000Q1			4-pin Micro QD	SPST e/m Relay		

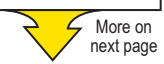
* Infrared LED Visible Red LED Visible Red Laser

** For 9 m cable, add suffix W/30 to the 2 m model number (example, Q60BB6AF2000 W/30). A model with a QD requires a mating cable (see pages 414 and 419).



† Minimum range varies by established cutoff point (see excess gain curves, page 481 and cutoff point deviation curves, page 518).

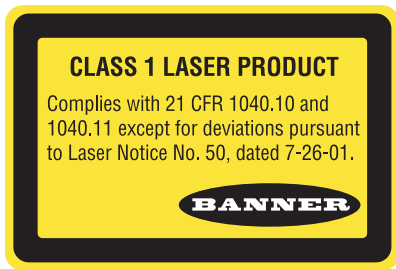
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Q60 Specifications	
Supply Voltage and Current	Q60BB6AF and Q60BB6AFV models: 10 to 30V dc (10% max. ripple) at less than 50 mA exclusive of load Q60BB6LAF models: 10 to 30V dc (10% max. ripple) at less than 35 mA exclusive of load Q60VR3LAF and Q60VR3AFV Universal models: 12 to 250V dc or 24 to 250V ac, 50/60 Hz Input power 1.5 W max.
Supply Protection Circuitry	Protected against reverse polarity and transient voltages (Q60VR3 models' dc hookup is without regard to polarity)
Output Configuration	Q60BB6AF, Q60BB6AFV and Q60BB6LAF models: Bipolar: one NPN (current sinking) and one PNP (current sourcing) open-collector transistor Q60VR3AF, Q60VR3LAF and Q60VR3AFV cabled models: E/M Relay (SPDT), normally closed and normally open contacts Q60VR3AFQ1, Q60VR3AFVQ1 and Q60VR3LAFQ1 (QD) models: E/M Relay (SPST), normally open contact
Output Rating	DC models: 150 mA max. each output @ 25C OFF-state leakage current: less than 5 µA @ 30V dc Output saturation NPN: less than 200 mV @ 10 mA; less than 1V @ 150 mA Output saturation PNP: less than 1V at 10 mA; less than 1.5V at 150 mA Universal Voltage models: Min. voltage and current: 5V dc, 10 mA Mechanical life of relay: 50,000,000 operations Electrical life of relay at full resistive load: 100,000 operations Max. switching power (resistive load): Cabled models: 1250VA, 150 W QD models: 750VA, 90W Max. switching voltage (resistive load): Cabled models: 250V ac, 125V dc QD models: 250V ac, 125V dc Max. switching current (resistive load): Cabled models: 5 A @ 250V ac, 5 A @ 30V dc derated to 200 mA @ 125V dc QD models: 3 A @ 250V ac, 3 A @ 30V dc derated to 200 mA @ 125V dc
Output Protection Circuitry	Q60BB6AF, Q60BB6LAF and Q60BB6AFV models: Protected against continuous overload or short circuit of outputs All models: Protected against false pulse on power-up
Output Response Time	Q60BB6AF, Q60BB6LAF and Q60BB6AFV models: 2 milliseconds ON/OFF Q60VR3AF, Q60VR3LAF and Q60VR3AFV Universal models: 15 milliseconds ON/OFF NOTE: 150 millisecond delay on power-up (Q60BB6LAF has 1 second max. delay at power-up); outputs do not conduct during this time.
Repeatability	500 microseconds
Sensing Hysteresis	For Infrared models, see chart HC-3; for Visible Red models, see chart HC-4; and for Laser models, see chart HC-2, all on page 512. 2000 mm cutoff - less than 3% of set cutoff distance 1600 mm cutoff - less than 2.25% of set cutoff distance 1200 mm cutoff - less than 1.30% of set cutoff distance 800 mm cutoff - less than 0.5% of set cutoff distance 400 mm cutoff - less than 0.25% of set cutoff distance
Adjustments	2 momentary push buttons: [ON-delay (+) an OFF-delay (-)] ON Delay select: 8 milliseconds to 16 seconds LO/DO select OFF Delay select: 8 milliseconds to 16 seconds Push-button lockout for security Slotted, geared, 2-turn, cutoff range adjustment screw (mechanical stops on both ends of travel)
Indicators	Q60AF and Q60AFV models: ON-Delay Green ON Steady: Run mode, ON-delay is active Green Flashing: ON-delay Selection mode is active OFF-Delay Green ON Steady: Run mode, OFF-delay is active Green Flashing: OFF-delay Selection mode is active 5-Segment Light Bar*: Indicates relative delay time during ON/OFF-delay Selection modes Output Amber ON Steady: Outputs are conducting Green ON Steady: During ON/OFF-delay Selection modes Dark Operate Green ON Steady: Dark Operate is selected Lockout Green ON Steady: Buttons are locked out Light Operate Green ON Steady: Light Operate is selected Signal Green ON Steady: Sensor is receiving signal Green Flashing: Marginal signal (1.0 to 2.25 excess gain) *Output, Dark Operate, Lockout, Light Operate and Signal indicators function as 5-Segment Light Bar during ON/OFF-delay Selection modes



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Q60 Specifications (cont'd)	
<p>Indicators (cont'd)</p> <p>Note: outputs are active during on/off timing selection mode.</p>	<p>Q60LAF models:</p> <p>ON-Delay Green ON Steady: RUN mode, ON-delay active Green Flashing: ON-delay Selection mode</p> <p>OFF-Delay Green ON Steady: RUN mode, OFF-delay active Green Flashing: OFF-delay Selection mode</p> <p>5-Segment Light Bar* Indicates relative delay time during ON/OFF-delay Selection modes</p> <p>Output Yellow ON Steady: Outputs are conducting Green ON Steady: ON/OFF-delay Selection</p> <p>Dark Operate Green ON Steady: Dark Operate selected</p> <p>Lockout Green ON Steady: Buttons locked out</p> <p>Light Operate Green ON Steady: Light Operate selected</p> <p>Signal Green ON Steady: Sensor receiving signal Green Flashing: Marginal signal (1.0 to 2.25 excess gain)</p> <p>*Output, Dark Operate, Lockout, Light Operate and Signal indicators function as 5-Segment Light Bar during ON/OFF-delay Selection modes</p>
Laser Characteristics	<p>Spot Size: approximately 4 x 2 mm throughout range (collimated beam)</p> <p>Angle of Divergence: 5 milliradians</p> <p>NOTE: Contact factory for custom laser spot size.</p>
Construction	<p>Housing: ABS polycarbonate blend Lens: acrylic Cover: Clear ABS</p>
Environmental Rating	IEC IP67; NEMA 6
Connections	2 m or 9 m integral cable. DC models offer a 5-pin Euro-style QD fitting. AC models offer 4-pin Micro-style QD fitting. QD cables are ordered separately. See pages 414 and 419.
Operating Conditions	<p>Temperature: Q60BB6LAF (DC) models: -10° to +50° C</p> <p>Q60VR3LAF Universal models: -10° to +45° C</p> <p>All others: -20° to +55° C</p> <p>Relative humidity: 90% at 50° C (non-condensing)</p>
Certifications	 
Hookup Diagrams	<p>DC: DC08 (p. 521) Universal Cabled: UN01 (p. 528) Universal QD: UN04 (p. 528)</p>



Class 1 Lasers

Lasers that are safe under reasonably foreseeable conditions of operation, including the use of optical instruments for intrabeam viewing. Reference 60825-1 Amend. 2 © IEC:2001(E), section 8.2.

For safe laser use:

- Do not permit a person to stare at the laser from within the beam.
- Do not point the laser at a person's eye at close range.
- Locate open laser beam paths either above or below eye level, where practical.

Class 2 Lasers

Lasers that emit visible radiation in the wavelength range from 400 nm to 700 nm where eye protection is normally afforded by aversion responses, including the blink reflex. This reaction may be expected to provide adequate protection under reasonably foreseeable conditions of operation, including the use of optical instruments for intrabeam viewing. Reference 60825-1 Amend. 2 © IEC:2001(E), section 8.2.

For safe laser use:

- Do not permit a person to stare at the laser from within the beam.
- Do not point the laser at a person's eye at close range.
- Locate open laser beam paths either above or below eye level, where practical.



Fiber Optic Systems

Fiber System Overview page 170

- Fiber Systems Explained
- When to Use Fiber Systems
- Selection information for sensors and fibers
- Choosing Plastic or Glass Fibers



D10 page 172

- Advanced amplifier for use with plastic fibers
- High-performance, low-contrast sensing
- Easy-to-set TEACH programming
- Manual adjustment capability for fine tuning
- 4-digit display of signal strength and operating status
- Visible red or green sensing beam



FI22 page 186

- Low-profile design to mount directly on equipment
- 8-segment LED status bar for signal strength, sensing contrast, programming status and diagnostic warnings
- Completely sealed, IP67 point-of-use or inline fiber optic amplifier



D12 page 178

- Glass and plastic fiber optic models
- Models for standard applications, high-speed response and increased power
- AC-coupled for high-sensitivity applications



Plastic Fibers page 188

- Inexpensive and easily cut to length during installation
- Very bendable, for a precise fit
- Available coiled, for applications requiring articulated or reciprocating motion
- Diameters of 0.25, 0.5, 1.0 or 1.5 mm



R55F page 183

- Green, blue, white, red or infrared LED colors
- For mounting flat or to a 35 mm DIN rail
- Models for glass and plastic fiber optics



Glass Fibers page 204

- For hostile environments: high temperatures, corrosive materials, extreme moisture and high levels of shock and vibration
- Inherent immunity to extreme electrical noise
- Quickly custom designed and built for your unique applications

The broadest selection of fiber sensors in the world.

SENSORS

PLASTIC FIBERS

GLASS FIBERS

Fiber Systems

Two-part fiber systems include the sensor and the separately purchased application-specific fiber.

1. Sensors


























The sensor contains all the electronics, the amplifier and the mechanical interface to the fiber. Some models are sealed and rated IP67 to mount directly on a machine; others are designed to be DIN-rail mounted in a centralized control enclosure.

2. Fibers

Sensing fibers are non-electronic, light-transmitting, optical-quality glass or plastic strands encased in cladding that reflects light to the core. Fibers transmit and/or receive light from the LED of a sensor. Glass fibers are arranged in bundles, and plastic fibers are typically packaged as monofilaments with a protective jacket of polyethylene, PVC, stainless-steel braid or other material. Fiber sensing tips have a wide variety of shapes and configurations.

When to Use Fiber Systems

- **Confined areas.** The small size and flexibility of fibers allows precise positioning where space is limited.
- **High temperatures.** Fiber optic assemblies can tolerate elevated temperatures—in some cases as high as 480° C.
- **High vibration and shock.** The low mass of fibers enables them to withstand extreme vibration and mechanical shock.
- **Corrosive and wet environments.** Special purpose fibers withstand corrosive materials, moisture and even repeated washdown.
- **Explosive environments.** Fibers are passive and can safely pipe light to and from hazardous areas.
- **Noisy environments.** Fibers are non-electronic mechanical components and are completely immune to electrical noise.
- **Unique target shapes and requirements.** Fiber optic sensing heads can be custom designed and optimally shaped to the physical and optical requirements of a specific application.

Sensor Model	Models for Plastic Fibers	Page Number	Models for Glass Fibers	Page Number
WORLD-BEAM®		page 70		page 70
MINI-BEAM®		page 79		page 79
QM42		page 140		
Q45		page 146		page 146
OMNI-BEAM™		page 159		page 159
D10		page 172		
D12		page 178		page 178
R55F		page 183		page 183
FI22		page 186		
D11		page 34		
ECONO-BEAM®		page 34		page 34
MAXI-BEAM®		page 35		page 35
MULTI-BEAM®				page 35
PC44		See data sheet p/n 32910		
VALU-BEAM®		page 34		page 34
SM512				page 35

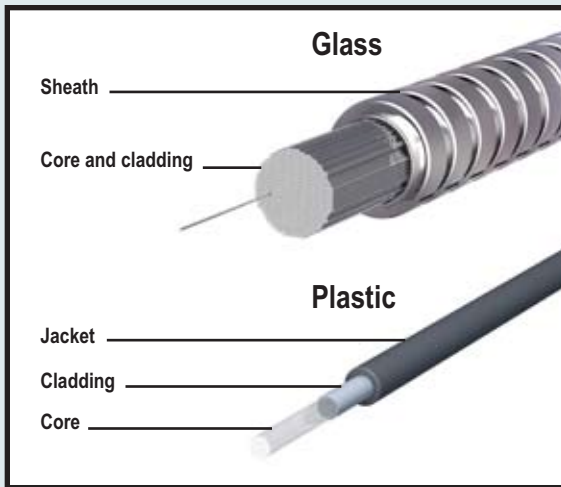
Typical Applications

- Punch presses
- Vibratory feeders
- Conveyors
- Web control
- Tablet counting
- Ovens
- Semiconductor processing equipment
- Liquid level

Compare & select fiber optic sensors online:
www.bannerengineering.com/iselect



Fiber Construction



- Core** Thin glass or plastic center of the fiber through which light travels.
- Cladding** Outer optical material surrounding the core that reflects light back into the core.
- Jacket/Sheath** Protective layer to protect fiber from damage and moisture.

Choosing Plastic or Glass

Plastic fibers are for general purpose use. They tolerate severe flexing, can be cut to length in the field and cost less than glass fibers. Glass fibers are the best choice for challenging environments such as high temperatures, corrosive materials and moisture.



Plastic fibers page 188

- Inexpensive and easily cut to length during installation
- Bend for a precise fit
- Available in high-flex models to withstand flexing
- Offered with special jackets that withstand corrosion, impact and abrasion
- Available in coiled versions for applications requiring articulated or reciprocating motion
- Available in diameters of 0.25, 0.5, 1.0 or 1.5 mm
- Can be quickly custom designed and built for your unique applications











Glass fibers page 204

- Solve numerous challenging sensing requirements
- Ideal for hostile environments such as high temperatures to 480° C, corrosive materials and extreme moisture
- Withstand high levels of shock and vibration
- Inherently immune to extreme electrical noise
- Available with choice of sheathings: standard stainless-steel flexible conduit, PVC or other flexible tubing
- Can be quickly custom designed

Specialty fibers for specific sensing applications.



							
DURA-BEND™ for extremely tight radius bends	Fluoropolymer encapsulated fibers	Focused beam fibers	Convergent beam fibers	Linear array fibers	Liquid level detection fibers	High temperature fibers	STEELSKIN™ for impact, abrasion

- SENSORS
- PLASTIC FIBERS
- GLASS FIBERS

SENSORS
PLASTIC FIBERS
GLASS FIBERS

D10 Series

Redefining High-Performance Fiber Optic Sensing

- Features advanced fiber optic amplifier for use with plastic fibers
- Available with visible red or green beam
- Delivers high-performance, low-contrast sensing with automatic TEACH options or manual adjustment
- Available in bipolar, dual-discrete and analog/discrete output models

Expert™ Models:

- 4-digit TEACH and signal strength display or bargraph readout
- Operating status indicators
- Easy-to-set static, dynamic and single-point programming
- Manual fine tuning
- Remote configuration, using TEACH wire

PLASTIC FIBER

BRACKETS
PAGE 371

OD CABLES
4- & 6-Pin Pico
PAGE 410 & 411

PLASTIC FIBERS
PAGE 188



Expert™ Advanced LED Display

- Configuration and performance indicator
- Quick and easy setup
- Constant status monitoring in RUN mode

Expert™ Dual-Discrete Outputs

- Two configurable individual setpoints
- Current sourcing (PNP) or current sinking (NPN)



Expert™ Analog & Discrete Outputs

- Two configurable individual setpoints: one for analog and one for discrete output
- Current sourcing (PNP) or current sinking (NPN)
- One 4-20 mA current analog output or 0-10V dc voltage analog output



D10 Expert™ with Numeric Display	page 173
D10 Expert™ with Bargraph Display	174
D10 Discrete Output	174

D10 Expert™ with Numeric Display

- Numeric display of signal strength and operating status
- Two output options: two discrete outputs in the same sensor; or discrete output and either a 4-20 mA current or a 0-10V dc voltage analog output in the same sensor



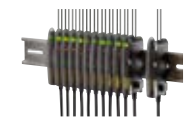
D10 Expert™ with Bargraph Display

- Easy-to-read 8-segment light bar display indicator for TEACH and signal strength
- Bipolar discrete outputs: one current sourcing (PNP) and one current sinking (NPN)



D10 Expert™ with Bussable Power

- Connect up to 16 devices side-to-side
- Reduce wiring cost; connect power to one sensor and bus to the next
- Save making up to 30 power connections



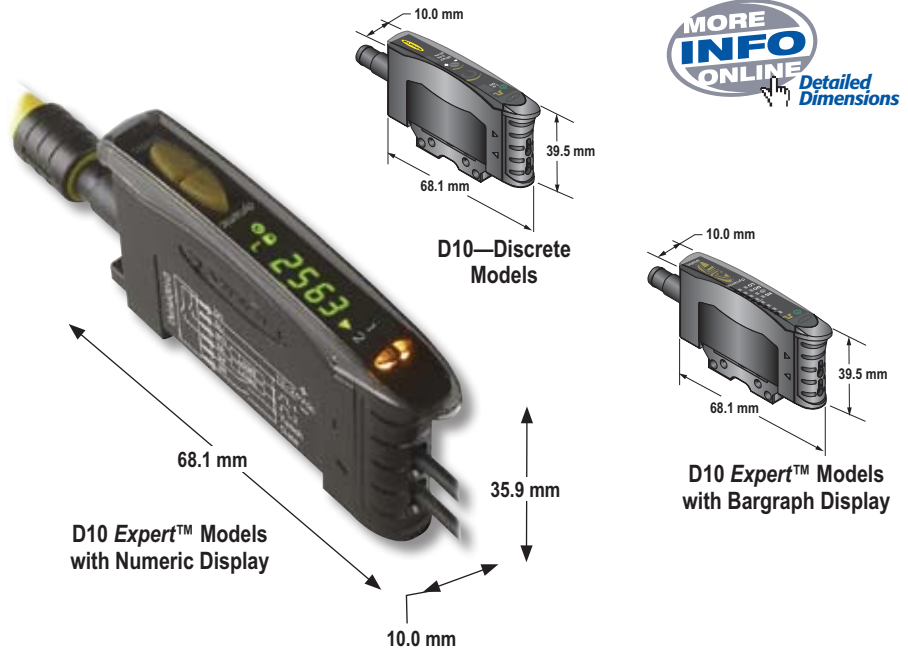
D10 Discrete Output

- 12-turn manual sensitivity adjustment
- Pulse rate LED indicator for signal strength
- Bipolar discrete outputs: one current sourcing (PNP) and one current sinking (NPN)



D10 Sensors

- Static and dynamic programming push buttons or manual gain potentiometer
- Informative signal-strength readout with LED display, bargraph display or mechanical indicator
- Output indicators
- 2 m or 9 m integral cable, or Pico-style quick-disconnect



D10 Expert™ with Numeric Display—Dual Discrete, 12-24V dc



Models	Sensing Mode/LED*	Range	Cable**	Outputs	Data Sheet
D10DNFP		Range varies by Power Level/Speed Selection used and with fiber optics used. See data sheet part number 64154 for range information.	2 m	Dual NPN	64154
D10DNFPQ			6-pin Pico QD		
D10DPFP			2 m	Dual PNP	
D10DPFPQ			6-pin Pico QD		
D10DNFPG			2 m	Dual NPN	
D10DNFPGQ			6-pin Pico QD		
D10DPFPG			2 m	Dual PNP	
D10DPFPGQ			6-pin Pico QD		

D10 Expert™ with Numeric Display—Analog/Discrete, 12-24V dc



Models	Sensing Mode/LED*	Range	Cable**	Discrete Output	Analog Output	Data Sheet
D10INFP		Range varies by Power Level/Speed Selection used and with fiber optics used. See data sheet part number 65448 for range information.	2 m	NPN	4-20 mA	65448
D10INFPQ			6-pin Pico QD			
D10IPFP			2 m	PNP		
D10IPFPQ			6-pin Pico QD			
D10INFPG			2 m	NPN	4-20 mA	
D10INFPGQ			6-pin Pico QD			
D10IPFPG			2 m	PNP		
D10IPFPGQ			6-pin Pico QD			

* Visible Red LED Visible Green LED

** For 9 m cable, add suffix **W30** to the 2 m model number (example, **D10DNFP W30**). A model with a QD requires a mating cable (see page 411).

SENSORS
PLASTIC FIBERS
GLASS FIBERS



D10 Expert™ with Numeric Display—Analog/Discrete, 15-24V dc

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Analog Output	Data Sheet
D10UNFP		Range varies by Power Level/Speed Selection used and with fiber optics used. See fibers section on page 188 or reference data sheet part number 65448 for range information.	2 m	NPN	0-10V	65448
D10UNFPQ			6-pin Pico QD			
D10UPFP			2 m	PNP		
D10UPFPQ			6-pin Pico QD			
D10UNFPG			2 m	NPN	0-10V	
D10UNFPGQ			6-pin Pico QD			
D10UPFPG			2 m	PNP		
D10UPFPGQ			6-pin Pico QD			



D10 Expert™ with Bargraph Display—Discrete, 10-30V dc

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet	
D10BFP		Range varies by Power Level/Speed Selection used and with fiber optics used. See fibers section on page 188 or reference data sheet part number 117830 for range information.	2 m	Bipolar NPN/PNP	EGCP-26 to EGCP-29 (p. 489)	BPP-26 to BPP-29 (p. 508)	117830	
D10BFPQ			6-pin Pico QD					
D10BFPG			2 m		6-pin Pico QD	EGCP-30 to EGCP-33 (pp. 489-490)		BPP-30 to BPP-33 (pp. 508-509)
D10BFPGQ			6-pin Pico QD					




D10—Discrete, 10-30V dc

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Data Sheet				
D10AFP		Range varies by Power Level/Speed Selection used and with fiber optics used. See fibers section on page 188 or reference data sheet part number 118431 for range information.	2 m	Bipolar NPN/PNP	118431				
D10AFPQ			4-pin Pico QD						
D10AFPG			2 m			4-pin Pico QD			
D10AFPGQ			4-pin Pico QD						
D10AFPY			Range varies by Power Level/Speed Selection used and with fiber optics used. See fibers section on page 188 or reference data sheet part number 118431 for range information.			2 m	Bipolar NPN/PNP	118431	
D10AFPYQ						4-pin Pico QD			
D10AFPGY						2 m			4-pin Pico QD
D10AFPGYQ						4-pin Pico QD			

* Visible Red LED Visible Green LED



** For 9 m cable, add suffix **W/30** to the 2 m model number (example, **D10UNFP W/30**). A model with a QD requires a mating cable (see pages 410 and 411).


SENSORS
PLASTIC FIBERS
GLASS FIBERS

D10 Expert™ with Numeric Display—Dual-Discrete Specifications			
Required Fiber Optic Cable	Banner P-Series plastic fibers (See Plastic Fiber Optic section, page 188)		
Supply Voltage and Current	12 to 24V dc (10% max. ripple) at less than 65 mA, exclusive of load		
Supply Protection Circuitry	Protected against reverse polarity and transient voltage.		
Output Configuration	Two independently configured current sourcing (PNP) or current sinking (NPN) solid-state transistors, depending on model.		
Output Rating	150 mA max. load OFF-state leakage current: less than 10 µA at 24V dc ON-state saturation voltage: NPN: less than 1.5V at 150 mA load PNP: less than 2.5V at 150 mA load		
Output Protection Circuitry	Protected against false pulse on power-up and continuous short-circuit		
Output Response Time	Programmable, 50 microseconds, 200 microseconds, 1 millisecond, 2.5 milliseconds NOTE: less than 1 second delay on power-up; outputs do not conduct during this time.		
Adjustments	Two push buttons or remote programming of (TEACH) switching threshold response time, OFF-delay, light/dark operate, and display		
Indicators	Four-digit digital display plus LED indicators for active channel, push-button lockout, OFF-delay and light/dark operate selection; two yellow LEDs serve as output indicators and active channel indicator.		
Construction	Black ABS/polycarbonate alloy (UL94 V-0 rated) housing, clear polycarbonate cover.		
Environmental Rating	IEC IP50; NEMA 1		
Connections	PVC-jacketed 2 m or 9 m 6-wire integral cable, or integral 6-pin Pico-style quick-disconnect fitting. QD cables are ordered separately. See page 411.		
Operating Conditions	Temperature: -20° to +55° C Storage Temperature: -20° to +80° C Relative humidity: 90% @ 50° C		
	Number of Devices Stacked	Ambient Temperature Rating	Load Specification
	3	55° C	150 mA
	7	50° C	50 mA
10	45° C	50 mA	
Installation	35 mm DIN rail or included mounting bracket		
Certifications			
Hookup Diagrams	DC14: (p. 523)		

D10 Expert™ with Numeric Display—Analog/Discrete Specifications			
Required Fiber Optic Cable	Banner P-Series plastic fibers (See Plastic Fiber Optic section, page 188)		
Supply Voltage and Current	4-20 mA Analog Models: 12-24V dc (10% max. ripple) at less than 65 mA exclusive of load 0-10V dc Analog Models: 15-24V dc (10% max. ripple) at less than 70 mA exclusive of load		
Supply Protection Circuitry	Protected against reverse polarity and transient voltage.		
Output Configuration	Two independently configurable outputs, depending on model: NPN w/analog (4-20 mA or 0-10V) or PNP w/analog (4-20 mA or 0-10V)		
Output Rating	Discrete Output: 150 mA, max. load OFF-state leakage current: less than 10 µA at 24V dc ON-state saturation voltage: NPN: < 1.5V @ 150 mA PNP: < 2.5V @ 150 mA	Analog Output: 4-20 mA or 0-10V dc Load: 4-20 mA Models: 100Ω max. impedance 0-10V dc Models: 1 MΩ min. impedance	
Output Protection Circuitry	Protected against false pulse on power-up and continuous short-circuit		
Output Response Time	Discrete Output: Programmable, 50 microseconds, 200 microseconds, 1 millisecond, 2.5 milliseconds Analog Output: 1 millisecond NOTE: less than 1 second delay on power-up; outputs do not conduct during this time.		
Adjustments	Push-button or remote programming of (TEACH) switching threshold response time, OFF-delay, light/dark operate, and display		
Indicators	Four-digit digital display plus LED indicators for active channel, push-button lockout, OFF-delay and light/dark operate selection; two yellow output indicators.		

More on next page

D10 Expert™ with Numeric Display—Analog/Discrete (cont'd)			
Construction	Black ABS/polycarbonate alloy (UL94 V-0 rated) housing, clear polycarbonate cover.		
Environmental Rating	IEC IP50; NEMA 1		
Connections	PVC-jacketed 2 m or 9 m 6-wire integral cable, or integral 6-pin Pico-style quick-disconnect. QD cables are ordered separately. See page 411.		
Operating Conditions	Temperature: -20° to +55° C Storage Temperature: -20° to +80° C Relative humidity: 90% @ 50° C		
	Number of Devices Stacked	Ambient Temperature Rating	Load Specification
	3	55° C	150 mA
	7	50° C	50 mA
	10	45° C	50 mA
Installation	35 mm DIN rail or included mounting bracket		
Certifications	 		
Hookup Diagrams	NPN Models: DC15 (p. 523) PNP Models: DC16 (p. 523)		

D10 Expert™ with Bargraph Display—Discrete Specifications	
Required Fiber Optic Cable	Banner P-Series plastic fibers (See Plastic Fiber Optic section, page 188)
Supply Voltage and Current	10 to 30V dc (10% max. ripple) at less than 45 mA, exclusive of load
Supply Protection Circuitry	Protected against reverse polarity, over voltage and transient voltage.
Delay at Power Up	200 milliseconds max.; outputs do not conduct during this time
Output Configuration	Bipolar: 1 current sourcing (PNP) and 1 current sinking (NPN)
Output Rating	150 mA max. load @ 25° C (derate 1 mA per ° C increase) OFF-state leakage current: less than 5 µA at 30V dc ON-state saturation voltage: NPN: less than 200 mV at 10 mA and 1V at 150 mA load PNP: less than 1V at 10 mA and 1.5V at 150 mA load
Output Protection Circuitry	Protected against output short-circuit, continuous overload, transient over-voltages, and false pulse on power-up
Output Response Time	500 microseconds (normal mode) or 200 microseconds (high-speed mode)
Repeatability	100 microseconds (normal mode) or 66 microseconds (high-speed mode)
Adjustments	Two push buttons and remote wire <ul style="list-style-type: none"> • Expert-style configuration (Static and Dynamic TEACH, and Windows SET) • Manually Adjust (+/-) sensitivity (from buttons only) • LO/DO, OFF-Delay, and response speed configurable (from buttons or remote wire) • Push-button lockout (from remote wire only) Factory Default Settings: Light Operate, Normal Speed, No Delay
Indicators	8-segment red bargraph: Light-to-dark signal difference relative to taught condition (window SET) Sensing contrast (Static or Dynamic TEACH) Green Status Indicators: LO, DO, High Speed (HS) and OFF-Delay Green LED: Power ON Yellow LED: Output conducting
Construction	Black ABS/polycarbonate alloy (UL94 V-0 rated) housing, clear polycarbonate cover.
Environmental Rating	IEC IP50, NEMA 1
Connections	PVC-jacketed 2 m or 9 m 6-wire integral cable, or integral 6-pin Pico-style quick-disconnect. QD cables are ordered separately. See page 411.
Operating Conditions	Temperature: -10° to +55° C Storage Temperature: -20° to +85° C Relative humidity: 90% @ 55° C
Installation	35 mm DIN rail or included mounting bracket
Certifications	
Hookup Diagrams	DC08 (p. 521)

D10—Discrete Specifications	
Required Fiber Optic Cable	Banner P-Series plastic fibers (See Plastic Fiber Optic section, page 188)
Supply Voltage	10 to 30V dc (10% max. ripple) @ less than 25 mA, exclusive of load
Supply Protection Circuitry	Protected against reverse polarity and transient voltage
Output Configuration	Bipolar: 1 current sourcing (PNP) and 1 current sinking (NPN)
Output Rating	100 mA per output with short circuit protection OFF-state leakage current: less than 10 μ A sourcing; 200 μ A sinking ON-state saturation voltage: NPN: 1.6V @ 100 mA PNP: 2.0V @ 100 mA
Output Protection Circuitry	Protected against output short-circuit and false pulse on power up (max. 100 milliseconds delay on power up; outputs do not conduct during this time).
Output Response Time	Standard models (with crosstalk avoidance circuitry): 500 microseconds High-speed models: 200 microseconds
Repeatability	Standard models: 95 microseconds High-speed models: 50 microseconds
Adjustments	12-turn Sensitivity potentiometer with relative position indicator; LO/DO Selection switch; 0 or 40 milliseconds OFF-delay switch NOTE: Use proper ESD techniques while making adjustments under cover.
Indicators	Two LEDs: Green and Yellow Green ON steady: Power ON Yellow flashing: Light Sensed Signal strength indicator (Banner's AID Alignment Indicator Device - the faster the flash, the more light is received).
Construction	Black ABS/polycarbonate alloy (UL94 V-0 rated) housing, clear polycarbonate cover.
Environmental Rating	IEC IP50; NEMA 1
Connections	PVC-jacketed 2 m or 9 m attached cable, or 4-pin Pico-style quick-disconnect fitting. QD cables are ordered separately. See page 410.
Operating Conditions	Temperature: -10° to +55° C Storage: -20° to +85° C Relative humidity: 90% @ 55° C (non-condensing)
Certifications	Approvals in process.
Hookup Diagrams	DC04 (p. 520)

SENSORS

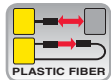
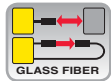
PLASTIC FIBERS

GLASS FIBERS

D12

Complete Family of Plastic and Glass Fiber Optic Sensors

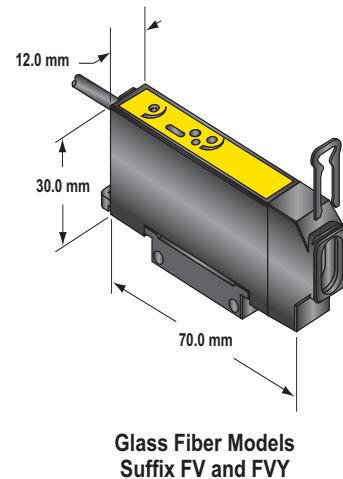
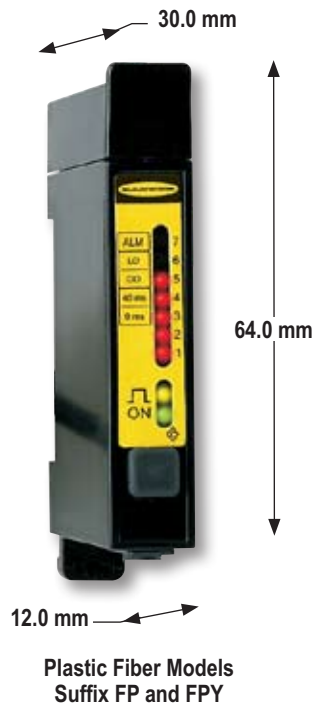
- Features LED bargraph that indicates signal strength, sensing contrast, programming status and diagnostic warnings, when not in high-speed mode
- Available in glass and plastic fiber optic models
- Includes marginal gain indicator with alarm output
- Solves routine applications with economical standard models
- Features high-speed sensing response and higher sensing power in some models
- Excels in low-contrast applications with ac-coupled models
- Features easy push-button TEACH-mode setup on D12E Expert™ models



D12 Expert™ Models	page 179
D12 Standard Models	179
D12 AC-Coupled Models	180

D12 Sensors

- 7-LED bargraph signal strength indicators
- Dual-LED multi-function status indicators
- Sensitivity adjustment
- 2 m or 9 m attached cable, or Pico-style quick-disconnect
- 35 mm DIN-rail mountable



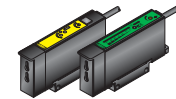
D12 Expert™, 10-30V dc



Models	Sensing Mode/LED*	Maximum Range	Switching Threshold Setting	Cable**	Output Type	Data Sheet
D12EN6FV	 GLASS FIBER	Range varies by sensing mode and fiber optics used. See data sheet part number 41974 for maximum range specifications.	Just above the "dark" condition	2 m	NPN	41974
D12EP6FV					PNP	
D12E2N6FV			Midway between "dark" and "light" conditions		NPN	
D12E2P6FV					PNP	
D12EN6FP	 PLASTIC FIBER		Just above the "dark" condition		NPN	
D12EP6FP					PNP	
D12E2N6FP			Midway between "dark" and "light" conditions		NPN	
D12E2P6FP					PNP	

SENSORS
PLASTIC FIBERS
GLASS FIBERS

D12 and D12 High-Speed, 10-30V dc



Models	Sensing Mode/LED*	Range	Cable**	Output Type	Output Response	Excess Gain	Data Sheet
D12SN6FV	 GLASS FIBER	Range varies by sensing mode and fiber optics used	2 m	NPN	500 μs	EGCG-40 & EGCG-41 (p. 487)	32822
D12SN6FVQ			4-Pin Pico Pigtail QD				
D12SP6FV			2 m	PNP			
D12SP6FVQ			4-Pin Pico Pigtail QD				
D12SN6FVY	 HIGH-SPEED GLASS FIBER		2 m	NPN	Selectable 50 μs or 500 μs***	EGCG-42 & EGCG-43 (p. 487)	
D12SN6FVYQ			4-Pin Pico Pigtail QD				
D12SN6FVY1†			2 m				
D12SN6FVY1Q†			4-Pin Pico Pigtail QD				
D12SP6FVY			2 m	PNP			
D12SP6FVYQ			4-Pin Pico Pigtail QD				
D12SP6FVY1†			2 m				
D12SP6FVY1Q†			4-Pin Pico Pigtail QD				
D12SN6FP	 PLASTIC FIBER		2 m	NPN	500 μs	EGCP- 34 & EGCP-35 (p. 490)	
D12SN6FPQ			4-Pin Pico Pigtail QD				
D12SP6FP			2 m	PNP			
D12SP6FPQ			4-Pin Pico Pigtail QD				
D12SN6FPY	 HIGH-SPEED PLASTIC FIBER	2 m	NPN	Selectable 50 μs or 500 μs***	EGCP-36 & EGCP-37 (p. 490)		
D12SN6FPYQ		4-Pin Pico Pigtail QD					
D12SN6FPY1†		2 m					
D12SN6FPY1Q†		4-Pin Pico Pigtail QD					
D12SP6FPY		2 m	PNP				
D12SP6FPYQ		4-Pin Pico Pigtail QD					
D12SP6FPY1†		2 m					
D12SP6FPY1Q†		4-Pin Pico Pigtail QD					

† Y1 models have 20 milliseconds output pulse stretcher.

* Visible Red LED

** For 9 m cable, add suffix W/30 to the 2 m model number (example, D12EN6FV W/30). A model with a QD requires a mating cable (see page 410).

*** When 50 microseconds is selected, bargraph is disabled.

D12 High-Power, 10-30V dc



Models	Sensing Mode/LED*	Range	Cable**	Output Type	Output Response	Excess Gain	Data Sheet
D12SN6FPH		Range varies by sensing mode and fiber optics used	2 m	NPN	500 μs	EGCP- 38 & EGCP-39 (p. 490)	34970
D12SN6FPHQ			4-Pin Pico Pigtail QD				
D12SP6FPH			2 m	PNP			
D12SP6FPHQ			4-Pin Pico Pigtail QD				

D12 AC-Coupled, 10-30V dc



Models	Sensing Mode/LED*	Range	Cable**	Output Type	Output Response	Data Sheet
D12DAB6FV		Range varies by Power Level/Speed Selection used and with fiber optics used. See data sheet part number 38384 for range information.	2 m	Bipolar NPN/PNP	50 μs	38384
D12DAB6FVQ			4-Pin Pico Pigtail QD			
D12DAB6FP			2 m		50 μs	
D12DAB6FPQ			4-Pin Pico Pigtail QD			

* Visible Red LED



** For 9 m cable, add suffix W30 to the 2 m model number (example, D12SN6FPH W30). A model with a QD requires a mating cable (see page 410).



D12 Expert™ Specifications

Supply Voltage and Current	10 to 30V dc at 45 mA max. (exclusive of load); 10% max. ripple
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	NPN open collector (both outputs) or PNP open collector (both outputs), depending on model Load output: NO and programmable Light or Dark-Operate; Alarm output: NO
Output Rating	150 mA max. each output OFF-state leakage current: less than 10 μA at 30V dc ON-state saturation voltage: less than 1 volt at 10 mA dc; less than 1.5 volts at 150 mA dc The total load may not exceed 150 mA
Output Protection Circuitry	Protected against false pulse on power-up and short circuit of outputs (trips at 175 mA)
Output Response Time	200 microseconds ON/OFF (40 milliseconds OFF when OFF-delay selected) (NOTE: False pulse protection circuit causes a 0.1 second delay on power-up)
Output Operation Mode	Light operate or dark operate: selected by push button
Output Timing Functions	ON/OFF (no delay) or fixed 40 millisecond OFF-delay; selected by push button
Repeatability	66 microseconds
Adjustments	Push-button TEACH-mode sensitivity setting; Remote teaching input is provided
Indicators	Green LED lights for DC power ON and flashes when ready for TEACH mode; 1 Hz when ready to learn first condition; 2 Hz for second condition Yellow LED lights for load output ON (conducting) 7-segment moving dot red LED display indicates relative received light signal strength, output program settings, relative contrast level and alarm
Mounting Bracket	D12 Sensors mount directly to a standard DIN rail, or may be through-hole mounted using the supplied mounting bracket and M3 x 0.5 hardware



SENSORS
PLASTIC FIBERS
GLASS FIBERS

D12 Expert™ Specifications (cont'd)	
Construction	Black ABS housing with acrylic cover, stainless steel M3 x 0.5 hardware for use with thermoplastic polyester mounting bracket (supplied); the plastic fiber clamping element is Acetal
Environmental Rating	IEC IP11; NEMA 2
Connections	PVC-jacketed 2 m or 9 m cables, or 150 mm pigtail with 4-pin Pico-style quick-disconnect (QD) are available. QD cables are ordered separately. See page 410.
Operating Conditions	Temperature: -20° to +70° C Relative humidity: 90% at 50° C (non-condensing)
Certifications (except D10E2)	 
Hookup Diagrams	DC17 (p. 524)

D12 Standard, High-Speed and High-Power Specifications	
Supply Voltage and Current	10 to 30V dc at 45 mA max. (exclusive of load)
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	Outputs are NPN (sinking) or PNP (sourcing), depending on model Complementary: one normally open (NO) and the other normally closed (NC); NC output may be wired as diagnostic alarm output by reversing power supply connections except high speed "Y" and "Y1" suffix models (see hookups)
Output Rating	150 mA max. each output OFF-state leakage current: less than 10 µA at 30V dc ON-state saturation voltage: less than 1 volt at 10 mA dc; less than 1.5 volts at 150 mA dc The total load may not exceed 150 mA
Output Protection Circuitry	Protected against false pulse on power-up and short circuit of outputs
Output Response Time	Standard and High-Power Models: 500 microseconds ON/OFF High-Speed Models: selectable 50 or 500 microseconds ON/OFF (NOTE: False pulse protection circuit causes a 0.1 second delay on power-up)
Output Timing Functions	"Y1" models have fixed 20 milliseconds pulse stretcher (OFF-delay) when 50 microseconds mode is used
Repeatability	130 microseconds; "Y" and "Y1" models have selectable 50 microseconds/500 microseconds response; repeatability in 50 microseconds mode is 15 microseconds
Adjustments	All models have a SENSITIVITY control on top of sensor (15-turn slotted brass screw, clutched at both ends of adjustment); "Y" and "Y1" (high speed models) also have a top-mounted response mode selector switch
Indicators	Two top-mounted LED indicators, one yellow and one green, and one 7-segment red LED moving dot bargraph; Note that the 7-segment bargraph and marginal excess gain indication (bargraph segment #7) are inoperative in the 50 µs response mode of "Y" and "Y1" models Green LED lights for DC Power ON Yellow LED lights for NORMALLY OPEN OUTPUT CONDUCTING On all models in 500 microseconds response mode, the 7-segment moving dot red LED bargraph lights to indicate relative received light signal strength; On all models in 50 and 500 microseconds response mode, segment #1 flashes to indicate OUTPUT OVERLOAD; On all models in the 500 microseconds response mode, segment #7 flashes to indicate MARGINAL EXCESS GAIN; On standard and high power models, a flashing LED corresponds to the "ON" state of the alarm output; (Alarm output not available on Y & Y1 models)
Mounting Bracket	D12 Sensors mount directly to a standard DIN rail, or may be through-hole mounted using the supplied mounting bracket and M3 x 0.5 hardware
Construction	Black ABS housing with acrylic cover, stainless steel M3 x 0.5 hardware for use with thermoplastic polyester mounting bracket (supplied); the plastic fiber clamping element is Acetal
Environmental Rating	IEC IP11; NEMA 2
Connections	PVC-jacketed 2 m or 9 m cables, or 150 mm pigtail with 4-pin Pico-style quick-disconnect (QD) are available. QD cables are ordered separately. See page 410.
Operating Conditions	Temperature: -20° to +70° C Relative humidity: 90% at 50° C (non-condensing)
Certifications	 
Hookup Diagrams	NPN Models: DC05 (p. 521) PNP Models: DC06 (p. 521)

D12 AC-Coupled Specifications	
Supply Voltage and Current	10 to 30V dc at 60 mA max. (exclusive of load)
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	Bipolar: one NPN (current sinking) and one PNP (current sourcing) open-collector transistor
Output Rating	150 mA max. each output OFF-state leakage current: less than 10 μ A at 30V dc ON-state saturation voltage: less than 1 volt at 10 mA dc; less than 1.5 volts at 150 mA dc The total load may not exceed 150 mA
Output Protection Circuitry	Protected against false pulse on power-up and short circuit of outputs
Output Response Time	50 microseconds ON/OFF (NOTE: False pulse protection circuit causes a 0.1 second delay on power-up)
Output Operation Mode	Light operate or dark operate: selected by switch
Output Timing Functions	Pulse output; adjustable from 1 to 70 milliseconds
Repeatability	15 microseconds ON
Adjustments	Three top-panel controls: SENSITIVITY control (15-turn slotted brass screw, clutched at both ends of adjustment), a light- or dark-operate select switch, and an OUTPUT PULSE adjustment (3/4-turn potentiometer)
Indicators	Three top-mounted LED indicators: Green LED: lights to indicate dc Power ON Yellow LED: lights for Output Conducting Red LED: lights whenever AGC system is locked onto the signal
Mounting Bracket	D12 Sensors mount directly to a standard DIN rail, or may be through-hole mounted using the supplied mounting bracket and M3 x 0.5 hardware
Construction	Black ABS housing with acrylic cover, stainless steel M3 x 0.5 hardware for use with thermoplastic polyester mounting bracket (supplied); the plastic fiber clamping element is Acetal
Environmental Rating	IEC IP11; NEMA 2
Connections	PVC-jacketed 2 m or 9 m cables, or 150 mm pigtail with 4-pin Pico-style quick-disconnect (QD) are available. QD cables are ordered separately. See page 410.
Operating Conditions	Temperature: -40° to +70° C Relative humidity: 90% at 50° C (non-condensing)
Application Note	D12 AC-coupled sensors should not be used in areas of known electrical "noise" or RF fields.
Hookup Diagrams	DC04 (p. 520)

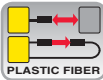
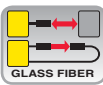


R55F

Glass or Plastic Fiber Optic Sensors

- Delivers outstanding color contrast sensitivity
- Features innovative TEACH function with two options for setting the sensing threshold
- Reliably detects 16 levels of gray scale at up to 10,000 actuations per second
- Available in two fiber types: economical plastic for repeated flexing and glass for harsh conditions
- Easily mounts in confined areas, either flat or to 35 mm DIN rail
- Provides bipolar (NPN/PNP) outputs with delay settings of 0, 20 and 40 milliseconds.

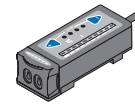
SENSORS
PLASTIC FIBERS
GLASS FIBERS



R55 Fiber Optic Sensors

- 10-element signal strength indicator bargraph
- 2 m or 9 m attached cable, or Euro-style quick-disconnect
- Simple push-button programming and status indicators
- Models for use with glass or plastic fiber optics
 - Glass fiber models function well in harsh environments typically associated with printing processes.
 - Plastic fiber models function well in applications that require repeated flexing of the fibers.
- Quick fiber installation without tools






R55 Fiber Optic, 10-30V dc

- SENSORS
- PLASTIC FIBERS
- GLASS FIBERS

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Data Sheet
R55F		Range varies by sensing mode and fiber optics used.	2 m	Bipolar NPN/PNP	57945
R55FQ	GLASS FIBER		5-pin Euro QD		
R55FV			2 m		
R55FVQ	GLASS FIBER		5-pin Euro QD		
R55FVG			2 m		
R55FVGQ	GLASS FIBER		5-pin Euro QD		
R55FVB			2 m		
R55FVBQ	PLASTIC FIBER		5-pin Euro QD		
R55FVW			2 m		
R55FVWQ	GLASS FIBER		5-pin Euro QD		
R55FP			2 m		
R55FPQ	PLASTIC FIBER		5-pin Euro QD		
R55FPG			2 m		
R55FPGQ	PLASTIC FIBER		5-pin Euro QD		
R55FPB			2 m		
R55FPBQ	PLASTIC FIBER		5-pin Euro QD		
R55FPW			2 m		
R55FPWQ	PLASTIC FIBER		5-pin Euro QD		

* Infrared LED Visible Red LED Visible Green LED Visible Blue LED Visible White LED

** For 9 m cable, add suffix **W/30** to the 2 m model number (example, **R55F W/30**). A model with a QD requires a mating cable (see page 414).

R55 Fiber Optic Specifications	
Supply Voltage and Current	10 to 30V dc (10% max. ripple) at less than 70 mA, exclusive of load
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	Bipolar: One current sourcing (PNP) and one current sinking (NPN) open-collector transistor
Output Rating	150 mA max each output @ 25° C (derate ≈ 1 mA per ° C increase) OFF-state leakage current: less than 5 µA @ 30V dc ON-state saturation voltage: PNP: less than 1V @ 10 mA; 1.5V @ 150 mA NPN: less than 200 mV @ 10 mA; 1V @ 150 mA
Output Protection Circuitry	Protected against false pulse on power-up and continuous overload or short-circuit of outputs
Output Response Time	50 microseconds NOTE: 100 millisecond delay on power-up; outputs do not conduct during this time.
Adjustments	<p>Using push buttons (“+” Dynamic and “-” Static): Manually adjust Switch Point using “+” or “-” buttons Dynamic TEACH (teach on-the-fly) sensitivity adjustment Static TEACH sensitivity adjustment Static Single-Point TEACH Light operate/Dark operate OFF-Delay select: 0 milliseconds, 20 milliseconds or 40 milliseconds</p> <p>Using Remote TEACH input (gray wire): Dynamic TEACH (teach on-the-fly) sensitivity adjustment Static TEACH sensitivity adjustment Static Single-Point TEACH Light operate/Dark operate OFF-Delay select: 0 milliseconds, 20 milliseconds or 40 milliseconds Push button lockout for security</p>
Indicators	10-segment (Green) light bar indicates signal strength Light Operate (Green) Dark Operate (Green) Outputs Conducting (Yellow) OFF-Delay (Green): SETUP Mode: OFF–no delay RUN Mode: OFF–no delay Flashing–20 milliseconds delay ON–20 or 40 milliseconds delay ON–40 milliseconds delay
Construction	Black ABS/polycarbonate blend; nylon fiber clip mounts to standard 35 mm DIN rail 1 stainless steel right angle bracket and 1 PBT polyester bracket for mounting to flat surfaces also included with sensor
Environmental Rating	IEC IP67; NEMA 6
Connections	2 m or 9 m PVC-jacketed 5-conductor cable, or 5-pin Euro-style quick-disconnect (QD) fitting. QD cables are ordered separately. See page 414. Fibers: Fiber clip (no tool required)
Operating Conditions	High ambient humidity levels will cause transmission loss Temperature: -30° to +70° C (unless otherwise specified) Max. operating temperatures 60° C at 95% Relative Humidity Relative humidity: 90% at 50° C (non-condensing)
Application Notes	<ul style="list-style-type: none"> Do not mount the fiber tip directly perpendicular to shiny surfaces; position it at approximately a 15° angle in relation to the sensing target. Minimize web or product “flutter” whenever possible to maximize sensing reliability.
Certifications	
Hookup Diagrams	DC08 (p. 521)

SENSORS

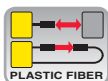
PLASTIC FIBERS

GLASS FIBERS

FI22 Expert™

Low-Profile Inline Fiber Optic Sensors

- Features a low profile for inconspicuous surface mounting
- Includes 8-segment LED light bar that indicates relative received signal strength, sensing contrast, programming status and diagnostic warnings
- Offers TEACH-mode programming for static, dynamic and single-point configuration, and manual adjustment for fine tuning
- Features easy-to-read TEACH and signal strength readout, as well as a continuous readout of operating status
- Can be programmed for either light- or dark-operate output



FI22 Expert™ Sensors

- *Push-button TEACH-mode programming*
- *2 m or 9 m integral cable, or 6-pin Pico-style quick-disconnect*
- *Easy-to-read 8-segment bargraph status indicator*
- *Custom bracket for quick snap-in mounting*



Plastic Fiber Models
Suffix FP



FI22 Expert™, 10-30V dc

Models	Sensing Mode/LED*	Range	Cable**	Output Type	Excess Gain	Beam Pattern	Data Sheet
FI22FP	<p>PLASTIC FIBER</p>	Range varies by sensing mode and fiber optics used. See data sheet part number 108899 for maximum range specifications.	2 m	Bipolar NPN/PNP	Opposed mode: EGCP-40, EGCP-41 & EGCP-42 (p. 490)	Opposed mode: BPP-34, BPP-35 & BPP-36 (p. 509)	108899
FI22FPQ			6-pin Pico QD		Diffuse mode: EGCP-43, EGCP-44 & EGCP-45 (p. 490)	Diffuse mode: BPP-37, BPP-38 & BPP-39 (p. 509)	

* Visible Red LED

** For 9 m cable, add suffix **W30** to the 2 m model number (example, **FI22FP W30**). A model with a QD requires a mating cable (see page 411).

SENSORS
PLASTIC FIBERS
GLASS FIBERS

FI22 Expert™ Specifications	
Supply Voltage	10 to 30V dc (10% max. ripple) @ less than 32 mA exclusive of load
Supply Protection Circuitry	Protected against reverse polarity, over voltage, and transient voltages
Delay at Power Up	250 milliseconds max.; outputs do not conduct during this time
Output Configuration	Bipolar: 1 current sourcing (PNP) and 1 current sinking (NPN)
Output Rating	100 mA max. load @ 25° C (derate 1 mA per ° C increase) OFF-state leakage current: less than 50 µA at 30V dc ON-state saturation voltage: NPN: less than 200 mV @ 10 mA and 1V @ 100 mA load PNP: less than 1.5V @ 10 mA and 2.0V @ 100 mA load
Output Protection	Protected against output short-circuit, continuous overload, transient over-voltages, and false pulse on power up
Output Response Time	500 microseconds
Repeatability	100 microseconds
Adjustments	2 push buttons and remote wire • Expert™ TEACH programming (two-point static, dynamic and single-point static) • Manually adjust (+/-) thresholds (from buttons only – not available from remote wire) • LO/DO and OFF-Delay configurable (from buttons or remote wire) • Push-button lockout (from remote wire only)
Indicators	8-segment red bargraph: Light-to-dark signal difference relative to taught condition (single-point TEACH) or Sensing contrast (two-point TEACH) Green LED: Power ON Yellow LED: Output conducting
Construction	PC/ABS blend plastic housing; polycarbonate cover
Environmental Rating	IP67; NEMA 6
Connections	5-conductor 2 m PVC cable, 9 m PVC cable, or 6-pin integral Pico-style quick-disconnect fitting. QD cables are ordered separately. See page 411.
Operating Conditions	Temperature: -10° to +55° C Relative humidity: 90% @ 50° C (non-condensing)
Certifications	
Hookup Diagrams	DC08 (p. 521)

Plastic Fiber Optics

- Provide an economical alternative to glass fiber optics for piping photoelectric sensing light to and from confined areas with suitable environments
- Ideal for detecting small objects
- Withstand repeated flexing and bending
- Available in individual or bifurcated styles*
- Available with optional DURA-BEND™ fibers for improved flexibility for difficult-to-access locations, without the decreased performance to which excessively bent standard plastic fibers optics are prone
- Available with core diameters of 0.25, 0.50, 0.75, 1.0 and 1.5 mm



Plastic Fiber Optic Model Key

P B P 4 6 U C X

PLASTIC FIBER FAMILY designator

Same for all plastic fibers

ASSEMBLY STYLE designator

- B = Bifurcated fiber
- I = Individual fiber*
- DI = Dual Individual fiber*

SENSING END designator

- A = 90° Angle
- AT = 90° Angle/Thread
- CF = Coaxial Ferrule
- CT = Coaxial Thread
- E = Encapsulated
- EFP = Extended Ferrule Probe
- F = Ferrule
- FM = Ferrule Miniature
- FMP = Ferrule Miniature Probe
- L = Lensed
- P = Probe
- PF = Probe Ferrule
- PMSB = Probe Miniature Side-view Bendable
- PS = Probe Side-view
- PSB = Probe Side-view Bendable
- PSM = Probe Side-view Miniature
- R = Rectangular
- RS = Rectangular Side-view
- T = Thread
- TA = Thread/90° Angle
- TP = Thread/Probe

MODIFICATIONS designator

"MXX" = Sensing end tip modification

CONTROL END designator

- T5 = Terminated
- TMB5 = STEELSKIN™ braiding over monocoil reinforcement
- U = Underterminated straight cable**
- UC = Underterminated Coiled cable
- UHF = Underterminated DURA-BEND™ multi-core cable

FIBER LENGTH designator

- 3 = 1 m (1000 mm)
- 6 = 2 m (2000 mm)
- 100 = 30 m (30480 mm)

FIBER CORE DIAMETER designator

- 1 = 0.25 mm
- 2 = 0.50 mm
- 3 = 0.75 mm
- 4 = 1.00 mm
- 6 = 1.50 mm
- 1X4 = 4 x 0.25 mm
- 1X16 = 16 x 0.265 mm
- 1X32 = 32 x 0.265 mm

* All individual plastic fiber optics are sold and used in pairs. Bifurcated fibers are two-way fibers with a single sensing end that both emits and receives light and with dual-control sensor ends that attach separately to the sensor's LED and photodetector.
** Plastic fibers with "U" in the suffix of the model numbers have unterminated control ends; cut them to the required length. Use supplied cutter.

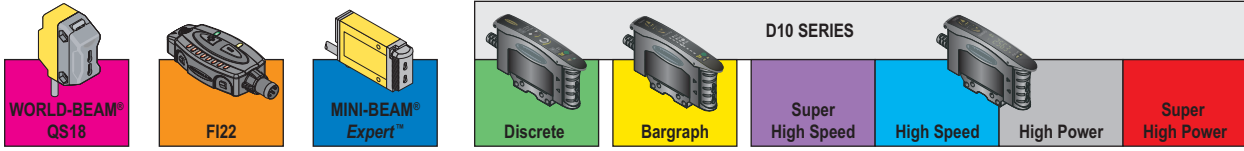
Plastic Fiber Optics Specifications	
Construction	<p>Optical Fiber: acrylic (PMMA) monofilament, except as noted</p> <p>Protective Jacket: black polyethylene, except as noted</p> <p>Threaded End Tips and Hardware: nickel-plated brass, except as noted</p> <p>Probe End Tips: annealed (bendable) 304 stainless steel</p> <p>Angled End tips: hardened 304 stainless steel</p> <p>Ferrule End Tips: 303 stainless steel</p>
Sensing Range	Refer to the specific fiber optic/sensor combination
Implied Dimensional Tolerance	All dimensions are in millimeters: x = ±2.5 mm, x.x = ±0.25 mm and x.xx = ±0.12 mm, unless specified. "L" = ±40 mm per meter
Minimum Bend Radius	<p>8 mm for 0.25 mm diameter fibers</p> <p>12 mm for 0.5 mm diameter fibers (except DURA-BEND™)</p> <p>25 mm for 1.0 mm diameter fibers (except DURA-BEND™)</p> <p>38 mm for 1.5 mm diameter fibers</p>
Repeat Bending/Flexing	Life expectancy of plastic fiber optic cable is in excess of one million cycles at bend radii of no less than the minimum and a bend of 90° or less. Avoid stress at the point where the cable enters the sensor ("control end") and at the sensing end tip. Coiled plastic fiber optic assemblies are recommended for any application requiring reciprocating fiber motion.
Chemical Resistance	The acrylic core of the monofilament optical fiber will be damaged by contact with acids, strong bases (alkalis) and solvents. The polyethylene jacket will protect the fiber from most chemical environments. However, materials may migrate through the jacket with long term exposure. Samples of fiber optic material are available from Banner for testing and evaluation.
Temperature Extremes	Temperatures below -30° C will cause embrittlement of the plastic materials but will not cause transmission loss. Temperatures above +70° C will cause both transmission loss and fiber shrinkage.
Operating Temperature	-30° to +70° C, unless otherwise specified

⚠ APPLICATION NOTES AND WARNINGS ⚠

- 1** Plastic fiber assemblies with "U" in the suffix of the model numbers have unterminated control ends (the end that is coupled to the photoelectric sensor). The customer can cut these fiber optic assemblies to the required length using the supplied cutter. Use only the supplied cutter to ensure optimal light coupling efficiency.
- 2** Terminated plastic fiber assemblies are optically ground and polished and cannot be shortened, spliced or otherwise modified.
- 3** Do not subject the plastic fibers to sharp bends, pinching, high tensile loads or high levels of radiation.
- 4** When ordering fiber lengths in excess of 2 m, take into account light signal attenuation due to the additional length.
- 5** Due to their light transmission properties, plastic fiber optics are recommended for use only with visible light fiber optic sensors.
- 6** Use caution when applying fiber optics in hazardous locations. Although fiber optic assemblies are, by themselves, intrinsically safe, the sensor and associated electronics must be LOCATED IN A SAFE ENVIRONMENT. Alternatively, fiber optics may be used with NAMUR sensor model Q45AD9FP (page 157). Fiber optics do not necessarily provide a hermetic seal between a hazardous environment and the safe environment.

FIBER SYSTEMS

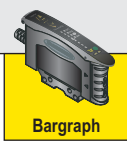
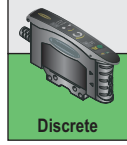
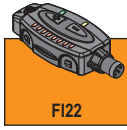
SENSORS
PLASTIC FIBERS
GLASS FIBERS



Model Number	Drawing & Dimensions	Core Dia. (mm)	Min. Bend Radius (mm)	Features	Free Cut*	Typical Range (mm)
PBF16U		0.25	8	• Smooth ferrule	✓	 Details Online
PBF26U		0.5	12	• Smooth ferrule	✓	 Details Online
PBF46U		1.0	25	• Smooth ferrule	✓	 Details Online
PBF46UM3MJ1.3		1.0	25	• Smooth ferrule; thin jacket (ø 1.3)	✓	 Details Online
PBF66U		1.5	38	• Smooth ferrule; long range	✓	 Details Online
PBFM16U		0.25	8	• Non-bendable miniature tip	✓	 Details Online
PBFM46U		1.0	25	• Smooth ferrule	✓	 Details Online
PBT16U		0.25	8	• Thread	✓	 Details Online
PBT26U		0.5	12	• Thread	✓	 Details Online
PBT46U		1.0	25	• Thread	✓	 Details Online
PBT66U		1.5	38	• Thread; long range	✓	 Details Online

NA: WORLD-BEAM QS18 not recommended.

* Fibers can be free cut using fiber cutter (see page 203).



D10 SERIES

Super High Speed

High Speed

High Power

Super High Power



SENSORS
PLASTIC FIBERS
GLASS FIBERS

Model Number	Drawing & Dimensions	Core Dia. (mm)	Min. Bend Radius (mm)	Features	Free Cut*	Typical Range (mm)
Probe	PBEFP26U 	0.5	12	• Smooth ferrule; non-bendable tip	✓	NA Details Online
	PBFMP16UMP2 	0.25	8	• Smooth ferrule; non-bendable tip	✓	NA Details Online
	PBP16U 	0.25	8	• Thread; bendable tip	✓	NA Details Online
	PBP26U 	0.5	12	• Thread; bendable tip	✓	NA Details Online
	PBP46U 	1.0	25	• Thread; bendable tip	✓	NA Details Online
	PBPF26U 	0.5	12	• Thread; bendable tip	✓	NA Details Online
	PBPF26UMB 	0.5	12	• Flat mounting block; bendable tip	✓	NA Details Online
Side-view	PBPMBS36U 	0.75	20	• Smooth ferrule; bendable tip	✓	NA Details Online
	PBPS26U 	0.5	12	• Smooth ferrule; bendable tip	✓	NA Details Online
	PBPS46U 	1.0	25	• Smooth ferrule; bendable tip	✓	NA Details Online
	PBPS46UMT 	1.0	25	• Thread; non-bendable tip	✓	NA Details Online
	PBPS66U 	1.5	38	• Smooth ferrule; non-bendable tip	✓	NA Details Online

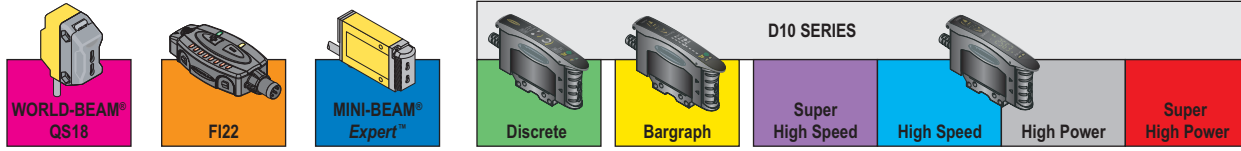
NA: WORLD-BEAM QS18 not recommended.

* Fibers can be free cut using fiber cutter (see page 203)

More information online at bannerengineering.com

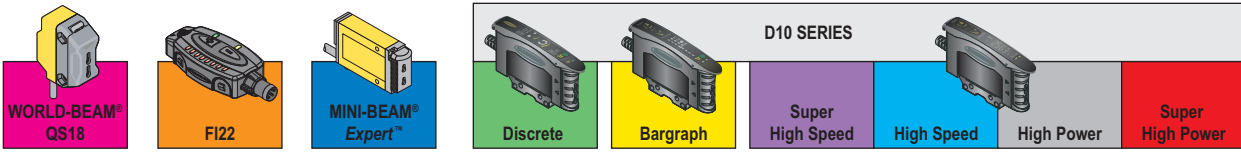
FIBER SYSTEMS

SENSORS
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Model Number	Drawing & Dimensions	Core Dia. (mm)	Min. Bend Radius (mm)	Features	Free Cut*	Typical Range (mm)				
Diffuse	Coaxial	PBCF21X46U		0.5 4X 0.25	12	• Miniature probe tip	✓	 Details Online		
		PBCF46U		1.0 16X 0.265	25	• Smooth ferrule	✓	 Details Online		
		PBCT21X46U		0.5 4X 0.25	12	• Miniature thread	✓	 Details Online		
		PBCT26U		0.5 9X 0.25	12	• Thread	✓	 Details Online		
		PBCT26UM3		0.5 9X 0.25	12	• Miniature thread	✓	 Details Online		
		PBCT26UM4M2.5		0.5 9X 0.25	12	• Thread	✓	 Details Online		
		PBCT46U		1.0 16X 0.265	25	• Thread	✓	 Details Online		
		PBFMX43T5		4X 0.25	8	• Best for repetitive flexing (1,000s of cycles)		 Details Online		
		High-Flex		PBP46UC		1.0	25	• For applications involving reciprocating motion	✓	 Details Online
				PBT46UC		1.0	25	• For applications involving reciprocating motion	✓	 Details Online
PLI-A10				0.5 9X 0.25	12	• Anodized AL tip; ø 0.5-3.2 mm beam spot • Glass lens	✓			

NA: WORLD-BEAM QS18 not recommended. NA: MINI-BEAM Expert not recommended.
 * Fibers can be free cut using fiber cutter (see page 203). Indicates lens available for model. See page 195 for details.



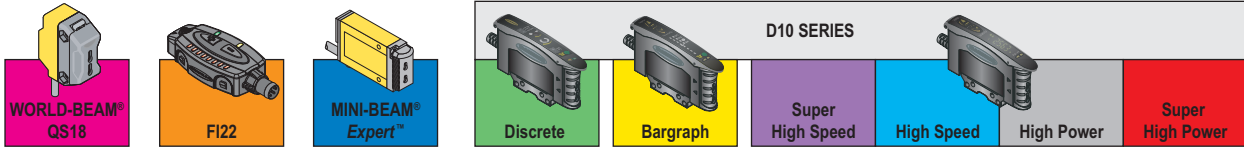
Model Number	Drawing & Dimensions	Core Dia. (mm)	Min. Bend Radius (mm)	Features	Free Cut*	Typical Range (mm)
DURA-BEND	PBF46UHF 	1.0	1	• Smooth ferrule	✓	50-250 Details Online
	PBFM46UHF 	1.0	1	• Smooth ferrule	✓	50-250 Details Online
	PBP46UHF 	1.0	1	• Thread; bendable tip	✓	50-250 Details Online
	PBPS46UHF 	1.0	1	• Smooth ferrule; non-bendable tip	✓	20-100 Details Online
	PBT26UHF 	0.5	1	• Thread	✓	NA 10-60 Details Online
	PBT46UHF 	1.0	1	• Thread	✓	50-250 Details Online
Area Sensing (Array)	PBR1X326U 	32X 0.265	25	• Rectangular tip	✓	NA 50-300 Details Online
	PBRS1X326U 	32X 0.265	25	• Rectangular tip; side sensing	✓	NA 50-300 Details Online
Mechanical Convergent	P22-C1 	0.5	12	• Straight exit with lenses; 3 mm range; DURA-BEND fiber	✓	
	P12-C1 	0.5	12	• Side exit with lenses; 3 mm range; DURA-BEND fiber	✓	
	P32-C2 	1.0	12	• Flat mount; 2 mm range; DURA-BEND fiber	✓	

NA: WORLD-BEAM QS18 not recommended.
 * Fibers can be free cut using fiber cutter (see page 203).

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FIBER SYSTEMS

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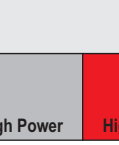
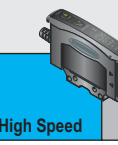
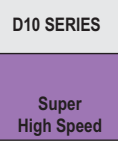
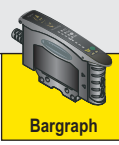
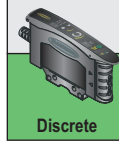
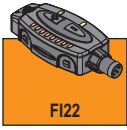


Model Number	Drawing & Dimensions	Core Dia. (mm)	Min. Bend Radius (mm)	Features	Free Cut*	Typical Range (mm)
Diffuse STEELSKIN		1.0	12	• 90° Angle/Thread		Details Online
		0.5 9X 0.25	12	• Miniature thread		Details Online
		0.5 9X 0.25	12	• Thread		Details Online
		1.0	12	• Smooth ferrule		Details Online
		1.0	12	• Smooth ferrule; non-bendable tip		Details Online
		1.0	12	• Thread		Details Online
		1.0	12	• Thread/90° Angle		Details Online
		1.0	12	• Thread; bendable tip		Details Online
High Temp		1.0	25	• Thread; withstands 105° C		Details Online

NA: WORLD-BEAM QS18 not recommended.

Indicates lens available for model. See page 195 for details.

* Fibers can be free cut using fiber cutter (see page 203).



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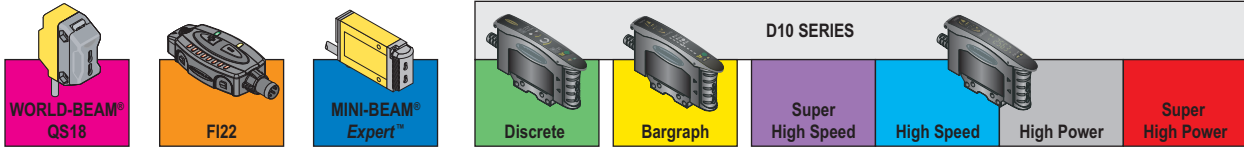
Model Number	Drawing & Dimensions	Core Dia. (mm)	Min. Bend Radius (mm)	Features	Free Cut*	Typical Range (mm)		
Diffuse	Liquid Level	PBE46UTMLLP		1.0	25	<ul style="list-style-type: none"> Fluoropolymer encapsulated Sensor switches when tip of fiber is immersed in liquid 	✓	
		PBE46UTMLLPH1		1.0	25	<ul style="list-style-type: none"> Fluoropolymer encapsulated; withstands 105° C Sensor switches when tip of fiber is immersed in liquid 	✓	
		PBT26UM6M.1		0.5	12	<ul style="list-style-type: none"> Quartz probe; polypropylene housing Sensor switches when tip of quartz is immersed in liquid 	✓	
		TGR38MPFMQ		0.5	12	<ul style="list-style-type: none"> Quartz glass rod stainless steel collar 	✓	
		PDI46U-LLD		1.0	1	<ul style="list-style-type: none"> Clear tube mount; DURA-BEND fiber Sensor switches when liquid meniscus reaches optical axis 	✓	
Flat Pack	PBR526U		0.5	12	<ul style="list-style-type: none"> 3.2 mm thickness; DURA-BEND fiber 	✓		
	PBE46UTMNL		1.0	25	<ul style="list-style-type: none"> Fluoropolymer encapsulated tip 	✓		
Convergent Spot Lens	L4C6		ref. model PBCT26U	ref. model PBCT26U	<ul style="list-style-type: none"> Anodized AL housing; ø 0.25 mm beam spot @ 6 mm Fixed focus 			
	L4C20		ref. model PBCT26U	ref. model PBCT26U	<ul style="list-style-type: none"> Anodized AL housing; ø 4 mm beam spot @ 20 mm Fixed focus 			
	LZ3C8		ref. model PBCT26UM3	ref. model PBCT26UM3	<ul style="list-style-type: none"> Anodized AL housing; ø 0.5 - 3.2 mm adj. beam spot Adjustable focus 			

NA: WORLD-BEAM QS18 not recommended.

NA: D10-Discrete not recommended.

* Fibers can be free cut using fiber cutter (see page 203).

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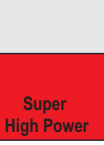
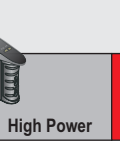
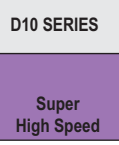
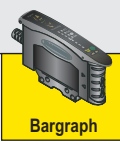
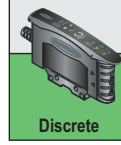
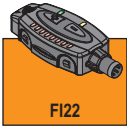


Model Number	Drawing & Dimensions	Core Dia. (mm)	Min. Bend Radius (mm)	Features	Free Cut*	Typical Range (mm)
PIA16U		0.25	8	• 90° Angle	✓	Details Online
PIA26U		0.5	12	• 90° Angle	✓	Details Online
PIAT16U		0.25	8	• 90° Angle/Thread	✓	Details Online
PIAT26U		0.5	12	• 90° Angle/Thread	✓	Details Online
PIAT46U		1.0	25	• 90° Angle/Thread	✓	Details Online
PIAT46UM-4X-4MT		1.0	25	• 90° Angle/Thread	✓	Details Online
PIAT66U		1.5	38	• 90° Angle/Thread; long range	✓	Details Online
PIF16U		0.25	8	• Smooth ferrule	✓	Details Online
PIF26U		0.5	12	• Smooth ferrule	✓	Details Online
PIF26UMLS		0.5	12	• Smooth ferrule; thick jacket (ø 2.2 mm)	✓	Details Online

NA: WORLD-BEAM QS18 not recommended.

Indicates lens available for model. See page 201 for details.

* Fibers can be free cut using fiber cutter (see page 203).



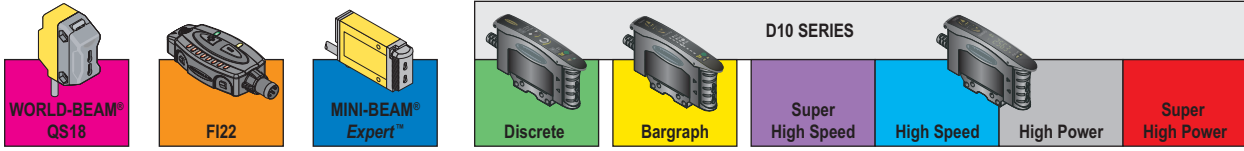
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Model Number	Drawing & Dimensions	Core Dia. (mm)	Min. Bend Radius (mm)	Features	Free Cut*	Typical Range (mm)	
Standard	PIF46U 	1.0	25	• Smooth ferrule	✓	Details Online	
	PIF66U 	1.5	38	• Smooth ferrule; long range	✓	Details Online	
	PIFM46U 	1.0	25	• Smooth ferrule; miniature tip	✓	Details Online	
	PIL46U 	1.0	25	• Plastic lens; ultra-long range • Lens available separately, see page 201.	✓	Details Online	
	PIT16U 	0.25	8	• Thread	✓	Details Online	
	PIT26U 	0.5	12	• Thread	✓	Details Online	
	PIT46U 	1.0	25	• Thread	✓	Details Online	
	PIT66U 	1.5	38	• Thread; long range	✓	Details Online	
	Probe	PIP16U 	0.25	8	• Smooth ferrule; non-bendable tip	✓	Details Online
		PIP26U 	0.5	12	• Thread; bendable tip	✓	Details Online
		PIP46U 	1.0	25	• Thread; bendable tip	✓	Details Online

NA: WORLD-BEAM QS18 not recommended.

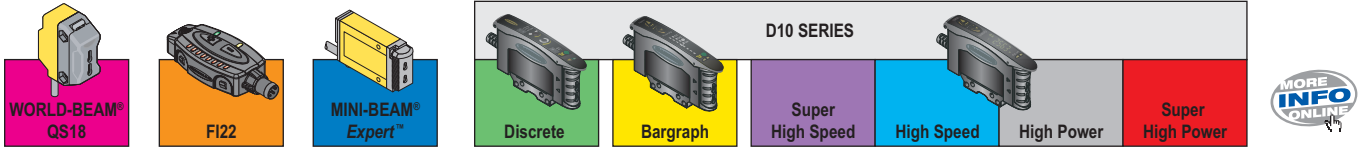
* Fibers can be free cut using fiber cutter (see page 203).

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Model Number	Drawing & Dimensions	Core Dia. (mm)	Min. Bend Radius (mm)	Features	Free Cut*	Typical Range (mm)	
Opposed	Side-View	PLIS-1 	0.5	12	<ul style="list-style-type: none"> Low beam divergence angle of 2° Ideal for wafer mapping 	✓	Details Online
		PIPS26U 	0.5	12	<ul style="list-style-type: none"> Smooth ferrule; non-bendable tip 	✓	Details Online
		PIPS46U 	1.0	25	<ul style="list-style-type: none"> Smooth ferrule; non-bendable tip 	✓	Details Online
		PIPS66U 	1.5	38	<ul style="list-style-type: none"> Smooth ferrule; non-bendable tip 	✓	Details Online
		PIPSB46U 	1.0	25	<ul style="list-style-type: none"> Smooth ferrule; bendable tip 	✓	Details Online
		PIPSM26U 	0.5	12	<ul style="list-style-type: none"> Miniature smooth ferrule; non-bendable tip 	✓	Details Online
		L2RA 	ref. model PIT46U	ref. model PIT46U	<ul style="list-style-type: none"> Compact glass prism M2.5 thread 	✓	
High-Flex	Side-View	PIFM1X46U 	4X 0.25	8	<ul style="list-style-type: none"> Best for repetitive flexing (1,000s of cycles) 	✓	Details Online
		PIT1X46U 	4X 0.25	8	<ul style="list-style-type: none"> Best for repetitive flexing (1,000s of cycles) 	✓	Details Online
		PIP46UC 	1.0	25	<ul style="list-style-type: none"> For applications involving reciprocating motion 	✓	Details Online
		PIT46UC 	1.0	25	<ul style="list-style-type: none"> For applications involving reciprocating motion 	✓	Details Online

NA: WORLD-BEAM QS18 not recommended. Indicates lens available for model. See page 201 for details.
 * Fibers can be free cut using fiber cutter (see page 203).



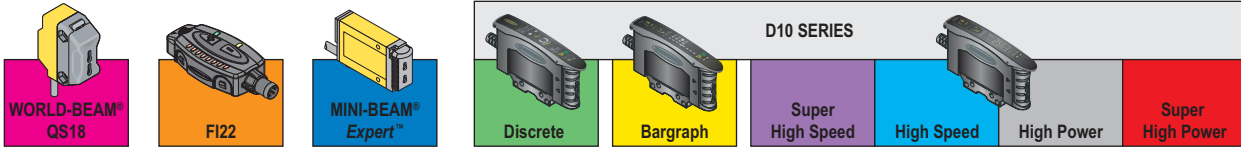
Model Number	Drawing & Dimensions	Core Dia. (mm)	Min. Bend Radius (mm)	Features	Free Cut*	Typical Range (mm)
DURA-BEND	PIAT46UHF 	1.0	1	• 90° Angle/Thread	✓	200-1200 Details Online
	PIF46UHF 	1.0	1	• Smooth ferrule	✓	200-1000 Details Online
	PIFM46UHF 	1.0	1	• Smooth ferrule; miniature tip	✓	200-1000 Details Online
	PIP46UHF 	1.0	1	• Thread; bendable tip	✓	200-1000 Details Online
	PIPS46UHF 	1.0	1	• Smooth ferrule; non-bendable tip	✓	50-450 Details Online
	PIPSB46UHF 	1.0	1	• Smooth ferrule; bendable tip	✓	50-450 Details Online
	PIT26UHF 	0.5	1	• Thread	✓	NA 50-300 Details Online
	PIT46UHF 	1.0	1	• Thread	✓	200-1000 Details Online
Chemical Resistant	PIE46UT 	1.0	25	• Fluoropolymer encapsulated; lens	✓	500-3000 Details Online
	PIE66UTMNL 	1.5	38	• Fluoropolymer encapsulated; lens	✓	200-1400 Details Online
	PIES46UT 	1.0	25	• Fluoropolymer encapsulated; side-view prism	✓	100-600 Details Online

NA: WORLD-BEAM QS18 not recommended. Indicates lens available for model. See page 201 for details.
* Fibers can be free cut using fiber cutter (see page 203).

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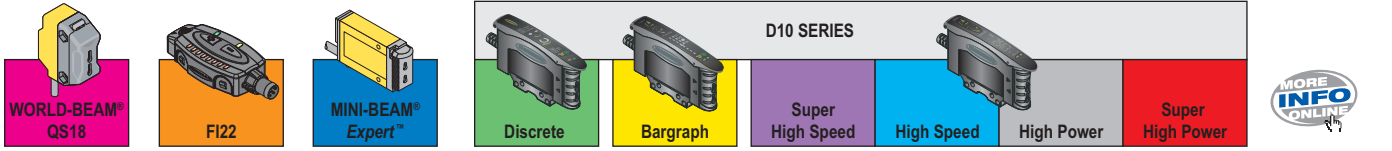


Model Number	Drawing & Dimensions	Core Dia. (mm)	Min. Bend Radius (mm)	Features	Free Cut*	Typical Range (mm)		
Opposed	Area Sensing (Array)	PIRX1166U		16X 0.265	25	• Ultra-compact head; straight exit; 5.25 mm width	✓	Details Online
		PIRS1X166U		16X 0.265	25	• Ultra-compact head; side exit; 5.25 mm width	✓	Details Online
		PIRS1X166UM4		16X 0.265	25	• Compact head; side exit; 10 mm width	✓	Details Online
		PIRS1X166UMPM.75		16X 0.265	25	• Side exit; 19 mm width	✓	Details Online
		PIRS1X166UMPMAL		16X 0.265	25	• Side exit; 34 mm width	✓	Details Online
		High Temp	PIT46UHT1		1.0	25	• Thread; withstands 105° C	✓
Slot	PDIS46UM12		1.0	25	• Easy mount "fork" head; DURA-BEND fiber	✓		
	PDISM46UM5MA		1.0	25	• 90° Angle; ompact "fork" head; DURA-BEND fiber	✓		

NA: WORLD-BEAM QS18 not recommended.

Indicates lens available for model. See page 201 for details.

* Fibers can be free cut using fiber cutter (see page 203).



Model Number	Drawing & Dimensions	Core Dia. (mm)	Min. Bend Radius (mm)	Features	Free Cut*	Typical Range (mm)
STEELSKIN	PIAT43TMB5 	1.0	12	• 90° Angle/Thread		 Details Online
	PIF43TMB5 	1.0	12	• Smooth ferrule		 Details Online
	PIPS43TMB5 	1.0	12	• Smooth ferrule; non-bendable tip		 Details Online
	PIT43TMB5 	1.0	12	• Thread		 Details Online
	PITA43TMB5 	1.0	12	• Thread/90° Angle		 Details Online
	PITP43TMB5 	1.0	12	• Thread; bendable tip		 Details Online
Dual Individual	PDIT26T5 	0.5	12	• Accomplish 2 inspections using only one sensor		 Details Online
	PDIT4100U 	1.0	25	• 30 m duplex fiber cable		✓ Contact factory for sensing range.
Vacuum	PIF66UM.52M.19D 	1.5	38	• For use with VFT-M8MVS (ambient side) See page 209.		✓ Contact factory for sensing range.
Extended Range Lens	L2 	ref. model PIT46U	ref. model PIT46U	• Range-extending lens • M2.5 thread		
	LO8FP 	ref. model PIL46U	ref. model PIL46U	• Ultra-long range-extending lens; use with raw plastic fiber		

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Opposed

NA: WORLD-BEAM QS18 not recommended.

NA: MINI-BEAM Expert not recommended.

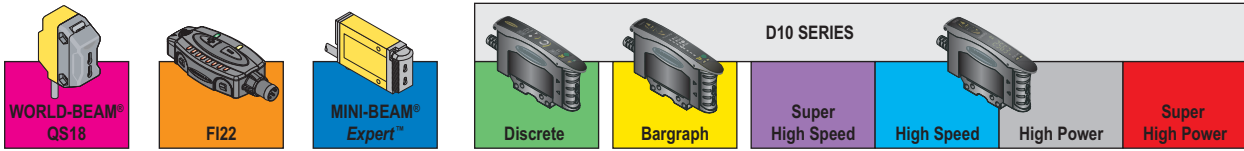
Indicates lens available for model. See page 201 for details.

* Fibers can be free cut using fiber cutter (see page 203).

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		Model Number	Drawing & Dimensions	Core Dia. (mm)	Min. Bend Radius (mm)	Features	Free Cut**	Typical Range (mm)
Diffuse	High-Temp	BMT16.6S-HT		1.57	19	<ul style="list-style-type: none"> High performance glass fiber optics for use with Banner D10 plastic fiber sensors Miniature thread; end tip withstands 315° C 		<p style="text-align: right;">Details Online</p>
	High-Temp	IMT.756.6S-HT†		1.27	19	<ul style="list-style-type: none"> High performance glass fiber optics for use with Banner D10 plastic fiber sensors Miniature thread; end tip withstands 315° C 		<p style="text-align: right;">Details Online</p>

NA: WORLD-BEAM QS18 not recommended.


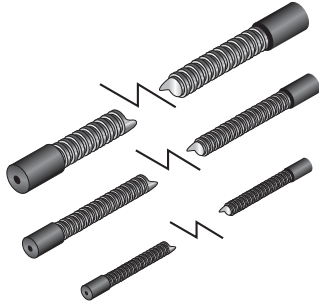
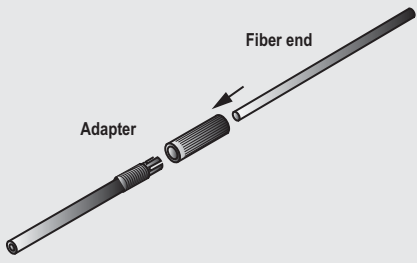
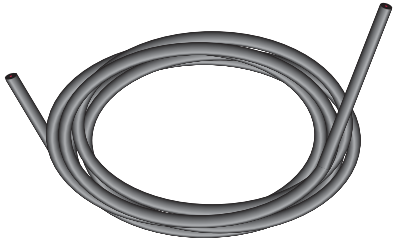
NA: MINI-BEAM Expert not recommended.

Indicates lens available for model. See page 201 for details.

* Fibers can be free cut using fiber cutter (see page 203).

† Fibers are sold separately, must order two fibers to form a pair.

Fiber Optic Accessories

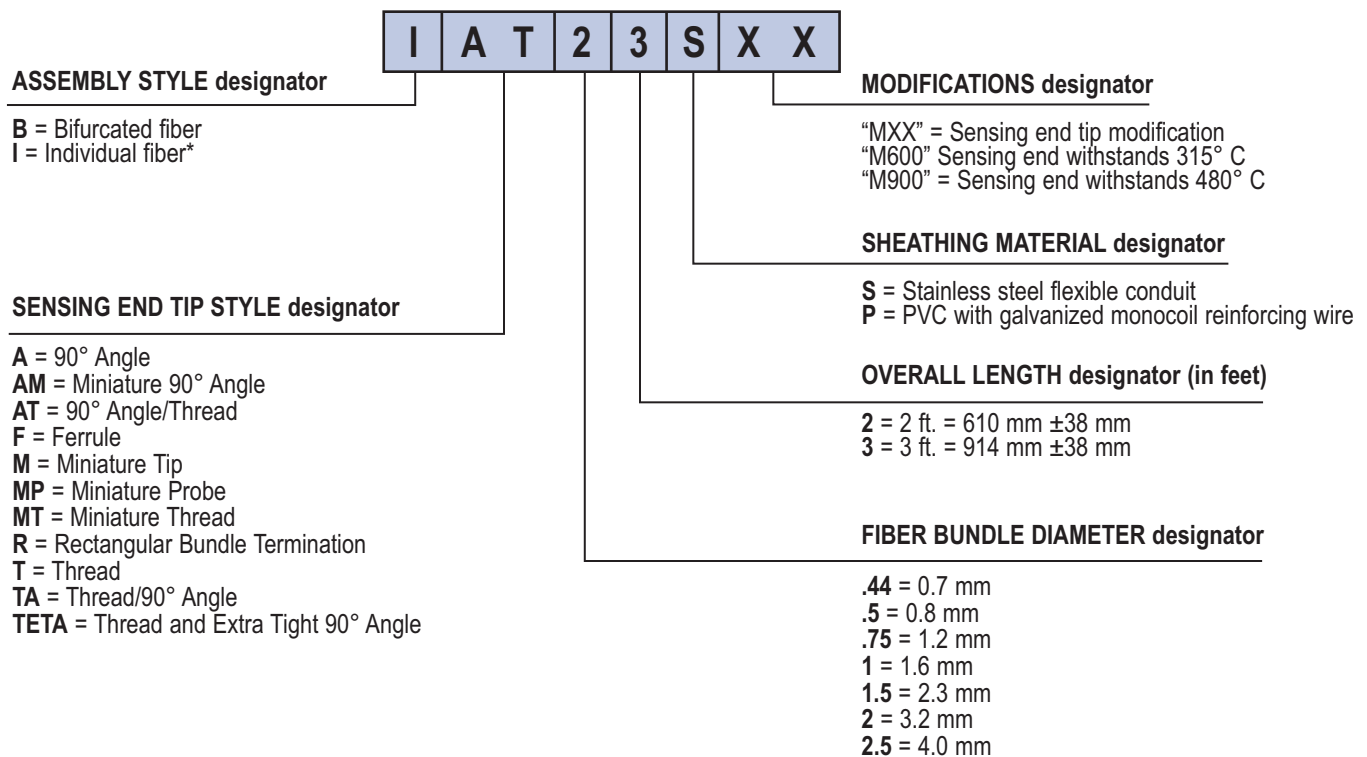
Model Number		Model Specific Features	General Features		Drawings
Fiber Cutters	PFK20	• For use with 0.25 mm and 0.5 mm diameter cables.	<ul style="list-style-type: none"> • These kits are used with unterminated plastic fiber cables. • Each kit contains 40 bushings and 10 cutter assemblies (cutters can be purchased separately in packages of 25 - reference model PFC-2-25). 		 <p>NOTE: Bushings used with Q45, OMNI-BEAM, ECONO-BEAM, MAXI-BEAM and VALU-BEAM sensors only.</p>
	PFK40	• For use with 1 mm and 1.5 mm diameter cables.			
Plastic Fiber Field-Installable Sheathing	PFS69S6T	• May be used with bifurcated fiber assemblies having M6 x 0.75 threaded end tips (e.g., PBCT46U, PBP46U, PBT46UHT1 and PBT66U).	<ul style="list-style-type: none"> • Stainless steel sheathing with stainless steel end fittings (one end internally threaded to capture fiber end tips, other end non-threaded) is used in applications where protection is required for plastic fiber optic cables. • All models listed are 1.8 m in length. • Other lengths are available by contacting Banner Applications Department. 		
	PFS53S6T	• May be used with individual or bifurcated fiber assemblies having M4 x 0.7 threaded end tips (e.g., PBCT26U, PBP46U, PIP46U, PIT46U and PIT66U).			
	PFS44S6T	• May be used with individual fiber assemblies having M3 x 0.5 threaded end tips (e.g., PIP26U, PIT26U and PIT1X46U).			
Plastic Fiber Adapters	UPFA-1-100	• Use to adapt plastic fiber optic cables with outside jacket diameter of 1.0 mm, such as PIT26U and PBP16U.	<ul style="list-style-type: none"> • Compression fitting adapters are used with small-diameter unterminated plastic fiber cables. • Use when interfacing small-diameter plastic fibers to D10, D11, D12, PC44, QM42, QS18, R55F, FI22 and MINI-BEAM plastic fiber sensor families. • Each kit contains 100 pairs of adapters. One pair will interface either one bifurcated fiber optic cable or a pair of individual cables to a fiber optic amplifier. 		
	UPFA-2-100	• Use to adapt plastic fiber optic cables with outside jacket diameter of 1.25 mm or 1.3 mm, such as PBCT26U and PBF46UM3MJ1.3.			
Model Number	Core	Length	Type	Drawing	
Unterminated Individual and Bifurcated Plastic Fibers	PIU230U	0.5 mm	9 m	Single	
	PIU260U		18 m		
	PIU430U	1.0 mm	9 m	Single	
	PIU460U		18 m		
	PIU630U	1.5 mm	9 m	Single	
	PIU660U		18 m		
	PBU430U	1.0 mm	9 m	Duplex	
	PBU460U		18 m		

Glass Fiber Optics

- Solve numerous challenging sensing applications in the most hostile environments, including temperatures up to 480° C, corrosive materials and extreme moisture
- Withstand severe shock and vibration
- Ignore extreme electrical noise
- Constructed of a combination of optical glass fiber, stainless steel, PVC, brass, molded thermoplastics and optical-grade epoxy



Glass Fiber Optic Model Key



* Individual glass fibers are packaged separately.

Glass Fiber Optics Specifications	
Construction	Combination of optical glass fiber, stainless steel or PVC, brass, molded thermoplastics, and optical-grade epoxy. Optical fiber is F2 core, EN1 clad, approx. 50 µm diameter per strand. Flexible steel interlock sheathing is 302 stainless.
Sensing Range	Refer to the specific fiber optic to be used.
Bend Radius	Inside bend radius must be 12 mm or greater for PVC covered fiber optic assemblies, and 25 mm or greater for stainless steel armored cable covered fibers.
Length	Standard length for assemblies is 915 mm; see dimension diagrams. Most models are available from the factory with shorter or longer cable lengths, up to 18 m max.
Length Dimension Tolerance	Overall assembly length: ±12 mm per 300 mm of length Shrink junction dimensions: ±12 mm
Implied Dimensional Tolerances	All dimensions are in millimeters: x = ±2.5 mm, x.x = ±0.25 mm and x.xx = ±0.12 mm, unless specified.
Operating Conditions	Fiber assemblies with stainless-steel (SS) sheathing and metal end tips: -140° to +249° C Fiber assemblies with PVC sheathing and/or plastic end tips: -40° to +105° C Special order assemblies with SS sheathing and metal end tips and model suffix "M600": -140° to +315° C* Special order assemblies with SS sheathing and metal end tips and model suffix "M900": -140° to +480° C*; note dimensional changes from STD models * sensing end tip only

⚠ Application Notes and Warnings ⚠

- 1** The ends of glass fiber optic assemblies are optically ground and polished. Care taken in this manufacturing process accounts for the light coupling efficiency of the fiber optic assembly. As a result, glass fiber assemblies cannot be shortened, spliced or otherwise modified.
- 2** Use caution when applying fiber optics in hazardous locations. Although fiber optic assemblies are by themselves, intrinsically safe, the sensor and associated electronics must be LOCATED IN A SAFE ENVIRONMENT. Alternatively, fiber optics may be used with sensor model SMI912FQD (page 34). This sensor is approved for use inside hazardous areas when used with an appropriate intrinsic barrier. Also, see NAMUR sensor models Q45AD9F (page 156) and MIAD9F (page 90). Fiber optics do not necessarily provide a hermetic seal between a hazardous environment and the safe environment.
- 3** In applications where glass fibers to insulate the control from high voltage, specify silicone rubber, Teflon®, or high-density polyethylene sheathing with no reinforcing wire in the cable. It is the responsibility of the user to test each fiber optic assembly for insulation capacity.
- 4** Do not subject the fibers to sharp bends, pinching, repeated flexing or high levels of radiation.
- 5** When ordering fiber lengths in excess of 1 m, take into account light signal reduction of 5 percent per 300 mm of additional length.

* Teflon® is a registered trademark of Dupont™.

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Indicates lenses available for model. See page 207 for details.
M600 Available 315° C models. Add M600 to end of model number (example, BA23SM600).
M900 Available 480° C models. Add M900 to end of model number (example, BA23SM900).

Model Number	Drawing & Dimensions	Core Dia. (mm)	Min. Bend Radius (mm)	Features	Typical Range (mm)
Standard	BA23S 	3.18	19	• 90° Angle M600 M900	 Details Online
	BAT23S 	3.18	19	• 90° Angle/Thread M600 M900	 Details Online
	BF23P 	3.18	19	• Smooth ferrule M600 M900	 Details Online
	BMT.442P 	0.69	9.5	• Miniature thread NA	 Details Online
	BT23S 	3.18	19	• Thread M600 M900	 Details Online
	BTA23S 	3.18	19	• Thread/90° Angle M600 M900	 Details Online
Miniature Probe	BAM.752S 	1.17	19	• ø 1.5 mm non-bendable probe; 90° angle M600	 Details Online
	BM.752S 	1.17	19	• ø 1.5 mm non-bendable probe M600	 Details Online
	BMP.753P 	1.17	9.5	• ø 1.5 mm non-bendable probe NA	 Details Online
Area Sensing (Array)	BR2.53S 	3.96	19	• Straight exit; 38 mm width M600	 Details Online
	BR23S 	3.18	19	• Straight exit; 10 mm width M600	 Details Online



M600 Available 315° C models. Add M600 to end of model number (example, BA23SM600).

M900 Available 480° C models. Add M900 to end of model number (example, BA23SM900).

Model Number	Drawing & Dimensions	Core Dia. (mm)	Min. Bend Radius (mm)	Features	Typical Range (mm)
Diffuse Side-view	BA1.53SMETA 	2.29	19	• Ultra-compact head M600	 Details Online
	BA1.53SMTA 	2.29	19	• Compact head M600	 Details Online
	BTETA1.53S 	2.29	19	• Ultra-compact head; thread M600	 Details Online
Vacuum BMT13SMVF		1.57	19	• Miniature thread; entire cable withstands 480° C	Details Online Contact factory representative for range information
Convergent Beam Spot L10		ref. glass fiber key or call factory	ref. glass fiber key or call factory	• Glass lens; withstands 315° C • Focuses light to .80 mm with ø 1.6 mm fiber	

SENSORS
PLASTIC FIBERS
GLASS FIBERS



Glass Fiber Optics—Additional Models Available

In addition to the configurations shown, Banner offers thousands of readily available alternative fiber models:

- Substitute PVC over monocoil sheathing for stainless steel.
- Reduce or increase glass fiber optic bundle diameters.
Example: Change ø 3.18 mm bundle to ø 1.57 mm.
- Substitute a rectangular-shaped fiber bundle (0.5 x 2.5 mm) for a circular bundle.
- Change endtip material from brass to stainless steel.
- Modify straight or angled probe tip dimensions.
- Modify overall fiber length in intervals of 305 mm (standard lengths are 914 and 610 mm).

SENSORS
PLASTIC FIBERS
GLASS FIBERS



Indicates lenses available for model. See page 209 for details.

M600 Available 315° C models. Add **M600** to end of model number (example, BA23SM600).

M900 Available 480° C models. Add **M900** to end of model number (example, BA23SM900).

Model Number	Drawing & Dimensions	Core Dia. (mm)	Min. Bend Radius (mm)	Features	Typical Range (mm)
Standard	IA23S 	3.18	19	• 90° Angle M600 M900	 Details Online
	IAT23S 	3.18	19	• 90° Angle/Thread M600 M900	 Details Online
	IF23P 	3.18	19	• Smooth ferrule M600 M900	 Details Online
	IMT.442P 	0.69	9.5	• Miniature thread M600 M900	 Details Online
	IT23S 	3.18	19	• Thread M600 M900	 Details Online
	ITA23S 	3.18	19	• Thread/90° Angle M600 M900	 Details Online
Miniature Probe	IAM.752S 	1.17	19	• ø 1.5 mm non-bendable probe; 90° angle M600	 Details Online
	IM.752S 	1.17	19	• ø 1.5 mm non-bendable probe M600	 Details Online
	IMP.753P 	1.17	9.5	• ø 1.5 mm non-bendable probe M600	 Details Online
Area Sensing (Array)	IR2.53S 	3.96	19	• Straight exit; 38 mm width M600	 Details Online
	IR23S 	3.18	19	• Straight exit; 10 mm width M600	 Details Online



M600 Available 315° C models. Add M600 to end of model number (example, BA23SM600).

M900 Available 480° C models. Add M900 to end of model number (example, BA23SM900).

Model Number	Drawing & Dimensions	Core Dia. (mm)	Min. Bend Radius (mm)	Features	Typical Range (mm)	
Side-view	IA1.53SMETA 	2.29	19	<ul style="list-style-type: none"> Ultra-compact head M600 		
	IA1.53SMTA 	2.29	19	<ul style="list-style-type: none"> Compact head M600 		
	ITETA1.53S 	2.29	19	<ul style="list-style-type: none"> Ultra-compact head; thread M600 		
Vacuum	IMT753SMVF 	1.27	19	<ul style="list-style-type: none"> Miniature thread; entire cable withstands 480° C 	Contact factory representative for range information	
Diffuse	Extended Range Lens	L9 	ref. model IT23S	ref. model IT23S	<ul style="list-style-type: none"> Glass lens; withstands 315° C 	
		L16F 	ref. model IT23S	ref. model IT23S	<ul style="list-style-type: none"> Plastic housing; withstands 105° C 	
		L16FAL 	ref. model IT23S	ref. model IT23S	<ul style="list-style-type: none"> Aluminum housing; withstands 315° C 	
		L16FSS 	ref. model IT23S	19	<ul style="list-style-type: none"> Stainless steel housing withstands 480° C 	
Vacuum Feed Through	VFT-M8MVS 	3.56	-	<ul style="list-style-type: none"> Seals to 1 x 10⁻⁹ torr; withstands 120° C 		
Liquid Level	TGR 	3.18	-	<ul style="list-style-type: none"> Use with BT23S Sensor switches when tip of glass rod is immersed in liquid 		

SENSORS
PLASTIC FIBERS
GLASS FIBERS

PART & AREA
 SLOT & LABEL
 COLOR & LUMINESCENCE
 OPTICAL BUTTONS
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R58 Expert™

Color Registration Mark Sensors Provide High Color Contrast Sensitivity

Features

- Provides excellent color contrast sensitivity through advanced electronic circuitry
- Detects inconspicuous registration marks in low-contrast, high-gloss sensing applications
- Optimizes application contrast by automatically choosing red, green or blue sensing LEDs
- Offers continuous readout of operating status with easy-to-read, 8-segment light bar indicator
- Features static and dynamic TEACH programming and manual adjustment
- Provides a sensing image that measures 1.2 by 3.8 mm at 10 mm from the lens
- Includes bipolar discrete outputs: current sinking (NPN) and current sourcing (PNP)
- Offers configurable light- or dark-operate outputs
- Includes optional 30-millisecond ON/OFF-delay
- Performs 10,000 actuations per second (10 kHz switching frequency)
- Features rugged, zinc alloy die-cast housing rated IP67; NEMA 6
- Features high-quality acrylic lens suitable for food processing applications
- Includes integral cable or 5-pin Euro-style pigtail quick disconnect

Three LED sensing colors in one sensor

- ▶ Includes three LEDs: red, green and blue
- ▶ Automatically selects the correct LED to use based on the contrast of the background and the registration mark being sensed



Convenient and flexible mounting

- ▶ Includes two lens locations on each sensor
- ▶ Offers threaded lens and cap for easy exchange without tools
- ▶ Available with a vertical or horizontal light spot, depending on model
- ▶ Includes eight M5 threaded mounting holes for easy installation



Range and application tolerant

- ▶ Tolerates a +/-3 mm shift from the 10 mm focal point
- ▶ Accommodates web flutter and similar variations in the target's location



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Special-Purpose Sensors

PART & AREA

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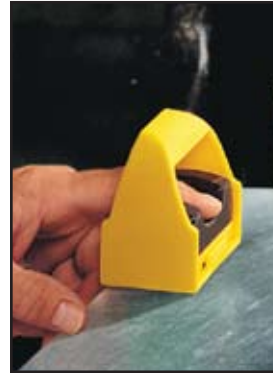
OPTICAL BUTTONS

MAGNETIC



Part & Area Sensors page 212

- Optical crosshatch pattern for detecting objects as small as 5.6 mm
- Fast 0.8 to 3.2 millisecond response time
- Three lengths and two ranges



Optical Buttons page 234

- Zero-force ergonomic replacement for capacitive switches and mechanical push buttons
- Momentary (OTB) and alternate (LTB) action switches
- Bright, easy-to-see sequence indicators (VTB)
- Self-checking models (STB) for use with safety controls



Slot & Label Sensors page 215

- Self-contained fixed-distance opposed-mode slot sensor
- Rugged metal or plastic U-shaped housing
- Slot widths from 10 to 220 mm, depending on model
- Fixed-sensitivity, potentiometer sensitivity adjustment or push-button programming, depending on model
- Models for detecting label on web backing



Magnetic Sensors page 241

- For detecting the presence of large metal objects
- Flat-pak or 18 mm barrel-style housing
- Self-contained replacement for inductive loop technology



Color Sensors page 224

- 3-color registration mark sensor for detecting even subtle differences
- True color sensors for detecting color and intensity
- Push-button programming
- Fast sensing response times



Pick-to-Light Sensors page 345

- K50 and K80 low-cost, self-contained sensors for bin-picking operations
- Ultra-bright optical touch buttons for indicating bin-picking sequences
- Two- or one-component light sensors for part assembly and error proofing



Luminescence Sensors page 230

- Low-cost luminescent sensing
- For luminescent marks on luminescent backgrounds and reflective surfaces such as ceramic, metal or mirrored glass
- Fast 250 milliseconds response time

PART & AREA

SLOT & LABEL

COLOR & LUMINESCENCE

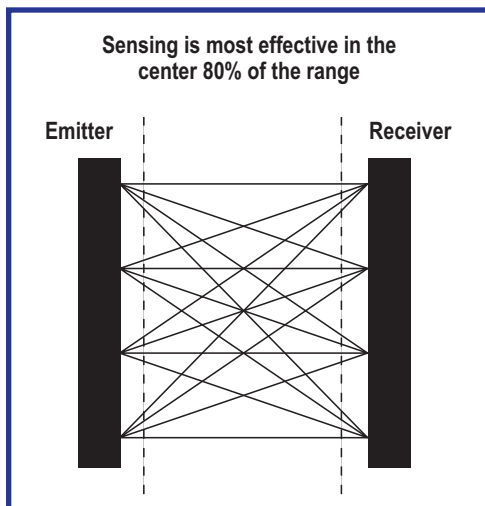
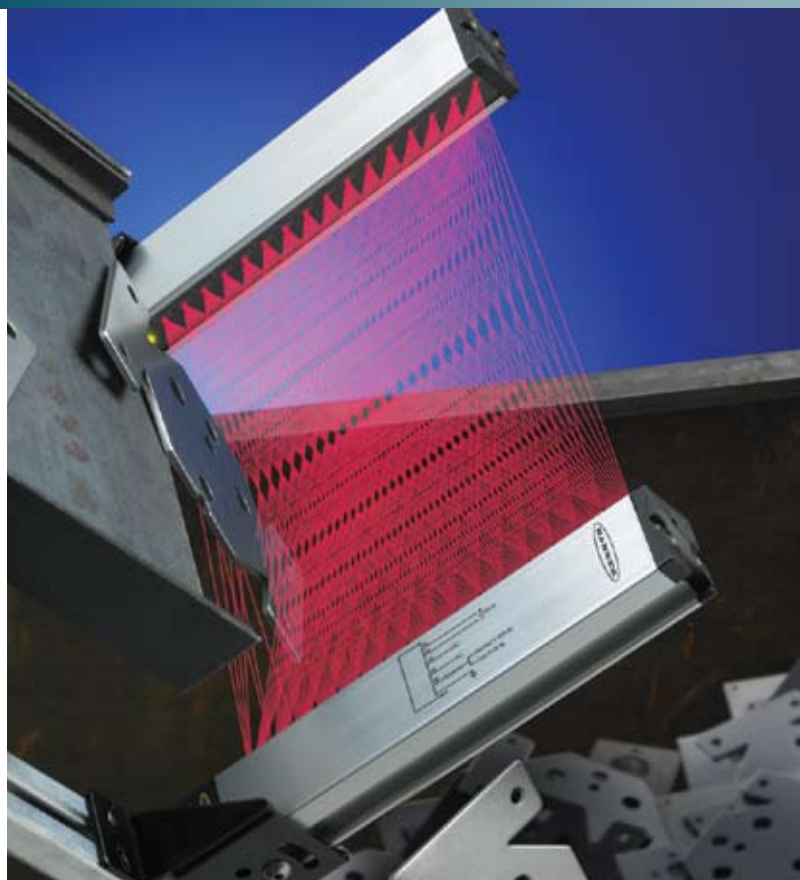
OPTICAL BUTTONS

MAGNETIC

LX High-Speed Part-Sensing Light Screen

Special synchronized multiple-beam infrared LED emitters and receivers generate a precise optical crosshatched pattern with extraordinary sensitivity to small objects.

- Detects objects as small as 5.6 mm and extremely flat objects that pass anywhere through the light screen
- Ideal for die-protection (part ejection verification), small part or pill counting, parcel handling and sorting by height



LX Series optical crosshatch pattern



Industry's fastest response speed

- Responds in 0.8 to 3.2 milliseconds—faster than comparable products, even at its slowest response speed
- Enables automated systems to operate at peak efficiency

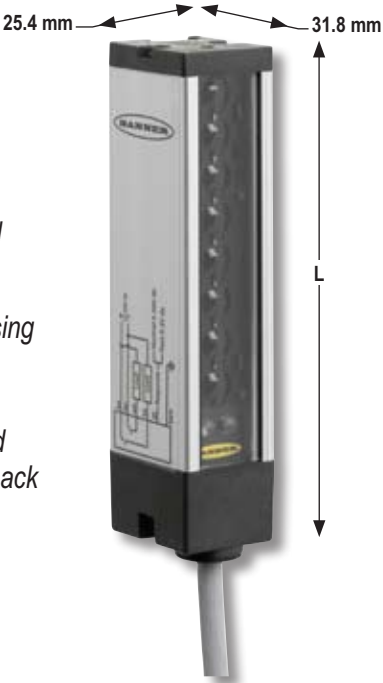
A variety of lengths and ranges

- Available in 67, 143 or 295 mm lengths and two sensing ranges: 100 to 200 mm and 300 mm to 2 m
- Features rugged silver anodized housing with IP65 rating
- Uses integrated T-slot mounting channel for unique mounting flexibility



LX Sensors

- Precise optical crosshatch pattern of infrared beams for detecting extremely small objects
- Simple wiring configuration; emitter and receiver need no synchronization wire
- Rugged silver anodized aluminum housing
- Three lengths and two sensing ranges
- Integrated mounting holes on ends, and T-slot mounting channel on sides and back
- 5-pin Euro-style QD cables with shield ordered separately (see page 415)



Models	Length (L)
LX3	113.4 mm
LX6	189.6 mm
LX12	342.0 mm

LX, 10-30V dc



Models		Normal Range	Reduced Range	Sensing Array Length	Cable*	Output Type	Data Sheet
Standard-Range Models	LX3E	300 mm-2 m	150-600 mm	67 mm	2 m	Bipolar NPN/PNP	108865
	LX3R			143 mm			
	LX6E	Minimum Object Detection Size 9.5 mm dia.	Minimum Object Detection Size 9.5 mm dia.	295 mm			
	LX6R			67 mm			
	LX12E	Minimum Object Detection Size 5.6 mm dia.	Minimum Object Detection Size 5.6 mm dia.	143 mm			
	LX12R			295 mm			

* For 5-pin 150 mm Euro-style Pigtail, add suffix **Q** to the 2 m model number (example, **LX3EQ**). QD models require a mating cable (see page 415).

LX Specifications		
Sensing Range	Normal (see hookups)	Reduced
	Short-range models: 100 to 200 mm	75 to 150 mm
	Standard-range models: 300 mm to 2 m	150 to 600 mm
Supply Voltage and Power	10 to 30V dc (10% max. ripple) at less than 1 watt each for emitter and receiver (exclusive of load)	
Supply Protection Circuitry	Protected against reverse polarity and transient voltages.	
Output Configuration	Bipolar: One current sourcing (PNP) and one current sinking (NPN) open-collector transistor	



PART & AREA


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OPTICAL BUTTONS

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LX Specifications (cont'd)					
Output Rating	125 mA max. each output OFF-state leakage current: less than 5 μ A Output saturation voltage (PNP output): less than 1 volt at 10 mA and less than 1.5 volts at 100 mA Output saturation voltage (NPN output): less than 0.5 volts at 10 mA and less than 0.6 volts at 100 mA				
Output Protection Circuitry	Protected against false pulse on power-up and continuous overload or short circuit of outputs				
Output Response Time	LX3: 0.8 milliseconds ON-time; 6 milliseconds OFF-time (5 milliseconds OFF-delay) LX6: 1.6 milliseconds ON-time; 7 milliseconds OFF-time (5 milliseconds OFF-delay) LX12: 3.2 milliseconds ON-time; 8.5 milliseconds OFF-time (5 milliseconds OFF-delay)				
Minimum Object Detection Size	Smallest diameter rod that can be detected in sensing range: 5.6 mm (short-range) or 9.5 mm (standard-range), depending on model.				
Indicators	<table border="0" style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> Emitter: LED1 (Green) ON: Power ON, good sensor OFF: Reduced Range </td> <td style="width: 50%; vertical-align: top;"> LED2 (Red) ON: Reduced range OFF: Normal range Flashing: Emitter hardware failure </td> </tr> <tr> <td style="vertical-align: top;"> Receiver: LED1 (Yellow) ON: Output conducting OFF: Output not conducting </td> <td style="vertical-align: top;"> LED2 (Bicolor Green/Red) Green: Normal range Red: Reduced range Flashing Red: Receiver hardware failure </td> </tr> </table>	Emitter: LED1 (Green) ON: Power ON, good sensor OFF: Reduced Range	LED2 (Red) ON: Reduced range OFF: Normal range Flashing: Emitter hardware failure	Receiver: LED1 (Yellow) ON: Output conducting OFF: Output not conducting	LED2 (Bicolor Green/Red) Green: Normal range Red: Reduced range Flashing Red: Receiver hardware failure
Emitter: LED1 (Green) ON: Power ON, good sensor OFF: Reduced Range	LED2 (Red) ON: Reduced range OFF: Normal range Flashing: Emitter hardware failure				
Receiver: LED1 (Yellow) ON: Output conducting OFF: Output not conducting	LED2 (Bicolor Green/Red) Green: Normal range Red: Reduced range Flashing Red: Receiver hardware failure				
Construction	Aluminum housing, die-cast zinc with black-coated encaps, acrylic lens window				
Environmental Rating	IEC IP65				
Connections	2 m 5-conductor (with drain) PVC-jacketed cable or 150 mm pigtail with 5-pin Euro-style quick-disconnect fitting, depending on model. QD cables are ordered separately. See page 415.				
Operating Conditions	Temperature: -20° to +70° C Relative humidity: 90% at 50° C (non-condensing)				
Application Notes	i) The best sensing resolution occurs within the center 80 percent of the sensing area, between the emitter and receiver. ii) Low-profile packages can be reliably detected. iii) Outputs are energized whenever the light screen is interrupted. iv) Successive parts must be spaced up to 12 milliseconds (LX12) for reliable detection.				
Certifications					
Hookup Diagrams	SP02 (p. 530)				

Slot & Label Sensors

SLM

page 216

- Available in eight slot widths, from 10 to 220 mm
- Installs easily using molded-in beam guides that simplify beam placement
- Includes single-turn potentiometer sensitivity adjustment and visible red beam
- Features sealed die-cast metal housing rated IEC IP67; NEMA 6
- Ideal for counting, sensing parts on conveyor rails and belts, detecting edges and gear teeth, and other applications

SL

page 219

- Self-contained fixed-distance opposed-mode slot sensors
- Rugged U-shaped housings
- Molded-in beam guides to simplify mounting and beam placement
- Models with 10 and 30 mm wide slots
- Fixed sensitivity, potentiometer sensitivity adjustment or push-button programming, depending on model



SLC1

page 222

- Continuous automatic internal adjustment of sensing threshold and drift compensation
- Registration accuracy of ± 0.3 mm typical at web speeds up to 15 m per second
- Heavy-duty metal housing, 1 mm slot
- For clear or opaque labels and backing



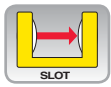
SLM

Rugged Metal Fixed-distance Slot Sensors

- Available in painted or nickel-plated diecast metal housings
- Senses objects that pass between the fixed-distance, opposed-mode emitter and receiver
- Requires no alignment or fibers
- Mounts easily and economically, using molded-in beam guides that simplify beam placement
- Available with current sourcing (PNP), current sinking (NPN) or bipolar (one NPN and one PNP) output, depending on model
- Delivers a fast response time of 500 microseconds
- Features a single-turn potentiometer sensitivity adjustment and a visible red beam
- Offers light- or dark-operate, selected with a sealed switch
- Operates at 10 to 30V dc
- Available with 2 m or 9 m attached cable, 4-pin Euro-style pigtail or 3-pin Pico-style quick-disconnect
- Features rugged, sealed, die-cast metal housing rated IEC IP67 (NEMA 6)



PART & AREA
SLOT & LABEL
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MAGNETIC

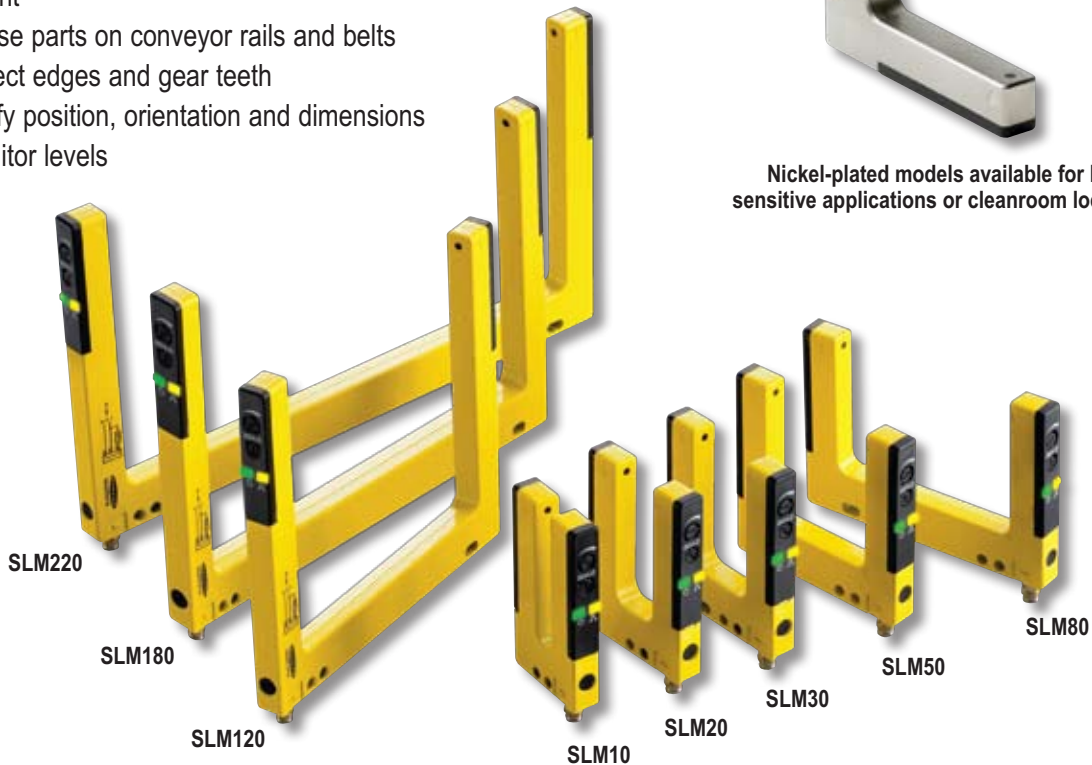


Available in eight slot widths from 10 to 220 mm for a wide variety of applications

- Count
- Sense parts on conveyor rails and belts
- Detect edges and gear teeth
- Verify position, orientation and dimensions
- Monitor levels



Nickel-plated models available for ESD sensitive applications or cleanroom locations.

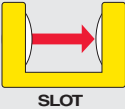


SLM Sensors

- Rugged, sealed, die-cast metal housing rated IEC IP67 (NEMA 6)
- Selection switch for light/dark operate
- Single-turn potentiometer sensitivity adjustment
- Models with yellow painted or nickel-plated surface
- 2 m or 9 m attached cable, Pico-style quick-disconnect or 150 mm pigtail with Euro-style quick-disconnect



SLM, 10-30V dc

Models†	Sensing Mode/LED*	Slot Width/Depth	Overall Width (W)	Overall Depth (D)	Cable**	Output Type	Response	Data Sheet
SLM10B6		10 mm/ 60.8 mm	42 mm	80 mm	2 m	Bipolar	500 µs	122703
SLM10B6QPMA					4-Pin Euro Pigtail QD	NPN/PNP		
SLM10P6Q					3-Pin Pico QD	PNP		
SLM10N6Q					3-Pin Pico QD	NPN		
SLM20B6		20 mm/ 60.8 mm	52 mm	80 mm	2 m	Bipolar		
SLM20B6QPMA					4-Pin Euro Pigtail QD	NPN/PNP		
SLM20P6Q					3-Pin Pico QD	PNP		
SLM20N6Q					3-Pin Pico QD	NPN		
SLM30B6		30 mm/ 60.8 mm	62 mm	80 mm	2 m	Bipolar		
SLM30B6QPMA					4-Pin Euro Pigtail QD	NPN/PNP		
SLM30P6Q					3-Pin Pico QD	PNP		
SLM30N6Q					3-Pin Pico QD	NPN		
SLM50B6		50 mm/ 60.8 mm	82 mm	80 mm	2 m	Bipolar		
SLM50B6QPMA					4-Pin Euro Pigtail QD	NPN/PNP		
SLM50P6Q					3-Pin Pico QD	PNP		
SLM50N6Q					3-Pin Pico QD	NPN		
SLM80B6	80 mm/ 60.8 mm	112 mm	80 mm	2 m	Bipolar			
SLM80B6QPMA				4-Pin Euro Pigtail QD	NPN/PNP			
SLM80P6Q				3-Pin Pico QD	PNP			
SLM80N6Q				3-Pin Pico QD	NPN			
SLM120B6	120 mm/ 120.7 mm	152 mm	140 mm	2 m	Bipolar			
SLM120B6QPMA				4-Pin Euro Pigtail QD	NPN/PNP			
SLM120P6Q				3-Pin Pico QD	PNP			
SLM120N6Q				3-Pin Pico QD	NPN			
SLM180B6	180 mm/ 120.7 mm	202 mm	140 mm	2 m	Bipolar			
SLM180B6QPMA				4-Pin Euro Pigtail QD	NPN/PNP			
SLM180P6Q				3-Pin Pico QD	PNP			
SLM180N6Q				3-Pin Pico QD	NPN			

*  Visible Red LED

** For 9 m cable, add suffix **W30** to the 2 m model number (example, **SLM10B6 W30**). A model with a QD requires a mating cable (see pages 410 and 412).

† Standard models have yellow painted surface. For models with nickel-plated surface, add the suffix **N** to the model number (example, **SLM10P6QN**).



PART & AREA

SLOT & LABEL

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OPTICAL BUTTONS

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SLM, 10-30V dc (cont'd)

Models†	Sensing Mode/LED*	Slot Width/ Depth	Overall Width (W)	Overall Depth (D)	Cable**	Output Type	Response	Data Sheet
SLM220B6		220 mm/ 120.7 mm	252 mm	140 mm	2 m	Bipolar NPN/PNP	500 μs	122703
SLM220B6QPMA					4-Pin Euro Pigtail QD			
SLM220P6Q					3-Pin Pico QD	PNP		
SLM220N6Q					3-Pin Pico QD	NPN		

* Visible Red LED

** For 9 m cable, add suffix **W30** to the 2 m model number (example, **SLM10B6 W30**). A model with a QD requires a mating cable (see pages 410 and 412).

† Standard models have yellow painted surface. For models with nickel-plated surface, add the suffix **N** to the model number (example, **SLM10P6QN**).

SLM Specifications

Slot Opening	10, 20, 30, 50, 80, 120, 180 or 220 mm (depending on model); beam is 5 mm from outer edge							
Supply Voltage and Current	10 to 30V dc (10% ripple) @ less than 25 mA, exclusive of load.							
Supply Protection Circuitry	Protected against reverse polarity and transient voltages.							
Output Configuration	Cabled and Euro-style QD models: Bipolar: One current sourcing (PNP) and one current sinking (NPN) Pico-style QD models: Current sourcing (PNP) or current sinking (NPN), depending on model							
Output Rating	100 mA with short circuit protection OFF-state leakage current: less than 10 μA sourcing; less than 200 μA sinking ON-state saturation voltage: NPN: 1.6V @ 100 mA PNP: 2.0V @ 100 mA							
Output Protection Circuitry	Protected against output short-circuit and false pulse on power up. 100 milliseconds max. delay at power up; outputs do not conduct during this time.							
Minimum Object Detection* at Max. Gain	SLM10...	SLM20...	SLM30...	SLM50...	SLM80...	SLM120...	SLM180...	SLM220...
	0.76 mm	0.91 mm	1.20 mm	1.20 mm	1.50 mm	1.80 mm	1.80 mm	2.40 mm
Minimum Object Detection* at 2X Excess gain	0.30 mm	0.30 mm	0.40 mm	0.60 mm	0.75 mm	0.90 mm	0.90 mm	1.00 mm
Hysteresis**	0.10 mm	0.10 mm	0.10 mm	0.10 mm	0.20 mm	0.20 mm	0.20 mm	0.20 mm
Repeatability***	0.02 mm	0.02 mm	0.02 mm	0.04 mm	0.06 mm	0.08 mm	0.08 mm	0.08 mm
Output Response Time	500 microseconds							
Repeatability	95 microseconds							
Adjustments	1-turn potentiometer Sensitivity adjustment Light Operate / Dark Operate Selection switch							
Indicators	Two LED Indicators: Power (Green) and Output (Yellow) Green ON steady: Power ON Green flashing: Sensor short circuit Yellow ON steady: Output activated							
Construction	Housing: Die-cast zinc with yellow paint; models with "N" at the end of the model number have nickel plating Endcaps: ABS Optic windows: Acrylic							
Environmental Rating	IEC IP67; NEMA 6							
Connections	Cabled models: 2 m or 9 m 4-conductor, PVC-jacketed cable Pico-style QD models: 3-pin, threaded (see page 410) Euro-style QD models: 4-pin, threaded 150 mm pigtail with polyurethane (PUR) cable (see page 412)							
Operating Conditions	Temperature: -20° to +60° C Relative humidity: 90% @ 55° C (non-condensing)							
Certifications	Approvals in process. Contact factory for more information.							
Hookup Diagrams	Bipolar Models: DC04 (p. 520) All others: DC01 (p. 520)							

* **Minimum Object Detection:** Smallest diameter rod that can be detected when passed slowly through sensing beam.

NOTE: Minimum object detection is measured midway between the emitter and receiver. For best results, objects to be detected should be placed in the midway position when possible. The minimum object detection size may increase if the object is very close to the receiver side.

** **Hysteresis:** Distance an object must move to toggle between output OFF and output ON conditions.

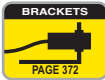
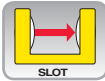
*** **Repeatability:** Variation in switching distance for a standard target at controlled sensing conditions.



SL30 and SL10 Opposed-Mode Fixed-Distance Sensors

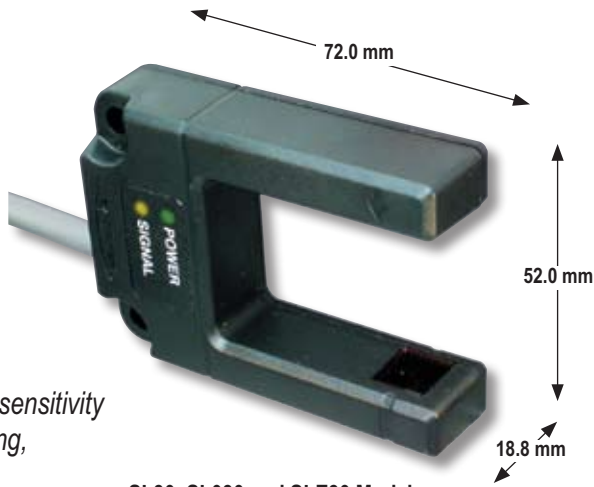
- Provides easy-to-use self-contained opposed-mode sensor pair in a rugged U-shaped housing
- Available in 10 mm-wide sensing slot (SL10 models) or 30 mm-wide sensing slot (SL30 models)
- Ideal for registration mark detection, hole detection, gear tooth detection, edge guiding and counting
- Uses visible red sensing beam (infrared on SLO models)
- Features manual sensitivity adjustment or easy push-button TEACH-mode setup, depending on model
- Provides an economical choice for many OEM applications with fixed sensitivity (SLO model)

- PART & AREA
- SLOT & LABEL
- COLOR & LUMINESCENCE
- OPTICAL BUTTONS
- MAGNETIC

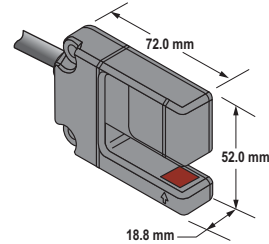


SL Series Slot Sensors

- Molded-in beam guides to simplify mounting and beam placement
- 10 or 30 mm slot width for a wide variety of sensing applications
- 10 to 30V dc operation
- Bipolar PNP/NPN outputs
- Fixed-sensitivity, 4-turn potentiometer sensitivity adjustment or push-button programming, depending on model
- 2 m or 9 m attached cable, or 5-pin Euro-style quick-disconnect



SL30, SL030 and SLE30 Models



SL10 and SLE10 Models





SL30 and SL10, 10-30V dc

Models	Sensing Mode/LED*	Slot Width	Cable**	Output Type	Response	Repeatability	Data Sheet
SL30VB6V		30 mm	2 m	Bipolar NPN/PNP	1 ms	250 μs	56407
SL30VB6VQ			5-Pin Euro QD				
SL30VB6VY			2 m		300 μs	75 μs	
SL30VB6VYQ			5-Pin Euro QD				
SL10VB6V		10 mm	2 m		1 ms	250 μs	58341
SL10VB6VQ			5-Pin Euro QD				
SL10VB6VY			2 m		300 μs	75 μs	
SL10VB6VYQ			5-Pin Euro QD				



SLO30, 10-30V dc

Models	Sensing Mode/LED*	Slot Width	Cable**	Output Type	Response	Repeatability	Data Sheet
SLO30VB6		30 mm	2 m	Bipolar NPN/PNP	1 ms	250 μs	60073
SLO30VB6Q			5-Pin Euro QD				
SLO30VB6Y			2 m		300 μs	75 μs	
SLO30VB6YQ			5-Pin Euro QD				

* Visible Red LED Infrared LED

** For 9 m cable, add suffix **W/30** to the 2 m model number (example, **SL30VB6V W/30**). A model with a QD requires a mating cable (see page 414).

SL30, SL10 and SLO30 Specifications

Supply Voltage and Current	10 to 30V dc, 30 mA
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	Bipolar: One current sinking (NPN) and one current sourcing (PNP) open-collector transistor.
Output Rating	150 mA, each output
Output Protection Circuitry	Protected against false pulse on power-up and short-circuit of outputs
Output Response Time	1 millisecond or 300 microseconds, depending on model
Repeatability	250 microseconds or 75 microseconds, depending on model
Adjustments	SL30 and SL10: 4-turn clutched potentiometer sensitivity adjustment SLO30: None
Indicators	Green: Power ON/OFF indicator Yellow: Signal condition indicator
Construction	Housing: ABS/polycarbonate Lenses: Acrylic
Environmental Rating	IP67; NEMA 6
Connections	2 m or 9 m 5-conductor PVC-jacketed attached cable, or 5-pin Euro-style quick-disconnect (QD) fitting. QD cables are ordered separately. See page 414.
Operating Conditions	Temperature: -40° to +70° C Relative humidity: 90% @ 50° C (non-condensing)
Certifications	
Hookup Diagrams	SP03 (p. 530)

PART & AREA
SLOT & LABEL
COLOR & LUMINESCENCE
OPTICAL BUTTONS
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SLE30 and SLE10 Expert™, 10-30V dc



Models	Sensing Mode/LED*	Slot Width	Cable**	Output Type	Response	Repeatability	Data Sheet
SLE30B6V		30 mm	2 m	Bipolar NPN/PNP	500 μs	100 μs	58338
SLE30B6VQ			5-Pin Euro QD				
SLE30B6VY			2 m		150 μs	75 μs	
SLE30B6VYQ			5-Pin Euro QD				
SLE10B6V		10 mm	2 m		500 μs	100 μs	60378
SLE10B6VQ			5-Pin Euro QD				
SLE10B6VY			2 m		150 μs	75 μs	
SLE10B6VYQ			5-Pin Euro QD				

* Visible Red LED

** For 9 m cable, add suffix W/30 to the 2 m model number (example, SLE30B6V W/30). A model with a QD requires a mating cable (see page 414).

SLE30 and SLE10 Expert™ Specifications

Supply Voltage and Current	10 to 30V dc (10% max. ripple) at less than 45 mA, exclusive of load
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	Bipolar: One current sourcing (PNP) and one current sinking (NPN) open-collector transistor
Output Rating	150 mA max. each output at 25° C, derated to 100 mA at 70° C (derate ≈1 mA per ° C) OFF-state leakage current: less than 5 μA @ 30V dc ON-state saturation current: less than 1V @ 10 mA; less than 1.5V @ 150 mA
Output Protection Circuitry	Protected against false pulse on power-up and continuous overload or short-circuit of outputs
Output Response Time	Sensors will respond to either a "light" or a "dark" signal of 500 microseconds (or 150 microseconds, depending on model) or longer duration, 1 kHz max. NOTE: 1 second delay on power-up; outputs are non-conducting during this time.
Repeatability	100 microseconds or 75 microseconds, depending on model
Adjustments	Push-button TEACH-mode sensitivity setting; remote TEACH-mode input is provided (gray wire)
Indicators	Two LEDs: Yellow and Bicolor Green/Red Green (RUN Mode): ON when power is applied Flashes when received light level approaches the switching threshold Red (TEACH Mode): OFF when no signal is received. Pulses to indicate signal strength (received light level). Rate is proportional to signal strength (the stronger the signal, the faster the pulse rate). This is a function of Banner's Alignment Indicating Device (AID™). Alternating Red/Green: Flashing Yellow (Static TEACH): ON to indicate sensor is ready to learn output ON condition OFF to indicate sensor is ready to learn output OFF condition Yellow (Dynamic TEACH): Pulses at 0.5 Hz when ready to sample ON to indicate Dynamic TEACH sampling OFF to indicate sampling was accepted Yellow (RUN Mode): ON when outputs are conducting
Construction	Housing: ABS/polycarbonate Lenses: Acrylic
Environmental Rating	IEC IP67; NEMA 6
Connections	PVC-jacketed 5-conductor 2 m or 9 m unterminated cable, or 5-pin Euro-style quick-disconnect (QD) fitting. QD cables are ordered separately. See page 414.
Operating Conditions	Temperature: -20° to +70° C Relative humidity: 90% at 50° C (non-condensing)
Application Notes	The first condition presented during TEACH mode becomes the output ON condition.
Certifications	
Hookup Diagrams	DC08 (p. 521)

PART & AREA
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OPTICAL BUTTONS
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SLC1 C-GAGE® Label Sensors

- Accurately detects labels on web backing
- Requires no user adjustments—ADL™ (Adaptive Digital Logic) provides revolutionary self-learning capability
- Provides continuous automatic internal adjustment of sensing threshold and drift compensation
- Offers typical registration accuracy of ±0.3 mm at web speeds up to 1.5 m per second
- Reliably detects the presence of most types of labels on web backing, regardless of whether the labels or web are clear or opaque



PART & AREA
SLOT & LABEL
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MAGNETIC

OD CABLES
5-Pin Euro
PAGE 414

SLC1 Sensors

- Dual-LED indicators
- Heavy-duty metal housing, 1 mm slot
- Web alignment guides
- 2 m or 9 m integral cable, or Euro-style quick-disconnect





SLC1, 10-30V dc

Models	Slot Width	Cable**	Output Type	Response	User Adjustments	Data Sheet
SLC1BB6	1 mm	2 m	Bipolar NPN/PNP	100 μ s	None Required	59369
SLC1BB6Q		5-pin Euro QD				

** For 9 m cable, add suffix W/30 to the 2 m model number (example, SLC1BB6 W/30). A model with a QD requires a mating cable (see page 414).

SLC1 Specifications	
Supply Voltage and Current	10 to 30V dc (10% max. ripple) @ less than 60 mA (exclusive of load)
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Power-Up or Reset Delay	1 second typical (outputs are non-conducting during this time)
Output Configuration	Bipolar: one current-sourcing (PNP) and one current-sinking (NPN) open-collector transistor
Output Rating	150 mA max. (each output) OFF-state leakage current: less than 5 μ A @ 30V dc Output saturation voltage: less than 1V @ 10 mA dc; less than 1.6V @ 150 mA dc
Output Protection Circuitry	Protected against continuous overload and short-circuit of outputs Overload trip point: greater than 200 mA, typical, at 20° C
Output Invert Control/Reset	Gray wire has dual functionality, and may be controlled by a PLC Input impedance: 10 K Ω Outputs ON during gap (turn OFF at leading edge of label): leave open, or connect to 0 to +1V dc Outputs ON during label (turn ON at leading edge of label): connect to +5 to 30V dc Microprocessor reset: toggle gray wire to opposite polarity for > 100 milliseconds (see Hookups, page 530)
Registration Accuracy*	\pm 0.3 mm typical, web speeds up to 1.5 m per second
Maximum Web Speed*	10 m per second
Response Time*	100 microseconds
Minimum Sensing Speed*	100 mm per minute
Maximum Switching Speed*	1 kHz
Minimum Gap or Label Size	2 mm
Adjustments	No user adjustments; automatic continuous adjustment of sensing threshold and drift compensation under internal microprocessor control Adjustment interval: every 250 milliseconds or 4 labels, whichever is greater
Indicators	Two LEDs, Green and Yellow: Green ON steady: power ON Green flashing @ 4 Hz: output overloaded Yellow ON steady: NPN and PNP outputs ON Green and Yellow flashing alternately @ 1 Hz: internal error; reset sensor
Construction	Housings are machined aluminum with black anodized finish
Environmental Rating	IP67; NEMA 6
Connections	2 m or 9 m 5-wire attached cable, or 5-pin Euro-style quick-disconnect fitting. QD cables are sold separately. See page 414.
Operating Conditions	Temperature: +5° to 50° C Relative humidity: 90% at 50° C, non-condensing
Certifications	
Hookup Diagrams	SP04 (p. 530)

* Based on 3.2 mm gap between labels, and web speeds of up to 10 m per second. Instantaneous web speed, not average web speed, must be used to determine actual operating speeds in stepped-advance label systems.

Color & Luminescence Sensors

R58 Expert™

page 225

- Outstanding color contrast sensitivity even in low-contrast or high-gloss applications
- Ultra-fast 10 kHz switching frequency
- Easy-to-set, automatic *Expert*™ TEACH programming and manual fine tuning
- Bipolar discrete outputs: one current sourcing (PNP) and one current sinking (NPN)



QC50/QCX50 page 228

- For comparing 3 different colors or shades of one color
- Models for challenging applications such as differentiating dark blue from black
- Easy to set and program
- Three programming parameters: channel, sensing mode and tolerance level



QL50/QL55 page 230

- Low-cost luminescent sensing
- For luminescent marks on luminescent backgrounds and reflective surfaces such as ceramic, metal or mirrored glass
- Fast 250 milliseconds response time
- Easy push-button programming



R58 Expert™

Registration Mark Sensors

- Provides excellent color contrast sensitivity, detecting contrasts as low as 2% over a wide range of colors
- Optimizes application contrast by automatically choosing red, green or blue sensing LEDs
- Maximizes performance in low-contrast or high-gloss applications
- Detects small, inconspicuous registration marks
- Features Static and Dynamic programming and manual adjustment
- Provides a sensing image that measures 1.2 by 3.8 mm at 10 mm from the lens
- Includes bipolar discrete outputs: current sinking (NPN) and current sourcing (PNP)
- Offers configurable light- or dark-operate outputs
- Includes optional 30 milliseconds ON/OFF-delay
- Features 10,000 actuations per second (10 kHz switching frequency)

PART & AREA

SLOT & LABEL

COLOR & LUMINESCENCE

OPTICAL BUTTONS

MAGNETIC

Convenient and flexible mounting

- Two lens locations on each sensor
- Threaded lens and cap for easy exchange without tools
- Vertical or horizontal light spot, depending on model



Range and application tolerant

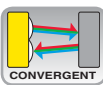
The R58E tolerates a ± 3 mm shift from the 10 mm focal point, to accommodate web flutter and similar variations in the target's location.



Three LED sensing colors in one sensor



Each sensor includes three LEDs and automatically selects the correct one to use, based on the contrast between the color of the registration mark and its background.



- PART & AREA
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- OPTICAL BUTTONS
- MAGNETIC

R58 Expert™ Sensors

- Easy-to-read 8-segment light bar indicator
- Rugged zinc alloy die-cast housing
- High-quality acrylic lens suitable for food processing applications
- IP67; NEMA 6
- Push-button configuration for light/dark operate and ON/OFF-delays
- Integral cable or Euro-style quick-disconnect pigtail
- 5-pin Euro-style QD cables with shield ordered separately (see page 415)




R58 Expert™, 10-30V dc



Models	Sensing Mode/LED*	Sensing Image Orientation	Focus	Cable**	Output Type	Data Sheet
R58ECRGB1		Parallel to sensor length 	10 mm	2 m	Bipolar NPN/PNP	122928
R58ECRGB1Q				5-pin Euro Pigtail QD		
R58ECRGB2		Perpendicular to sensor length 		2 m		
R58ECRGB2Q				5-pin Euro Pigtail QD		

* Visible Red, Green or Blue LED, depending on contrast of registration mark

** For 9 m cable, add suffix W/30 to the 2 m model number (example, R58ECRGB1 W/30). A model with a QD requires a mating cable (see page 415).

R58 Expert™ Specifications	
Supply Voltage and Current	10 to 30V dc (10% max. ripple); Supply current (exclusive of load current): 75 mA @ 10V dc 35 mA @ 30V dc
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	Bipolar: One current sourcing (PNP) and one current sinking (NPN) open-collector transistor
Output Rating	100 mA max. (each output) OFF-state leakage current: NPN: less than 200 µA PNP: less than 10 µA NPN saturation: less than 200 mV @ 10 mA and less than 1V @ 100 mA PNP saturation: less than 1.2V @ 10 mA and less than 1.6V @ 100 mA
Output Protection Circuitry	Protected against false pulse on power-up and continuous overload or short-circuit of outputs.
Output Response Time	50 microseconds NOTE: 1 second delay on power-up; outputs do not conduct during this time.
Repeatability	15 microseconds
Tri-Color LED Sensing Image	Rectangular: 1.2 x 3.8 mm at 10 mm from face of lens; image oriented either parallel or perpendicular to sensor length, depending on model Red: 636 nm Green: 525 nm Blue: 472 nm
Adjustments	Using push buttons (“+” Dynamic and “-” Static): Manually adjust discrete output switchpoint using “+” or “-” buttons Dynamic TEACH (teach on-the-fly) sensitivity adjustment Static TEACH sensitivity adjustment Light operate/Dark operate OFF-delay/ON-delay Sensing beam color enable/disable Using Remote TEACH input (gray wire): Dynamic TEACH (teach on-the-fly) sensitivity adjustment Static TEACH sensitivity adjustment Light operate/Dark operate OFF-delay/ON-delay Sensing beam color enable/disable Disable push buttons for security
Indicators	8-segment Bargraph display: Red signal strength indicator relative to taught signal level; higher segment number for higher measured sensing contrast Green ON steady: Power to sensor is ON Yellow ON steady: Outputs ON 2-position Green: LED ON next to DO for dark operate LED ON next to LO for light operate 2-position Green: LED ON next to ON for ON-delay LED ON next to OFF for OFF-delay
Construction	Zinc alloy die-cast and steel housing with black painted finish and o-ring sealed lens and lens port cap. Lens: Acrylic Lens port cap and lens holder: ABS Push buttons: Thermoplastic elastomer Labels: Polycarbonate
Environmental Rating	IEC IP67; NEMA 6
Connections	PVC-jacketed 5-conductor 2 m or 9 m attached cable with internal strain relief, or 150 mm pigtail with 5-pin Euro-style quick-disconnect. QD cables are ordered separately. See page 415.
Operating Conditions	Temperature: -10° to +55° C Relative humidity: 90% at 50° C (non-condensing) Storage temperature: -20° to +80° C
Vibration and Mechanical Shock	All models meet IEC 68-2-6 and IEC 68-2-27 testing criteria.
Application Notes	<ul style="list-style-type: none"> Do not mount the sensor directly perpendicular to shiny surfaces; position it at approximately a 15° angle in relation to the sensing target Minimize web or product “flutter” whenever possible to maximize sensing reliability.
Certification	
Hookup Diagrams	DC08 (p. 521)

PART & AREA

SLOT & LABEL

COLOR & LUMINESCENCE

OPTICAL BUTTONS

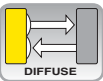
MAGNETIC

QC50 True Color Sensor

- Accurately analyzes and compares colors or varying intensities of color
- Available in two versions for application flexibility: QC50 models for most applications and QCX50 models for challenging applications such as differentiating dark blue from black
- Offers easy-to-set push-button programming options for up to three colors
- Features compact, self-contained design
- Offers fast sensing response time of 335 microsecond (QC50) and 5 milliseconds (QCX50)
- Includes three programming parameters: channel, sensing mode and tolerance level
- Available in models with three NPN or three PNP outputs, one for each color channel



- PART & AREA
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- MAGNETIC



QC50 Sensors

- *Push-button SET for easy programming*
- *Bright LEDs indicators for output of programmed colors*
- *3-position swivel connector*
- *8-pin Euro-style QD cables with open-shield ordered separately (see page 417)*



50.0 mm





QC50, 10-30V dc

Models	Sensing Beam*	Range	Cable**/ Connector	Response Time	Output Type	Data Sheet
QC50A3N6XDWQ		20 mm typical; varies according to sensor configuration	8-pin Euro QD	335 μs	NPN, 3 channels	111523
QC50A3P6XDWQ					PNP, 3 channels	
QCX50A3N6XDWQ				Selectable	NPN, 3 channels	
QCX50A3P6XDWQ				5 ms or 1 ms	PNP, 3 channels	

* Visible White LED
 ** Mating cable required (see page 417).

QC50 Specifications

Sensing Receiver	Solid-state photodiode device with R, G, B filters						
Minimum Spot Diameter	4 mm						
Supply Voltage and Current	10 to 30V dc, 2 V pp max ripple 40 mA max @ 24V dc (excluding output current)						
Supply Protection Circuitry	Protected against reverse polarity, over-voltage, and transient voltage						
Output Configuration	3 PNP or 3 NPN outputs, depending on model 30V dc max. Saturation voltage: less than 2V						
Output Rating	100 mA max. load per output channel						
Output Protection Circuitry	Protected against output short-circuit, continuous overload, transient over-voltages, and false pulse on power-up						
Output Response Time	QC50 models: 335 microseconds QCX50 models: Selectable 5 milliseconds (normal) or 1 millisecond NOTE: 500 milliseconds delay at power-up; outputs do not conduct during this time. <table style="width: 100%; border: none;"> <tr> <td style="text-align: center;">Gate ON-time:</td> <td style="text-align: center;">QC50 models 335 microseconds</td> <td style="text-align: center;">QCX50 models 700 microseconds</td> </tr> <tr> <td style="text-align: center;">Gate OFF-time:</td> <td style="text-align: center;">QC50 models 170 microseconds</td> <td style="text-align: center;">QCX50 models 400 microseconds</td> </tr> </table>	Gate ON-time:	QC50 models 335 microseconds	QCX50 models 700 microseconds	Gate OFF-time:	QC50 models 170 microseconds	QCX50 models 400 microseconds
Gate ON-time:	QC50 models 335 microseconds	QCX50 models 700 microseconds					
Gate OFF-time:	QC50 models 170 microseconds	QCX50 models 400 microseconds					
Data Retention	EEPROM nonvolatile memory						
Ambient Light Rejection	According to EN 609475-2						
Adjustments	2 push buttons (Set and Select) <ul style="list-style-type: none"> • Color, scanning, color modes, delay and tolerance • Manual adjustment of color channels, sensing mode and tolerance level 						
Indicators	4-Digit LCD Display: indicates sensing mode, run status, tolerance level, output status Yellow Output LED: ON when any output is conducting 3 Green Channel Output Status LEDs: ON when its corresponding output is conducting						
Construction	ABS shock-resistant housing; glass window and lens						
Environmental Rating	IEC IP62						
Connections	8-pin Euro-style swivel quick-disconnect fitting. QD cables are ordered separately. See page 417.						
Operating Conditions	Temperature: -10° to +55° C Relative humidity: 90% at 50° C (non-condensing)						
Shock Resistance	Approx. 30 G; 3 shocks per axis; 11 milliseconds duration						
Vibration	0.5 mm amplitude; 10 to 60 Hz frequency; 30 minutes for each X, Y, Z axis						
Certifications							
Hookup Diagrams	NPN Models: SP05 (p. 531) PNP Models: SP06 (p. 531)						

PART & AREA
 SLOT & LABEL
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 OPTICAL BUTTONS
 MAGNETIC

QL50 and QL55 Luminescence Sensors

- Features compact, self-contained design
- Detects luminescence inherent in a material or luminophores added to a material to make it luminescent
- Senses luminescent marks, even on luminescent backgrounds and reflective surfaces such as ceramic, metal or mirrored glass
- Includes easy-to-set programming options
- Responds in 250 microseconds
- Available in models with NPN or PNP discrete outputs (QL50) or with selectable NPN or PNP outputs (QL55)



QL50 Models	page 230
QL55 Models	232

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- DIFFUSE
- BRACKETS
PAGE 372
- QD CABLES
4-Pin Euro
PAGE 412

QL50 Sensors

- *Push-button programming for easy setup*
- *Bright LED indicators for operating and output status*
- *3-position swivel QD connector*





QL50, 10-30V dc

Models	Sensing Beam/LED*	Range	Cable/Connector**	Output	Data Sheet
QL50AP6XD20BQ		0-40 mm	4-pin Euro QD	PNP	112151
QL50AN6XD20BQ				NPN	

* Black Ultraviolet LED Returned Luminescence

** Mating cable required (see page 412).

QL50 Specifications

Spot Diameter	1.5 mm @ 10 mm
Supply Voltage	10 to 30V dc, 2V max. ripple 30 mA max. @ 30V dc (excluding output current)
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	PNP or NPN discrete output, depending on model 30V dc max Leakage current: less than 1 μ A
Output Rating	100 mA max. load
Output Protection	Protected against output overload and short circuit
Output Response Time	250 microseconds
Data Retention	EEPROM nonvolatile memory
Ambient Light Rejection	According to EN 60947-5-2
Adjustments	1 push button (set), and remote program wire: <ul style="list-style-type: none"> • Fine-detect autaset for Light Operate or Dark Operate • 20 milliseconds output OFF-delay • Remote wire to +V dc for remote programming and/or push-button lockout
Indicators	Yellow Output LED: ON when output is conducting Bicolor Ready/Error LED: <ul style="list-style-type: none"> Green ON: Default and Quick-Set programming RUN mode Green OFF: Threshold Green Flashing: Fine-Detection Program mode/Delay status Green/Red bicolor flashing: programming error
Construction	ABS shock-resistant housing; glass lens and window (tilted, antireflective)
Environmental Rating	IEC IP62
Connections	4-pin Euro-style swivel quick-disconnect fitting. QD cables are ordered separately. See page 412.
Operating Conditions	Temperature: -25° to +55° C Relative humidity: 90% at 50° C non-condensing
Shock Resistance	Approx. 30 G; 3 shocks per axis; 11 milliseconds duration
Vibration	0.5 mm amplitude; 10 to 60 Hz frequency; 30 minutes for each X, Y, Z axis
Certifications	
Hookup Diagrams	SP07 (p. 531)

PART & AREA

SLOT & LABEL

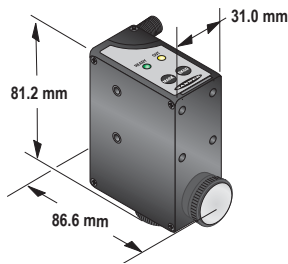
COLOR & LUMINESCENCE

OPTICAL BUTTONS

MAGNETIC

QL55 Sensors

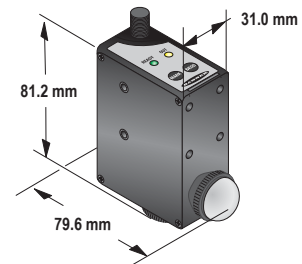
- Push-button programming
- Bright LED indicators for operating and output status
- Robust metal housing
- 3-position swivel QD connector



QL55M6XD30BQ Model



QL55M6XD15BQ Model



QL55M6XD50BQ Model



QL55, 10-30V dc


Models	Sensing Beam/LED*	Sensing Range	Cable/Connector**	Output Type	Data Sheet
QL55M6XD15BQ		9-18 mm	4-pin Euro QD	One selectable NPN or PNP discrete plus one 0 to 5.5V dc analog	112153
QL55M6XD30BQ		20-40 mm			
QL55M6XD50BQ		40-75 mm			

* Black Ultraviolet LED Returned Luminescence
 ** Mating cable required (see page 412).

QL55 Specifications	
Spot Diameter	QL55M6XD15BQ: 2 mm QL55M6XD30BQ: 3 mm QL55M6XD50BQ: 4 mm
Supply Voltage	10 to 30V dc, 2 V pp max ripple 80 mA max @ 30V dc (excluding output current)
Supply Protection Circuitry	Protected against reverse polarity
Output Configuration	Discrete NPN or PNP Analog 0 to 5.5V dc ± 10%, ripple 40 mV pp max. Saturation voltage: 1V max. NPN / 2V max PNP Leakage current: less than 100 µA
Output Rating	200 mA max. load
Output Protection	NPN/PNP: Protected against reverse polarity, overload and short circuit (pull down/up resistance 10 kΩ) Analog: Protected against short circuit (output resistance 2.2 kΩ)
Output Response Time	250 microseconds



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 MAGNETIC

QL55 Specifications (cont'd)	
Response Curves	See chart RC-1 on page 516.
Data Retention	EEPROM nonvolatile memory
Ambient Light Rejection	According to EN 60947-5-2
Adjustments	2 push buttons (MARK and BKGD) determine switching threshold and Light/Dark operate 2 selector switches • 20 milliseconds Output OFF-delay • NPN/PNP output
Indicators	Red Output LED ON: output is conducting Green Ready/Overload LED ON: normal operating condition, RUN mode Flashing 2 Hz: setup failure due to insufficient contrast Flashing 4 Hz: output overload condition (verify output current ≤ 200 mA)
Construction	Housing: zinc, aluminum, and magnesium alloy Lens: glass
Environmental Rating	IEC IP62
Connections	4-pin Euro-style quick-disconnect fitting. QD cables are ordered separately. See page 412.
Operating Conditions	Temperature: -10° to +55° C Relative humidity: 85% at 50° C (non-condensing)
Shock Resistance	30 G; 3 shocks per axis; 11 milliseconds duration
Vibration	0.5 mm amplitude; 10 to 60 Hz frequency; 30 minutes for each X, Y, Z axis
Certifications	
Hookup Diagrams	SP08 (p. 531)

PART & AREA

SLOT & LABEL

COLOR & LUMINESCENCE

OPTICAL BUTTONS

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OPTO-TOUCH™

Optical Touch Buttons

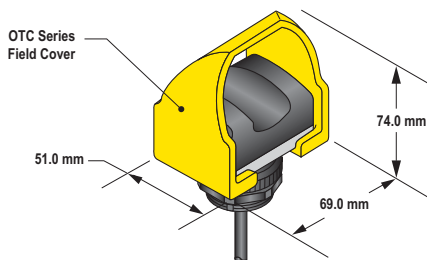
- OTB models are momentary-action touch buttons with electromechanical relay or solid-state outputs.
- LTB models are alternate-action touch buttons with electromechanical relay outputs.
- VTB models are momentary-action touch buttons with solid-state outputs and an illuminating base for sequential part-picking operations.
- STB models are momentary-action touch buttons with solid-state or electromechanical relay outputs and redundant optical channels for inputs to safety controls.



OTB Models	page 234
LTB Models	237
VTB Models	238
STB Models	239

Optical Buttons

- 2 m or 9 m, integral cable or quick-disconnect fitting
- Ergonomically designed touch buttons to eliminate hand, wrist and arm stress
- Dual indicator LEDs
- Additional field cover color options available



OTB, LTB, VTB and STB Models with cover



OTB, LTB, VTB and STB Models





OTB Momentary Action, 10-30V dc

Models	Cable*	Upper Housing	Output Type	Data Sheet
OTBVN6	2 m	Polysulfone	NPN	28436
OTBVN6QD	4-Pin Mini QD			
OTBVN6L	2 m	Polycarbonate	NPN	
OTBVN6LQD	4-Pin Mini QD			
OTBVP6	2 m	Polysulfone	PNP	
OTBVP6QD	4-Pin Mini QD			
OTBVP6L	2 m	Polycarbonate	PNP	
OTBVP6LQD	4-Pin Mini QD			



OTB Momentary Action, 20-30V ac or dc

Models	Cable*	Upper Housing	Output Type	Data Sheet
OTBVR81	2 m	Polysulfone	SPDT e/m Relay	28436
OTBVR81QD	5-Pin Mini QD			
OTBVR81L	2 m	Polycarbonate	SPDT e/m Relay	
OTBVR81LQD	5-Pin Mini QD			



OTB Momentary Action, 120V ac

Models	Cable*	Upper Housing	Output Type	Data Sheet
OTBA5	2 m	Polysulfone	SPDT e/m Relay	28436
OTBA5QD	5-Pin Mini QD			
OTBA5L	2 m	Polycarbonate	SPDT e/m Relay	
OTBA5LQD	5-Pin Mini QD			



OTB Momentary Action, 220/240V ac

Models	Cable*	Upper Housing	Output Type	Data Sheet
OTBB5	2 m	Polysulfone	SPDT e/m Relay	28436
OTBB5QD	5-Pin Mini QD			
OTBB5L	2 m	Polycarbonate	SPDT e/m Relay	
OTBB5LQD	5-Pin Mini QD			

* For 9 m cable, add suffix **W30** to the 2 m model number (example, **OTBVN6 W30**). A model with a QD requires a mating cable (see page 420)

PART & AREA




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OTB Specifications	
Supply Voltage and Current	OTBVR81 models: 20 to 30V ac/dc OTBA5 models: 105 to 130V ac, 50-60 Hz OTBB5 models: 210 to 250V ac, 50-60 Hz OTBVN6/VP6 models: 10 to 30V dc All models require less than 25 mA (exclusive of load)
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	OTBVR81, OTBA5, and OTBB5 models: SPDT electromechanical relay OTBVN6 models: Complementary NPN (sinking) open-collector transistor; 1 normally open (NO) and 1 normally closed (NC) OTBVP6 models: Complementary PNP (sourcing) open-collector transistors; 1 normally open (NO) and 1 normally closed (NC)
Output Rating	Electromechanical relay models: Max. switching current: 7 amps (resistive load), 1 HP max. Min. load: 0.05 watts (dc), 0.05 VA (ac) Mechanical life of relay: 50,000,000 operations (min.) Electrical life of relay: 100,000 operations (min.) at full resistive load Transient suppression is recommended when switching inductive loads Solid-state output models: 150 mA max. load (each output) ON-state saturation voltage: less than 1 volt at signal levels; less than 1.5 volts at full load OFF-state leakage current: less than 1 µA
Response Time	100 milliseconds ON/OFF
Output Protection	All models protected against false pulse on power-up Models with solid-state outputs have overload and short circuit protection
Indicators	Two Red indicator LEDs: one lights whenever power is applied; the other lights whenever the switch is activated making the normally-open (NO) output conduct
Construction	Totally encapsulated, non-metallic enclosure. Black polysulfone or red polycarbonate upper housing (see Application Notes below); fiber-reinforced thermoplastic polyester base. Electronics fully epoxy-encapsulated. Supplied with a field cover of polypropylene (TP).
Environmental Rating	Meets NEMA standards 1, 3, 4, 4X, 12 and 13; IEC IP66
Connections	PVC-jacketed 2 m or 9 m cables, or Mini-style quick-disconnect (QD) fitting. QD cables are ordered separately. See page 420.
Ambient Light Immunity	120,000 lux (direct sunlight)
EMI/RFI Immunity	Immune to both single and mixed EMI and RFI noise sources
Operating Conditions	Temperature: -20° to +50° C Relative humidity: 90% at 50° C (non-condensing)
Application Notes	Environmental considerations for models with polysulfone upper housings: The polysulfone upper housing will become embrittled with prolonged exposure to outdoor sunlight. Window glass effectively filters longer wavelength ultraviolet light and provides excellent protection from sunlight. Environmental considerations for models with polycarbonate upper housings: Avoid prolonged exposure to hot water and moist high-temperature environments above 66° C. Avoid contact with aromatic hydrocarbons (such as xylene and toluene), halogenated hydrocarbons and strong alkalis. Clean periodically using mild soap solution and a soft cloth. Avoid strong alkaline materials.
Certifications	  
Hookup Diagrams	DC Models: DC03 (p. 520) AC/DC Models: OTBVR81 Models: UN01 (p. 528) AC Models: OTBA5 Models: AC08 (p. 526) OTBB5 Models: AC08 (p. 526)



LTB Alternate Action, 120V ac

Models	Cable*	Upper Housing	Output Type	Data Sheet
LTBA5	2 m	Polysulfone	SPDT e/m Relay	28437
LTBA5QD	5-Pin Mini QD			
LTBA5L	2 m	Polycarbonate		
LTBA5LQD	5-Pin Mini QD			






LTB Alternate Action, 220/240V ac

Models	Cable*	Upper Housing	Output Type	Data Sheet
LTBB5	2 m	Polysulfone	SPDT e/m Relay	28437
LTBB5QD	5-Pin Mini QD			
LTBB5L	2 m	Polycarbonate		
LTBB5LQD	5-Pin Mini QD			

* For 9 m cable, add suffix **W30** to the 2 m model number (example, **LTBA5 W30**). A model with a QD requires a mating cable (see page 420).

LTB Specifications

Supply Voltage and Current	LTBA5 models: 105 to 130V ac, 50-60 Hz LTBB5 models: 210 to 250V ac, 50-60 Hz
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	All models have SPDT electromechanical relay - complementary outputs: one normally open (NO) contact and one normally closed (NC) contact which "toggle" from open to closed when the button is activated
Output Rating	Max. voltage is 250V ac or 30V dc Max. current: 7 amps (resistive load), 1 HP max. Min. load: .05 watts (dc), 0.5VA (ac) Mechanical life of relay: 50,000,000 operations (min.) Electrical life of relay: 100,000 operations (min.) at full resistive load Transient suppression is recommended when switching inductive loads.
Output Protection	All models protected against false pulse on power-up
Indicators	Two Red indicator LEDs: one lights whenever power is applied; the other lights when the infrared sensing beam is interrupted
Construction	Totally encapsulated, non-metallic enclosure. Black polysulfone or red polycarbonate upper housing; fiber-reinforced thermoplastic polyester base. Electronics fully epoxy-encapsulated. Supplied with a field cover of polypropylene (TP).
Environmental Rating	Meets NEMA standards 1, 3, 4, 4X, 12 and 13; IEC IP66
Connections	PVC-jacketed 2 m or 9 m cables, or Mini-style quick-disconnect (QD) fitting. QD cables are ordered separately. See page 420.
Ambient Light Immunity	120,000 lux (direct sunlight)
EMI/RFI Immunity	Immune to both single and mixed EMI and RFI noise sources
Operating Conditions	Temperature: -20° to +50° C Relative humidity: 90% at 50° C (non-condensing)
Application Notes	Environmental considerations for models with polysulfone upper housings: The polysulfone upper housing will become embrittled with prolonged exposure to outdoor sunlight. Window glass effectively filters longer wavelength ultraviolet light and provides excellent protection from sunlight. Environmental considerations for models with polycarbonate upper housings: Avoid prolonged exposure to hot water and moist high-temperature environments above 66° C. Avoid contact with aromatic hydrocarbons (such as xylene and toluene), halogenated hydrocarbons and strong alkalis. Clean periodically using mild soap solution and a soft cloth. Avoid strong alkaline materials.
Certifications	  
Hookup Diagrams	AC08 (p. 526)



VTB, 12-30V dc

Models	Job Light(s) Color	Cable*	Upper Housing	Output Type	Job Light Input	Data Sheet
VTBN6	Green	2 m	Polysulfone	NPN	0V dc	67570
VTBN6Q		4-Pin Euro QD				
VTBN6R	Red	2 m				
VTBN6RQ		4-Pin Euro QD				
VTBN6B	Blue	2 m				
VTBN6BQ		4-Pin Euro QD				
VTBN6GR	Green & Red	2 m				
VTBN6GRQ		5-Pin Euro QD				
VTBN6L	Green	2 m	Polycarbonate	NPN	0V dc	67570
VTBN6LQ		4-Pin Euro QD				
VTBN6RL	Red	2 m				
VTBN6RLQ		4-Pin Euro QD				
VTBN6BL	Blue	2 m				
VTBN6BLQ		4-Pin Euro QD				
VTBN6GRL	Green & Red	2 m				
VTBN6GRLQ		5-Pin Euro QD				
VTBP6	Green	2 m	Polysulfone	PNP	+10 to 30V dc	67570
VTBP6Q		4-Pin Euro QD				
VTBP6R	Red	2 m				
VTBP6RQ		4-Pin Euro QD				
VTBP6B	Blue	2 m				
VTBP6BQ		4-Pin Euro QD				
VTBP6GR	Green & Red	2 m				
VTBP6GRQ		5-Pin Euro QD				
VTBP6L	Green	2 m	Polycarbonate	PNP	+10 to 30V dc	67570
VTBP6LQ		4-Pin Euro QD				
VTBP6RL	Red	2 m				
VTBP6RLQ		4-Pin Euro QD				
VTBP6BL	Blue	2 m				
VTBP6BLQ		4-Pin Euro QD				
VTBP6GRL	Green & Red	2 m				
VTBP6GRLQ		5-Pin Euro QD				

* For 9 m cable, add W/30 to the 2 m model number (example, VTBN6 W/30). A model with a QD requires a mating cable (see pages 412 and 414).

VTB Specifications

See page 358.



STB Self-Checking, 10-30V dc

Models	Cable*	Upper Housing	Output Type	Data Sheet
STBVP6	2 m	Polysulfone	Complementary PNP Solid-state	64136
STBVP6Q	4-Pin Mini QD			
STBVP6Q5	4-Pin Euro QD			
STBVP6L	2 m	Polycarbonate		
STBVP6LQ	4-Pin Mini QD			
STBVP6LQ5	4-Pin Euro QD			

STB Self-Checking, 20-30V ac/dc



Models	Cable*	Upper Housing	Output Type	Data Sheet
STBVR81	2 m	Polysulfone	Two Independent and Complementary e/m Relays	64136
STBVR81Q	5-Pin Mini QD			
STBVR81Q6	5-Pin Euro QD			
STBVR81L	2 m	Polycarbonate		
STBVR81LQ	5-Pin Mini QD			
STBVR81LQ6	5-Pin Euro QD			


* For 9 m cable, add suffix **W30** to the 2 m model number (example, **STBVP6 W30**). A model with a QD requires a mating cable (see pages 412 and 420).

STB Specifications

Supply Voltage and Current	STBVP6 Models: 10 to 30V dc STBVR81 Models: 20 to 30V ac/dc
Supply Protection Circuitry	Protected against transient voltages and reverse polarity
Output Configuration	STBVP6 Models: Complementary PNP (sourcing) open collector transistors STBVR81 Models: Complementary electromechanical relay
Output Rating	STBVP6 Models (solid-state outputs): Max. load: 150 mA ON-state saturation voltage: $\leq 15V$ @ full load OFF-state leakage current: less than 1 μA STBVR81 Models (electromechanical relay): Max. voltage: 125V dc, 150V ac Max. switching current: 1A Max. resistive load power: 60 VA ac or 30 W dc Mechanical life of relay: 10^9 cycles Electrical life of relay: 1.5×10^5 cycles at 1 amp, 24 resistive
Output Protection	All models protected against false pulse on power-up. Models with solid-state outputs have overload and short-circuit protection.
Response Time	20 milliseconds ON/OFF
Indicators	2 Green LED indicators: Power: ON – power applied OFF – power off Output/fault: ON – button is activated OFF – button is deactivated Flashing – internal fault or blocked button on power-up detected
Construction	Totally encapsulated, non-metallic enclosure. Black polysulfone or red polycarbonate upper housing (see Application Notes, page 240); fiber-reinforced PBT polyester base. Electronics fully epoxy-encapsulated. Supplied with polypropylene (TP) field cover.
Environmental Rating	Meets NEMA standards 1, 3, 4, 4X, 12 and 13; IEC IP66




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STB Specifications (cont'd)	
Connections	PVC-jacketed 2 m cables standard on integral-cable kits; QD fitting, depending on model. Accessory QD mating cables required for QD models. QD cables are ordered separately. See pages 412 and 420. STBVP6 models: 4-wire (4-pin Mini-style QD, add suffix Q or 4-pin Euro-style QD, add suffix Q5) STBVR81 models: 5-wire (5-pin Mini-style QD, add suffix Q or 5-pin Euro-style QD, add suffix Q6) Integral 9 m cables are also available by adding suffix W/30 to the 2 m model number.
Ambient Light Immunity	Up to 100,000 lux
EMI/RFI Immunity	Immune to EMI and RFI noise sources per IEC 947-5-2
Operating Conditions	Temperature: 0° to +50° C Relative humidity: 90% @ +50° C (non-condensing)
Application Notes	Environmental considerations for models with polysulfone upper housings: The polysulfone upper housing will become brittle with prolonged exposure to outdoor sunlight. Window glass effectively filters ultraviolet light and provides excellent protection from sunlight. Avoid contact with strong alkalis. Clean periodically using mild soap solution and a soft cloth. Environmental considerations for models with polycarbonate upper housings: Avoid prolonged exposure to hot water and moist high-temperature environments above 66° C. Avoid contact with aromatic hydrocarbons (such as xylene and toluene), halogenated hydrocarbons and strong alkalis. Clean periodically using mild soap solution and a soft cloth.
Certifications	
Hookup Diagrams	STB Relay Models: UN01 (p. 528) STB Solid-state Models: DC03 (p. 520)

Optical Buttons Field Covers



Models	Description	Data Sheet
OTC-1-BK	Black cover	 28436
OTC-1-GN	Green cover	
OTC-1-RD	Red cover	
OTC-1-YW	Yellow cover	

Field covers are designed to prevent inadvertent activation of optical touch buttons due to objects (loose clothing, debris, etc.) which might accidentally block their sensing beams. Field covers are constructed of rugged polypropylene and are highly resistant to abrasion and to damage by most chemicals. OTBs are shipped with a black cover, STBs with a yellow cover and VTBs without a cover.



M-GAGE™

Vehicle Detection Sensors

- Detects metal objects, such as cars, trucks, motorcycles, bicycles and railcars, even when they aren't moving
- Features patented magnetoresistive-based passive sensing technology, for increased reliability
- Offers two housing designs: compact Flat-Pak Q7M for retrofits and 18 mm universal S18M for new installations
- Ideal for car wash entries and exits, fast food drive-ups, loading docks, vehicle counting, automatic overhead doors, gate actuation and turn lanes
- Easily installs above or below grade
- Features completely self-contained design with no external controller
- Replaces inductive loop sensors
- Allows PLC to be used instead of amplifiers and timer cards
- Provides reliable activation in unstable soil and substrates



SureCross™ M-GAGE sensor with integrated wireless connectivity and battery life up to 10 years (see page 338).

MORE INFO ONLINE
Detailed Dimensions



M-GAGE™ Sensors

- Two housing styles
- Easy remote programming
- Rugged ABS/polycarbonate or epoxy-encapsulated anodized aluminum, depending on model
- Dual indicator LEDs
- Integral TEACH button on S18M models
- 5-pin Euro-style QD cables with shield ordered separately (see page 415)
- Optional interface modules and power supplies for simplified setup, wiring and additional status indication (see page 449)

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S18M, 10-30V dc

Model	Sensor Type	Cable*	Range	Output Type**	Data Sheet
S18MB		2 m	Range varies, depending on application and target being sensed. See data sheet for more information.	Bipolar NPN/PNP	114430
S18MBQ		5-pin Euro QD			




Q7M, 10-30V dc

Model	Sensor Type	Cable*	Range	Output Type**	Data Sheet
Q7MB		2 m	Range varies, depending on application and target being sensed. See data sheet for more information.	Bipolar NPN/PNP	117172
Q7MBQ		5-pin Euro Pigtail QD			

* Other cable lengths are available—up to 60 m; consult factory for more information. A model with a QD connector requires a mating cable (see page 415).

** Consult factory for other output options.

M-GAGE™ S18M and Q7M Specifications

Supply Voltage	10 to 30V dc (10% max. ripple) at 43 mA, exclusive of load Above +50° C, supply voltage is 10 to 24V dc (10% max. ripple)
Sensing Technology	Passive 3-axis magnetoresistive transducer
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	Two solid-state outputs conduct when object is sensed; one NPN (current sinking) and one PNP (current sourcing)
Output Protection	Protected against short-circuit conditions
Output Ratings	100 mA max. (each output) NPN saturation: less than 200 mV @ 10 mA and less than 600 mV @100 mA; OFF-state leakage current: less than 200 µA PNP saturation: less than 1.2V @ 10 mA and less than 1.6V @100 mA; OFF-state leakage current: less than 5 µA
Output Response Time	20 milliseconds
Delay at Power-Up	0.5 seconds
Temperature Effect	Less than 0.5 milligauss/° C
Adjustments	Configuration of Background Condition and Sensitivity Level may be set using the sensor's push button (S18M models) or remotely via the portable programming box.
Indicators	Two indicators: Green: Power Indicator Red/Yellow: Configuration/Output Indicator
Remote TEACH Input	Impedance 12 KΩ (low = less than 2V dc)
Construction	S18M: Threaded Barrel: Thermoplastic polyester Push-Button Housing: ABS/PC Push Button: Santoprene Lightpipes: Acrylic Q7M: Housing: Anodized aluminum End Caps: Thermoplastic polyester
Operating Conditions	Temperature: -40° to +70° C Relative humidity: 100%
Connections	2 m or 9 m shielded 5-conductor (with drain) PVC jacketed attached cable, or 5-pin Euro-style quick-disconnect. QD cables are ordered separately. See page 415.
Environmental rating	Leak proof design is rated IEC IP67; NEMA 6P
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements method 201A (vibration: 10 to 60 Hz max., double amplitude 0.06", maximum acceleration 10G). Also meets IEC 947-5-2: 30G 11 ms duration, half sine wave.
Certifications	
Hookup Diagrams	MI12 (p. 534)

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L-GAGE®

Light Gauging Sensors

LT3 **page 244**

- Exceptionally accurate advanced time-of-flight sensing technology provides precise measurements over long ranges.
- Retroreflective mode sensor has 50 m range.
- Ranges with diffuse mode sensor are 5 m for white targets and 3 m for gray targets.
- Sensors offer either analog and discrete, or dual-discrete output, with independent window limits.



LT7 **page 248**

- Extremely long-range sensor uses a Class 1 laser beam for accuracy over long distances.
- Retroreflective mode sensor has 250 m range.
- Ranges with diffuse mode sensor are up to 10 m for white, 7 m for gray and 3 m for black targets.
- Models are available with discrete output only or with discrete and analog output.
- RS-422 or SSI compatible serial connections are provided.



LG **page 252**

- One-piece laser gauging system requires no separate controller.
- Ultra narrow beam delivers precise distance, height and thickness measurement and gauging.
- Two sensing ranges are available: 45 to 60 mm and 75 to 125 mm.



Q50 **page 256**

- LED sensor delivers laser-like performance in a compact, low-cost package.
- Models are available to gauge distances either from 100 to 400 mm or 50 to 200 mm, with analog or discrete output.
- Features include high resolution and a fast, selectable response time.

LIGHT GAUGING

ULTRASONIC

MEASURING LIGHT SCREENS

TEMPERATURE

RADAR

L-GAGE® LT3

Laser Distance-Gauging Sensors

Advanced time-of-flight technology at less cost
 The L-GAGE® LT3 sensor uses "time-of-flight" technology for precise, long-distance gauging at the speed of light. The microprocessor-controlled laser distance-gauging sensor features a unique design for exceptional accuracy and range at a much lower cost than competitive laser-gauging devices. Precise performance and low price make the LT3 an ideal solution for a variety of precision inspection applications.

- Available in accurate diffuse-mode models with ranges to 5 m and retroreflective models with a 50 m range
- Emits one million pulses per second
- Reliably detects angled targets

Analog & discrete outputs, or dual-discrete models

The LT3 can include both a discrete (switched) output and an analog output in the same unit, with independently programmable window limits. For added flexibility, the analog output is available in a choice of 4 to 20 mA or 0 to 10V dc. You can also choose models with two independent discrete outputs, selectable PNP (sourcing) or NPN (sinking).

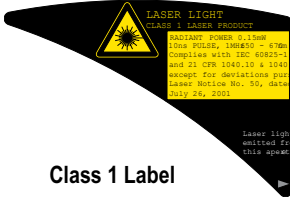
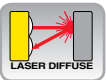


Compact, self-contained design

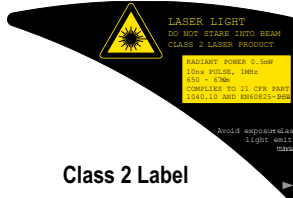
- The LT3's design conserves production space and decreases setup time.
- The self-contained system measures just 68.5 by 35.3 by 87.0 mm, to fit and function in tighter spaces than competitive systems.

Simple 3-step programming

Programming the LT3 takes just three short steps, which are conveniently printed on the side of the sensor. In addition, push-button TEACH-mode programming sets custom sensing windows. And remote programming offers added security and convenience.

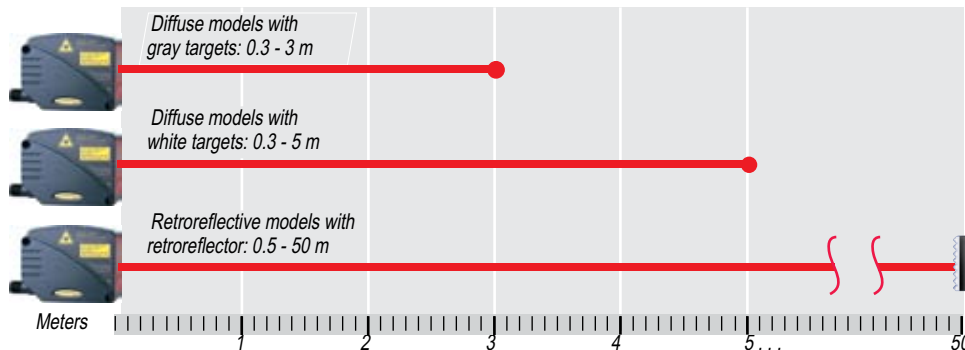


Class 1 Label



Class 2 Label

LT3 Sensing Ranges



L-GAGE® LT3 Sensors

- Programmable output response for three speeds using simple push-button TEACH
- Bright, visible laser spot to simplify alignment
- Analog outputs in a choice of 0 to 10V dc or 4 to 20 mA sourcing
- Rugged construction to withstand demanding sensing environments; rated IEC IP67, NEMA 6
- 2 m or 9 m attached cable, or 8-pin Euro-style quick-disconnect
- 8-pin Euro-style QD cables with shield ordered separately (see page 416)



L-GAGE® LT3, 12-24V dc

Models	Sensing Mode/LED*	Laser Class	Sensing Distance	Cable**	Discrete Output	Analog Output	Data Sheet	
LT3BD	 LASER DIFFUSE	Class 2	0.3 to 5 m for 90% reflectivity white card (see Performance Curve RRC-1 on page 510 for more information)	2 m	Dual NPN or PNP Selectable	None	68503	
LT3BDQ				8-pin Euro QD				
LT3PU				2 m	PNP	0 to 10V dc	65742	
LT3PUQ				8-pin Euro QD				
LT3NU				2 m	NPN	0 to 10V dc		
LT3NUQ				8-pin Euro QD				
LT3PI				2 m	PNP	4 to 20 mA		
LT3PIQ				8-pin Euro QD				
LT3NI				2 m	NPN	4 to 20 mA		
LT3NIQ				8-pin Euro QD				
LT3BDLV	 LASER RETRO	Class 1	0.5 to 50 m† (see Performance Curve RRC-2 on page 510 for more information)	2 m	Dual NPN or PNP Selectable	None		68503
LT3BDLVQ				8-pin Euro QD				
LT3PULV				2 m	PNP	0 to 10V dc	68504	
LT3PULVQ				8-pin Euro QD				
LT3NULV				2 m	NPN	0 to 10V dc		
LT3NULVQ				8-pin Euro QD				
LT3PILV				2 m	PNP	4 to 20 mA		
LT3PILVQ				8-pin Euro QD				
LT3NILV				2 m	NPN	4 to 20 mA		
LT3NILVQ				8-pin Euro QD				

* Visible Red Laser

** For 9 m cable, add suffix **W30** to the 2 m model number (example, **LT3BD W30**). A model with a QD requires a mating cable (see page 416).




† Retroreflective range specified using included model BRT-TVHG-8X10P high-grade target.



L-GAGE® LT3 Specifications			
Sensing Beam	<p>Typical beam dia: 6 mm @ 3 m</p> <p>Typical laser lifetime: 75,000 hours</p> <p>Diffuse: 658 nm visible red IEC and CDRH Class 2 laser; 0.5 mW max. radiant output power</p> <p>Retroreflective: 658 nm visible red IEC and CDRH Class 1 laser, 0.15 mW max. radiant output power</p>		
Sensing Range	<table border="1" style="width: 100%;"> <tr> <td style="width: 50%;">Diffuse: 90% white card: 0.3 to 5 m 18% gray card: 0.3 to 3 m 6% black card: 0.3 to 2 m</td> <td style="width: 50%;">Retroreflective: 0.5 to 50 m (using supplied target)</td> </tr> </table>	Diffuse: 90% white card: 0.3 to 5 m 18% gray card: 0.3 to 3 m 6% black card: 0.3 to 2 m	Retroreflective: 0.5 to 50 m (using supplied target)
Diffuse: 90% white card: 0.3 to 5 m 18% gray card: 0.3 to 3 m 6% black card: 0.3 to 2 m	Retroreflective: 0.5 to 50 m (using supplied target)		
Supply Voltage and Current	12 to 24V dc (10% max. ripple); 108 mA max. @ 24V dc or [2600/V dc] mA		
Supply Protection Circuitry	Protected against reverse polarity and transient voltages		
Delay at Power-up	1 second; outputs do not conduct during this time		
Output Rating	<p>Discrete (switched) output: 100 mA max.</p> <p>OFF-state leakage current: less than 5 µA</p> <p>Output saturation NPN: less than 200 mV @ 10 mA; less than 600 mV @ 100 mA</p> <p>Output saturation PNP: less than 1.2V at 10 mA; less than 1.6V at 100 mA</p> <p>Analog voltage output: 2.5 kΩ min. load impedance (voltage sourcing)</p> <p>Analog current output: 1 kΩ max. @ 24V; max. load resistance = $[V_{cc}-4.5/0.02 \Omega]$ (current sourcing)</p>		
Output Configuration	<p>Discrete (switched): Solid-state switch; NPN (current sinking) or PNP (current sourcing), depending on model. Dual-discrete models feature selectable NPN or PNP, depending on wiring hookup.</p> <p>Analog output: 0 to 10V dc or 4 to 20 mA</p>		
Output Protection	Protected against short circuit conditions		
Output Response Time	<p>Discrete output</p> <p>Fast: 1 millisecond ON/OFF Medium: 10 milliseconds ON/OFF Slow: 100 milliseconds ON/OFF</p> <p>Diffuse Analog Voltage output (-3 dB)</p> <p>Fast: 450 Hz (1 millisecond average/1 millisecond update rate)</p> <p>Medium: 45 Hz (10 milliseconds average/2 milliseconds update rate)</p> <p>Slow: 4.5 Hz (100 milliseconds average/4 milliseconds update rate)</p> <p>Retroreflective Analog Voltage output (-3 dB)</p> <p>Fast: 114 Hz (6 milliseconds average/ 1 millisecond update rate)</p> <p>Medium: 10 Hz (48 milliseconds average/ 1 millisecond update rate)</p> <p>Slow: 2.5 Hz (192 milliseconds average/ 1 millisecond update rate)</p>		
Resolution/Repeatability	See charts RRC-1 and RRC-2 on page 510.		
Color Sensitivity (typical)	Diffuse: 90% white to 18% gray: less than 10 mm; 90% white to 6% black: less than 20 mm. See chart CSC-1 on page 511.		
Analog Linearity	<p>Retroreflective: ± 60 mm from 0.5 to 50 m (0.12% of full scale) (Specified @ 24V dc, 22° C using supplied BRT-TVHG-8X10P retroreflector)</p> <p>Diffuse: ± 30 mm from 0.3 to 1.5 m; ± 20 mm from 1.5 to 5 m (Specified @ 24V dc, 22° C using a 90% reflectance white card)</p>		
Discrete Output Hysteresis	<table border="1" style="width: 100%;"> <tr> <td style="width: 50%;">Diffuse Fast: 10 mm Medium: 5 mm Slow: 3 mm</td> <td style="width: 50%;">Retroreflective Fast: 20 mm Medium: 10 mm Slow: 6 mm</td> </tr> </table>	Diffuse Fast: 10 mm Medium: 5 mm Slow: 3 mm	Retroreflective Fast: 20 mm Medium: 10 mm Slow: 6 mm
Diffuse Fast: 10 mm Medium: 5 mm Slow: 3 mm	Retroreflective Fast: 20 mm Medium: 10 mm Slow: 6 mm		
Temperature Effect	<table border="1" style="width: 100%;"> <tr> <td style="width: 50%;">Diffuse: less than 2 mm/ ° C</td> <td style="width: 50%;">Retroreflective: less than 3 mm/° C</td> </tr> </table>	Diffuse: less than 2 mm/ ° C	Retroreflective: less than 3 mm/° C
Diffuse: less than 2 mm/ ° C	Retroreflective: less than 3 mm/° C		
Minimum Window Size	<table border="1" style="width: 100%;"> <tr> <td style="width: 50%;">Diffuse: 20 mm</td> <td style="width: 50%;">Retroreflective: 40 mm</td> </tr> </table>	Diffuse: 20 mm	Retroreflective: 40 mm
Diffuse: 20 mm	Retroreflective: 40 mm		
Remote TEACH Input	18 kΩ min. (65 kΩ at 5V dc)		
Remote TEACH	<p>To teach: Connect yellow wire to +5 to 24V dc</p> <p>To disable: Connect yellow wire to 0 to +2V dc (or open connection)</p>		
Adjustments	<p>Response speed: Push button toggles between fast, medium and slow (see Output Response Time)</p> <p>Window limits (analog or discrete): TEACH-mode programming of near and far window limits. Limits may also be taught remotely using TEACH input.</p> <p>Analog output slope: The first limit taught is assigned to minimum output current or voltage (4 mA or 0V dc)</p>		



L-GAGE® LT3 Specifications (cont'd)

Laser Control	Connect red wire to +5 to 24V dc to enable laser beam; connect to 0 to +1.8V dc (or open connection) to disable; when sensor is powered laser enable time is 100 millisecond delay on enable, when sensor is powered.
Indicators	Green Power ON LED: Indicates when power is ON, overloaded output and laser status Yellow Output LED: Indicates when discrete load output is conducting Red Signal LED: Indicates target is within sensing range and the condition of the received light signal Yellow Speed LED: Indicates the response speed setting Red/Yellow TEACH LEDs: In programming mode; indicate active output(s)
Construction	Housing: ABS/polycarbonate blend Window: Acrylic Quick-disconnect: ABS/polycarbonate blend
Environmental Rating	IP67; NEMA 6
Connections	2 m or 9 m shielded 7-conductor (with drain) PVC-jacketed attached cable, or 8-pin Euro-style quick-disconnect. QD cables are ordered separately. See page 416.
Operating Conditions	Temperature: 0° to +50° C Relative humidity: 90% at 50° C (non-condensing)
Application Notes	<ul style="list-style-type: none"> • For best accuracy, allow 30-minute warm-up before programming or operating • Retroreflective performance specifications are based on use with supplied BRT-TVHG-8X10P high-grade target. Results may vary with other retroreflective target materials.
Certifications	  
Hookup Diagrams	Discrete/Analog Models: NPN: MI01 (p. 532) PNP: MI02 (p. 532) Dual-Discrete Models: NPN: MI03 (p. 532) PNP: MI04 (p. 532)

LIGHT
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TEMPERATURE

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L-GAGE® LT7

Highly Accurate Time-of-Flight Laser Gauging Sensors

- Available in extremely long-range retroreflective models with ranges to 250 m or in diffuse models with ranges to 10 m
- Features TEACH-mode programming, using either integrated push buttons or a serial interface
- Provides ongoing LCD display of sensing distance in millimeters or hundredths of an inch
- Delivers excellent ± 10 mm linearity
- Offers choice of RS-422 or SSI-compatible serial connection
- Uses visible Class 2 alignment laser for accurate alignment
- Provides quick warmup to minimize drift



Discrete outputs or analog and discrete models

- Diffuse models provide 2 discrete outputs (PNP) and one 4 to 20 mA output for long-range precision background suppression up to 10 m.
- Retroreflective models offer two discrete outputs (PNP) for extremely long-range sensing.
- All models offer two alarm outputs with ongoing LCD display for easy troubleshooting.

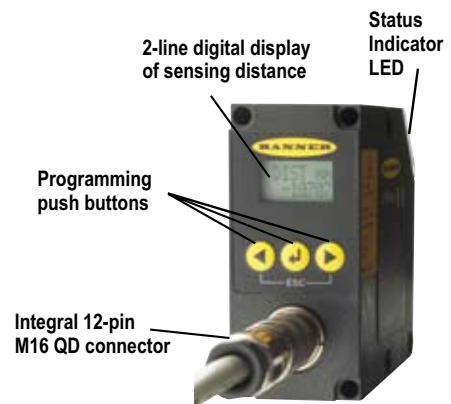
Retroreflective models

- Ideal for long-range automated storage and retrieval applications
- Features ± 2 mm resolution

Diffuse models

- Features dark-color performance, ideal for automotive applications
- Offers ± 4 mm resolution

LASER RETRO
LASER DIFFUSE
BRACKETS PAGE 372
QD CABLES 12-Pin M16 PAGE 418
REFLECTORS PAGE 425

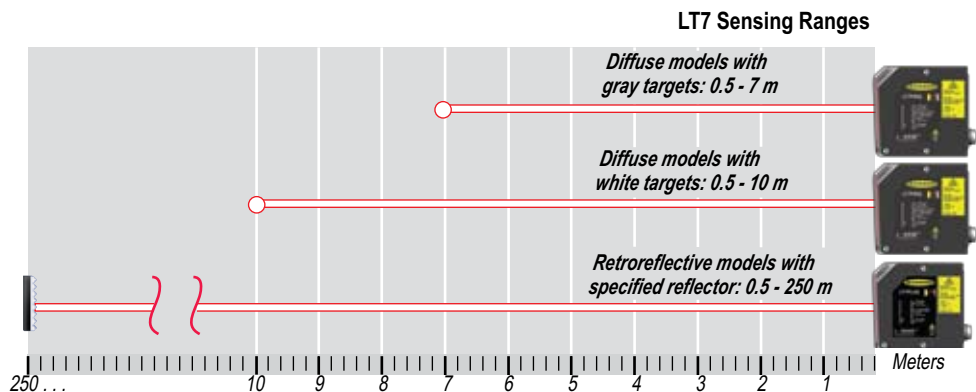


Operating Mode
Laser Class 1

Setup Mode
Laser Class 2
Do not stare into beam

λ : 650nm
 t_r : 0,3 μ s; T: 1 μ s
 P_{max} : 3mW

EN 60825-1. 03/97.



L-GAGE® LT7 Sensors

- Status Indicator LEDs
- 2-line digital display
- Programming push buttons
- Integral 12-pin M16 QD connector
- Class 1 sensing laser and Class 2 visible alignment laser
- 2 PNP Alarm Outputs
- RS-422 or SSI-compatible serial connection



L-GAGE® LT7, 18-30V dc



Models	Sensing Mode/LED*	Laser Class	Sensing Distance***	Cable**	Discrete Output	Analog Output	Serial	Data Sheet
LT7PLVQ	 LASER RETRO	Class 1 Sensing Laser (Class 2 Alignment Laser)	0.5 to 250 m	12-pin M16 QD	2 PNP	—	RS-422 or SSI	120244
LT7PIDQ	 LASER DIFFUSE		0.5 to 10 m			4-20 mA		

* Infrared Laser
 ** A model with a QD requires a mating cable (see page 418).
 *** Diffuse-mode range specified using a 90% reflectance white card.
 Retroreflective-mode range specified using a BRT-250, BRT-540 or BRT-700 retroreflective target (see page 429).

LIGHT GAUGING
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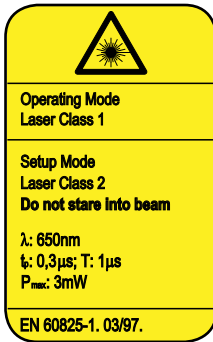


L-GAGE® LT7 Specifications

Sensing Range	LT7PLVQ: 0.5 to 250 m (using specified reflector) LT7PIDQ: 6% Black card: 0.5 to 3 m 18% Gray card: 0.5 to 7 m 90% White card: 0.5 to 10 m																			
Supply Voltage and Current	18 to 30V dc (10% max. ripple)																			
Power Consumption	Less than 4.5 W @ 25° C																			
Measuring Laser	Infrared, 900 nm, Class 1																			
Laser Control	Measurement laser is ON when sensor is ON. Pilot (visible) laser enabled during Programming mode; alternates with measurement laser.																			
Spot Size	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th style="text-align: center;">Distance</th> <th style="text-align: center;">Spot Size</th> </tr> </thead> <tbody> <tr> <td rowspan="4">LT7PLVQ:</td> <td style="text-align: center;">10 m</td> <td style="text-align: center;">ø 20 mm</td> </tr> <tr> <td style="text-align: center;">50 m</td> <td style="text-align: center;">ø 100 mm</td> </tr> <tr> <td style="text-align: center;">100 m</td> <td style="text-align: center;">ø 200 mm</td> </tr> <tr> <td style="text-align: center;">250 m</td> <td style="text-align: center;">ø 500 mm</td> </tr> <tr> <td rowspan="3">LT7PIDQ:</td> <td style="text-align: center;">4 m</td> <td style="text-align: center;">3 x 10 mm</td> </tr> <tr> <td style="text-align: center;">6 m</td> <td style="text-align: center;">4 x 12 mm</td> </tr> <tr> <td style="text-align: center;">10 m</td> <td style="text-align: center;">10 x 20 mm</td> </tr> </tbody> </table>		Distance	Spot Size	LT7PLVQ:	10 m	ø 20 mm	50 m	ø 100 mm	100 m	ø 200 mm	250 m	ø 500 mm	LT7PIDQ:	4 m	3 x 10 mm	6 m	4 x 12 mm	10 m	10 x 20 mm
	Distance	Spot Size																		
LT7PLVQ:	10 m	ø 20 mm																		
	50 m	ø 100 mm																		
	100 m	ø 200 mm																		
	250 m	ø 500 mm																		
LT7PIDQ:	4 m	3 x 10 mm																		
	6 m	4 x 12 mm																		
	10 m	10 x 20 mm																		
Pilot Laser (Alignment)	Visible red, 650 nm, Class 2																			
Discrete & Analog Output Protection	Protected against continuous overload and short circuit																			
Discrete Outputs	(2) 100 mA, PNP																			
Discrete Switch Points	Adjustable in 1 mm steps																			
Discrete Output Hysteresis	Adjustable, 10 mm min.																			
Alarm Outputs	50 mA, PNP (NO)																			
Analog Output	LT7PLVQ: None LT7PIDQ: 4-20 mA																			
Maximum Cable Length	100 m																			
Output Response Time	12 milliseconds																			
Linearity	±10 mm																			
Resolution/Repeatability	LT7PLVQ: ±2 mm LT7PIDQ: ±4 mm																			
Color Sensitivity	LT7PLVQ: Not Applicable LT7PIDQ: Contact Factory																			
Temperature Effect	Less than ± 5 mm over the total sensing range																			
Minimum Analog Window Size	LT7PLVQ: Not Applicable LT7PIDQ: 300 mm																			
Adjustments	Push-button-directed password enable/disable, measurement unit select, offset value select, output limits set, output mode select, analog output slope select (diffuse models only) and output limit manual adjust. See data sheet for information.																			
Serial Interface	RS-422 or SSI compatible																			
Serial Measurement Speed	SSI: 1.4 milliseconds (SSI cycle 80 microseconds) RS-422: 2.9 milliseconds @ 57.6 kBaud																			



L-GAGE® LT7 Specifications (cont'd)	
Indicators	4 LEDs: Green: Power ON/OFF Red: Alarm (Error) LED Orange: Output 1 and Output 2 conducting LEDs 2-line digital LCD display. See data sheet for more information.
Construction	ABS shock-resistant housing; PMMA window; polycarbonate displays
Weight	Approximately 230 g
Environmental Rating	IEC IP67
Connections	12-pin M16 connector; 100 m max. cable length; use only cables listed on page 418.
Operating Conditions	Temperature: -10° to +50° C in continuous operation
Storage Temperature	-30° to +75° C
Vibration/Shock	EN 60947-5-2
Application Notes	<ul style="list-style-type: none"> • All specifications are based on the specified surface at constant ambient conditions and following a minimum operating time of 15 minutes. • For best accuracy, allow a 15-minute warmup before programming or operating • Crosstalk avoidance: Light spots must be separated by at least 200 mm.
Certifications	CE
Hookup Diagrams	MI05 (p. 533)



Class 1 (Infrared Sensing Laser)

Lasers that are safe under reasonably foreseeable conditions of operation, including the use of optical instruments for intrabeam viewing. Reference 60825-1 Amend. 2 © IEC:2001(E), section 8.2.

Class 2 (Visible Alignment Laser)

Lasers that emit visible radiation in the wavelength range from 400 to 700 nm where eye protection is normally afforded by aversion responses, including the blink reflex. This reaction may be expected to provide adequate protection under reasonably foreseeable conditions of operation, including the use of optical instruments for intrabeam viewing. Reference 60825-1 Amend. 2 © IEC:2001(E), section 8.2.

L-GAGE® LG

Short-range Laser Sensors

Extremely compact, self-contained design

The Banner L-GAGE® LG Series replaces large, two-piece laser gauging sensors with a completely self-contained, compact housing measuring only 55 x 82 x 20 mm.

- Features a one-piece design to conserve production space
- Wires easily, decreasing setup time
- Provides a highly accurate solution at a much lower cost
- Does not touch parts it measures, so can be used with moving processes, hot parts and sticky parts

Ultra-precise & flexible, with analog & discrete outputs

Advanced digital signal processing algorithms make the LG Series Class 2 modulated visible laser gauging sensor a powerhouse of performance for a wide range of measurement applications.

- Features an outstanding maximum resolution of 3 µm for flat white targets
- Uses an ultra-narrow beam for applications requiring precise measurement of distance, height or thickness as well as gauging applications
- Lets you pick the exact range you need with the push of a button
- Houses discrete (switched) and analog outputs in the same unit, each independently programmable



LIGHT GAUGING

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MEASURING LIGHT SCREENS

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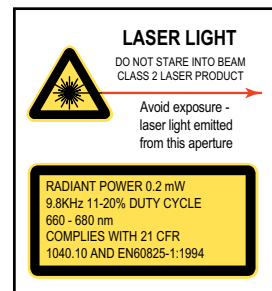
RADAR



Push-button setup for custom-sized sensing windows

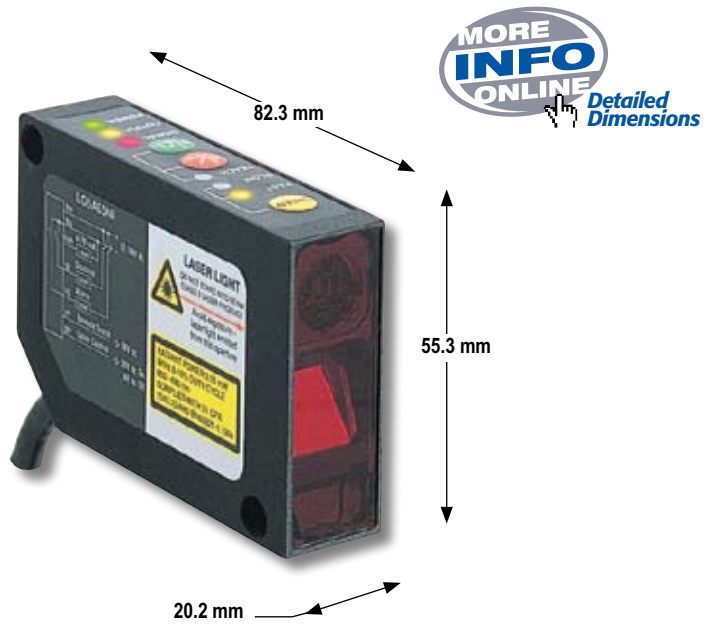
Unlike older, inflexible, fixed-range technology, Banner's TEACH-mode programming lets you set your own custom-sized sensing windows anywhere within the measuring range, using just one push button.

- Available ranges of 45 to 60 mm and 75 to 125 mm
- Can be programmed for analog output, discrete output or both simultaneously with independently controlled sensing window limits



L-GAGE® LG Sensors

- Choice of NPN or PNP discrete output and either voltage or current analog output
- Push-button setup or remote configuration
- LED indicators and output programming push buttons
- 2 m or 9 m attached cable, or 8-pin Euro-style quick-disconnect
- 8-pin Euro-style QD cables with shield ordered separately (see page 416)



L-GAGE® LG5, 12-30V dc



Models	Sensing Beam/LED*	Laser Class	Sensing Distance	Beam Size	Cable**	Discrete Output	Analog Output	Data Sheet	
LG5A65PU		Class 2	45-60 mm	At 53 mm: 0.4 mm x 0.6 mm Focus 70 mm	2 m	PNP	0-10V dc	59786	
LG5A65PUQ					8-pin Euro Pigtail QD				4-20 mA
LG5A65PI					2 m		NPN		
LG5A65PIQ					8-pin Euro Pigtail QD				4-20 mA
LG5A65NU					2 m	NPN	0-10V dc		
LG5A65NUQ					8-pin Euro Pigtail QD				4-20 mA
LG5A65NI					2 m		NPN		
LG5A65NIQ					8-pin Euro Pigtail QD				4-20 mA
LG5B65PU		Class 2	45-60 mm	At 53 mm: 0.1 mm Focus 53 mm	2 m	PNP		0-10V dc	
LG5B65PUQ					8-pin Euro Pigtail QD				4-20 mA
LG5B65PI					2 m		NPN	0-10V dc	
LG5B65PIQ					8-pin Euro Pigtail QD				4-20 mA
LG5B65NU					2 m	NPN	0-10V dc		
LG5B65NUQ					8-pin Euro Pigtail QD			4-20 mA	
LG5B65NI					2 m		NPN		0-10V dc
LG5B65NIQ					8-pin Euro Pigtail QD			4-20 mA	

* Visible Red Laser

** For 9 m cable, add suffix **W30** to the 2 m model number (example, **LG5A65PU W30**). A model with a QD requires a mating cable (see page 416).

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L-GAGE® LG10, 12-30V dc


Models	Sensing Beam/LED*	Laser Class	Sensing Distance	Beam Size	Cable**	Discrete Output	Analog Output	Data Sheet	
LG10A65PU	<p>LASER DIFFUSE</p>	Class 2	75-125 mm	At 125 mm: 0.6 mm x 0.8 mm Focus 180 mm	2 m	PNP	0-10V dc	59786	
LG10A65PUQ					8-pin Euro Pigtail QD				4-20 mA
LG10A65PI					2 m		NPN		
LG10A65PIQ					8-pin Euro Pigtail QD				4-20 mA
LG10A65NU					2 m	NPN	0-10V dc		
LG10A65NUQ					8-pin Euro Pigtail QD				4-20 mA
LG10A65NI					2 m		NPN		
LG10A65NIQ					8-pin Euro Pigtail QD				4-20 mA

* Visible Red Laser

** For 9 m cable, add suffix **W30** to the 2 m model number (example, **LG10A65PU W30**). A model with a QD requires a mating cable (see page 416).

L-GAGE® LG5 and LG10 Specifications	
Sensing Beam	650 nm visible Red IEC and CDRH Class 2 laser; 0.20 mW max. radiant output power
Supply Voltage and Current	12 to 30V dc (10% max. ripple); 50 mA max @ 24V dc (exclusive of load)
Supply Protection Circuitry	Protected against reverse polarity and transient overvoltages
Delay at Power-up	1.25 second
Output Rating	Discrete (switched) and Alarm outputs: 100 mA max. OFF-state leakage current: less than 5 µA Output saturation voltage PNP outputs: less than 1.2V at 10 mA and less than 1.6V at 100 mA NPN outputs: less than 200 mV at 10 mA and less than 600 mV at 100 mA Analog Current output: 1 kΩ max @ 24V dc, max load resistance = [(Vcc - 4.5)/0.02]Ω (current sourcing) Analog Voltage output: 2.5 kΩ min. load impedance (voltage sourcing)
Output Configuration	Discrete (switched) & alarm outputs: Solid-state switch; choose NPN (current sinking) or PNP (current sourcing) models Analog output: 4 to 20 mA (current sourcing), 0 to 10V dc (voltage sourcing)
Output Protection	Discrete and alarm outputs are protected against continuous overload and short circuit
Output Response Time	Discrete Outputs (ON/OFF) Fast: 2.0 milliseconds Medium: 10 milliseconds Slow: 100 milliseconds Analog Output (-3dB) Fast: 450 Hz (1 millisecond average/1 millisecond update rate) Medium: 45 Hz (10 millisecond average/2 millisecond update rate) Slow: 4.5 Hz (100 millisecond average/5 millisecond update rate)
Analog Resolution and Repeatability of Discrete Trip Point	LG5: Fast: Less than 40 µm @ 50 mm Medium: Less than 12 µm @ 50 mm Slow: Less than 3 µm @ 50 mm See chart RRC-3 on page 510 LG10: Fast: Less than 150 µm @ 100 mm Medium: Less than 50 µm @ 100 mm Slow: Less than 10 µm @ 100 mm See chart RRC-4 on page 510
Analog Linearity* *Resolution and linearity specified @ 24V dc, 22° C, using a white ceramic test surface (see Application Notes)	LG5: +/- 60 µm over 45 to 60 mm sensing window +/- 10 µm over 49 to 51 mm sensing window LG10: +/- 200 µm over 75 to 125 mm sensing window +/- 20 µm over 95 to 100 mm sensing window



L-GAGE® LG5 and LG10 Specifications (cont'd)	
Minimum Window Size (Analog or Discrete)	LG5: 1.5 mm LG10: 5 mm
Discrete Output Hysteresis	LG5: Less than 0.2 mm LG10: Less than 1.0 mm
Color Sensitivity (typical)	LG5: Less than 75 µm for white to dark gray ceramic target LG10: Less than 100 µm for white to dark gray ceramic target
Temperature Effect	LG5: +/- 7 µm/° C LG10: +/- 25 µm/° C
Remote TEACH and Laser Control Input Impedance	18 kΩ min. (65 kΩ min. at 5V dc)
Remote TEACH	To teach: Connect yellow wire to +5 to 30V dc To disable: Connect yellow wire to 0 to +2V dc (or open connection)
Adjustments	Response speed: Push button toggles between Slow, Medium, and Fast (see Output Response Time) Window limits (analog or discrete): TEACH-mode programming of near and far window limits. Limits may also be taught remotely using TEACH wire. Analog output slope: The first limit taught is assigned to the minimum analog output (0V dc or 4 mA).
Laser Control	To enable laser: Connect green wire to +5 to 30V dc To disable laser: Connect green wire to 0 to +2V dc (or open connection) 250 millisecond delay upon enable/disable
Indicators	Green Power ON LED: Indicates when power is ON, overloaded output and laser status. Yellow Output LED: Indicates when discrete load output is conducting. Red Signal LED: Indicates when target is within sensing range and the condition of the received light signal. Tri-color Red/Green/Yellow TEACH LED: Indicates sensor is ready for programming each limit (indicates Red for analog output, Green for discrete, and Yellow for simultaneous analog and discrete.) Yellow Fast/Slow LEDs: Combination of 2 lights ON or OFF indicates 1 of 3 response speeds
Construction	Housing: Zinc alloy die-cast, plated and painted finish Cover plate: aluminum with painted finish Lens: acrylic
Environmental Rating	IP67; NEMA 6
Connections	2 m or 9 m 7-conductor shielded PVC-jacketed attached cable, or 150 mm 8-pin Euro-style pigtail quick-disconnect. Mating QD cables are purchased separately. See page 416.
Operating Conditions	Temperature: -10° to +50° C Relative humidity: 90% at 50° C (non-condensing)
Vibration and Mechanical Shock	Vibration: 60 Hz, 30 minutes, 3 axes Shock: 30G for 11 milliseconds, half sine wave, 3 axes
Application Notes	For comparison, a white ceramic test surface has approximately 91% of the reflectivity of a white Kodak test card with a matte finish. A dark gray ceramic test surface has approximately 11% of the reflectivity of a white Kodak test card with a matte finish. (Allow 15-minute warm-up for maximum linearity.)
Certifications	
Hookup Diagrams	NPN Models: MI06 (p. 533) PNP Models: MI07 (p. 533)

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L-GAGE® Q50

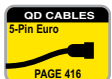
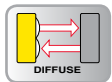
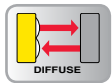
Low-cost LED-based Distance Measurement Sensors

A low-cost alternative to laser measurement sensors

The compact, self-contained L-GAGE® Q50 triangulation sensor combines laser-like performance with LED safety and economy. The Q50 features analog outputs with programmable sensing window limits, and a unique tightly collimated emitter that enables it to operate in tight spaces or on small targets. The Q50 is an appealing laser alternative for many applications, including dry-bulk level measurement, package filling, roll-diameter measurement, loop control and dimensional measurement.

Patented scalable analog output

- Automatically scales the analog output over the width of the programmed sensing window
- Streamlines setup and maximizes resolution in electrically noisy environments
- Offers 4 to 20 mA (current sourcing) or 0 to 10V (voltage sourcing) output configurations
- Available with discrete output



Reliable sensing for varied targets

- 50 to 300 mm range visible red beam models
- 50 to 400 mm range infrared beam models
- Sensor linearity less than 1 percent of full scale

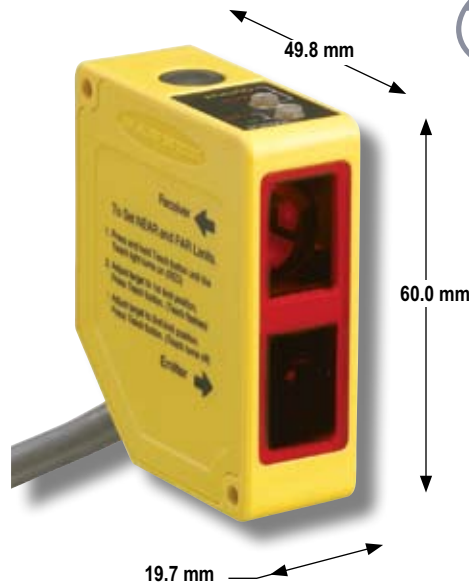


Programmable features

- Offers TEACH programming and remote programming
- Requires no potentiometer adjustments
- Offers choice of positive or negative analog output slope
- Allows choice of output response speed from 4 to 64 milliseconds
- Provides remote location programming for maximum security and convenience

L-GAGE® Q50 Sensors

- Simple push-button TEACH programming
- Range indicator LED
- High resolution of less than 1 mm
- Fast response, to 4 milliseconds
- 2 m or 9 m attached cable, or swivel 5-pin Euro-style quick-disconnect
- 5-pin Euro-style QD cables with shield, ordered separately (see page 416)



L-GAGE® Q50 Discrete Output, 12-30V dc



Models	Sensing Beam/LED*	Range	Cable**	Output Type	Response Time	Data Sheet
Q50AVN	 DIFFUSE	50-150 mm	2 m	NPN	48 ms	67417
Q50AVNQ			5-pin Euro QD		4 ms	
Q50AVNY			2 m			
Q50AVNYQ			5-pin Euro QD			
Q50AVP			2 m	PNP	48 ms	
Q50AVPQ			5-pin Euro QD		4 ms	
Q50AVPY			2 m			
Q50AVPYQ			5-pin Euro QD			
Q50AN	 DIFFUSE	50-200 mm	2 m	NPN	48 ms	67417
Q50ANQ			5-pin Euro QD		4 ms	
Q50ANY			2 m			
Q50ANYQ			5-pin Euro QD			
Q50AP			2 m	PNP	48 ms	
Q50APQ			5-pin Euro QD		4 ms	
Q50APY			2 m			
Q50APYQ			5-pin Euro QD			

* Infrared LED Visible Red LED

** For 9 m cable, add suffix **W/30** to the 2 m model number (example, **Q50AVN W/30**). A model with a QD requires a mating cable (see page 416).

More on next page

LIGHT GAUGING

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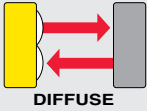
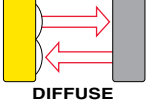
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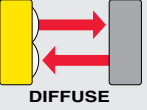
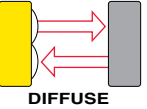
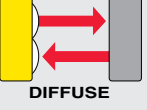
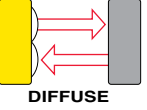


L-GAGE® Q50 Discrete Output, 12-30V dc (cont'd)

Models	Sensing Beam/LED*	Range	Cable**	Output Type	Response Time	Data Sheet
Q50BVN	 DIFFUSE	100-300 mm	2 m	NPN	48 ms	65741
Q50BVNQ			5-pin Euro QD			
Q50BVNY			2 m			
Q50BVNYQ			5-pin Euro QD			
Q50BVP			2 m	PNP	48 ms	
Q50BVPQ			5-pin Euro QD			
Q50BVPY			2 m		4 ms	
Q50BVPYQ			5-pin Euro QD			
Q50BN	 DIFFUSE	100-400 mm	2 m	NPN	48 ms	65741
Q50BNQ			5-pin Euro QD			
Q50BNY			2 m		4 ms	
Q50BNYQ			5-pin Euro QD			
Q50BP			2 m	PNP	48 ms	
Q50BPQ			5-pin Euro QD			
Q50BPY			2 m		4 ms	
Q50BPYQ			5-pin Euro QD			

L-GAGE® Q50 Analog Output, 15-30V dc




Models	Sensing Beam/LED*	Range	Cable**	Output Type	Response Time	Data Sheet	
Q50AVI	 DIFFUSE	50-150 mm	2 m	4 to 20 mA	4 ms or 64 ms selectable	67416	
Q50AVIQ			5-pin Euro QD				
Q50AVU			2 m	0 to 10V			
Q50AVUQ			5-pin Euro QD				
Q50AI	 DIFFUSE	50-200 mm	2 m	4 to 20 mA		4 ms or 64 ms selectable	67416
Q50AIQ			5-pin Euro QD				
Q50AU			2 m	0 to 10V			
Q50AUQ			5-pin Euro QD				
Q50BVI	 DIFFUSE	100-300 mm	2 m	4 to 20 mA	4 ms or 64 ms selectable		64323
Q50BVIQ			5-pin Euro QD				
Q50BVU			2 m	0 to 10V			
Q50BVUQ			5-pin Euro QD				
Q50BI	 DIFFUSE	100-400 mm	2 m	4 to 20 mA		4 ms or 64 ms selectable	64323
Q50BIQ			5-pin Euro QD				
Q50BU			2 m	0 to 10V			
Q50BUQ			5-pin Euro QD				

*  Infrared LED  Visible Red LED

** For 9 m cable, add suffix **W/30** to the 2 m model number (example, **Q50BVN W/30**). A model with a QD requires a mating cable (see page 416).

L-GAGE® Q50 Discrete Output Specifications

Sensing Beam	Wavelength: Q50..V: 685 nm (typical) Q50..: 880 nm (typical) Beam Size: Q50..V: 20 mm dia. (max.) Q50..: 20 mm dia. (max.)
Sensing Range	Q50AV: 50 to 150 mm Q50A: 50 to 200 mm Q50BV: 100 to 300 mm Q50B: 100 to 400 mm
Supply Voltage and Current	12 to 30V dc (10% max. ripple); 70 mA max. (exclusive of load)
Supply Protection Circuitry	Protected against reverse polarity and transient overvoltages
Output Configuration	Solid-state Complementary; Choose NPN (current sinking) or PNP (current sourcing) models.
Delay at Power-up	2 seconds
Output Rating	Complementary Discrete Output 150 mA max., per output OFF-state leakage current: Less than 10 µA ON-state saturation voltage: Less than 1V @ 10 mA and less than 1.5V @ 100 mA
Output Protection	Protected against false pulse on power-up and continuous overload or short circuit of outputs.
Output Response Time	2-second delay on power-up: Fast: 4 milliseconds ON/OFF Slow: 48 milliseconds ON/OFF
Output Hysteresis	See charts HC-5 and HC-6 on page 512.
Sensing Repeatability	Slow Response (Q50..): 0.5% of sensing distance Fast Response (Q50..Y): 1.0% of sensing distance
Color Sensitivity (typical)	See charts CSC-2 and CSC-3 on page 511.
Temperature Effect	Q50B.. models: From 0° to 50° C: 0.25 mm/° C From -10° to 55° C: 0.35 mm/° C Q50A.. models: From 0° to 50° C: 0.08 mm/° C From -10° to 55° C: 0.11 mm/° C
Remote TEACH Input Impedance	15 kΩ
Remote TEACH Input	To TEACH: Connect gray wire to +5 to 30V dc To Disable: Connect gray wire to 0 to +2V dc (or open connection)
Adjustments	Sensing Window Limits: TEACH-mode programming of near and far window limits may be set using the TEACH push button or remotely using the gray TEACH wire.
Indicators	Range LED Indicator (Green/Red) Green — Target is within sensing range Red — Target is outside sensing range Flashing Green — Outputs are overloaded OFF — Sensor Power OFF Teach/Output LED Indicator (Yellow/Red) Yellow (window limits) — Target is within taught window limits Yellow (fixed field) — Target is closer than cutoff limit OFF — Target is outside taught window limits Red — Sensor is in TEACH mode
Ambient Light Immunity	< 10,000 LUX
Construction	Housing: Molded ABS/Polycarbonate Window Lens: Lens: Acrylic Hardware: M3 hardware is included
Environmental Rating	IEC IP67; NEMA 6P
Connections	2 m or 9 m 5-conductor PVC-covered attached cable, or 5-pin Euro-style quick-disconnect. See page 416.
Operating Conditions	Temperature: -10° to +55° C Relative humidity: 90% at +50° C (non-condensing)
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements. Method 201A (Vibration: 10 to 60 Hz max. double amplitude 0.06", maximum acceleration 10G). Also meets IEC 947-5-2 requirements: 30G, 11 milliseconds duration, half sine wave.
Application Notes	Allow 15-minute warm-up for maximum performance
Certifications	
Hookup Diagrams	MI08 (p. 533)

LIGHT
GAUGING


ULTRASONIC

MEASURING
LIGHT SCREENS

TEMPERATURE

RADAR

LIGHT GAUGING
ULTRASONIC
MEASURING LIGHT SCREENS
TEMPERATURE
RADAR

L-GAGE® Q50 Analog Output Specifications				
Sensing Beam	Wavelength: Q50..V: 685 nm (typical) Q50..: 880 nm (typical)			
	Beam Size: Q50..V: 20 mm dia. (max.) Q50..: 20 mm dia. (max.)			
Sensing Range	Q50AV: 50 to 150 mm Q50A: 50 to 200 mm			
	Q50BV: 100 to 300 mm Q50B: 100 to 400 mm			
Supply Voltage and Current	15 to 30V dc (10% max. ripple); 70 mA max. (exclusive of load)			
Supply Protection Circuitry	Protected against reverse polarity and transient overvoltages			
Output Configuration	4-20 mA current sourcing models: 1 kΩ max. load @ 24V dc. Max. load = [(Vcc -4.5)/0.02]Ω 0-10V voltage sourcing models: 15 mA max.			
Delay at Power-up	2 seconds			
Output Protection	Protected against short circuit conditions			
Output Response Time	Analog Output	Average Interval	Update Rate	-3 dB Frequency Response
	Fast:	4 milliseconds	1 millisecond	112 Hz
	Slow:	64 milliseconds	4 milliseconds	7 Hz
Resolution	See RRC-5 and RRC-6 on page 510 for typical value. Q50B models: Target Distance: 200 mm Slow Response: 1 mm (max) Fast Response: 4 mm (max) Q50A models: Target Distance: 100 mm Slow Response: 0.5 mm (max) Fast Response: 2 mm (max)			
Linearity	Q50B.. models: ±3 mm Q50A.. models: ±1.5 mm			
Color Sensitivity (typical)	See charts CSC-4 and CSC-5 on page 511.			
Temperature Effect	Q50B.. models: From 0° to 50° C: 0.25 mm/° C From -10° to 55° C: 0.35 mm/° C Q50A.. models: From 0° to 50° C: 0.08 mm/° C From -10° to 55° C: 0.11 mm/° C			
Remote and Speed Input Impedance	15 kΩ			
Remote TEACH Input	To Teach: Connect gray wire to +5 to 30V dc To Disable: Connect gray wire to 0 to +2V dc (or open connection)			
Adjustments	Fast Speed: Connect black wire to +5 to 30V dc Slow Speed: Connect black wire to 0 to +2V dc (or open connection)			
Indicators	Range LED Indicator (Green/Red)	Green — Target is within sensing range Red — Target is outside sensing range OFF — Sensor Power OFF		
	Teach/Output LED Indicator (Yellow/Red)	Yellow — Target is within taught window limits OFF — Target is outside taught window limits Red — Sensor is in TEACH mode		
Ambient Light Immunity	< 10,000 LUX			
Construction	Housing: Molded ABS/Polycarbonate Hardware: M3 hardware is included. Window Lens: Acrylic			
Environmental Rating	IEC IP67; NEMA 6P			
Connections	2 m or 9 m 5-conductor PVC-covered attached cable, or 5-pin Euro-style quick-disconnect. See page 416.			
Operating Conditions	Temperature: -10° to +55° C Relative humidity: 90% at +50° C (non-condensing)			
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements. Method 201A (Vibration: 10 to 60Hz max. double amplitude 0.06", maximum acceleration 10G). Also meets IEC 947-5-2 requirements: 30G, 11 milliseconds duration, half sine wave.			
Application Notes	Allow 15-minute warm-up for maximum performance			
Certifications				
Hookup Diagrams	MI09 (p. 534)			

U-GAGE®

Ultrasonic Sensors

QT50U

page 262

- Long-range ac or dc sensor covers 8 m, with minimal dead zone.
- Advanced programming capability includes a unique temperature compensation feature.
- Retrosonic mode has reduced dead zone.
- Each output has two independent near and far limits.
- Optional Teflon® coating resists harsh chemicals.



S18U

page 266

- Compact 18 mm straight or right-angle housing
- Highly accurate detection from 30 to 300 mm
- Wide range of mounting options



QS18U

page 269

- Compact 18 mm universal housing
- Compensation for air temperature fluctuations
- Optional encapsulation for resistance to harsh chemicals (IP68)



T30U

page 272

- Right-angle T-style housing with 30 mm threaded lens
- Analog and discrete outputs in the same sensor
- Programmable sensing windows with 150 mm to 1 m range or 300 mm to 2 m range
- Optional Teflon® coating for resistance to harsh chemicals

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T30U models with temperature compensation, longer sensing ranges, shorter dead zones and improved linearity.



Q45U

page 276

- Operating window limits from 100 mm to 3 m
- Discrete output models for ON/OFF presence detection or HIGH/LOW level control
- Programmable response time



Q45UR

page 280

- Ultra-accurate remote gauging
- Compact housing with choice of three remote sensing heads
- Compensation for temperature variations at remote head



T18U

page 284

- Dual range, opposed ultrasonic sensors
- Two combinations of range and response time in the same unit
- Ideal for sensing under bright lighting and for clear materials
- T-style sensor with 18 mm threaded lens

U-GAGE® QT50U

Long-range Ultrasonic Sensor



Enhanced long-range sensing

- Senses extended range of up to 8 m
- Features ultrasonic dead-zone of only 2.5% of the total range—75% less than comparable products
- Available in analog or discrete dc models and in ac/dc universal voltage models with electromechanical relay output
- Offers retrosonic sensing mode

Designed for challenging applications

- Features a completely sealed, shock-resistant housing that is ideal for monitoring levels of liquids as well as solids
- Uses a narrow sensing beam to detect targets at long range within confined areas—such as a storage tank—without interference from the tank walls
- Available in a chemically resistant model with a Teflon® coating to protect the transducer
- Provides continuous monitoring (analog model)
- Offers dual-discrete option for setting independent near and far limits for both outputs, for applications requiring high and low-limit sensing



Chemically resistant models

Engineered for flexibility

- Offers a multitude of configurations in the same analog or discrete unit, using an advanced microprocessor and 8 DIP switches (dc models only)
- Compensates for temperature, for greatest sensing accuracy
- Reduces dead zone and detects objects of any size, shape and orientation (retrosonic mode)



Push-button programming

- Simplifies setup with push-button and remote TEACH-mode programming
- Shows status during setup and operation, using highly visible LEDs indicators

* Discrete dc model shown.



LIGHT GAUGING

ULTRASONIC

MEASURING LIGHT SCREENS

TEMPERATURE

RADAR

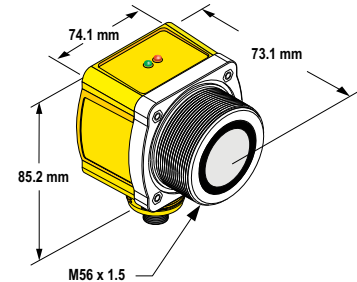
BRACKETS
PAGE 372

OD CABLES
5-Pin Euro + 5-Pin Micro + 5-Pin Mini
PAGE 415, 419 & 421

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U-GAGE® QT50U Sensors

- Push-button TEACH programming for easy setup
- Rugged encapsulated design for harsh environments
- Cabled or quick-disconnect models
- Bright LED status indicators for setup and operation
- QD cables with shield, ordered separately (see pages 415, 419 and 421)



DC and Universal Voltage Models

Teflon®-protected Models (Suffix -CRFV)

U-GAGE® QT50U, 10-30V dc



Models*	Range	Cable**	Output	Data Sheet
QT50ULB	200 mm - 8 m	2 m	Selectable: 0 to 10V dc or 4 to 20 mA	70137
QT50ULBQ		5-pin Mini QD		
QT50ULBQ6		5-pin Euro QD		
QT50UDB	200 mm - 8 m	2 m	Selectable Dual NPN or PNP	110112
QT50UDBQ		5-pin Mini QD		
QT50UDBQ6		5-pin Euro QD		

U-GAGE® QT50U Universal Voltage, 85-264V ac/24-250V dc



Models*	Range	Cable*	Output Operation Mode	Output	Data Sheet
QT50UVR3W	200 mm - 8 m	2 m	Window-limit (complementary outputs)	SPDT e/m relay	117764
QT50UVR3WQ1		5-pin Micro QD			
QT50UVR3WQ		5-pin Mini QD			
QT50UVR3F	200 mm - 8 m	2 m	Pump/level control (pump-in and pump-out logic)	SPDT e/m relay	117764
QT50UVR3FQ1		5-pin Micro QD			
QT50UVR3FQ		5-pin Mini QD			

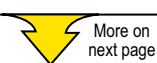
* For sensors with Teflon®-protected face and transducer, add suffix -CRFV to the model number (example, QT50ULB-CRFV). See data sheet part number 122155 for additional info.

** For 9 m cable, add suffix W/30 to the 2 m model number (example, QT50ULB W/30). A model with a QD requires a mating cable (see pages 415, 419 and 421).


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U-GAGE® QT50U DC Specifications	
Effective Beam	See charts EBPC-1, EBPC-2 and EBPC-3 on page 513.
Supply Voltage and Current	Analog models: 10 - 30V dc (10% max. ripple); 100 mA max @ 10V, 40 mA max. @ 30V (exclusive of load) Dual-discrete models: 10 to 30V dc (10% max. ripple); 100 mA max. @ 10V, 40 mA @ 30V (exclusive of load)
Ultrasonic Frequency	75 kHz burst, rep. rate 96 milliseconds
Supply Protection Circuitry	Protected against reverse polarity and transient overvoltages
Output Protection	Protected against short circuit conditions
Delay at Power-up	1.5 seconds
Output Configuration	Analog models: Voltage sourcing: 0 to 10V dc Current sourcing: 4 to 20 mA Dual-discrete models: Dual PNP or NPN, selectable using DIP switch
Output Ratings	Analog Voltage Output: 0 to 10V dc Minimum load resistance = 500 Ω Minimum required supply voltage for full 0-10V output span = $(\frac{1000}{R_{LOAD}} + 13)V$ dc Analog Current Output: 4 to 20 mA Maximum load resistance = 1 kΩ or $(\frac{V_{supply} - 5}{0.02})$ Ω, whichever is lower Minimum required supply voltage for full 4-20 mA output span = 10V dc or $[(R_{Load} \times 0.02) + 5]V$ dc, whichever is greater. 4-20 mA output calibrated at 25° C with 250 Ω load. Discrete Output: 150 mA max. OFF-State leakage current: less than 5 μA Output saturation: NPN: less than 200 mV @ 10 mA; less than 650 mV @ 150 mA PNP: less than 1.2V @ 10 mA; less than 1.65V @ 150 mA
Temperature Effect	Uncompensated: 0.2% of distance/° C Compensated: 0.02% of distance/° C
Linearity (Analog Models)	+/- 0.2% of span from 200 to 8000 mm; +/- 0.1% of span from 500 to 8000 mm (1 mm minimum)
Resolution/Repeatability	1.0 mm
Hysteresis	5 mm
Output Response Time	Analog models: 100 to 2300 milliseconds Dual-discrete models: 100 to 1600 milliseconds
Minimum Window Size	20 mm
Adjustments	Sensing window limits: TEACH-Mode programming of near and far window limits may be set using the push buttons or remotely using TEACH input.
Indicators	Green Power ON LED: Indicates power is ON Red Signal LED: Indicates target is within sensing range, and the condition of the received signal. Teach/Output indicator (bicolor Yellow/Red): Yellow –Target is within taught limits Yellow OFF (Discrete) –Target is outside taught window limits Red –Sensor is in TEACH mode Yellow Flashing (Analog) –Target is outside taught window limits
Remote TEACH	See data sheet p/n 70137 (Analog) and p/n 110112 (Discrete)
Construction	Transducer: Ceramic/Epoxy composite Housing: ABS/Polycarbonate Membrane Switch: Polyester Lightpipes: Acrylic
Environmental Rating	Leakproof design is rated IEC IP67; NEMA 6P
Connections	2 m or 9 m shielded 5-conductor (with drain) PVC jacketed attached cable, or 5-pin Euro-style quick-disconnect or 5-pin Mini-style quick-disconnect. QD cables are ordered separately. See pages 415 and 421.
Operating Conditions	Temperature: -20° to +70° C Relative humidity: 100%
Vibration and Mechanical Shock	All models meet Mil Std. 202F requirements. Method 201A (vibration: 10 to 60Hz max., double amplitude 0.06", maximum acceleration 10G). Also meets IEC 947-5-2 requirements: 30G 11 milliseconds duration, half sine wave
Temperature Warmup Drift	Less than 0.8% of sensing distance upon power-up with Temperature Compensation enabled
Application Notes	<ul style="list-style-type: none"> • Objects passing inside the specified near limit (200 mm) may produce a false response • For best accuracy, allow 30 minute warm-up before programming or operating



U-GAGE® QT50U DC Specifications (cont'd)

Certifications		
Hookup Diagrams	Analog Models: MI11 (p. 534)	Discrete Models: MI10 (p. 534)

U-GAGE® QT50U Universal Voltage Specifications

Effective Beam	See charts EBPC-1, EBPC-2 and EBPC-3 on page 513.	
Supply Voltage	85 to 264V ac, 50/60 Hz / 24 to 250V dc (1.5 watts max., exclusive of load)	
Ultrasonic Frequency	75 kHz burst, rep. rate 96 milliseconds.	
Supply Protection Circuitry	Protected against transient over voltages. DC hookup is without regard to polarity.	
Output Protection	Protected against short circuit conditions	
Delay at Power-up	1.5 seconds	
Output Configuration	SPDT (Single-Pole, Double-Throw) electromechanical relay output. One normally open (NO) and one normally closed (NC).	
Output Ratings	Max. switching power (resistive load): 2000 VA, 240 W (1000 VA, 120 W for sensors with Micro QD) Max. switching voltage (resistive load): 250V ac, 125V dc Max. switching current (resistive load): 8A @ 250V ac, 8A @ 30V dc derated to 200 mA @ 125V dc (4A max. for sensors with Micro QD) Min. voltage and current: 5V dc, 10 mA Mechanical life of relay: 50,000,000 operations Electrical life of relay at full resistive load: 100,000 operations NOTE: Transient suppression is recommended when switching inductive loads.	
Temperature Effect	Uncompensated: 0.2% of distance/° C	Compensated: 0.02% of distance/° C
Repeatability	1.0 mm	
Hysteresis	Window-limit sensor models: 5 mm	Fill-level control sensor models: 0 mm
Output Response Time	Selectable 1600, 400 or 100 milliseconds	
Minimum Window Size	20 mm	
Adjustments	Sensing limits: TEACH-Mode programming of near and far limits may be set using the TEACH push button. Sensor configuration: Output response time and temperature compensation mode may be set using the Speed push button. Factory default settings: 400 milliseconds output response time; temperature compensation enabled	
Indicators	Green Power ON LED: Indicates power is ON Red Signal LED: Indicates target is within sensing range, and the condition of the received signal. Output indicator (bicolor Yellow/Red): Indicates output status or TEACH mode Response indicator (bicolor Yellow/Red): Indicates output response time selection	
Construction	Transducer: Ceramic/Epoxy composite	Housing: ABS
	Membrane Switch: Polyester	
Environmental Rating	Leakproof design is rated IEC IP67; NEMA 6P	
Connections	2 m or 9 m shielded 5-conductor (with drain) PVC jacketed attached cable, or 5-pin Micro-style quick-disconnect or 5-pin Mini-style quick-disconnect. QD cables are ordered separately. See pages 419 and 421.	
Operating Conditions	Temperature: -20° to +70° C	Relative humidity: 100%
Vibration and Mechanical Shock	All models meet Mil Std. 202F requirements. Method 201A (vibration: 10 to 60Hz max., double amplitude 0.06", maximum acceleration 10G). Also meets IEC 947-5-2 requirements: 30G 11 milliseconds duration, half sine wave	
Temperature Warmup Drift	Less than 1.0% of sensing distance upon power-up with Temperature Compensation enabled	
Application Notes	Objects passing inside the specified minimum sensing distance (200 mm) may produce a false response.	
Certifications	Contact factory for more information.	
Hookup Diagrams	UN05 (p. 529)	

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U-GAGE® S18U

Compact Ultrasonic Sensor

On-board diagnostics

The highly accurate U-GAGE® S18U is the industry's first compact ultrasonic sensor with push-button TEACH programming and diagnostic LEDs integrated right into the housing. The S18U small size doesn't limit its accuracy. It is unaffected by target color and has all the features of much larger sensors:

- Integrated diagnostic LEDs and push-button programming
- Minimal dead zone
- Retrosonic sensing mode
- Temperature compensation circuitry
- Programmable background suppression
- Analog and discrete versions



LIGHT GAUGING

ULTRASONIC

MEASURING LIGHT SCREENS

TEMPERATURE

RADAR

BRACKETS
PAGE 373

OD CABLES
5-Pin Euro
PAGE 415

Two housing styles

- Available in straight or right-angle versions with a wide variety of mounting hardware for enhanced sensing versatility
- Ideal for material handling and packaged goods applications, such as bottling or liquid level detection and control for small containers
- Senses from 30 to 300 mm



Straight



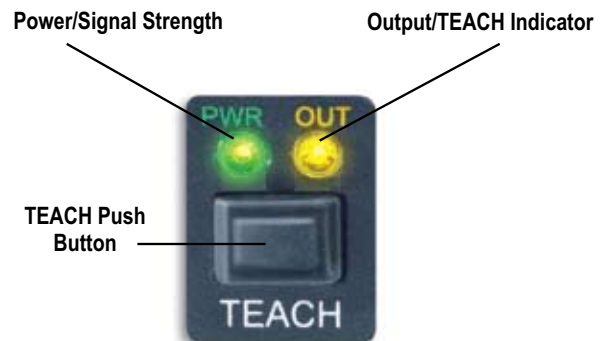
Right Angle



Accessory wave guides are available for narrowing sensing beam. (see page 445)

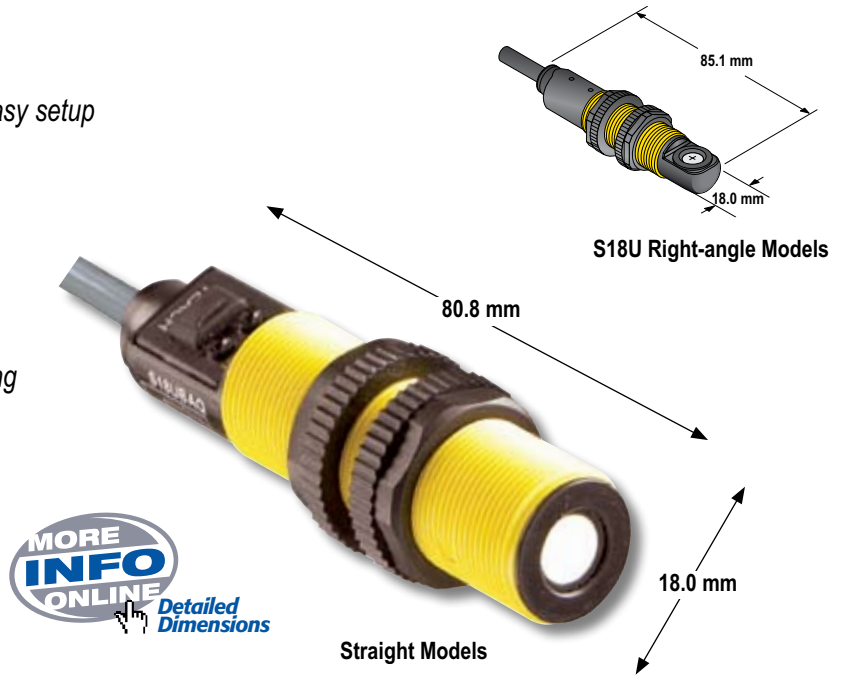
Integrated push-button programming

Program the unit with its integrated TEACH-mode push button or remote TEACH wire. Bright LEDs indicate status during setup and offer visual diagnostics during operation. Configure a set sensing window, background suppressed sensing or retrosonic mode for detecting any object regardless of shape, angle or size.



U-GAGE® S18U Sensors

- Push-button TEACH programming for easy setup
- 18 mm threaded barrel housing
- Straight or right-angle housing
- Rugged encapsulated design for harsh environments
- Bright diagnostic LEDs on sensor housing
- 5-pin Euro-style QD cables with shield, ordered separately (see page 415)
- Optional wave guides for narrowing sensing beam (see page 444)



U-GAGE® S18U, 10-30V dc



Models	Range	Cable*	Output	Housing Configuration	Data Sheet
S18UUA	30 - 300 mm	2 m	0 to 10V dc	Straight	110738
S18UUAQ		5-pin Euro QD			
S18UIA		2 m	4 to 20 mA		
S18UIAQ		5-pin Euro QD			
S18UUAR	30 - 300 mm	2 m	0 to 10V dc	Right-Angle	110738
S18UUARQ		5-pin Euro QD			
S18UIAR		2 m	4 to 20 mA		
S18UIARQ		5-pin Euro QD			
S18UBA	30 - 300 mm	2 m	Bipolar NPN/PNP	Straight	108964
S18UBAQ		5-pin Euro QD		Right-Angle	
S18UBAR		2 m			
S18UBARQ		5-pin Euro QD			

* For 9 m cable, add suffix W/30 to the 2 m model number (example, S18UUA W/30). A model with a QD requires a mating cable (see page 415).

U-GAGE® S18U Specifications	
Effective Beam	See charts EBPC-4 and EBPC-5 on page 513.
Supply Voltage and Current	10 to 30V dc (10% max. ripple); 65 mA max. (exclusive of load), 40 mA typical @ 25V input
Ultrasonic Frequency	300 kHz, rep. rate 2.5 milliseconds
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Protection	Protected against short circuit conditions





U-GAGE® S18U Specifications (cont'd)	
Output Ratings	Analog: Analog Voltage Output: 2.5 kΩ min. load resistance Minimum supply for a full 10V output is 12V dc (for supply voltages between 10 and 12, V out max is at least V supply -2) Analog Current Output: 1 kΩ max @ 24V input Max load resistance = (Vcc-4)/0.02 Ω Discrete: 100 mA max. OFF-state leakage current: less than 5 µA NPN saturation: less than 200 mV @ 10 mA and less than 600 mV @ 100 mA PNP saturation: less than 1.2V @ 10 mA and less than 1.6V @ 100 mA
Output Configuration	Analog: 0 to 10V dc or 4 to 20 mA, depending on model Discrete: Bipolar: One NPN (current sinking) and one PNP (current sourcing) output in each model. Solid-state switch conducts when target is sensed within sensing window.
Output Response Time	Analog: 30 milliseconds: Black wire at 0-2V dc (or open) Discrete: 5 milliseconds 2.5 milliseconds: Black wire at 5-30V dc
Delay at Power-up	300 milliseconds
Linearity* (Analog output models)	2.5 milliseconds response: ± 1 mm 30 milliseconds response: ± 0.5 mm
Resolution* (Analog output models)	2.5 milliseconds response: 1 mm 30 milliseconds response: 0.5 mm
Repeatability	0.5 mm
Temperature Effect	0.02% of distance/ ° C
Temperature Warmup Drift	Less than 1.7% of sensing distance upon power-up
Minimum Window Size	5 mm
Switching Hysteresis (Discrete output models)	0.7 mm
Adjustments	Sensing window limits: TEACH-Mode programming of near and far window limits may be set using the push-button or remotely using TEACH input.
Indicators	Power/Signal Strength (Red/Green) Green —Target is within sensing range Red —Target is outside sensing range OFF —Sensing power is OFF TEACH/Output Indicator (Yellow/Red) Yellow —Target is within taught limits OFF —Target is outside taught window limits Red —Sensor is in TEACH mode
Remote TEACH Input	Impedance: 12 kΩ
Construction	Threaded Barrel: Thermoplastic polyester Push-Button Housing: ABS/PC Push Button: Santoprene Lightpipes: Acrylic
Environmental Rating	Leakproof design is rated IEC IP67; NEMA 6P
Connections	2 m or 9 m shielded 5-conductor (with drain) PVC jacketed attached cable, or 5-pin Euro-style quick-disconnect. QD cables are ordered separately. See page 415.
Operating Conditions	Temperature: -20° to +60° C Relative humidity: 100%
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements. method 201A (vibration: 10 to 60 Hz max., double amplitude 0.06", maximum acceleration 10G). Also meets IEC 947-5-2 requirements: 30G 11 milliseconds duration, half sine wave
Application Notes	Objects passing inside the specified near limit may produce a false response.
Certifications	
Hookup Diagrams	Analog Models: MI13 (p. 535) Discrete Models: MI12 (p. 534)

*Linearity and resolution are specified using a 50 x 50 mm aluminum plate at 22° C under fixed sensing conditions.



QS18U

Ultrasonic WORLD-BEAM® Sensor

- Senses clear or transparent material and color variations
- Senses within a 50 to 500 mm window with a 15 millisecond response time
- Delivers high accuracy in wet or dirty environments
- Available in encapsulated IP68 models rated for a range of harsh conditions
- Features push-button TEACH for easy programming at the sensor or remotely

Features

- TEACH setup using on-board push-button or remote wire
- 2 m or 9 m integral cable, 4-pin Euro- or Pico-style integral quick-disconnect, or 150 mm threaded pigtail QD cable options
- Wide operating range of -20° to 60° C
- Retrosonic sensing mode

LIGHT
GAUGING

ULTRASONIC

MEASURING LIGHT
SCREENS

TEMPERATURE

RADAR

Applications

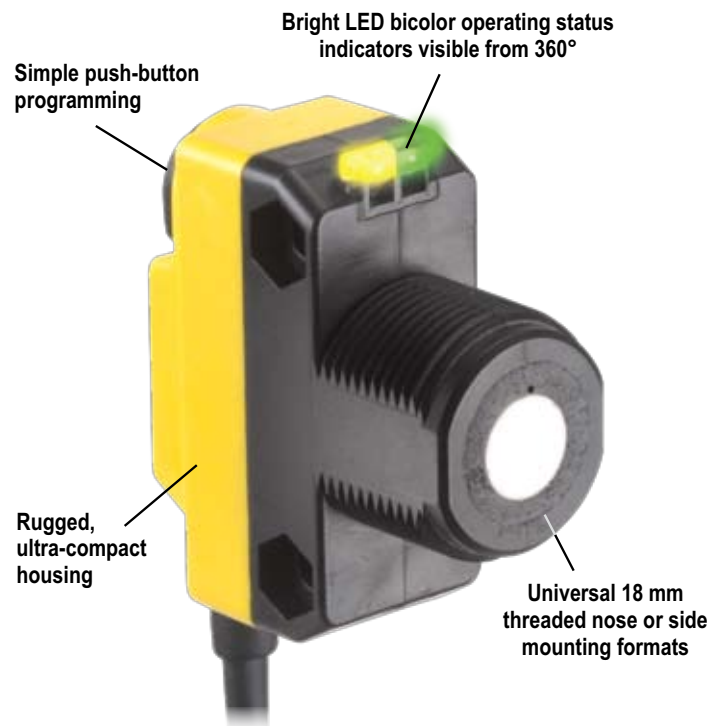
- Sense clear web materials in confined areas
- Detect clear or shiny bottles in a filling line
- Detect highly reflective surfaces
- Verify liquid or dry bulk levels from inside cramped locations



Choice of pre-wired cable, Pico- or Euro-style integral QD connector, or pigtail QD (not shown)



Accessory wave guides are available for narrowing sensing beam. (see page 444.)



- LIGHT GAUGING
- ULTRASONIC
- MEASURING LIGHT SCREENS
- TEMPERATURE
- RADAR

WORLD-BEAM® QS18U Sensors

- Bicolor LED indicator for power and signal strength
- Bicolor LED indicator for TEACH/output
- Choice of cables and connectors
- Rugged, ultra-compact housing
- 4-pin Pico- or Euro-style QD cables with shield ordered separately (see pages 411 and 412)
- Optional wave guides for narrowing sensing beam (see page 444)



WORLD-BEAM® QS18U, 12-30V dc




Model	Range	Cable*	TEACH Options	Output	Data Sheet
QS18UNA	50 - 500 mm	2 m	Integral push button and remote TEACH (IP67; NEMA 6P)	NPN	119287
QS18UNAQ8		4-pin Euro QD			
QS18UPA		2 m		PNP	
QS18UPAQ8		4-pin Euro QD			
QS18UNAE†	50 - 500 mm	2 m	Remote TEACH (epoxy-encapsulated, IP68; NEMA 6P)	NPN	119287
QS18UNAEQ8†		4-pin Euro QD			
QS18UPAE†		2 m		PNP	
QS18UPAEQ8†		4-pin Euro QD			

* For 9 m cable, add suffix **W30** to the 2 m model number (example, **QS18UNA W30**). A model with a QD requires a mating cable (see pages 411 and 412).
QD models:

- For 4-pin integral Euro-style QD, add suffix **Q8** (example, **QS18UNAQ8**).
- For 4-pin 150 mm Euro-style pigtail, add suffix **Q5** (example, **QS18UNAQ5**).
- For 4-pin integral Pico-style QD, add suffix **Q7** (example, **QS18UNAQ7**).
- For 4-pin 150 mm Pico-style pigtail, add suffix **Q** (example, **QS18UNAFQ**).

† Models are epoxy-encapsulated, IP68; NEMA 6P with remote TEACH programming

WORLD-BEAM® QS18U Specifications					
Sensing Range	50 to 500 mm				
Sensing Beam	See charts EBPC-6 and EBPC-7 on pages 513-514.				
Supply Voltage	12 to 30V dc (10% max. ripple); 25 mA max. (exclusive of load)				
Ultrasonic Frequency	300 kHz, rep. rate 7.5 milliseconds				
Supply Protection Circuitry	Protected against reverse polarity and transient voltages				
Output Protection	Protected against short circuit conditions				
Delay at Power-Up	300 milliseconds				
Output Configurations	Solid-state switch conducts when target is sensed within sensing window; One NPN (current sinking) or one PNP (current sourcing), depending on model.				
Temperature Effect	Non-encapsulated models: $\pm 0.05\%$ per °C from -20° to +50° C, $\pm 0.1\%$ per °C from +50° to +60° C Encapsulated models: $\pm 0.05\%$ per °C from 0° to +60° C, $\pm 0.1\%$ per °C from -20° to 0° C				
Repeatability	0.7 mm				
Hysteresis	1.4 mm				
Output Ratings	100 mA max. OFF-state leakage current: less than 10 μ A (sourcing); less than 200 μ A (sinking) NPN ON-state saturation voltage: less than 1.6V @ 100 mA PNP ON-state saturation voltage: less than 2.0V @ 100 mA				
Output Response Time	15 milliseconds				
Minimum Window Size	5 mm				
Adjustments	Sensing window limits: TEACH-Mode programming of near and far window limits may be set using the push button or remotely using TEACH input.				
Indicators	<table border="0"> <tr> <td style="vertical-align: top;"> Range Indicator (Red/Green) Green—Target is within sensing range Red—Target is outside sensing range OFF—Sensing power is OFF </td> <td style="vertical-align: top;"> Teach/Output Indicator (Yellow/Red) Yellow—Target is within taught limits OFF—Target is outside taught window limits Red—Sensor is in TEACH mode </td> </tr> </table>	Range Indicator (Red/Green) Green —Target is within sensing range Red —Target is outside sensing range OFF —Sensing power is OFF	Teach/Output Indicator (Yellow/Red) Yellow —Target is within taught limits OFF —Target is outside taught window limits Red —Sensor is in TEACH mode		
Range Indicator (Red/Green) Green —Target is within sensing range Red —Target is outside sensing range OFF —Sensing power is OFF	Teach/Output Indicator (Yellow/Red) Yellow —Target is within taught limits OFF —Target is outside taught window limits Red —Sensor is in TEACH mode				
Construction	<table border="0"> <tr> <td>Housing: ABS</td> <td>Push-Button Housing: ABS</td> </tr> <tr> <td>Push Button: TPE</td> <td>Lightpipes: Polycarbonate</td> </tr> </table>	Housing: ABS	Push-Button Housing: ABS	Push Button: TPE	Lightpipes: Polycarbonate
Housing: ABS	Push-Button Housing: ABS				
Push Button: TPE	Lightpipes: Polycarbonate				
Environmental Rating	Leakproof design, rated IEC IP67 or IP68; NEMA 6P, depending on model				
Connections	2 m or 9 m 4-conductor PVC jacketed attached cable, or 4-pin Euro-style integral QD (Q8), or 4-pin Pico-style integral QD (Q7), or 4-pin Euro-style 150 mm pigtail QD (Q5), or 4-pin Pico-style 150 mm pigtail QD (Q), depending on model. See pages 411 and 412.				
Operating Conditions	Temperature: -20° to +60° C Relative humidity: 100% (non-condensing)				
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements method 201A (vibration: 10 to 60 Hz max., double amplitude 0.06", maximum acceleration 10G). Also meets IEC 947-5-2 requirements: 30G 11 milliseconds duration, half sine wave.				
Temperature Warmup Drift	See data sheet p/n 119287 for more information.				
Application Notes	Objects passing inside the specified near limit may produce a false response.				
Certifications					
Hookup Diagrams	M114 (p. 535)				

U-GAGE® T30U

Compact Sensors in Universal Housing

Incredible versatility

The U-GAGE® T30U sets new standards for ultrasonic sensor versatility by including discrete (switched) and analog outputs in the same compact sensor. Dual-discrete models also are available.

Two model types

- Combined analog and discrete output models:
 - Offers choice of either NPN or PNP discrete output and either 0-10V dc or 4-20 mA sourcing analog output—in the same compact sensor
 - Features outputs that are independently configurable
- Dual-discrete output:
 - Features two NPN or two PNP discrete outputs
 - Offers independently programmable outputs
 - Available in models for direct liquid level control (pump in/pump out)



Patented, ultra-short T-shaped package

The T30U is the shortest 30 mm diameter ultrasonic sensor available and is less than half the length of comparable competitive sensors.

- Four LED indicators keep you constantly informed of programming and operating status.
- Strength of flashing red LED indicates the strength of the received signal.
- Two yellow LEDs indicate the target is within the operating window limits.
- Digital filtering provides immunity from random electrical and acoustic noise, as well as protection from transient voltage and reverse polarity.
- Optional Teflon® coating protects the transducer from harsh chemicals.

Teflon® is a registered trademark of Dupont™.



Coming in 2008—New T30UX Models

- Longer sensing ranges: 1, 2 and 3 m with shorter dead zones
- Built-in temperature compensation
- Improved linearity of analog output



Push-button TEACH-mode programming

- Features simple 3-step push-button setup for accurate, custom sensing windows within a 150 mm to 1 m range or a 300 mm to 2 m range
- Can be programmed from a remote location using an external switch, computer or controller for added security and convenience



Chemically resistant models

LIGHT
GAUGING

ULTRASONIC

MEASURING LIGHT
SCREENS

TEMPERATURE

RADAR

BRACKETS
PAGE 373

OD CABLES
5-Pin Euro
PAGE 415



U-GAGE® T30U Sensors

- T-style right-angle sensor package with 30 mm threaded mount
- 2 m or 9 m attached cable, or quick-disconnect fitting
- Easy-to-use push-button programming
- LED indicators for Power, Signal and both outputs
- 5-pin Euro-style QD cables with shield ordered separately (see page 415)



U-GAGE® T30U, 12-24V dc



Models*	Range	Frequency	Cable**	Discrete Output(s)	Analog Output	Response Time	Data Sheet		
T30UINA	150 mm - 1 m	228 kHz	2 m	NPN	4 to 20 mA	48 ms	57438		
T30UINAQ			5-pin Euro QD						
T30UIPA			2 m	PNP					
T30UIPAQ			5-pin Euro QD						
T30UINB	300 mm - 2 m†	128 kHz	2 m	NPN	4 to 20 mA	96 ms	57438		
T30UINBQ			5-pin Euro QD						
T30UIPB			2 m	PNP					
T30UIPBQ			5-pin Euro QD						
T30UDNA	150 mm - 1 m	228 kHz	2 m	Dual NPN	None	48 ms	59200		
T30UDNAQ			5-pin Euro QD						
T30UDPA			2 m	Dual PNP					
T30UDPAQ			5-pin Euro QD						
T30UDNB	300 mm - 2 m†	128 kHz	2 m	Dual NPN	None	96 ms	59200		
T30UDNBQ			5-pin Euro QD						
T30UDPB			2 m	Dual PNP					
T30UDPBQ			5-pin Euro QD						
T30UHNA	150 mm - 1 m	228 kHz	2 m	Pump/Level Control Dual NPN	None	48 ms	63974		
T30UHNAQ			5-pin Euro QD			96 ms			
T30UHNB	300 mm - 2 m†	128 kHz	2 m			Pump/Level Control Dual PNP	None	48 ms	63974
T30UHNBQ			5-pin Euro QD					96 ms	
T30UHPA	150 mm - 1 m	228 kHz	2 m	Pump/Level Control Dual PNP	None			48 ms	63974
T30UHPAQ			5-pin Euro QD					96 ms	
T30UHPB	300 mm - 2 m†	128 kHz	2 m			Pump/Level Control Dual PNP	None	48 ms	63974
T30UHQB			5-pin Euro QD					96 ms	

* For sensors with Teflon®-protected face and transducer (long-range models only), add suffix -CRFV to the model number (example, T30UINB-CRFV).

** For 9 m cable, add suffix W/30 to the 2 m model number (example, T30UINA W/30). A model with a QD requires a mating cable (see page 415).

† Teflon®-encapsulated models have a range of 300 - 1.5 m.

Teflon® is a registered trademark of Dupont™



U-GAGE® T30U, 15-24V dc

Models*	Range	Frequency	Cable**	Discrete Output(s)	Analog Output	Response Time	Data Sheet
T30UUNA	150 mm - 1 m	228 kHz	2 m	NPN	0 to 10V dc	48 ms	57438
T30UUNAQ			5-pin Euro QD				
T30UUPA			2 m	PNP			
T30UUPAQ			5-pin Euro QD				
T30UUNB	300 mm - 2 m†	128 kHz	2 m	NPN	0 to 10V dc	96 ms	
T30UUNBQ			5-pin Euro QD				
T30UUPB			2 m	PNP			
T30UUPBQ			5-pin Euro QD				

* For sensors with Teflon®-protected face and transducer (long-range models only), add suffix -CRFV to the model number (example, T30UUNB-CRFV).

** For 9 m cable, add suffix W30 to the 2 m model number (example, T30UUNA W30). A model with a QD requires a mating cable (see page 415).


† Teflon®-encapsulated models have a range of 300 - 1.5 m.

U-GAGE® T30U Specifications

Sensing Range	<p>“A” suffix models: 150 mm min. near limit; 1 m max. far limit</p> <p>“B” suffix models: 300 mm min. near limit; 2 m max. far limit</p> <p>“-CRFV” models: 300 mm min. near limit; 1.5 m max. far limit</p>
Effective Beam	See charts EBPC-8, EBPC-9, EBPC-10, EBPC-11 and EBPC-12 on page 514.
Supply Voltage	<p>Current sourcing analog output models: 12 to 24V dc (10% max. ripple); 90 mA (exclusive of load)</p> <p>Voltage sourcing analog output models: 15 to 24V dc (10% max. ripple); 90 mA (exclusive of load)</p> <p>Dual-discrete output models: 12 to 24V dc (10% max. ripple); 90 mA (exclusive of load)</p>
Ultrasonic Frequency	<p>Short Range: 228 kHz</p> <p>Long Range: 128 kHz</p>
Supply Protection Circuitry	Protected against reverse polarity and transient voltages.
Output Protection	Protected against continuous overload and short-circuit; transient over-voltage; no false pulse on power-up.
Output Configuration	<p>Discrete (switched) output: Solid-state switch conducts when target is sensed within sensing window; choose NPN (current sinking) or PNP (current sourcing) models.</p> <p>Analog output: Choose 0 to 10V dc sourcing or 4 to 20 mA sourcing output models; output slope may be selected using TEACH sequence.</p>
Output Ratings	<p>Discrete (switched) output: 100 mA max., total—both outputs</p> <p>OFF-state leakage current: less than 10 µA</p> <p>ON-state saturation voltage: less than 1V at 10 mA and less than 1.5V at 100 mA</p> <p>Analog Output:</p> <p>Voltage sourcing: 0 to 10V dc (at 1 kΩ min. resistance)</p> <p>Current sourcing: 4 to 20 mA, 1 Ω to Rmax.</p> $R_{max} = \frac{V^{supply} - 7V}{20 \text{ mA}}$
Output Response Time	<p>Discrete output: “A” suffix models: 48 milliseconds</p> <p>“B” suffix models: 96 milliseconds</p> <p>Analog output: “A” suffix models: 48 milliseconds average, 16-millisecond update</p> <p>“B” suffix models: 96 milliseconds average, 32-millisecond update</p>

Teflon® is a registered trademark of Dupont™.



U-GAGE® T30U Specifications (cont'd)	
Sensing Performance (Specified using a 100 x 100 mm aluminum target at 25° C under fixed sensing conditions.)	Analog sensing resolution or discrete output repeatability: ±0.25% of measured distance “A” suffix models: .5 mm min “B” suffix models: 1 mm min Analog linearity: ±0.5% of full-scale span Min. window size: 10 mm Hysteresis of discrete output: 2.5 mm Temperature effect: 0.2% of sensing distance per ° C
Adjustments	Sensing window limits (analog or discrete): TEACH-mode programming of near and far window limits may be set using membrane push buttons on sensor or remotely using TEACH input. Window limits may be programmed separately, or together. Analog output slope: the first limit taught is assigned to the minimum output value (4 mA or 0V).
Indicators	Four status LEDs: In RUN mode: Green ON Steady: Power ON, RUN mode Green Flashing: Discrete output is overloaded Red Flashing: Relative received signal strength Yellow analog ON Steady: Target is inside window limits Yellow discrete ON Steady: Output conducting In Program mode: Green OFF: PROGRAM mode Red Flashing: Relative received signal strength Yellow ON Steady: Ready for first window limit Yellow Flashing: Ready for second limit Yellow OFF: Not teaching this output
Construction	Molded reinforced thermoplastic polyester housing.
Environmental Rating	Leakproof design is rated IEC IP67; NEMA 6P
Connections	2 m or 9 m 5-conductor PVC-covered attached cable, or 5-pin Euro-style quick-disconnect fitting. QD cables are ordered separately. See page 415.
Operating Conditions	Temperature: -20° to +70° C Relative humidity: 100%
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements. Method 201A (Vibration: 10 to 60Hz max., double amplitude 0.06", maximum acceleration 10G). Also meets IEC 947-5-2 requirements: 30G, 11 milliseconds duration, half sine wave.
Application Notes	Objects passing inside the specified near limit will produce a false response. NOTE: For more information about out-of-range and signal loss response of the analog output, see product literature.
Certifications	
Hookup Diagrams	Analog/Discrete Models: MI16 (p. 535) Dual-Discrete Models: MI15 (p. 535)

U-GAGE® Q45U

Flexible Ultrasonic Sensors

The U-GAGE® Q45U series offers a choice of analog or bipolar discrete models, designed for either long-range or short-range sensing.

- Push-button TEACH programming makes it easy to set the near/far limits of the sensing window.
- Available ranges are 100 to 1400 mm for the short-range models and 0.25 to 3.0 m for the long-range models.
- Bipolar discrete models have switches for ON/OFF presence detection and HIGH/LOW level control.
 - In ON/OFF mode, detects either when the target is within the set range or when it is outside the range.
 - In HIGH/LOW mode, detects when the target is outside the configured range, for fill level control, web tensioning control and similar applications.
- Response time is programmed with switches in discrete models and with a potentiometer in analog models.
- For remote programming, analog models can be wired directly to an external switch, controller or computer to set window limits—ideal for inaccessible applications such as roll diameter detection for overhead cranes.



LIGHT GAUGING

ULTRASONIC

MEASURING LIGHT SCREENS

TEMPERATURE

RADAR

BRACKETS
PAGE 373

OD CABLES
5-Pin Euro + 5-Pin Mini
PAGE 415 & 421



Program storage cards

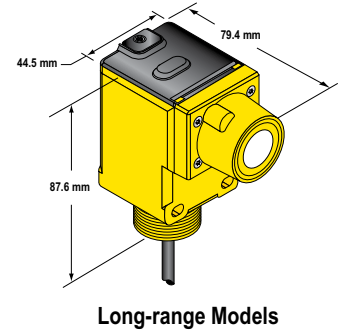
After you set up window limits, you can store the limits on circuit cards with non-volatile memory for fast setup. Just store the settings from any Q45U sensor on the card, and then transfer the settings to any Q45U sensor with the same available sensing range.

U-GAGE® Q45U Sensors

- 5-segment target position indicator
- 2 m or 9 m attached cable, or Mini- or Euro-style quick-disconnect
- Three status LEDs
- Simple push button for programming limits of sensing window
- 5-pin Mini- or Euro-style QD cables with shield ordered separately (see pages 415 and 421)



Short-range Models



Long-range Models



U-GAGE® Q45U Discrete Output, 12-24V dc



Models	Range	Temperature Compensation	Cable*	Output Type	Response Time	Data Sheet
Q45UBB63DA	100 mm - 1.4 m	No	2 m	Bipolar NPN/PNP	Programmable for 20, 40, 160, or 640 ms	44177
Q45UBB63DAQ			5-pin Mini QD			
Q45UBB63DAQ6			5-pin Euro QD			
Q45UBB63DAC		Yes	2 m			
Q45UBB63DACQ			5-pin Mini QD			
Q45UBB63DACQ6			5-pin Euro QD			
Q45UBB63BC	250 mm - 3 m†	Yes	2 m	Bipolar NPN/PNP	Programmable for 40, 80, 320, or 1280 ms	48454
Q45UBB63BCQ			5-pin Mini QD			
Q45UBB63BCQ6			5-pin Euro QD			

U-GAGE® Q45U Analog Output, 15-24V dc



Models	Range	Temperature Compensation	Cable*	Output Type	Response Time	Data Sheet	
Q45ULIU64ACR	100 mm - 1.4 m	Yes	2 m	Selectable 0 to 10V dc or 4 to 20 mA	Adjustable from 40 to 1280 ms	47818	
Q45ULIU64ACRQ			5-pin Mini QD				
Q45ULIU64ACRQ6			5-pin Euro QD				
Q45ULIU64BCR	250 mm - 3 m†	Yes	2 m		Selectable 0 to 10V dc or 4 to 20 mA	Adjustable from 80 to 2560 ms	48456
Q45ULIU64BCRQ			5-pin Mini QD				
Q45ULIU64BCRQ6			5-pin Euro QD				

* For 9 m cable, add suffix W/30 to the 2 m model number (example, Q45UBB63DA W/30). A model with a QD requires a mating cable (see pages 415 and 421).


† The far limit may be extended as far as 3.9 m for good acoustical targets—hard surfaces with area greater than 100 cm².



U-GAGE® Q45U Specifications

Sensing Range	<p>Near limit: 100 mm min. Long Range: Near limit: 250 mm min. Far limit: 1.4 m max. Long Range: Far limit: 3.0 m max.</p> <p>NOTE: The far limit may be extended on long range units, as far as 3.9 m for good acoustical targets (hard surfaces with area greater than 100 cm²)</p>																		
Supply Voltage and Current	<p>Discrete: 12 to 24V dc (10% max. ripple); 100 mA (exclusive of load) Analog: 15 to 24V dc (10% max. ripple); 100 mA (exclusive of load)</p>																		
Ultrasonic Frequency	<p>Long Range: 128 kHz Short Range: 230 kHz</p>																		
Supply Protection Circuitry	Protected against reverse polarity and transient voltages.																		
Output Protection Circuitry	Protected against false pulse on power-up and continuous overload or short-circuit of outputs.																		
Output Configuration	<p>Discrete: Bipolar: One current sourcing (PNP) and one current sinking (NPN) open-collector transistor. Analog: One voltage sourcing and one current sourcing; one or the other output is enabled by internal programming switch #2.</p>																		
Output Ratings	<p>Discrete: 150 mA max. (each) OFF-state leakage current: less than 25 µA at 24V dc ON-state saturation voltage: less than 1.5V at 10 mA; less than 2.0V at 150 mA Analog: Voltage sourcing: 0 to 10V dc, 10 mA max. Current sourcing: 4 to 20 mA, 1 to 500 Ω impedance</p>																		
Performance Specifications	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 30%;"></th> <th style="width: 35%; text-align: center;">Short Range</th> <th style="width: 35%; text-align: center;">Long Range</th> </tr> </thead> <tbody> <tr> <td>Analog resolution or discrete repeatability:</td> <td style="text-align: center;">± 0.1% of sensing distance (± 0.25 mm min.)</td> <td style="text-align: center;">± 0.1% of sensing distance (± 0.5 mm min.)</td> </tr> <tr> <td>Analog Linearity:</td> <td style="text-align: center;">1% of full scale</td> <td style="text-align: center;">1% of full scale</td> </tr> <tr> <td>Temperature effect:</td> <td style="text-align: center;">0.05% of sensing distance/° C with temp. comp. 0.2% of sensing distance/° C without temp. comp.</td> <td style="text-align: center;">0.05% of sensing distance/° C</td> </tr> <tr> <td>Min. window size:</td> <td style="text-align: center;">10 mm</td> <td style="text-align: center;">25 mm</td> </tr> <tr> <td>Hysteresis (discrete output):</td> <td style="text-align: center;">5 mm</td> <td style="text-align: center;">10 mm</td> </tr> </tbody> </table>		Short Range	Long Range	Analog resolution or discrete repeatability:	± 0.1% of sensing distance (± 0.25 mm min.)	± 0.1% of sensing distance (± 0.5 mm min.)	Analog Linearity:	1% of full scale	1% of full scale	Temperature effect:	0.05% of sensing distance/° C with temp. comp. 0.2% of sensing distance/° C without temp. comp.	0.05% of sensing distance/° C	Min. window size:	10 mm	25 mm	Hysteresis (discrete output):	5 mm	10 mm
	Short Range	Long Range																	
Analog resolution or discrete repeatability:	± 0.1% of sensing distance (± 0.25 mm min.)	± 0.1% of sensing distance (± 0.5 mm min.)																	
Analog Linearity:	1% of full scale	1% of full scale																	
Temperature effect:	0.05% of sensing distance/° C with temp. comp. 0.2% of sensing distance/° C without temp. comp.	0.05% of sensing distance/° C																	
Min. window size:	10 mm	25 mm																	
Hysteresis (discrete output):	5 mm	10 mm																	
Response Curves	<p>Short Range: See charts RC-2 and RC-4 on page 516. Long Range: See charts RC-3 and RC-5 on page 516.</p>																		
Adjustments	<p>The following may be selected by a 4-position DIP switch located on top of the sensor, beneath a transparent o-ring sealed acrylic cover:</p> <p>Discrete: Switch 1: Output normally open/normally closed (pump in/pump out) Switch 2: High/Low level control mode or ON/OFF presence sensing mode Switch 3 & 4: Response speed selection (digital filter)</p> <p>Analog: Switch 1: Output slope positive or output slope negative Switch 2: Current output mode or voltage output mode Switch 3: Loss of echo min/max mode or loss of echo Hold Mode Switch 4: Loss of echo min/max default output value</p>																		
Indicators	<p>Discrete: Three status LEDs: Green ON steady: power to sensor is ON Green flashing: output is overloaded Yellow ON steady: outputs are conducting (Yellow LED also indicates programming status during setup mode) Red flashing: indicates relative strength of received echo</p> <p>Analog: Three status LEDs: Green ON steady: power to sensor is ON Green flashing: current output fault detected (the 4-20 mA current path to ground has been opened) Yellow ON steady: target is sensed within the window limits (Yellow LED also indicates programming status during setup mode) Red flashing: indicates relative strength of received echo</p> <p>5-segment moving dot LED indicates the position of the target within the sensing window.</p>																		



U-GAGE® Q45U Specifications (cont'd)	
Construction	Molded PBT polyester thermoplastic polyester housing, o-ring sealed transparent acrylic top cover, and stainless steel hardware. Q45U sensors are designed to withstand 1200 psi washdown. The base of cabled models has a 1/2"-14NPS internal conduit thread.
Environmental Rating	Leakproof design is rated IEC IP67; NEMA 6P
Connections	2 m or 9 m attached cable, or 5-pin Mini-style or 5-pin Euro-style QD fitting. QD cables are ordered separately. See pages 415 and 421.
Operating Conditions	Temperature: -25° to +70° C Relative humidity: 100%
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements. Method 201A (Vibration: 10 to 60Hz max., double amplitude 0.06", maximum acceleration 10G). Method 213B conditions H & I (Shock: 75G with unit operating; 100G for non-operation). Also meets IEC 947-5-2 requirements: 30G, 11 milliseconds duration, half sine wave.
Application Notes	<p>Short Range: Min. target size: 10 x 10 mm aluminum plate at 500 mm 35 x 35 mm aluminum plate at 1.4 m</p> <p>Long Range: Min. target size: 50 x 50 mm aluminum plate at 3 m</p> <p>Discrete: Enable/Disable; Connect yellow wire to +5 to 24V dc to enable sensor and 0 to +2V dc to disable sensor. When the sensor is disabled, the last output state is held until the sensor is re-enabled. The wire must be held to the appropriate voltage for at least 40 milliseconds for the sensor to enable or disable.</p>
Certifications	
Hookup Diagrams	MI17 (p. 536)

LIGHT
GAUGING

ULTRASONIC

MEASURING LIGHT
SCREENS

TEMPERATURE

RADAR

U-GAGE® Q45UR

Remote Ultrasonic Sensors

Precise sensing for hard-to-access or difficult applications

The U-GAGE® Q45UR remote ultrasonic sensors are available with analog or bipolar discrete output. They offer the same advanced features as standard Q45U models, with the additional choice of three remote sensing heads for use in confined or difficult environments.

- Sensing head choices are 18 mm diameter threaded barrel housing in plastic or stainless steel, or ultra-compact plastic Flat-Pak.
- Sensing range is 50 to 250 mm.
- All models feature built-in temperature compensation and an operating temperature range from -25° to 70° C.
- Environmental rating is IEC IP65 and NEMA 4.
- Digital filtering provides immunity from random electrical and acoustic noise.

Push-button setup

Push-button TEACH-mode programming enables you to program exact sensing ranges and sensing windows, either by separately setting the lower and upper limits or by selecting the midpoint of a specific sensing window.

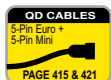


Push-button setup

Push-button TEACH-mode programming enables you to program exact sensing ranges and sensing windows, either by separately setting the lower and upper limits or by selecting the midpoint of a specific sensing window.

Analog and discrete output

- Response time is programmed with switches in discrete models and with a potentiometer in analog models.
- Adjustable response time is from 10 to 320 milliseconds for analog output sensors and 40 or 160 milliseconds for discrete output sensors.
- Analog models feature a selectable positive or negative output slope.
- Resolution is 0.1 mm for analog models and 0.6 mm for bipolar discrete models.

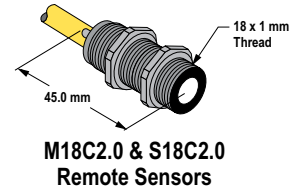


U-GAGE® Q45UR Sensors

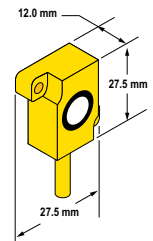
- 5-segment target position indicator
- 2 m or 9 m attached cable, or Mini- or Euro-style quick-disconnect
- Stainless steel barrel or plastic threaded barrel, and Flat-Pak transducer available
- Simple push button for programming limits of sensing window
- Remote sensing heads with built in temperature compensation
- 5-pin Mini- or Euro-style QD cables with shield ordered separately (see pages 415 and 421)



Q45UR Controllers
(S18C2.0 Remote Sensor separate)



M18C2.0 & S18C2.0 Remote Sensors



Q13C2.0 Remote Sensors



U-GAGE® Q45UR Discrete Output, 12-24V dc

Kit Models	Kit Includes Controller Model	Kit Includes Sensor Model	Sensor Range	Controller Cable*	Controller Output	Data Sheet
Q45UR3BA63CK	Q45UR3BA63C		50 - 250 mm	2 m	Bipolar NPN/PNP	59321
Q45UR3BA63CQK	Q45UR3BA63CQ			5-pin Mini QD		
Q45UR3BA63CQ6K	Q45UR3BA63CQ6			5-pin Euro QD		
Q45UR3BA63CKQ	Q45UR3BA63C		50 - 250 mm	2 m	Bipolar NPN/PNP	59321
Q45UR3BA63CQKQ	Q45UR3BA63CQ			5-pin Mini QD		
Q45UR3BA63CQ6KQ	Q45UR3BA63CQ6			5-pin Euro QD		
Q45UR3BA63CKKS	Q45UR3BA63C		50 - 250 mm	2 m	Bipolar NPN/PNP	59321
Q45UR3BA63CQKS	Q45UR3BA63CQ			5-pin Mini QD		
Q45UR3BA63CQ6KS	Q45UR3BA63CQ6			5-pin Euro QD		

U-GAGE® Q45UR Analog Output, 15-24V dc

Kit Models	Kit Includes Controller Model	Kit Includes Sensor Model	Sensor Range	Controller Cable*	Controller Output	Data Sheet
Q45UR3LIU64CK	Q45UR3LIU64C		50 - 250 mm	2 m	Selectable 0 to 10V dc or 4 to 20 mA	59323
Q45UR3LIU64CQK	Q45UR3LIU64CQ			5-pin Mini QD		
Q45UR3LIU64CQ6K	Q45UR3LIU64CQ6			5-pin Euro QD		
Q45UR3LIU64CKQ	Q45UR3LIU64C		50 - 250 mm	2 m		
Q45UR3LIU64CQKQ	Q45UR3LIU64CQ			5-pin Mini QD		
Q45UR3LIU64CQ6KQ	Q45UR3LIU64CQ6			5-pin Euro QD		
Q45UR3LIU64CKKS	Q45UR3LIU64C		50 - 250 mm	2 m		
Q45UR3LIU64CQKS	Q45UR3LIU64CQ			5-pin Mini QD		
Q45UR3LIU64CQ6KS	Q45UR3LIU64CQ6			5-pin Euro QD		



* For 9 m cable, add suffix W/30 to 2 m model number (example, Q45UR3BA63CK W/30). A model with a QD requires a mating cable (see pages 415 and 421).



U-GAGE® Q45UR High-Gain Controllers


Product P/N	Version	
63060	Q45UR3BA63CQ6-63060	Discrete
63667	Q45UR3LIU64CQ6-63667	Analog

NOTE: Special High-Gain controllers are available for small object detection. Contact factory for more information.

U-GAGE® Q45UR Remote Sensors Specifications	
Supply Voltage and Current	Discrete: 12 to 24V dc (10% max. ripple); 100 mA (exclusive of load) Analog: 15 to 24V dc (10% max. ripple); 100 mA (exclusive of load)
Ultrasonic Frequency	400 kHz
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Protection Circuitry	Both outputs are protected against continuous overload and short circuit
Output Rating	Discrete: 150 mA max. (each output) OFF-state leakage current: less than 25 µA at 24V dc ON-state saturation voltage: less than 1.5V at 10 mA; less than 2.0V at 150 mA Analog: Voltage sourcing: 0 to 10V dc, 10 mA max. Current sourcing: 4 to 20 mA, 1 to 500 Ω impedance
Output Configuration	Discrete: Bipolar: One current sourcing (PNP) and one current sinking (NPN) open collector transistor Analog: One voltage sourcing and one current sourcing; one or the other output is enabled by internal programming switch #2
Performance Specifications	Discrete: Response Speed: 40 or 160 milliseconds (switch selectable) Repeatability*: ±0.2% of measured distance Temperature stability: ±0.03% of the window limit positions per ° C from 0° to 50° C (±0.05% per ° C over remainder of operating temperature range) Sensing window width: 5 to 200 mm, when independent near and far limits are taught; 1, 2, 3, or 4 mm (switch selectable), when a sensing distance set point is taught Hysteresis: 0.5 mm Ultrasonic beam angle: ±3.5° Analog: Response Speed: 10 to 320 milliseconds (2 to 64 cycles) selectable Resolution*: 0.2% of sensing distance at 320 milliseconds response 0.4% of sensing distance at 10 milliseconds response Linearity*: 1% of full scale Temperature stability: ±0.03% of sensing distance per ° C from 0° to 50° C (±0.05% per ° C over remainder of operating temperature) Ultrasonic beam angle: ±3.5° * Repeatability and analog resolution and linearity are specified using a 50 x 50 mm aluminum plate at 22° C under fixed sensing conditions (Analog: using the 4 to 20 mA output @ 15V dc)
Response Curves	See chart RC-6 on page 516.
Adjustments	Discrete: The following may be selected by a 4-position DIP switch located on top of the controller, beneath a transparent O-ring sealed acrylic cover and beneath the black inner cover Switch 1: Output normally open (output is energized when target is within sensing window limits), or normally closed (output is energized when target is outside sensing window limits) Switches 2 & 3: Sensing window size (1, 2, 3 or 4 mm) Switch 4: Response speed selection (40 or 160 milliseconds) Analog: Push-button TEACH-mode programming of window limits. The following may be selected by a 4-position DIP switch located on top of the controller, beneath a transparent O-ring sealed acrylic cover and beneath the black inner cover Switch 1: Output slope: output value increases or decreases with distance Switch 2: Output mode: current output or voltage output Switches 3 & 4: Response to loss of echo Response Speed Adjustment: Single-turn potentiometer selects six response values from 10 to 320 milliseconds



U-GAGE® Q45UR Remote Sensors Specifications (cont'd)

Indicators	<p>Discrete: Three status LEDs: Green ON steady: Power to controller is ON Green flashing: Output is overloaded Yellow ON steady: Output are conducting (Yellow also indicates programming status during setup) Red flashing: Relative strength of received echo</p> <p>5-segment moving dot LED indicates the position of the target within the sensing window</p> <p>Analog: Three status LEDs: Green ON steady: Power to controller is ON Green flashing: Current output fault detected (indicates that the 4 to 20 mA current path to ground has been opened) Yellow ON steady: Target is sensed within the window limits (Yellow LED also indicates programming status during setup mode) Red flashing: Relative strength of received echo</p> <p>5-segment moving dot LED indicates the position of the target within the sensing window</p>
Construction	<p>Controller: Molded thermoplastic polyester housing, o-ring sealed transparent acrylic top cover, and stainless steel hardware</p> <p>Sensors: M18C2.0: Stainless steel M18 threaded barrel housing and jam nuts, polyetherimide front cover, ceramic transducer, polyurethane rear cover S18C2.0: Thermoplastic polyester S18 threaded barrel housing and jam nuts, polyetherimide front cover, ceramic transducer, polyurethane rear cover Q13C2.0: Molded 30% glass reinforced thermoplastic polyester housing, ceramic transducer, fully epoxy-encapsulated</p>
Environmental Rating	Controller: IEC IP67; NEMA 6P Sensor: IEC IP65; NEMA 4
Connections	<p>Controller: 2 m or 9 m attached cable, or 5-pin Mini-style or Euro-style quick-disconnect fitting. See pages 415 and 421.</p> <p>Sensor: 2 m attached PVC cable terminated with 4-pin Euro-style quick-disconnect fitting for connection to controller.</p>
Operating Conditions	Controller and sensor: -25° to +70° C Relative humidity: 85% (non-condensing)
Vibration and Mechanical Shock	All models meet Mil. Std. 202F requirements. Method 201A Vibration: 10 to 60Hz max., double amplitude 0.06" (maximum acceleration 10G). Method 213B conditions H & I (Shock: 75G with unit operating; 100G for non-operation). Also meets IEC 947-5-2 requirements: 30G, 11 milliseconds duration, half sine wave.
Application Notes	<p>Discrete: The TEACH-mode function of the controller is used to set the sensing distance set point. The sensing window size is set using DIP switches #2 and #3. The sensing distance set point is centered within the sensing window. The size of the sensing window may be adjusted at any time, with or without power applied, and without re-teaching the sensing distance set point. The controller has non-volatile memory which remembers the last sensing distance set point setting if power is removed and later reapplied. The sensing distance set point may be programmed using the Remote TEACH input (see hookup diagrams). Acceptable target angle is within ±5° of normal for a smooth, flat target; target rotation does affect the apparent target location with respect to the sensor.</p> <p>Analog: The controller has non-volatile memory which remembers the last sensing distance set point setting if power is removed and later reapplied. The sensing distance set point may be programmed using the Remote TEACH input (see hookup diagrams). Acceptable target angle is within ±5° of normal for a smooth, flat target; target rotation does affect the apparent target location with respect to the sensor.</p>
Certifications	
Hookup Diagrams	M117 (p. 536)

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U-GAGE® T18U

Opposed Dual Range Sensors

Dual ranges and response times

The versatile U-GAGE® T18U offers a choice of two combinations of range and response time in the same unit:

- Response time of 2 milliseconds and range of 600 mm for longer-range applications
- Ultra-fast response time of 1 millisecond with a range of 300 mm for high-speed applications such as counting

Reliable sensing of clear materials

- Uses high-frequency acoustic emitter and tuned receiver for accurate sensing in bright light and to reliably detect clear materials such as glass
- Offers high immunity to electrical and acoustic noise
- Operates at temperature range from -40° to 70° C
- Includes signal strength indicator to make alignment easy



LIGHT GAUGING

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MEASURING LIGHT SCREENS

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RADAR



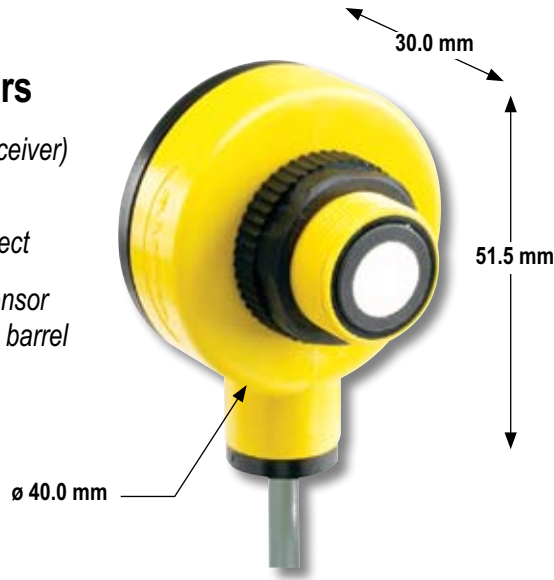
Popular patented housing

- Housed in T-style right-angle sensor package with 18 mm threaded mounting hub, for versatile mounting
- Measures only 40 mm in diameter and 30 mm deep
- Available with 4-pin Euro-style quick-disconnect or integral cable



U-GAGE® T18U Sensors

- Dual LED indicator system (receiver)
- 2 m or 9 m attached cable, or 4-pin Euro-style quick-disconnect
- Patented T-style right-angle sensor package with 18 mm threaded barrel



U-GAGE® T18U, 12-30V dc



Models*		Range	Cable**	Output	Response Time	Data Sheet
T186UE	Emitter	NORMAL resolution: 600 mm HIGH resolution: 300 mm	2 m	—	NORMAL resolution: 2 ms or HIGH resolution: 1 ms	40124
T186UEQ			4-pin Euro QD			
T18VN6UR	Receiver		2 m	NPN		
T18VN6URQ			4-pin Euro QD			
T18VP6UR	Receiver		2 m	PNP		
T18VP6URQ			4-pin Euro QD			


* Sensor pair requires one emitter and one receiver.

** For 9 m cable, add suffix **W30** to the 2 m model number (example, **T18VN6UR W30**). A model with a QD requires a mating cable (see page 412).

U-GAGE® T18U Specifications	
Sensing Range (no minimum range)	NORMAL resolution mode: to 600 mm HIGH resolution mode: to 300 mm
Supply Voltage	12 to 30V dc, 10% max. ac ripple. 50 mA (emitters); 35 mA (receivers), exclusive of output load.
Ultrasonic Frequency	Ultrasonic, 230 kHz
Minimum spacing (adjacent pairs)	50 mm for emitter-to-receiver separations of up to 150 mm. Add 10 mm of adjacent-pair spacing for every 100 mm of emitter-to-receiver spacing beyond 150 mm.
Receiver Output Configuration	T18VN models: NPN sinking, NO and NC (complementary) T18VP models: PNP sourcing, NO and NC (complementary)
Receiver Output Rating	150 mA max. each output at 25° C, derated to 100 mA at 70° C (derate ≈ 1 mA per ° C). Both outputs may be used simultaneously. ON-state saturation voltage: less than 1.5V at 10 mA; less than 2.0 V at 150 mA OFF-state leakage current: less than 1 µA at 30V dc Output protection: Overload and short-circuit protected. No false pulse upon receiver power-up: false pulse protection causes a 100 millisecond delay upon power-up.



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U-GAGE® T18U Specifications (cont'd)	
Output Response Time	NORMAL resolution mode: 2 milliseconds ON/OFF HIGH resolution mode: 1 millisecond ON/OFF
Rep Rate	NORMAL resolution mode: 125 Hz max. HIGH resolution mode: 200 Hz max.
Mechanical Sensing Repeatability at 300 mm range	NORMAL resolution mode: less than 2 mm HIGH resolution mode: less than 1 mm
Beam Angle (-3dB full angle)	15 ± 2°
Indicators	Emitters have a green LED for dc power ON. Receivers have two LED's, one yellow and one green. Indications are as follows: Green ON steady: dc power ON Green flashing: output overloaded Yellow flashing: sonic signal received (flash rate is proportional to received signal strength; flash is from full to half intensity).
Construction	T-style yellow PBT polyester housing with black PBT polyester back cover. Transducer housing is threaded M18 x 1. Mating jam nut is supplied for mounting. Acoustic face is epoxy reinforced. Circuitry is epoxy-encapsulated.
Environmental Rating	IEC IP67; NEMA 6P
Connections	Emitters: 2 m long attached PVC- covered 2-wire cable or 4-pin Euro-style quick-disconnect fitting. Receivers: 2 m long attached PVC-covered 4-wire cable or 4-pin Euro-style quick-disconnect fitting. 9 m long cables are available by request. Mating Euro-style quick-disconnect cables are also available. See page 412.
Operating Temperature	-40° to +70° C
Vibration and Mechanical Shock	Meets Mil.Std 202F requirements. Method 201A (Vibration: frequency 10 to 60 Hz, max., and double amplitude 0.06-inch, maximum acceleration 10G). Method 213B conditions H&I (Shock: 75G with unit operation; 100G for non-operation) Also meets IEC 947-5-2 requirements: 30G, 11 milliseconds duration, half sine wave.
Certifications	
Hookup Diagrams	Emitter Models: MI20 (p. 536) NPN Models: MI18 (p. 536) PNP Models: MI19 (p. 536)

A-GAGE®

Measuring Light Screens

EZ-ARRAY™

page 288

- Applications include edge and center-guiding, loop tension control, hole sizing, parts counting and on-the-fly product sizing and profiling.
- Closely spaced infrared beams detect objects as small as 5 mm wide; edge resolution is 2.5 mm.
- Controller functionality is built into the receiver, so basic setup requires no controller, software, or PC.
- Easy-to-use software is included for advanced configuration, using a PC.
- Configuration options include 14 measurement modes, three scanning methods, two analog and two discrete outputs and a serial output.
- Range is 4 meters.
- Array heights range from 150 to 2400 mm.



High-Resolution MINI-ARRAY®

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- High-resolution array excels at high-speed, precise process monitoring and inspection applications.
- Available heights range from 163 to 1951 mm.
- Closely spaced beams detect objects as small as 2.5 mm.
- Emitters and receivers can be up to 1.8 m apart.
- Controllers can be configured for a variety of measurement modes, scan modes and output configurations.



MINI-ARRAY®

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- Low-profile light screen pairs are designed for profiling and inspections.
- Available heights range from 133 to 1819 mm.
- Depending on the model's beam spacing, the array detects objects as small as 19 to 38 mm.
- Emitters and receivers can be up to 6 m apart or up to 17 m apart, depending on model.
- Configuration options include blanking, sensitivity and scanning mode.
- Controllers are available with DeviceNet™ Compatibility output.

DeviceNet™ is a trademark of open DeviceNet Vendor Association, Inc.

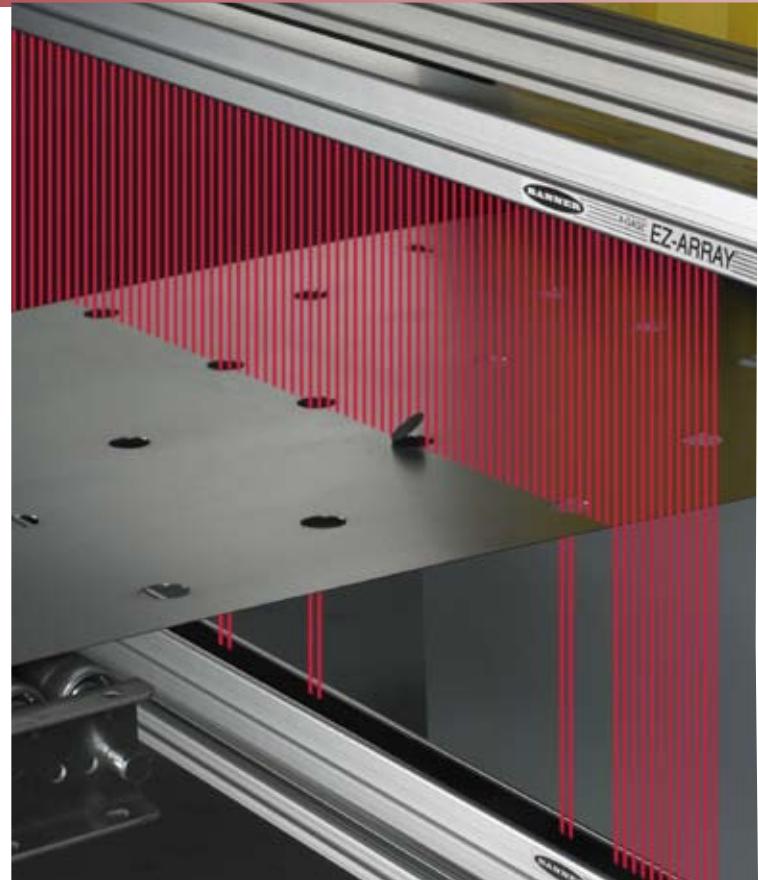
A-GAGE® EZ-ARRAY™

Two-Piece Measuring Light Screens

High accuracy monitoring and inspection

EZ-ARRAY™ excels at high-speed, precise process monitoring and inspection, profiling and web-guiding applications. It offers quick and simple installation with the sophistication to handle the toughest sensing applications.

- Two-piece design eliminates the needs for a separate controller.
- Two push buttons are provided for gain method selection and alignment/ blanking.
- High-excess-gain option for detecting opaque objects and maximizing range in dirty environments.
- Edge resolution of 2.5 mm on opaque objects in single and double edge scan mode.
- Low-contrast sensing of semi-transparent materials and objects as small as 5 mm.
- Seven Zone LED's provide instant alignment and beam blockage information.
- Remote TEACH-wire option is included for alignment, blanking, sensitivity, inverted display and DIP switch enabled/disabled.
- Aluminum housing is compact and rugged for demanding applications.

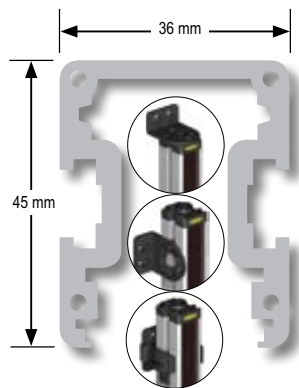


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Versatile mounting

- T-nut slots on both sides of the housing
- Mount at end caps, housing side or both



INTUSB485-1 Serial Adapter

Optional USB sensor adapter provides advanced configuration using a PC (see page 448)



Provides powerful configuration capabilities

- Straightforward applications can be configured using six-position DIP switch on front of the receiver.
- Easy-to-use graphic user interface software is included for advanced configuration using a PC (USB serial adapter required—sold separately).
- Integrated 3-digit diagnostic display indicates number of beams blocked, blanking configuration and troubleshooting codes.
- Bicolor LEDs indicate system and serial communication status.
- Array lengths range from 150 to 2400 mm.
- Working range is 400 mm to 4 m, with 5 mm beam spacing.



A-GAGE® EZ-ARRAY™ Light Screen

- Twelve array lengths
- Minimum object detection size of 5 mm
- Edge resolution of 2.5 mm for opaque objects
- Emitter/receiver separation up to 4 m
- Durable aluminum housing
- System status indicators and diagnostic display
- 8-pin Euro-style quick-disconnect fitting



EZ-ARRAY Light Screen	
W = 36.0 mm	D = 45.2 mm

Emitter/Receiver Models	Housing Length (L)
EA5E150Q Emitter EA5R150..Q Receiver	227 mm
EA5E300Q Emitter EA5R300..Q Receiver	379 mm
EA5E450Q Emitter EA5R450..Q Receiver	529 mm
EA5E600Q Emitter EA5R600..Q Receiver	678 mm
EA5E750Q Emitter EA5R750..Q Receiver	828 mm
EA5E900Q Emitter EA5R900..Q Receiver	978 mm
EA5E1050Q Emitter EA5R1050..Q Receiver	1128 mm
EA5E1200Q Emitter EA5R1200..Q Receiver	1278 mm
EA5E1500Q Emitter EA5R1500..Q Receiver	1578 mm
EA5E1800Q Emitter EA5R1800..Q Receiver	1878 mm
EA5E2100Q Emitter EA5R2100..Q Receiver	2178 mm
EA5E2400Q Emitter EA5R2400..Q Receiver	2478 mm

A-GAGE® EZ-ARRAY™ Light Screens, 12-30V dc–5 mm Beam Spacing



Emitter Model	Receiver Model NPN Outputs	Receiver Model PNP Outputs	Range	Analog Output	Array Length	Total Beams	Quick Start
EA5E150Q	EA5R150NIXMODQ EA5R150NUXMODQ	EA5R150PIXMODQ EA5R150PUXMODQ	400 mm-4 m	Current (4–20 mA) Voltage (0–10V)	150 mm	30	126701
EA5E300Q	EA5R300NIXMODQ EA5R300NUXMODQ	EA5R300PIXMODQ EA5R300PUXMODQ		Current (4–20 mA) Voltage (0–10V)	300 mm	60	
EA5E450Q	EA5R450NIXMODQ EA5R450NUXMODQ	EA5R450PIXMODQ EA5R450PUXMODQ		Current (4–20 mA) Voltage (0–10V)	450 mm	90	
EA5E600Q	EA5R600NIXMODQ EA5R600NUXMODQ	EA5R600PIXMODQ EA5R600PUXMODQ		Current (4–20 mA) Voltage (0–10V)	600 mm	120	
EA5E750Q	EA5R750NIXMODQ EA5R750NUXMODQ	EA5R750PIXMODQ EA5R750PUXMODQ		Current (4–20 mA) Voltage (0–10V)	750 mm	150	
EA5E900Q	EA5R900NIXMODQ EA5R900NUXMODQ	EA5R900PIXMODQ EA5R900PUXMODQ		Current (4–20 mA) Voltage (0–10V)	900 mm	180	
EA5E1050Q	EA5R1050NIXMODQ EA5R1050NUXMODQ	EA5R1050PIXMODQ EA5R1050PUXMODQ		Current (4–20 mA) Voltage (0–10V)	1050 mm**	210	
EA5E1200Q	EA5R1200NIXMODQ EA5R1200NUXMODQ	EA5R1200PIXMODQ EA5R1200PUXMODQ		Current (4–20 mA) Voltage (0–10V)	1200 mm**	240	
EA5E1500Q	EA5R1500NIXMODQ EA5R1500NUXMODQ	EA5R1500PIXMODQ EA5R1500PUXMODQ		Current (4–20 mA) Voltage (0–10V)	1500 mm**	300	
EA5E1800Q	EA5R1800NIXMODQ EA5R1800NUXMODQ	EA5R1800PIXMODQ EA5R1800PUXMODQ		Current (4–20 mA) Voltage (0–10V)	1800 mm**	360	
EA5E2100Q	EA5R2100NIXMODQ EA5R2100NUXMODQ	EA5R2100PIXMODQ EA5R2100PUXMODQ		Current (4–20 mA) Voltage (0–10V)	2100 mm**	420	
EA5E2400Q	EA5R2400NIXMODQ EA5R2400NUXMODQ	EA5R2400PIXMODQ EA5R2400PUXMODQ		Current (4–20 mA) Voltage (0–10V)	2400 mm**	480	

* A model with a QD requires a cable (see page 416).
 ** Models with array lengths 1050 mm and longer ship with a center bracket and two end-cap brackets.

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A-GAGE® EZ-ARRAY™ Specification

Supply Voltage (Limit Values)	Emitter: 12 to 30V dc Receiver Analog Current Models: 12 to 30V dc Receiver Analog Voltage Models: 15 to 30V dc
Supply Power Requirements	Emitter/Receiver Pair (Exclusive of discrete load): Less than 9 watts Power-up delay: 2 seconds
Emitter/Receiver Range	400 mm to 4 m
Field of View	Nominally ± 3°
Beam Spacing	5 mm
Light Source	Infrared LED
Minimum Object Detection Size	Straight Scan, Low-Contrast: 5 mm Straight Scan, High-Excess-Gain: 10 mm
Sensor Positional Resolution	Straight Scan: 5 mm Double-Edge Scan: 2.5 mm Single-Edge Scan: 2.5 mm
Teach Input (Receiver Gray Wire)	Low: 0 to 2 volts High: 6 to 30 volts or open (input impedance 22 kΩ)
Two Discrete Outputs	Solid-State NPN or PNP (current sinking or sourcing) Rating: 100 mA max. each output OFF-State Leakage Current: NPN: less than 200 uA @ 30V dc PNP: less than 10 uA @ 30V dc ON-State Saturation Voltage: NPN: less than 1.6V @ 100 mA PNP: less than 2.0V @ 100 mA Protected against false pulse on power-up and continuous overload or short circuit.
Two Analog Outputs	Voltage Sourcing: 0 to 10V (maximum current load of 5 mA) Current Sourcing: 4 to 20 mA (maximum resistance load = $(V_{supply} - 3) / 0.020$)
Serial Communication Interface	EIA-485 Modbus RTU (up to 15 nodes per communication ring) RTU binary format Baud Rate: 9600, 19.2K or 38.4K 8 Data Bits, 1 Stop Bit, and Even, Odd, or 2 Stop Bits and No Parity
Scan Time	Scan times depend on scan mode and sensor length. Straight scan times range from 2.8 to 26.5 milliseconds.
Status Indicators	Emitter: Red Status LED ON Steady—Status OK Flashing at 1 hz—Error Receiver: 7 Zone Indicators Red—Blocked channels within zone Green—All channels clear within zone 3-digit 7-segment indicators for measurement mode / diagnostic information Sensor Status Bicolor Indicator LED Red—Hardware Error or Marginal Alignment Green—OK Modbus Activity Indicator LED: Yellow Modbus Error Indicator LED: Red
System Configuration (Receiver Interface)	6-position DIP switch: Used to set scanning type, measurement modes, analog slope and discrete output 2 function. Alternate software GUI interface provides additional options; see full manual (p/n 130426).
Push Buttons (Receiver Interface)	Two momentary push buttons for alignment and gain level selection.
Connections	Serial communication: The receiver uses a PVC-jacketed, 5-conductor 22-gauge quick-disconnect cable, 5.4 mm diameter. QD cables are ordered separately. See page 422. Other Sensor connections: 8-conductor quick-disconnect cables (one each for emitter and receiver), ordered separately (may not exceed 75 m long), PVC-jacketed cables measure 5.8 mm diameter, have shield wire; 22-gauge conductors. QD cables are ordered separately. See page 416.
Construction	Aluminum housing with clear-anodized finish; acrylic lens cover
Environmental Rating	IEC IP65
Operating Conditions	Temperature: -40° to +70° C Relative humidity: 95% at 50° C (non-condensing)
Hookup Diagrams	NPN models: MI23 (p. 537) PNP models: MI24 (p. 537)



A-GAGE® High-Resolution MINI-ARRAY®

High-Resolution Inspection and Profiling Light Screen

The A-GAGE® High-Resolution MINI-ARRAY® has 120 sensing beams per foot, for reliable detection of objects as small as 2.5 mm. It features a 2 m range with easy, forgiving alignment and a unique TEACH setup routine that equalizes the gain of each sensing channel to the optimum level and automatically blanks any blocked areas along the length of the light screen.

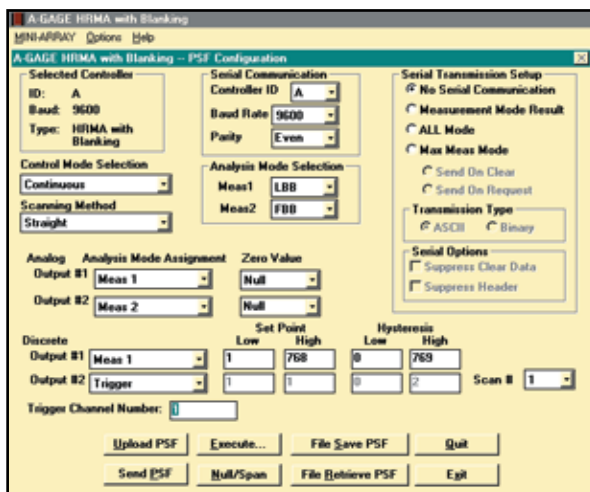
Ultra-precise monitoring & inspection

High-Resolution MINI-ARRAY systems excel in high-speed, precise monitoring and inspection applications, including on-the-fly sizing, profiling, precision edge and center guiding, and hole detection. Setup software allows system configuration using a PC.

- Delivers reliable 2.5 mm minimum detection throughout the array
- Available with discrete or analog outputs
- Offers programmable blanking, hysteresis and serial communication
- Reliably detects variable object size at a high resolution and fast response speed

A choice of 12 array heights to fit your precision measurement applications

- Available in heights from 163 to 1951 mm
- Features 7 measurement modes and 3 scanning methods



Many options, yet easy to program

- Software included with the control module makes it easy to configure the many options with a PC-compatible computer.
- Storable scanning programs eliminate reprogramming for repeated applications.
- Non-volatile memory of controller stores alignment settings.



Unique staggered LED array allows for industry's tightest sensing tolerance.

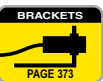
LIGHT
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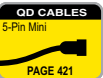
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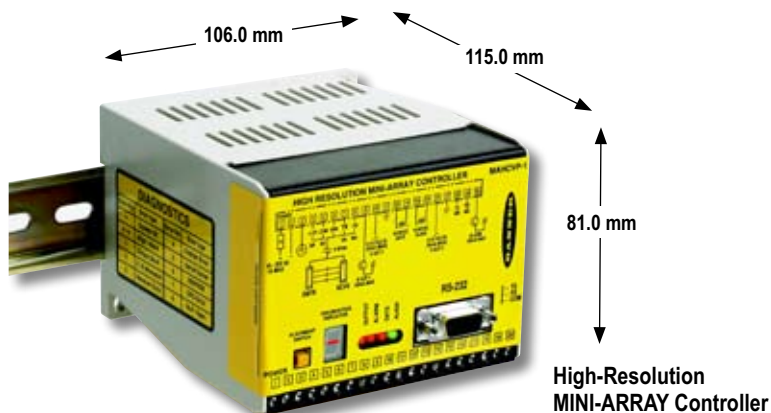
A-GAGE® High-Resolution MINI-ARRAY® System

- Twelve array lengths
- Minimum object detection size of 2.5 mm
- Emitter/receiver separation up to 1.8 m
- Configurable controller
- Rugged aluminum housing



High-Resolution MINI-ARRAY Sensors	
W = 38.1 mm	D = 38.1 mm

Emitter/Receiver Models	Housing Length (L)
MAHE6A Emitter MAHR6A Receiver	233 mm
MAHE13A Emitter MAHR13A Receiver	396 mm
MAHE19A Emitter MAHR19A Receiver	559 mm
MAHE26A Emitter MAHR26A Receiver	721 mm
MAHE32A Emitter MAHR32A Receiver	884 mm
MAHE38A Emitter MAHR38A Receiver	1046 mm
MAHE45A Emitter MAHR45A Receiver	1212 mm
MAHE51A Emitter MAHR51A Receiver	1374 mm
MAHE58A Emitter MAHR58A Receiver	1537 mm
MAHE64A Emitter MAHR64A Receiver	1700 mm
MAHE70A Emitter MAHR70A Receiver	1862 mm
MAHE77A Emitter MAHR77A Receiver	2025 mm



A-GAGE® High-Resolution MINI-ARRAY® Controllers†, 16-30V dc



Controller Models	Inputs	Solid-State Discrete Outputs	Analog Outputs	Serial Output	Data Sheet
MAHCVP-1	1 Sensor pair & Trigger (Gate)	2 PNP	(2) 0-10V Sourcing	RS-232 & RS-485	64118
MAHCVN-1		2 NPN	(2) 0-10V Sourcing		
MAHCIP-1		2 PNP	(2) 4-20 mA Sinking		
MAHCIN-1		2 NPN	(2) 4-20 mA Sinking		

† One controller and an emitter/receiver pair (of matching length) required per system.

A-GAGE® High-Resolution MINI-ARRAY® Sensors—2.5 mm Beam Spacing



Models*	Cable**	Housing Length	Total Beams	Array Length	Minimum Object Size	Range	Data Sheet
MAHE6A MAHR6A	5-pin Mini QD	233 mm	64	163 mm	2.5 mm	0.4 - 1.8 m	64118
MAHE13A MAHR13A		396 mm	128	325 mm			
MAHE19A MAHR19A		559 mm	192	488 mm			
MAHE26A MAHR26A		721 mm	256	650 mm			
MAHE32A MAHR32A		884 mm	320	813 mm			
MAHE38A MAHR38A		1046 mm	384	975 mm			
MAHE45A MAHR45A		1212 mm	448	1138 mm			
MAHE51A MAHR51A		1374 mm	512	1300 mm			
MAHE58A MAHR58A		1537 mm	576	1463 mm			
MAHE64A MAHR64A		1700 mm	640	1626 mm			
MAHE70A MAHR70A		1862 mm	704	1788 mm			
MAHE77A MAHR77A		2025 mm	768	1951 mm			

* "E" and "R" in model numbers denotes "Emitter" and "Receiver" respectively. Sold separately.
 ** A model with a QD requires a mating cable (see page 421).




A-GAGE® High-Resolution MINI-ARRAY® Controller Specifications


Power Requirements	16 to 30V dc @ 1.0 A (typical: 0.5 A @ 16V dc)
Inputs	Sensor input: Emitter and receiver wire in parallel to five terminals. Trigger (Gate) input: Optically isolated, requires 10 to 30V dc (7.5 kΩ impedance) for gate signal Remote alignment input: Optically isolated, requires 10 to 30V dc (7.5 kΩ impedance) for alignment sequence signal
Discrete (Switched) Outputs	NPN outputs: Open collector NPN transistor rated at 30V dc max., 150 mA max. PNP outputs: Open collector PNP transistor rated at 30V dc max., 150 mA max. All discrete outputs: OFF-state leakage current: less than 10 µA @ 30V dc ON-state saturation voltage: less than 1V @ 10 mA; less than 1.5V @ 150 mA
Serial Data Outputs	RS-232 or RS-485 interface. (Up to 15 control modules may be given unique addresses on one RS-485 party line.) ASCII or binary data format 9600, 19.2K or 39.4K baud rate 8 data bits, stop bit, and even, odd or no parity



A-GAGE® High-Resolution MINI-ARRAY® Controller Specifications (cont'd)

Analog Outputs	Voltage-sourcing outputs: 0 to 10V dc (25 mA current limit) Current-sinking outputs: 4 to 20 mA (16 to 30V dc input) Resolution: Span / Number of sensing channels Linearity: 0.1% of full scale Temperature variation: 0.01% of full scale per ° C
Output Configuration	MAHCVP-1: Two PNP discrete (switched), two 0-10V voltage sourcing MAHCVN-1: Two NPN discrete (switched), two 0-10V voltage sourcing MAHCIP-1: Two PNP discrete (switched), two 4-20 mA current sinking MAHCIN-1: Two NPN discrete (switched), two 4-20 mA current sinking
System Programming	Via RS-232 interface to PC-compatible computer running Windows® 95, 98, NT, ME, XP or 2000 and using software supplied with each control module.
Status Indicators	Output 1 (Red): Lights to indicate Discrete Output #1 is active Alarm (Red): Lights to indicate Discrete Output #2 is active Gate (Red): Lights to indicate Trigger (Gate) is active Align (Green): Lights to indicate emitter and receiver are aligned Diagnostics indicator: (Key on controller side label) Identifies System errors and status
Construction	Polycarbonate housing; mounts to flat surface or directly onto 35-mm DIN rail
Environmental Rating	NEMA 1; IP20
Operating Conditions	Temperature: 0° to +50° C Relative humidity: 95% @ 50° C (non-condensing)
Certifications	
Hookup Diagrams	0-10V sourcing: MI25 (p. 538) 4 to 20 mA voltage: MI26 (p. 538)

A-GAGE® High-Resolution MINI-ARRAY® Sensor Specifications

Emitter/Receiver Range	380 mm to 1.8 m
Minimum Object Sensitivity	2.5 mm
Sensor Scan Time	1.8 to 58.4 milliseconds, depending on scanning method and sensor length plus 1 millisecond post processing time for controller.
Power Requirements	12V dc ±2%, supplied by controller
Connections	Sensors connect to controller using two 5-conductor quick-disconnect cables (one each for emitter and receiver), ordered separately. Use only Banner cables, which incorporate a "twisted pair" for noise immunity. Cables measure 8.1 mm in diameter and are shielded and PVC-jacketed. Conductors are 20 gauge (0.9 mm). Emitter and receiver cables may not exceed 75 m long, each. See page 421.
Status Indicators	Emitter: Red LED lights to indicate proper emitter operation Receiver: Green indicates sensors aligned Yellow indicates marginal alignment of one or more beams Red indicates sensors misaligned or one or more beam(s) blocked
Construction	Aluminum, with black anodized finish; acrylic lens cover
Environmental Rating	NEMA 4, 13; IP65
Operating Conditions	Temperature: 0° to +50° C Relative humidity: 95% at 50° C (non-condensing)
Certifications	

System Configuration

Many options, yet easy to program.

The software included with the control module makes it easy to configure the **High-Resolution MINI-ARRAY®** using your PC-compatible computer*. Simply load the software, access the program, perform the "Ping" procedure to select the desired controller and access the Edit PSF Configuration screen, shown below. Each option is easily selectable, using your mouse and the pop-up menu-style selections.

*Running Windows® 95, 98, NT, ME, XP or 2000

Selected Controller
Identifies the specific control module being configured.

Analysis (Measurement) Mode Selection
Choose the measurement option that best tells you the size and/or position of objects as they relate to the array.

Serial Communication
Changes the identification and baud rate of the controller being configured.

Serial Transmission
Specifies the type of data transmitted from the control module to its host after each scan.
Measurement Mode Result: Data transmitted will reflect the Analysis Mode selections.
All Mode: Transmits all data.
Max. Meas. Mode: Sends only the largest measurement in each measuring event, to decrease transmission size and speed response. Choose to send when the array is clear or send at the host's request.
Transmission Type: ASCII or Binary, defines the format in which the data will be sent.
Serial Options: Suppress Clear Data or Suppress Header to decrease transmission size and speed response.

Control Mode Selection
Continuous Mode: The control module constantly polls the array for status.
Host Mode: The control module polls the array for status when prompted by a host controller.
Gate Mode: The control module polls the array for status when prompted by an input from a Gate sensor.

Scanning Method
Straight scan polls each beam sequentially to determine the target object's overall size. This is the most accurate and precise measurement, but also the most time-consuming.
Single Edge scan requires the target object to block beam 1 (closest to the sensors' cabled ends), then conducts a time-saving binary search to "hunt" for the target's overall height (one variable edge).
Double Edge scan conducts a binary search of the entire array to "hunt" for the target's overall width (two variable edges).

Trigger/Trigger Channel Number
May be used to trigger (or gate) the scan sequence of another A-GAGE High-Resolution MINI-ARRAY controller; in straight scanning mode, it defines when during each scan discrete Output #2 will change state.

Scan #: (1-9) Analog outputs are updated with an average value of the data received during the selected number of scans; discrete outputs respond only if the received data is identical for all of the selected number of consecutive scans.

Set Point and Hysteresis Selection
Assigns the set point to determine where within the array the output(s) will respond and hysteresis values to smooth output response.

Analog and Discrete Output Assignment
Assigns an analysis (measurement) mode to each output.

Alarm: Causes the control module to turn on discrete Output #2 whenever the System detects a sensing error or if the optical signal becomes marginal.

- LIGHT GAUGING
- ULTRASONIC
- MEASURING LIGHT SCREENS
- TEMPERATURE
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Downloadable Software
To test and verify software, download High-Resolution MINI-ARRAY with blanking version 1.0 (61330.exe) at www.bannerengineering.com.

- LIGHT GAUGING
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A-GAGE® MINI-ARRAY®

Inspection and Profiling Light Screens

A compact workhorse for inspection and profiling

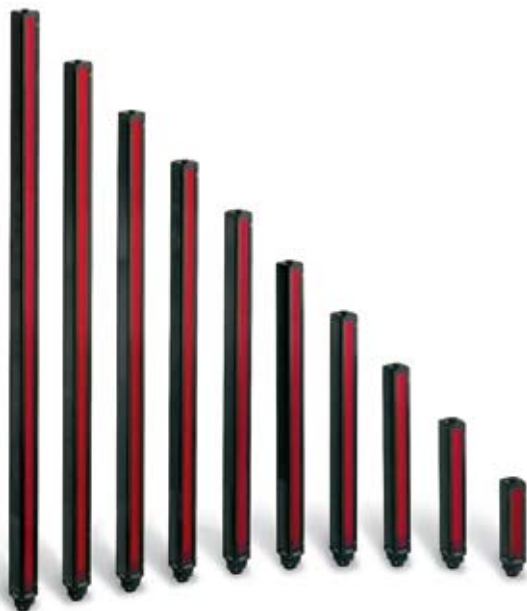
The programmable A-GAGE® MINI-ARRAY® measuring light screen system is ideal for inspection and profiling applications. Each system includes an emitter/receiver pair, one of nine controller modules and cables. Programmable controller modules offer a selection of measurement modes, scanning modes and output configurations.

- Features compact emitter/receiver footprint—just 38 square mm
- Offers choice of controllers for output in discrete (switched), analog, serial (ASCII or binary) or DeviceNet™
- Includes advanced configuration software
- Available in two models that have 16 discrete outputs

Ten emitter/receiver heights

- Offers 10 array lengths, from 130 mm to 1.8 m, to fit a wide range of applications
- Available with 9.5 or 19 mm beam spacing
- Makes status monitoring easy with indicators visible from three sides

- BRACKETS
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DeviceNet™ is a trademark of the Open DeviceNet Vendor Association, Inc.



Optional built-in DeviceNet™ fieldbus

Two controller models allow central monitoring and control of the operation status and diagnostics of several light screens at once over a DeviceNet control network. MINI-ARRAY communications are available through DeviceNet and can use change-of-state protocol or polled communication protocol.



Heated enclosures for severe environments

The MINI-ARRAY is available with heated enclosures for outdoor applications such as vehicle scanning in tollbooths and similar uses. The heated enclosures are available in 1.2, 1.5 and 1.8 m array lengths, in both painted aluminum and stainless steel for all environments. Optional power supplies are available for the heated enclosures.

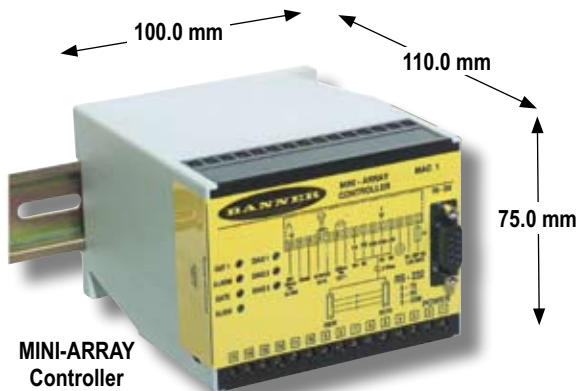
A-GAGE® MINI-ARRAY® System

- Ten array lengths
- Minimum object detection size of 19 or 38 mm
- Emitter/receiver separation up to 17 m
- Configurable controller
- Rugged aluminum housing
- 5-pin Mini-style QD cables with shield and "twisted pair" ordered separately (see page 421)



Emitter/Receiver Models	Housing Length (L)
BMEL6..A Emitter BMRL6..A Receiver	201 mm
BMEL12..A Emitter BMRL12..A Receiver	356 mm
BMEL18..A Emitter BMRL18..A Receiver	505 mm
BMEL24..A Emitter BMRL24..A Receiver	659 mm
BMEL30..A Emitter BMRL30..A Receiver	810 mm
BMEL36..A Emitter BMRL36..A Receiver	963 mm
BMEL42..A Emitter BMRL42..A Receiver	1115 mm
BMEL48..A Emitter BMRL48..A Receiver	1267 mm
BMEL60..A Emitter BMRL60..A Receiver	1572 mm
BMEL72..A Emitter BMRL72..A Receiver	1877 mm

- LIGHT GAUGING
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- RADAR



MINI-ARRAY Sensors	
W = 38.1 mm	D = 38.1 mm

A-GAGE® MINI-ARRAY® Controllers†, 16-30V dc



Controller Models	Inputs	Solid-State Discrete Outputs	Analog Outputs	Serial Output	Data Sheet
MAC-1	1 Sensor pair & Trigger (Gate)	1 Reed & 1 NPN	-	RS-232 & RS-485	43298
MACN-1		2 NPN	-		
MACP-1		2 PNP	-		
MACV-1		1 NPN	(2) 0-10V Sourcing	RS-232	
MACI-1		1 NPN	(2) 4-20 mA Sinking		
MAC16N-1	1 Sensor pair & Trigger (Gate)	16 NPN	-	RS-232	43298
MAC16P-1		16 PNP	-		
MACNXDN-1*	1 Sensor pair & Trigger (Gate)	2 NPN	-	-	59437
MACPXDN-1*		2 NPN	-	-	

* DeviceNet™ models

† One controller and an emitter/receiver pair (of matching length and resolution) required per system. DeviceNet™ is a trademark of the Open DeviceNet Vendor Association, Inc.



A-GAGE® MINI-ARRAY® Sensors–19.1 mm Beam Spacing

Models*	Cable**	Housing Length	Total Beams	Array Length	Minimum Object Size	Range	Data Sheet
BMEL616A BMRL616A	5-pin Mini QD	201 mm	8	133 mm	38.1 mm Interlaced Mode: 25.4 mm	0.9 - 17 m	43298
BMEL1216A BMRL1216A		356 mm	16	286 mm			
BMEL1816A BMRL1816A		505 mm	24	438 mm			
BMEL2416A BMRL2416A		659 mm	32	591 mm			
BMEL3016A BMRL3016A		810 mm	40	743 mm			
BMEL3616A BMRL3616A		963 mm	48	895 mm			
BMEL4216A BMRL4216A		1115 mm	56	1048 mm		0.9 - 14 m	
BMEL4816A BMRL4816A		1267 mm	64	1200 mm			
BMEL6016A BMRL6016A		1572 mm	80	1505 mm			
BMEL7216A BMRL7216A		1877 mm	96	1810 mm			



A-GAGE® MINI-ARRAY® Sensors–9.5 mm Beam Spacing



Models*	Cable**	Housing Length	Total Beams	Array Length	Minimum Object Size	Range	Data Sheet
BMEL632A BMRL632A	5-pin Mini QD	201 mm	16	143 mm	19.1 mm Interlaced Mode: 12.7 mm	0.6 - 6.1 m	43298
BMEL1232A BMRL1232A		356 mm	32	295 mm			
BMEL1832A BMRL1832A		505 mm	48	448 mm			
BMEL2432A BMRL2432A		659 mm	64	600 mm			
BMEL3882A BMRL3882A		810 mm	80	752 mm			
BMEL3632A BMRL3632A		963 mm	96	905 mm			
BMEL4232A BMRL4232A		1115 mm	112	1057 mm		0.6 - 4.6 m	
BMEL4832A BMRL4832A		1267 mm	128	1210 mm			
BMEL6032A BMRL6032A		1572 mm	160	1514 mm			
BMEL7232A BMRL7232A		1877 mm	192	1819 mm			

* "E" and "R" in models numbers denotes "Emitter" and "Receiver" respectively. Sold separately.


** A model with a QD requires a mating cable (see page 421).



A-GAGE® MINI-ARRAY® Controller Specifications																			
Power Requirements	16 to 30V dc @ 1.25 amps max. (see current requirements for sensors); controller alone, (without sensors connected) requires 0.1 amp.																		
Inputs	Sensor input (5 connections): Emitter and receiver wire in parallel to five terminals Trigger (Gate) input: Optically isolated, requires 10 to 30V dc (7.5K input impedance) for gate signal																		
Discrete Outputs	<p>MAC-1: Output 1 (OUT 1) - Reed relay contact rated 125V ac/dc max., 10 VA max. resistive load (non-inductive). Output 2 (ALARM) - Open collector NPN transistor rated 30V dc max., 150 mA max, short-circuit protected; may be configured as a second data analysis output, a system alarm output, or a scan trigger output for a parallel array OFF-state leakage current: less than 10 µA @ 30V dc ON-state saturation voltage: less than 1V @ 10 mA; less than 1.5V @ 150 mA</p> <p>MACN-1: (2) Open collector NPN transistor outputs MACP-1: (2) Open collector PNP transistor outputs; transistor rated 30V dc max. 150 mA max, short circuit protected; may be configured as a second data analysis output, a system alarm output, or a scan trigger output for a parallel array OFF-state leakage current: less than 10 µA @ 30V dc ON-state saturation voltage: less than 1V @ 10 mA; less than 1.5 V @ 150 mA</p> <p>MACV-1/MACI-1: Alarm - Open collector NPN transistor rated 30V dc max. 150 mA max, short circuit protected; may be configured as a data analysis output, a system alarm output, or a scan trigger output for a parallel array OFF-state leakage current: less than 10 µA @ 30V dc ON-state saturation voltage: less than 1V @ 10 mA; less than 1.5 V @ 150 mA</p> <p>MAC16P-1: Sixteen open collector PNP transistor outputs MAC16N-1: Sixteen open collector NPN transistor outputs 30V dc max, 150 mA max., short circuit protected OFF-state leakage current: less than 10 µA ON-state saturation voltage: less than 1V @ 10 mA; less than 1.9V @ 150 mA</p>																		
Serial Data Outputs	RS-232, ASCII or binary data format Baud Rate: 9600, 19.2K, or 38.4K, 8 data bits, 1 start bit, 1 stop bit, even parity Clear data may be suppressed Header string may be suppressed in binary format MAC-1: Up to 15 controllers may be given unique address for RS-485 party line																		
Analog Outputs	MACV-1: 0-10 Volts sourcing adjustable Null and Span (20 mA current limit) MACI-1: 4-20 mA current sinking adjustable Null and Span (16 to 30V input) Resolution: Span/(Number of sensor channels) Linearity: 0.1% of Full Scale Temperature variation: 0.01% of Full Scale/° C																		
Controller Programming	All models: Via RS-232 PC-compatible computer running Windows® 95, 98, NT, ME, XP or 2000 operating system and using Banner supplied software																		
Sensor Scan Time	All models: 55 microseconds per beam plus processing time. The processing time is dependent on the scan analysis and the number of active outputs. This timing assumes a straight scan, continuous, and TBB mode MAC-1, MACN-1 & MACP-1: 1 millisecond processing time MACV-1 & MACI-1: 1.5 milliseconds processing time MAC16N-1 & MAC16P-1: 2.3 to 7 milliseconds processing time																		
System Response Time	Outputs are not active for 5 seconds after system power up. Maximum response time for the system is two sensor scan cycles. A scan cycle includes a sensor scan plus any serial data transmission. Serial transmission (if activated) follows every sensor scan.																		
Status Indicators	<p>The following status LEDs are located on the top surface of the module: MACV-1 & MACI-1: V OUT (Red) - (also called I OUT) Indicates that the analog outputs are active MAC-1, MACN-1 & MACP-1: OUT 1 (Red) - Indicates that output 1 is energized MAC16N-1 & MAC16P-1: OUT (Red) - Indicates that at least one output is active ALARM (Red) - Indicates that Output 2 is active/MAC16N-1 & MAC16P-1: Indicates output 16 is active GATE (Red) - Indicates voltage is applied to Trigger (Gate) input ALIGN (Green) - Indicates sensor aligned (excess gain > 1x)</p> <table border="0"> <tr> <td></td> <td style="text-align: center;">Condition</td> <td style="text-align: center;">DIAG1 (Green)</td> <td style="text-align: center;">DIAG2 (Red)</td> <td style="text-align: center;">DIAG3 (Red)</td> </tr> <tr> <td rowspan="3" style="font-size: 2em; vertical-align: middle;">}</td> <td>Normal condition</td> <td style="text-align: center;">on</td> <td style="text-align: center;">off</td> <td style="text-align: center;">off</td> </tr> <tr> <td>Receiver error</td> <td style="text-align: center;">on</td> <td style="text-align: center;">on</td> <td style="text-align: center;">off</td> </tr> <tr> <td>Emitter error</td> <td style="text-align: center;">on</td> <td style="text-align: center;">off</td> <td style="text-align: center;">on</td> </tr> </table> <p>DIAG1 (Green) - Indicates power is applied to the module* DIAG2 (Red) - Indicates receiver failure DIAG3 (Red) - Indicates emitter failure</p>		Condition	DIAG1 (Green)	DIAG2 (Red)	DIAG3 (Red)	}	Normal condition	on	off	off	Receiver error	on	on	off	Emitter error	on	off	on
	Condition	DIAG1 (Green)	DIAG2 (Red)	DIAG3 (Red)															
}	Normal condition	on	off	off															
	Receiver error	on	on	off															
	Emitter error	on	off	on															

More on next page

LIGHT GAUGING
ULTRASONIC
MEASURING LIGHT SCREENS
TEMPERATURE
RADAR

A-GAGE® MINI-ARRAY® Controller Specifications (cont'd)	
Construction	Polycarbonate
Environmental Rating	NEMA 1; IP20
Operating Conditions	Temperature: -20° to +70° C Relative humidity: 95% (non-condensing)
Certifications	
Hookup Diagram	MAC-1: MI27 (p. 538) MACN-1/MACP-1: MI28 (p. 538) MACV-1/MACI-1: MI29 (p. 539) MAC16N-1/MAC16P-1: MI31 (p. 539)

A-GAGE® MINI-ARRAY® Controller with DeviceNet™ Specifications	
DeviceNet Configurations	Vendor code: 12 (Banner Corp.) Device type: 110 Product code: 1 (MACNXDN-1) 2 (MACPXDN-1) Connection types supported: Explicit Message, Poll, COS Network address: 0-63 (network configured), default = 63 Baud rate supported: 125K, 250K, 500K (network configured), default = 125K
Output Configurations	MACPXDN-1: Two PNP discrete (switched) MACNXDN-1: Two NPN discrete (switched)
Power Requirements*	Controller, emitter and receiver: 16 to 30V dc @ 1.2 A max. (typical: 0.5 A @ 16V dc)
DeviceNet Power*	11 to 25V dc - supplied by DeviceNet BUS Network
Inputs	Sensor input: Emitter and receiver wire in parallel to five terminals. Trigger (Gate) input: Optically isolated, requires 10 to 30V dc (7.5 kΩ impedance) for gate signal
Discrete Outputs	NPN outputs: Open collector NPN transistor rated at 30V dc max., 150 mA max. PNP outputs: Open collector PNP transistor rated at 30V dc max., 150 mA max. All discrete outputs: OFF-state leakage current: less than 10 μA @ 30V dc ON-state saturation voltage: less than 1V @ 10 mA; less than 1.5V @ 150 mA
System Programming	Via DeviceNet interface and supplied EDS files.
System Status Indicators	Output (steady red): Output #1 energized. Alarm (flashing red): Output #2 energized. Gate (steady red): Trigger (Gate) input status. Alignment (steady green): Proper emitter/receiver alignment and a clear, unblocked light screen (ON) when green or green/yellow receiver LEDs are ON. Diag 1 (Green), Diag 2 (Red), Diag 3 (Red): Used in combination to display System status
Network Status Indicator	Bicolored (Red/Green) LED visible on the control module front panel indicates network status: Steady Green: On-line, connected to master Flashing Green: On-line, address and baud rate OK Steady Red: Critical network fault or duplicate node address detected Flashing Red: Connection timeout OFF: No network power or off-line
Construction	Polycarbonate housing; mounts to flat surface or directly onto 35-mm DIN rail
Environmental Rating	NEMA 1; IP20
Operating Conditions	Temperature: -20° to +70° C Relative humidity: 95% @ 50° C (non-condensing)
*Application Note	The controller must be powered up before the DeviceNet connection in every power-up situation for proper operation
Hookup Diagrams	MI30 (p. 539)

DeviceNet™ is a trademark of the Open DeviceNet Vendor Association, Inc.

A-GAGE® MINI-ARRAY® Sensor Specifications

Emitter/Receiver Range Max range is specified at the point where 3x excess gain remains.	9.5 mm beam spacing Array Length 143 to 1057 mm: 0.6 to 6.1 m Array Length 1210 to 1819 mm: 0.6 to 4.6 m	19.1 mm beam spacing Array Length 133 to 1057 mm: 0.9 to 17 m Array Length 1200 to 1810 mm: 0.9 to 14 m
Minimum Object Sensitivity	9.5 mm Beam Spacing Straight, Edge Modes: 19.1 mm Interlaced Mode: 12.7 mm* With DeviceNet Controller: Straight, Edge Modes: 19.1 mm Skip Mode: Multiply the above by the number of skipped beams, plus 1 Interlaced Mode: 12.7 mm*	19.1 mm Beam Spacing Straight, Edge Modes: 38.1 mm Interlaced Mode: 25.4 mm* With DeviceNet Controller: Straight, Edge Modes: 38.1 mm Skip Mode: Multiply the above by the number of skipped beams, plus 1 Interlaced Mode: 25.4 mm*
	*Assumes sensing is in the middle 1/3 of sensing range.	
Sensor Scan Time	55 microseconds per beam, plus 1 millisecond post process time per scan. DeviceNet: Post process time will vary, based on the number of channels interrogated during each scan.	
Power Requirements [†] Maximum current is for a 6' sensor.	9.5 mm beam spacing 12V dc ±2%, supplied by controller Emitter: 0.10 A @ 12V dc Receiver: 0.75 A @ 12V dc [†]	19.1 mm beam spacing 12V dc ±2%, supplied by controller Emitter: 0.10 A @ 12V dc Receiver: 0.50 A @ 12V dc [†]
Connections	Sensors connect to controller using 5-conductor Mini-style quick-disconnect cables (one each for emitter and receiver), ordered separately. Use only Banner cables, which incorporate a "twisted pair" for noise immunity. Cables measure 8.1 mm dia. and are shielded and PVC-jacketed. Conductors are 20 gauge. Emitter and receiver cables may not exceed 75 m long, each. See page 421.	
Status Indicators	Emitter: Red LED lights to indicate proper emitter operation Receiver: Green indicates sensors aligned (> 3x excess gain) Yellow indicates marginal alignment of one or more beams (1x -3x excess gain) Red indicates sensors misaligned or one or more beam(s) blocked	
Construction	Aluminum, with black anodized finish; acrylic lens cover	
Environmental Rating	NEMA 4, 13; IP65	
Operating Conditions	Temperature: -20° to +70° C	Relative humidity: 95% at 50° C (non-condensing)

LIGHT
GAUGING

ULTRASONIC

MEASURING LIGHT
SCREENS

TEMPERATURE

RADAR

System Configuration

Many options, yet easy to program

The software included with the control module makes it easy to configure the **MINI-ARRAY®** using your PC-compatible computer*. Simply load the software, access the program and access the Edit PSF Configuration screen, shown below. Each option is easily selectable, using your mouse and the pop-up menu-style selections.

*Running Windows® 95, 98, NT, ME, XP or 2000

- LIGHT GAUGING
- ULTRASONIC
- MEASURING LIGHT SCREENS
- TEMPERATURE
- RADAR

Analysis (Measurement) Mode Selection

Choose the measurement option that best tells you the size and/or position of objects as they relate to the array.



Control Mode Selection

Continuous Mode: The control module constantly polls the array for status.
Gate Mode: The control module polls the array for status when prompted by an input from a Gate sensor.
Host Mode: The control module polls the array for status when prompted by a host controller.

Serial Communication

Changes the identification and baud rate of the controller being configured.



Blanking

Allows either 1 or 2 areas of the array to be blind to the activity of the area specified.

Serial Transmission

Choose ASCII, binary or no serial communication

Invert

Allows output to be normally open (No) or normally closed (Yes)

Scan #: (1-9) Analog outputs are updated with an average value of the data received during the selected number of scans; discrete outputs respond only if the received data is identical for all of the selected number of consecutive scans.

Set Point and Hysteresis Selection

Assigns the set point to determine where within the array the output(s) will respond and hysteresis values to smooth output response.



Scanning Method

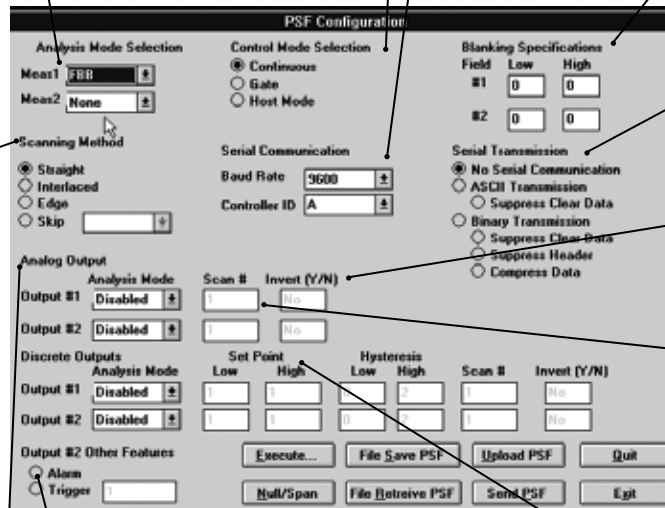
Straight scan polls each beam sequentially to determine the target object's overall size. This is the most accurate and precise measurement, but also the most time consuming.
Interlaced alternates a straight scan with a slanted beam scan to improve optical resolution in the center one third of the sensing range.
Edge activates only the beams located near the top edge of the object in the light screen to reduce sensing response time.
Skip - one to seven beams skipped reduces response time. Minimum object detection size increases proportionally to the number of beams skipped

Analog and Discrete Output Assignment

Assigns an analysis (measurement) mode to each output.

Alarm/Trigger

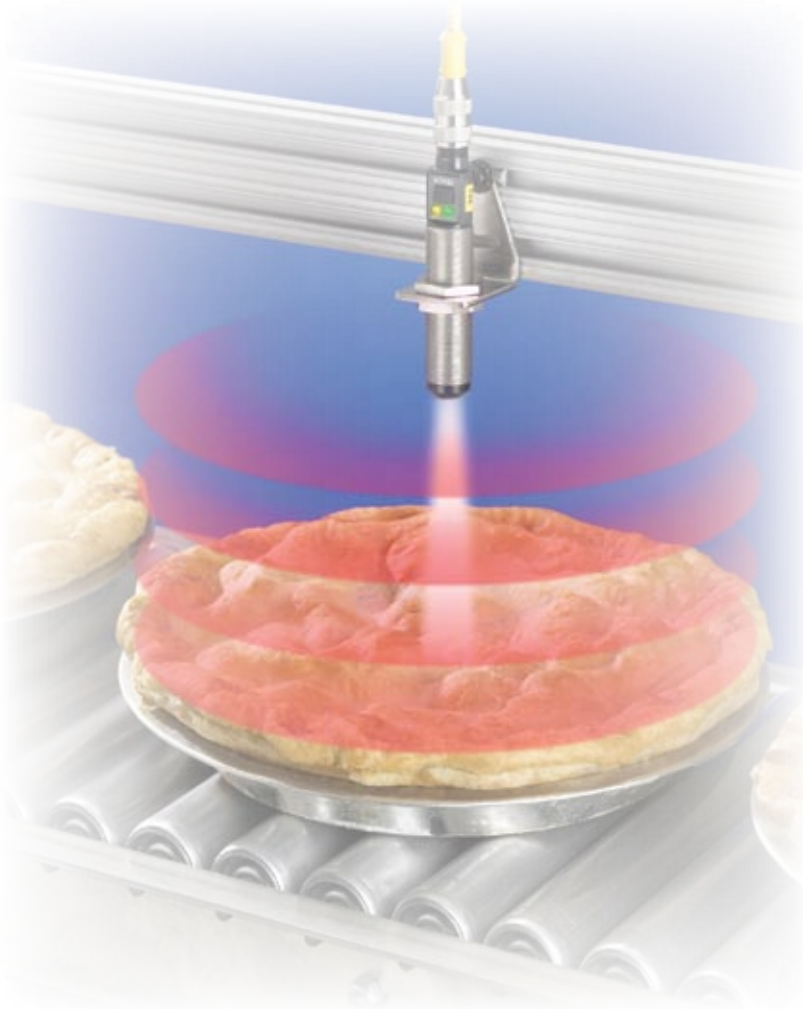
Output 2 may instead be programmed to serve as a trigger input for another MINI-ARRAY or ALARM for the self-diagnostic circuitry.



Downloadable Software

To test and verify software, download MINI-ARRAY version 1.3 (43989.exe) or Multiple (16) Output version 1.0 (59114_10.exe) at www.bannerengineering.com.





T-GAGE®

M18T Temperature Sensors

- Detects temperature difference between object and surroundings
- Monitors user defined window using analog or discrete outputs
- Senses temperatures from 0° to 300° C
- Sensitive to temperature contrasts of 3° C or more
- Works even if target object is not moving
- Requires no emitter, controller or external amplifier
- Uses remote or push-button programming
- Available in 3 models for different target sizes and distances
- Equipped with a 5-wire, 2 m shielded cable or with a 5-pin Euro-style integral quick-disconnect

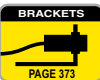
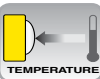
LIGHT
GAUGING

ULTRASONIC

MEASURING LIGHT
SCREENS

TEMPERATURE

RADAR



M18T 14: 1

- Narrow field of view
- For sensing small items
- Germanium lens



M18T 8: 1

- For general use
- Integrated lens



M18T 6: 1

- Plastic lens
- Safe for use near food
- For sensing hot and cold food before or after packaging



Optional accessory interface modules and power supplies for simplified setup, wiring and additional status indication (see page 449).

T-GAGE® M18T Sensors

- 18 mm stainless-steel barrel
- Rugged encapsulated housing
- Push-button programming
- 2 m or 9 m unterminated cable, or 5-pin Euro-style quick-disconnect
- 5-pin Euro-style QD cables with shield ordered separately (see page 415)
- Optional interface modules and power supplies for simplified setup, wiring and additional status indication (see page 449)



T-GAGE® M18T—Discrete, 10-30V dc



Models	Sensor Type	Cable*	D:S Ratio	Sensing Face	Overall Length (L)	Output Type	Data Sheet
M18TB8	<p>TEMPERATURE</p>	2 m	8:1	Integrated lens	81.2 mm	Bipolar NPN/PNP	120632
M18TB8Q		5-pin Euro QD			91.3 mm		
M18TB6E		2 m	6:1	Enclosed plastic face (for food industry use)	81.7 mm		
M18TB6EQ		5-pin Euro QD			91.8 mm		
M18TB14		2 m	14:1	Germanium lens	86.5 mm		
M18TB14Q		5-pin Euro QD			96.6 mm		

T-GAGE® M18T—Analog, 12-30V dc



Models	Sensor Type	Cable*	D:S Ratio	Sensing Face	Overall Length (L)	Output†	Data Sheet
M18TUP8	<p>TEMPERATURE</p>	2 m	8:1	Integrated lens	81.2 mm	0-10V dc Analog, plus 1 PNP Alarm	123698
M18TUP8Q		5-pin Euro QD			91.3 mm		
M18TUP6E		2 m	6:1	Enclosed plastic face (for food industry use)	81.7 mm		
M18TUP6EQ		5-pin Euro QD			91.8 mm		
M18TUP14		2 m	14:1	Germanium lens	86.5 mm		
M18TUP14Q		5-pin Euro QD			96.6 mm		

* For 9 m cable, add W/30 to the 2 m model number (example, M18TB8 W/30). A model with a QD requires a mating cable (see page 415).

† 0-10V dc analog models are listed. Contact factory for 4-20 mA analog models.

LIGHT GAUGING
ULTRASONIC
MEASURING LIGHT SCREENS
TEMPERATURE
RADAR

T-GAGE® M18T Specifications																																																									
Temperature Measurement Range	0° to 300° C standard; custom ranges available																																																								
Sensing Range and Distance to Spot Size (D:S) Ratio	Depends on object size and sensing field of view, see chart below. <table border="1" style="margin-left: 20px;"> <thead> <tr> <th rowspan="2">Sensor D:S Ratio</th> <th colspan="10">Distance From Sensor Face Versus Spot Size</th> <th rowspan="2">Distance (mm)</th> </tr> <tr> <th>100</th> <th>200</th> <th>300</th> <th>400</th> <th>500</th> <th>600</th> <th>700</th> <th>800</th> <th>900</th> <th>1000</th> </tr> </thead> <tbody> <tr> <td>6:1</td> <td>17</td> <td>33</td> <td>50</td> <td>67</td> <td>83</td> <td>100</td> <td>117</td> <td>133</td> <td>150</td> <td>167</td> <td rowspan="3" style="text-align: center;">Spot Size ø (mm)</td> </tr> <tr> <td>8:1</td> <td>13</td> <td>25</td> <td>38</td> <td>50</td> <td>63</td> <td>75</td> <td>88</td> <td>100</td> <td>113</td> <td>125</td> </tr> <tr> <td>14:1</td> <td>7</td> <td>14</td> <td>21</td> <td>29</td> <td>36</td> <td>43</td> <td>50</td> <td>57</td> <td>64</td> <td>71</td> </tr> </tbody> </table>	Sensor D:S Ratio	Distance From Sensor Face Versus Spot Size										Distance (mm)	100	200	300	400	500	600	700	800	900	1000	6:1	17	33	50	67	83	100	117	133	150	167	Spot Size ø (mm)	8:1	13	25	38	50	63	75	88	100	113	125	14:1	7	14	21	29	36	43	50	57	64	71
Sensor D:S Ratio	Distance From Sensor Face Versus Spot Size										Distance (mm)																																														
	100	200	300	400	500	600	700	800	900	1000																																															
6:1	17	33	50	67	83	100	117	133	150	167	Spot Size ø (mm)																																														
8:1	13	25	38	50	63	75	88	100	113	125																																															
14:1	7	14	21	29	36	43	50	57	64	71																																															
Wavelength	8 to 14 µm																																																								
Supply Voltage	Discrete models: 10 to 30V dc (10% max. ripple); 35 mA max. (exclusive of load) Analog models: 12 to 30V dc (10% max. ripple); 35 mA max. (exclusive of load)																																																								
Output Configuration	Discrete models: Bipolar: one NPN (current sinking) and one PNP (current sourcing) in each model Analog models: Analog 0-10V Alarm: PNP (current sourcing)																																																								
Output Protection	Protected against short circuit conditions																																																								
Output Ratings	Discrete models: 100 mA max. (each output) OFF-state leakage current: NPN: less than 200 µA; PNP: less than 10 µA NPN saturation: less than 200 mV @ 10 mA; less than 1V @ 100 mA PNP saturation: less than 1.2 V @ 10 mA; less than 1.6V @ 100 mA Analog models: Analog: 2.5 kΩ min. load resistance Alarm: OFF-state leakage: less than 10 µA Saturation: less than 1.2V @ 10 mA and less than 16V @ 100 mA																																																								
Output Response Time	Discrete models: 25 milliseconds Analog models: 75 milliseconds (for a 95% step change)																																																								
Delay at Power-Up	1.5 seconds																																																								
Repeatability (Relative)	Discrete models: 1° C Analog models: ±1% of measurement, or ±1° C, whichever is greater																																																								
Minimum Taught Differential	Discrete models: 3° C Analog models: 10° C																																																								
Hysteresis (discrete only)	5% of taught differential (min. 1° C)																																																								
Linearity (analog only)	From 0° to 50° C: ±2° C From 5° to 300° C: ±1° C or ±1%, whichever is greater																																																								
Adjustments	TEACH-Mode programming																																																								
Indicators	One bicolor (Green/Red) status LED, one Yellow LED Power ON/OFF LED OFF Power is OFF ON Green Sensor is in Run mode ON Red TEACH is active Output LED OFF Run Mode: Output is OFF TEACH mode: Waiting for Output OFF condition ON Yellow Run Mode: Outputs are energized TEACH mode: Waiting for Output ON condition Flashing Yellow Dynamic TEACH active																																																								
Remote Teach Input	Impedance: 3 kΩ																																																								
Construction	Threaded barrel: 304 stainless steel Push button housing: ABS/PC Lightpipes: Acrylic Push button: Santoprene																																																								
Operating Temperature	-20° to +70° C																																																								
Environmental Rating	Leakproof design is rated IEC IP67; NEMA 6																																																								
Temperature Warm-Up Time	5 minutes																																																								
Hookup Diagrams	Discrete: MI12 (p. 534) Analog: MI21 (p. 537)																																																								

R-GAGE™ QT50R

Radar-Based Adjustable-Field Sensor

For close and long-range presence detection in extreme weather conditions

The R-GAGE™ QT50R uses Frequency Modulated Continuous Wave (FMCW) radar to reliably detect moving or stationary targets, including cars, trains, trucks and cargo. Immune to most weather conditions, the QT50R effectively resists rain, wind, humidity and temperature.

- Provides presence, absence or change information for a detected target
- Detects objects up to a set distance, ignoring objects and backgrounds beyond the setpoint
- Operates at 24 GHz in the Industrial, Scientific and Medical (ISM) telecommunication band; no special licensing required
- Withstands extreme temperatures and strong wind
- Detects vehicles at distances up to 15 m
- Includes DIP switches for sensing distance, sensitivity and output configuration
- Provides 12 to 30V dc operation with bipolar PNP (sourcing) and NPN (sinking) output
- Features bright LED indicators for easy status monitoring



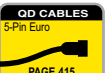
LIGHT GAUGING

ULTRASONIC

MEASURING LIGHT SCREENS

TEMPERATURE

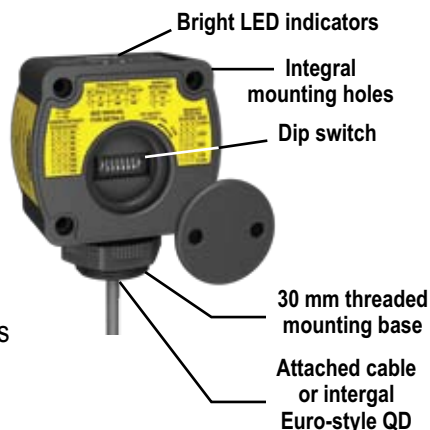
RADAR



Robust operation in a simple-to-use, easy-to-configure package

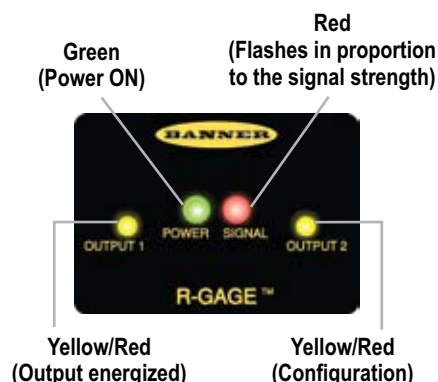
- Rugged IP67 housing for harsh environments
- Integral mounting holes, 30 mm mounting base or optional mounting brackets for installation flexibility
- 2 m attached cable or 5-pin Euro-style quick-disconnect
- Operating temperature range of -40° to +65° C
- 8 DIP switches for sensing distance, sensitivity and output configuration

- Adjustable sensing distance up to 15 m
- Adjustable beam width for fine-tuning sensitivity
- Selectable normally open (NO) or normally closed (NC) operation
- Configurable response speed from 0.1 to 1.3 seconds



Presence sensing in a broad range of weather conditions

- Cargo detection on a truck bed
- Truck detection at loading dock
- Access control to parking ramps and garage doors
- Car detection in drive-thru
- Position sensing of cranes
- Car detection and counting in tollbooths
- Train and tram detection and location in tunnels



R-GAGE™ QT50R Sensors

- DIP-switch-configurable sensitivity, sensing distance and output
- Rugged encapsulated design for harsh environments
- 2 m attached cable or 5-pin Euro-style quick-disconnect
- Bright LED status indicators on sensor top
- 30 mm threaded mounting base
- QD cables with shield, ordered separately (see page 415)



R-GAGE™ QT50R, 12-30V dc




Model	Max Range [†]	Cable [*]	Telecom Approval	Output	Data Sheet
QT50RAF-US	15 m	2 m	US	Bipolar NPN/PNP Selectable NO or NC	135460
QT50RAF-EU			Australia and Europe, except France and UK		
QT50RAF-UK			UK		
QT50RAF-FR			France		
QT50RAF-CA			Canada		

* For 5-pin Euro-style QD, add **Q** to the 2 m model (example, **QT50RAFQ-US**). A QD model requires a mating cable (see page 415).

† Range is dependent on target object.

- LIGHT GAUGING
- ULTRASONIC
- MEASURING LIGHT SCREENS
- TEMPERATURE
- RADAR

LIGHT GAUGING
 ULTRASONIC
 MEASURING LIGHT SCREENS
 TEMPERATURE
 RADAR

R-GAGE™ QT50R Specifications	
Range	Sensor will detect a proper object (see below) up to 15 m, depending on target
Effective Beam	See charts EBPC-13 and EBPC-14 on page 515
Detectable Objects	Objects containing metal or other high-dielectric material
Operating Principle	Frequency Modulated Continuous Wave (FMCW) radar
Operating Frequency	24 GHz, ISM Band (varies slightly by model and national telecom regulations)
Supply Voltage	12 to 30V dc, less than 100 mA (exclusive of load)
Supply Protection Circuitry	Protected against reverse polarity and transient overvoltages
Delay at Power-up	Less than 2 seconds
Output Configuration	Bipolar NPN/PNP outputs, 150 mA; DIP Switch 7 selects NO (default) or NC operation
Output Protection	Protected against short circuit conditions
Indicators	Power LED: Green (Power ON) Signal Strength LED: Red, flashes in proportion to signal strength Output LEDs: Yellow (output energized)/Red (configuration)
Adjustments	Dip-switch-configurable sensitivity, sensing distance and output configuration
Construction	Housing: ABS/polycarbonate Lightpipes: Acrylic Access Cap: Polyester
Operating Temperature	-40° to +65° C
Environmental Rating	IP67
Connections	2 m, 5-conductor, shielded, PVC-jacketed cable or 5-pin Euro-style QD. Mating QD cables are ordered separately. See page 415.
Certifications	 and ETSI/EN 300 440 or FCC Part 15, depending on model (consult factory for other certifications)
Hookup Diagram	MI22 (p. 537)

Vision

Presence PLUS®

Pro and P4 General-Purpose Sensors page 312

- Full-featured; one-piece or two-piece design
- Complete suite of location, inspection, analysis and geometric tools; all can be used simultaneously
- Gray scale, color, IP68 housing and high-resolution 1.3 megapixel models
- Optional bar code tool for locating, reading and grading 2D and 1D linear bar codes
- Optional OCR/OCV tool for optical character reading and verification



P4 Dedicated-Function page 313

- A complete family of application-specific vision sensors
- For detecting absence/presence, orientation, gray scale and bar codes
- Compact one-piece design with right-angle or in-line styles
- Optional bar code tool for locating, reading and grading 2D and 1D linear bar codes
- OCR/OCV tool for optical character reading and verification



Lighting page 321

- Maintenance free, rugged LED lighting in red, green, blue, white and infrared
- Ring lights, area lights, backlights, linear array lights, on-axis lights and specialty lights
- Models for direct connection to sensors or external power supply



Lenses page 333

- 4-75 mm standard C-mount lenses
- 3.5-75 mm high-performance lenses for less image distortion and greater depth of field
- 8-50 mm megapixel lenses for extraordinary resolution
- Focus locking on most models



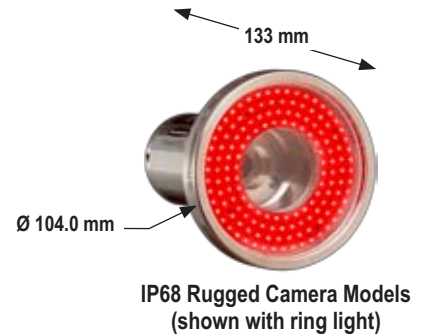
Accessories page 334

- Cables for sensors, cameras, serial, Ethernet and video connection
- Broad offering of brackets, fixtures and mounting systems
- Black and white or color monitors for viewing inspections
- Enclosures for protecting sensors and lights
- A variety of power supplies and interface modules for sensors and lights

- P4 & P4
General Purpose
- P4 Dedicated
Function
- LIGHTING
- LENSES
- ACCESSORIES

PresencePLUS® Pro

- Compact two-piece housing
- Black anodized aluminum, nickel-plated aluminum or stainless steel cameras
- Fourteen configurable discrete I/O (NPN/PNP)
- 20-pin removable terminal block
- IP68 rugged cameras with ring light or cover
- Six bicolor LED indicators
- Standard and high-performance C-mount lenses sold separately



PresencePLUS® P4

- Economical one-piece design
- Compact in-line or right-angle housing styles
- Seven configurable discrete I/O (NPN/PNP)
- Three bicolor bright LED indicators
- Standard and high-performance C-mount lenses sold separately





Software Tools

One Advanced Software Platform

- Seamless functionality across the entire *Pro* and *P4* vision sensor series
- Remote TEACH input similar to a photoelectric sensor self-learns the inspection tolerances of your application
- Easy, menu-driven, point-and-click interface on a PC
- Free ActiveX utilities for linking and embedding images and results
- Direct connectivity to EtherNet/IP and Modbus TCP industrial networks
- In nine languages including English, Simplified Chinese, Traditional Chinese, French, German, Japanese, Portuguese and Spanish with translated text, buttons, commands and icons in the respective language
- Free web download or CD-ROM; includes all Banner vision sensor manuals, troubleshooting guides, and lens and lighting selection guides
- Free firmware and software upgrades

Pro & P4
GENERAL PURPOSEP4 Dedicated
Function

LIGHTING

LENSES

ACCESSORIES

VISION TOOLS analyze the image.



Color Match: Inspects for matching hue and intensity



Average Color: Tests or communicates color content values sensed in a selected area



Average Gray Scale: Determines the gray scale intensity value of an area



Blob: Determines the presence, connectivity, size, shape and location of selected features



Edge: Determines the presence, number, classification and location of edges



Object: Determines the presence, number, classification, size and location of objects



Pattern Count: Determines the presence, number and location of pattern(s)



GEO Count: Detects the presence and location of a target pattern in any orientation



Bar Code: Finds, decodes and grades 2D and 1D linear bar codes



Bead Tool: Monitors a track of material for width, consistency and location



OCR/OCV: Reads and verifies optical characters

LOCATION TOOLS compensate for translational and rotational movement.



Locate: Determines translation and rotation by detecting relative movement of edges



Pattern Find: Determines translation and rotation by detecting relative movement of a pattern



GEO Find: Determines translation and rotation movement of a part up to 360° by detecting relative movement of a pattern

ANALYSIS TOOLS measure and evaluate the results of the vision tools.



Measure: Measures distance and angles between two prescribed points, lines or curves



Math: Performs arithmetic functions on any tool or constant



Test: Evaluates results of selected vision and analysis tools to determine whether an inspection passes or fails; performs logical operations; and activates outputs



Communication: Sends images or results of selected location, vision and analysis tools over the Ethernet or RS-232 serial communication ports to industrial Ethernet or PC networks

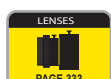
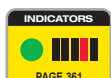
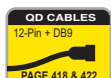
- P10 & P4
GENERAL PURPOSE
- P4 DEDICATED
FUNCTION
- LIGHTING
- LENSES
- ACCESSORIES

PresencePLUS®

Pro and P4

General-Purpose Sensors

- Universal software with three-step, point-and-click setup; supports nine languages
- Ethernet, serial and flexible discrete I/O in the same full-featured sensor
- Direct connectivity for all I/O to EtherNet/IP and Modbus TCP
- ActiveX connectivity to create custom operator control software with object-oriented programming
- Real-time video output for direct connection to a conventional monitor without a PC
- Remote and Quick TEACH with a single reference image or custom setup
- VGA color and high-resolution 1.3 megapixel models
- Complete suite of location, inspection, analysis and geometric tools; all can be used simultaneously for inspecting multiple features and complex applications
- Multiple inspection routines, stored and accessed without a PC
- Complete selection of lenses, lighting, brackets and accessories
- 10 to 30V dc operation



PresencePLUS® Pro Series

- Full-featured; compact camera with separate DIN-mountable controller
- Convenient 20-pin removable terminal block
- Six bicolor bright LED indicators
- Fourteen configurable discrete I/O (NPN/PNP)

PresencePLUS® Pro Models

PROII: 640 X 480 resolution CCD
 PROII COLOR: 752 X 480 resolution CMOS
 PROII 1.3: 1280 X 1024 resolution CMOS
 PROII Sealed Cameras: Rugged, IP68 housing

Models are available in black anodized aluminum, or IP68 rated stainless steel or nickel-plated aluminum.

Pro Models	page 315
P4 OMNI Models	317



PresencePLUS® P4 OMNI Series

- Full-featured; economical one-piece design
- Seven configurable discrete I/O (NPN/PNP)
- Three bicolor bright LED indicators
- In-line or right-angle housing

PresencePLUS® P4 OMNI Models

OMNI: 640 X 480 resolution CCD
 OMNI COLOR: 752 X 480 resolution CMOS
 OMNI 1.3: 1280 X 1024 resolution CMOS



PresencePLUS® P4 Dedicated-Function Sensors

- Four models with Locate, Measure, Math, Test, Communications and simplified suite of vision tools
- High-performance vision inspections in self-contained in-line or right-angle housing styles that fit in the palm of your hand
- Standardized GUI supports nine languages
- Remote TEACH function for inspection changeovers without a PC
- Connects directly to real-time video display without a PC
- Communicates over Ethernet, configurable discrete I/O and RS-232 serial lines
- Provides direct connectivity to EtherNet/IP and Modbus TCP industrial networks
- ActiveX utilities for custom operator controls
- Available with a variety of mounting brackets, lenses and lighting accessories

Pro & P4
GENERAL PURPOSE
P4 Dedicated Function
LIGHTING
LENSES
ACCESSORIES

AREA Models	page 317
GEO Models	317
EDGE Models	317
BCR Models	317



- BRACKETS
PAGE 403
- OD CABLES
12-Pin + DB9
PAGE 418 & 422
- ENCLOSURES
PAGE 438
- STANDS
PAGE 444
- INDICATORS
PAGE 361
- LIGHTS
PAGE 321
- LENSES
PAGE 333



PresencePLUS® P4 AREA

- Uses Blob and Gray Scale tools for basic inspections of defined areas
- High-speed analysis up to 10,000 parts per minute
- Standard resolution: 128 X 100
- High-resolution: 1280 X 1024



PresencePLUS® P4 GEO

- Uses GEO Count tool to detect presence, location and rotation of a target pattern (360°)
- Standard resolution: 128 X 100
- High-resolution: 1280 X 1024



PresencePLUS® P4 EDGE

- Uses Edge and Object tools to validate height, width, location and edges
- High-speed analysis faster than 10,000 parts per minute
- Standard resolution: 128 X 100
- High-resolution: 1280 X 1024



PresencePLUS® P4 BCR

- Finds and decodes 2D and 1D linear bar codes
- Industry standard bar code metrics and grading
- Standard resolution: 640 X 480
- High-resolution: 1280 X 1024

PresencePLUS®

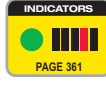
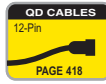
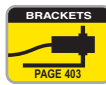
Pro and P4 ID, Bar Code & Traceability Solutions

The PresencePLUS® P4 BCR and BCR 1.3 vision sensors have been developed from the ground up for the most robust 2D and 1D linear bar code reading and capabilities—even when conditions and codes are less than ideal. Add the powerful Bar Code Reader (BCR) and Optical Character Reading and Verification (OCR/OCV) tools to the PresencePLUS Pro and P4 OMNI sensors—including the 1.3 megapixel and color models.

- Read and grade multiple 2D and 1D bar codes
- Use Optical Character Reading and Verification (OCR/OCV) for analyzing characters
- Verify data optically through the PresencePLUS sensor or industrial Ethernet communications
- Communicate code data and grade serially or over the Ethernet
- Display the bar code and OCR/OCV data on the live video output



- Pro & P4
GENERAL PURPOSE
- P4 DEDICATED
FUNCTION
- LIGHTING
- LENSES
- ACCESSORIES



PresencePLUS® P4 BCR

- One-piece dedicated function bar code reader
- In-line or right-angle housing
- Three bicolor bright LED indicators
- Seven configurable discrete I/O (NPN/PNP)
- High-resolution 1.3 megapixel models
- Optional OCR/OCV tool



PresencePLUS® Pro

- Full-featured; compact camera with separate DIN-mountable controller
- Convenient 20-pin removable terminal block
- Six bicolor bright LED indicators
- Fourteen configurable discrete I/O (NPN/PNP)
- Color, IP68 housing and high-resolution 1.3 megapixel models



PresencePLUS® P4 OMNI

- Full-featured; one-piece economical design
- In-line or right-angle housing
- Three bicolor bright LED indicators
- Seven configurable discrete I/O (NPN/PNP)
- Color and high-resolution 1.3 megapixel models

Pro Models	page 315
P4 OMNI Models	317
P4 BCR Models	317

PROII Controllers, 10-30V dc



Model	PPROCTL	PPROCTL1.3	PPROCTLC	Add premium tools to model (example, PPROCTL-BCBDOC)		
Resolution	640 x 480 Gray Scale	1280 x 1024 Gray Scale	752 x 480 Color & Gray Scale	BC = Bar Code Reader BD = Bead Tool OC = OCR/OCV BCBD = Bar Code Reader & Bead Tool BCOC = Bar Code Reader & OCR/OCV BDOC = Bead Tool & OCR/OCV BCBDOC = Bar Code Reader, Bead Tool & OCR/OCV		
Data Sheet	—	—	—			
Pro Camera Model Numbers				Ring Light	Window	Housing
	PPROCAM	PPROCAM1.3	PPROCAMC	—	—	Black Anodized Aluminum
IP68 Pro Camera Model Numbers				Ring Light	Window*	Housing
	PPROCAMSC-G	PPROCAM1.3SC-G	PPROCAMCSC-G	Lens Cover (No Light)	Glass	Nickel-plated Aluminum
	PPROCAMSC-P	PPROCAM1.3SC-P	PPROCAMCSC-P		Plastic	
	PPROCAMSSC-G	PPROCAM1.3SSC-G	PPROCAMCSSC-G		Glass	Stainless Steel
	PPROCAMSSC-P	PPROCAM1.3SSC-P	PPROCAMCSSC-P		Plastic	
	PPROCAMSR-G	PPROCAM1.3SR-G	—	Red	Glass	Nickel-plated Aluminum
	PPROCAMSR-P	PPROCAM1.3SR-P			Plastic	
	PPROCAMSSR-G	PPROCAM1.3SSR-G			Glass	Stainless Steel
	PPROCAMSSR-P	PPROCAM1.3SSR-P			Plastic	
	PPROCAMSI-G	PPROCAM1.3SI-G	—	Infrared	Glass	Nickel-plated Aluminum
	PPROCAMSI-P	PPROCAM1.3SI-P			Plastic	
	PPROCAMSSI-G	PPROCAM1.3SSI-G			Glass	Stainless Steel
	PPROCAMSSI-P	PPROCAM1.3SSI-P			Plastic	
	PPROCAMSB-G	PPROCAM1.3SB-G	—	Blue	Glass	Nickel-plated Aluminum
	PPROCAMSB-P	PPROCAM1.3SB-P			Plastic	
	PPROCAMSSB-G	PPROCAM1.3SSB-G			Glass	Stainless Steel
	PPROCAMSSB-P	PPROCAM1.3SSB-P			Plastic	
	PPROCAMSG-G	PPROCAM1.3SG-G	—	Green	Glass	Nickel-plated Aluminum
	PPROCAMSG-P	PPROCAM1.3SG-P			Plastic	
	PPROCAMSSG-G	PPROCAM1.3SSG-G			Glass	Stainless Steel
	PPROCAMSSG-P	PPROCAM1.3SSG-P			Plastic	
	PPROCAMSW-G	PPROCAM1.3SW-G	PPROCAMCSW-G	White	Glass	Nickel-plated Aluminum
	PPROCAMSW-P	PPROCAM1.3SW-P	PPROCAMCSW-P		Plastic	
	PPROCAMSSW-G	PPROCAM1.3SSW-G	PPROCAMCSSW-G		Glass	Stainless Steel
	PPROCAMSSW-P	PPROCAM1.3SSW-P	PPROCAMCSSW-P		Plastic	

* Windows are factory replaceable, contact factory at 1-888-373-6767.

Pro & P4
GENERAL PURPOSE
P4 DEDICATED FUNCTION
LIGHTING
LENSES
ACCESSORIES



Pro Basic Model Key

Basic kits include a controller, camera, camera-to-controller cordset, CD-ROM and quick start guide.

Controller and Camera	Camera-to-Controller Cordset Length	Cordset Style
<div style="border: 1px solid black; padding: 5px; display: inline-block;">P P _ K</div>	<div style="border: 1px solid black; padding: 5px; display: inline-block;">0 6</div>	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> </div>
<p>Blank = PPROCTL Controller & PPROCAM Gray Scale Camera (640 x 480)</p> <p>1.3 = PPROCTL1.3 Controller & PPROCAM1.3 Gray Scale Camera (1280 x 1024)</p> <p>C = PPROCTLC Controller & PPROCAMC Color Camera (752 x 480)</p>	<p>06 = 2 m</p> <p>23 = 7 m</p>	<p>Blank = Straight</p> <p>R = Right-Angle</p> <p>H = High-Flex</p> <p>RH = Right-Angle, High-Flex</p>



IP68 Pro Basic Model Key

Basic kits include a controller, sealed camera with cover or ring light, camera-to-controller cordset, ring light power cable, CD-ROM and quick start guide.

Controller and IP68 Camera	Housing Material	IP68 Ring Light	Window	Cordset Length
<div style="border: 1px solid black; padding: 5px; display: inline-block;">P P _ K</div>	<div style="border: 1px solid black; padding: 5px; display: inline-block;">SS</div>	<div style="border: 1px solid black; padding: 5px; display: inline-block;">R</div>	<div style="border: 1px solid black; padding: 5px; display: inline-block;">G</div>	<div style="border: 1px solid black; padding: 5px; display: inline-block;">13</div>
<p>Blank = PPROCTL Controller & IP68 Gray Scale Camera (640 x 480)</p> <p>1.3 = PPROCTL1.3 Controller & IP68 Gray Scale Camera (1280 x 1024)</p> <p>C = PPROCTLC Controller & IP68 Color Camera (752 x 480)</p>	<p>S = Nickel-plated Aluminum</p> <p>SS = Stainless Steel</p>	<p>C = Cover (no Light)</p> <p>W = White*</p> <p>R = Red</p> <p>G = Green</p> <p>B = Blue</p> <p>I = Infrared</p>	<p>G = Glass</p> <p>P = Plastic</p>	<p>13 = 4 m</p> <p>23 = 7 m</p>

* Recommended for color applications



P4 Sensors with OMNI Tool Set, 10-30V dc

Model Number		Vision Tools	Housing	Resolution	Data Sheet
	P4OR	OMNI Gray Scale	Right-Angle	640 x 480	125808
	P4OI		In-Line		
	P4O1.3R		Right-Angle	1280 x 1024	
	P4O1.3I		In-Line		
	P4COR	COLOR OMNI	Right-Angle	752 x 480	—
	P4COI		In-Line		

Add premium tools to model (example, P4OR-BC)
BC = Bar Code Reader
BD = Bead Tool
OC = OCR/OCV
BCBD = Bar Code Reader & Bead Tool
BCOC = Bar Code Reader & OCR/OCV
BDOC = Bead Tool & OCR/OCV
BCBDOC = Bar Code Reader, Bead Tool & OCR/OCV

P4 Sensors with Simplified Tool Set, 10-30V dc



Model Number		Vision Tools	Housing	Resolution	Data Sheet
	P4AR	AREA Blob & Gray Scale	Right-Angle	128 x 100	125439
	P4AI		In-Line		
	P4A1.3R		Right-Angle	1280 x 1024	
	P4A1.3I		In-Line		
	P4GR	GEO Geometric Pattern Count & Find	Right-Angle	128 x 100	121555
	P4GI		In-Line		
	P4G1.3R		Right-Angle	1280 x 1024	
	P4G1.3I		In-Line		
	P4ER	EDGE Edge & Object	Right-Angle	128 x 100	120413
	P4EI		In-Line		
	P4E1.3R		Right-Angle	1280 x 1024	
	P4E1.3I		In-Line		
	P4BCR*	BCR Bar Code Reader	Right-Angle	640 x 480	122800
	P4BCI*		In-Line		
	P4BC1.3R*		Right-Angle	1280 x 1024	
	P4BC1.3I*		In-Line		

* To add the OCR/OCV premium tool to any P4 BCR model, add suffix -OC to the model number (example, P4BCR-OC).

- Pro & P4
- GENERAL PURPOSE
- P4 DEDICATED FUNCTION
- LIGHTING
- LENSES
- ACCESSORIES

PresencePLUS® Pro—PROII Controller Specifications

Supply Voltage and Current	PPROCTL: 10 to 30V dc @ less than 1.5 A (exclusive of load) PPROCTL1.3 & PPROCTL1.3S: 10 to 30V dc @ less than 1.2 A (exclusive of load)
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Memory	Storage: 64 MB Inspections (jobs): 999 max.
Input/Output Configuration	NPN (sinking) or PNP (sourcing) software selectable
Output Rating	150 mA max. each output OFF-state leakage current: less than 100 µA ON-state saturation voltage: NPN—less than 1V @ 150 mA PNP—greater than V+ -2V
Input Specifications	NPN: ON— less than 3V PNP: ON— greater than (+V -2)V @ 1 mA max. OFF-state voltage— greater than 10V @ 4 mA max OFF-state voltage— less than 3V @ 6 mA max.
Indicators	6 LED indicators: Trigger, Ready, Power, Pass, Fail, Error
Display Options	PC or NTSC video (uses 9 m max. BNC cable)
Discrete I/O	1 Trigger IN (pin 3), 1 Strobe OUT (pin 4), 1 Remote TEACH IN (pin 6), 6 Programmable I/O (pins 9-14), 1 Product Change IN (pin 15), 4 Product Select IN (pins 16-19)
Communications	1 RJ-45 10/100 Ethernet connection for running PresencePLUS Pro software and/or output inspection results 1 RS-232 DB-9 port for output of inspection results
Construction	Steel with black zinc plating
Weight	546 g
Environmental Rating	IEC IP20; NEMA 1
Operating Conditions	Temperature: 0° to +50° C Relative Humidity: 90% (non-condensing)

PresencePLUS® PROII Camera Specifications

Imager Resolution	PPROCAM & PPROCAMS(S): 640 x 480 pixels PPROCAM1.3 & PPROCAM1.3S(S): 1280 x 1024 pixels PPROCAMC & PPROCAMCS(S): 752 x 480 pixels
Pixel Size	PPROCAM & PPROCAMS(S): 7.4 x 7.4 µm PPROCAM1.3 & PPROCAM1.3S(S): 6.7 x 6.7 µm PPROCAMC & PPROCAMCS(S): 6.0 x 6.0 µm
Imager Size	PPROCAM & PPROCAMS(S): 4.8 x 3.6 mm, 6 mm diagonal (1/3 inch CCD) PPROCAM1.3 & PPROCAM1.3S(S): 8.6 x 6.9 mm, 11 mm diagonal (2/3 inch CMOS) PPROCAMC & PPROCAMCS(S): 4.5 x 2.9 mm, 5.4 mm diagonal (1/3 inch CMOS)
Levels of Gray Scale or Color	PPROCAM, PPROCAM1.3, PPROCAMS(S) & PPROCAM1.3S(S): 256 Gray Scale PPROCAMC & PPROCAMCS(S): 256 Red, Green and Blue
Exposure Time	PPROCAM & PPROCAMS(S): 0.10 to 2830 milliseconds PPROCAM1.3 & PPROCAM1.3S(S): 0.10 to 1670 milliseconds PPROCAMC & PPROCAMCS(S): 0.10 to 1040 milliseconds
Full Image Acquisition*	PPROCAM & PPROCAMS(S): 48 frames per second max. PPROCAM1.3 & PPROCAM1.3S(S): 18 frames per second max. PPROCAMC & PPROCAMCS(S): 17 frames per second max.
Interface	LVDS
Lens Mount	Standard C-mount (1 inch—32 UN)
Construction	PPROCAM, PPROCAM1.3 & PPROCAMC: black anodized aluminum PPROCAMS, PPROCAM1.3S & PPROCAMCS: nickel-plated aluminum (Lens covers and ring lights are nickel-plated aluminum with glass or polycarbonate window) PPROCAMSS, PPROCAM1.3SS & PPROCAMCSS: 316 stainless steel (Lens covers and ring lights are stainless steel with glass or polycarbonate window)
Max. Cable Length	7 m
Weight	PPROCAM, PPROCAM1.3 & PPROCAMC: approx. 113 g PPROCAMS, PPROCAM1.3S & PPROCAMCS: Camera only—288 g Camera with cover—348 g Camera with ring light—585 g PPROCAMSS, PPROCAM1.3SS & PPROCAMCS: Camera only—723 g Camera with cover—348 g Camera with ring light—1480 g
Environmental Rating	PPROCAM, PPROCAM1.3 & PPROCAMC: IEC IP20; NEMA 1 PPROCAMS, PPROCAM1.3S & PPROCAMCS: IEC IP68; NEMA 6P PPROCAMSS, PPROCAM1.3SS & PPROCAMCSS: IEC IP68; NEMA6P and NEMA4X
Operating Temperature	0° to +50° C
Relative Humidity	PPROCAM, PPROCAM1.3 & PPROCAMC: 90% (non-condensing)
Hookup Diagrams	NPN: VS01 (p. 540) PNP: VS02: (p. 540)

* A reduced Field of View (FOV) dramatically increases acquisition rates.

P10 & P4 GENERAL PURPOSE
 P4 DEDICATED FUNCTION
 LIGHTING
 LENSES
 ACCESSORIES

PresencePLUS® P4 Specifications

Supply Voltage and Current	10 to 30V dc (24V dc $\pm 10\%$ if the sensor powers a light source) OMNI & BCR: less than 650 mA (exclusive of lights and I/O load) AREA, GEO & EDGE: less than 500 mA (exclusive of lights and I/O load) OMNI 1.3, COLOR OMNI, AREA 1.3, GEO 1.3, EDGE 1.3 & BCR 1.3: less than 550 mA (exclusive of lights and I/O load)
Memory	Storage: BCR—8 MB Inspection (jobs): 400 max. AREA, GEO, EDGE—8 MB Inspection (jobs): 500 max. All others—32 MB Inspection (jobs): 999 max.
Input/Output Configuration	NPN (sinking) or PNP (sourcing) software selectable
Output Rating	150 mA max. each output OFF-state leakage current: less than 100 μ A ON-state saturation voltage: NPN—less than 1V @ 150 mA max. PNP—greater than V+ -2V
Bicolor Status Indicators	PASS/FAIL: Green ON steady—PASS Red ON steady—FAIL POWER/ERROR: Green ON steady—POWER Red ON steady—ERROR READY/TRIGGER: Green ON steady—READY Yellow ON steady—TRIGGER
Display Options	PC or NTSC video (uses 9 m max. BNC cable)
Discrete I/O	1 Trigger IN 1 Strobe OUT 4 Programmable I/O 1 Product Change IN 1 Remote TEACH IN
Communications	1 RJ-45 10/100 Ethernet connection for running PresencePLUS P4 software and/or output inspection results RS-232 connection for output of inspection results
Imager Resolution	OMNI & BCR: 640 x 480 pixels OMNI 1.3, AREA 1.3, GEO 1.3, EDGE 1.3 & BCR 1.3: 1280 x 1024 pixels AREA, GEO & EDGE: 128 x 100 pixels COLOR OMNI: 752 x 480 pixels
Pixel Size	OMNI & BCR: 7.4 x 7.4 μ m OMNI 1.3, AREA 1.3, GEO 1.3, EDGE 1.3 & BCR 1.3: 6.7 x 6.7 μ m AREA, GEO & EDGE: 20 x 20 μ m
Imager Size	OMNI & BCR: 4.8 x 3.6 mm, 6 mm diagonal (1/3 inch CCD) OMNI 1.3, AREA 1.3, GEO 1.3, EDGE 1.3 & BCR 1.3: 8.6 x 6.9 mm, 11 mm diagonal (2/3 inch CMOS) AREA, GEO & EDGE: 2.6 x 2.0 mm, 3.3 mm diagonal (1/5 inch CMOS) COLOR OMNI: 4.5 x 2.9 mm, 5.4 mm diagonal (1/3 inch CMOS)
Levels of Gray Scale or Color	OMNI, OMNI 1.3, AREA, AREA 1.3, GEO, GEO 1.3, EDGE, EDGE 1.3, BCR & BCR 1.3: 256 Gray Scale COLOR OMNI: 256 Red, Green and Blue
Exposure Time	OMNI & BCR: 0.1 to 2830 milliseconds OMNI 1.3, AREA 1.3, GEO 1.3, EDGE 1.3 & BCR 1.3: 0.1 to 1670 milliseconds AREA, GEO & EDGE: 0.1 to 20.47 milliseconds COLOR OMNI: 0.1 to 1000 milliseconds
Full Image Acquisition	OMNI & BCR: 48 frames per second max.* AREA, GEO & EDGE: 500 frames per second max. OMNI 1.3, AREA 1.3, GEO 1.3, EDGE 1.3 & BCR 1.3: 27 frames per second max.* COLOR OMNI: 17 frames per second max.*
Lens Mount	Standard C-mount (1 inch—32 UN)
Construction	Black anodized aluminum housing, glass lens
Weight	In-line: 293 g Right-angle: 385 g
Environmental Rating	IEC IP20; NEMA 1
Operating Temperature	0° to +50° C
Relative Humidity	90% (non-condensing)
Hookup Diagrams	NPN: VS03 (p. 540) NPN: VS04 (p. 540)

* A reduced Field of View (FOV) dramatically increases acquisition rates.

GENERAL PURPOSE
Pro & P4

P4 Dedicated Function

LIGHTING

LENSES

ACCESSORIES

Vision Accessories

Pro & P4
GENERAL PURPOSEP4 DEDICATED
FUNCTION

LIGHTING

LENSES

ACCESSORIES



Lighting page 321

- Maintenance free, rugged LED lighting in red, green, blue, white and infrared
- Ring lights, area lights, backlights, linear array lights, on-axis lights and specialty lights for tough-to-light objects
- Filters and diffusers for improving lighting quality
- Window replacements for ring lights, area lights, backlights and linear array lights
- Power supplies and interface modules for powering and strobe control of lights



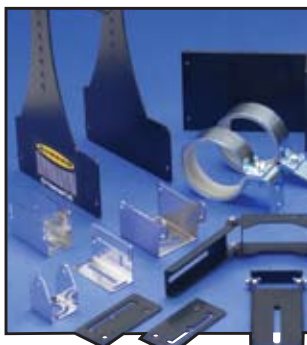
Lenses page 333

- 4-75 mm standard C-mount lenses
- 3.5-75 mm high-performance lenses for less image distortion and greater depth of field
- 8-50 mm megapixel lenses for extraordinary resolution
- Focus locking on most models



Monitors page 334

- Live video output for inspection visibility during operation
- CRT and flat-panel monitors for displaying images
- Two models for displaying current inspection number, bar code data read and first failed tool



Brackets page 403

- Broad offering of bracket styles for Pro and P4 sensors and Banner lights
- Swivel brackets for greater range of motion and flexibility in mounting
- Stainless steel, black corrosion resistant zinc or black ABS plastic brackets
- Column-mount brackets for flexible positioning of sensors and lights



Cables page 418

- Cables for sensors, cameras, video, serial and Ethernet connections
- Splitter cable for powering two lights from one P4 sensor
- High-flex cables for robotic applications



Enclosures page 438

- Offers models for sensors and lights
- Provides protection in rugged or harsh environments
- Prevents tampering



Adjustable Mounting System page 441

- 3" and 6" column, base and knuckle kits for positioning of sensor and lights
- Bogen arm with clamp for added flexibility in mounting
- 2" pivoting knuckle assembly for positioning spot light



Sensor Interface Modules and Power Supplies page 447

- Sensor interface modules for simplified wiring of P4 sensors in an electrical box
- Lighting interface for strobe operation of Banner lighting with any vision sensor
- Strobe control module for control of specialty strobe lights

Vision Lighting

Critical Role in Successful Vision Sensing

No matter how powerful or robust a sensor is, successfully solving challenging vision applications relies heavily on matching the vision application with appropriate lighting. A properly chosen light can guarantee constant, consistent light conditions and can be used to create an optimally contrasted image. The correct light will highlight the features under inspection, disregard background objects and overpower any ambient light in the mix.

Banner offers a wide selection of high-intensity LED lights with built-in current and strobe control. A variety of specialty lights are available, including fluorescent lights. A complete selection of polarizing filter kits, colored filters and lighting diffusers are offered to improve lighting quality.

The innovation leader with more than 40 years of sensor development, Banner understands the challenges of the factory floor. Banner has over 3,000 factory and field representatives worldwide, as well as the largest force of application engineers in the industry who solve thousands of the most challenging applications every year. With one of the industry's most extensive selections of vision lighting solutions, Banner continues its commitment of providing solutions for a variety of sensing needs.

Pro & P4
GENERAL PURPOSEP4 DEDICATED
FUNCTION

LIGHTING

LENSES

ACCESSORIES



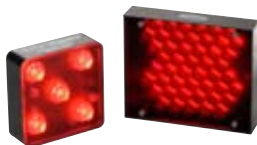
Ring Lights page 324

Mount directly to the sensor for easy setup and illuminates any object directly in front of the sensor



Backlights page 326

Install behind the target, directly facing the sensor; has a highly diffused surface and uniform brightness, with a lower intensity than other lights



Area Lights page 327

Provide even illumination in a concentrated area



Spot Lights page 328

Provide even illumination in a small concentrated spot



Linear Array Lights page 329

Provide high-intensity illumination of large areas, at long distances minimizing glare and shadows



Tubular Fluorescent Lights page 329

Feature flicker-free high-intensity illumination of large areas



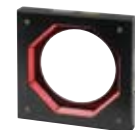
On-Axis Lights page 330

Provide collimated illumination in same optical path as camera



Highly Diffused Lights page 330

Softly illuminate from multiple directions, minimizing glare and shadows



Low-Angle Ring Lights page 331

Illuminate nearly perpendicular to the direction of an inspection, enhancing the contrast of surface features



Multi-Lights page 331

Have independently adjustable light intensity on each axis



Structured Lights page 331

Use Class 2 laser line with extra bright light for 3-dimensional sensing

- P70 & P4
GENERAL PURPOSE
- P4 DEDICATED
FUNCTION
- LIGHTING
- LENSES
- ACCESSORIES

		62 x 62 & 80 x 80 mm LED Ring Lights	70 mm High-Intensity LED Ring Lights	70 x 70 & 85 x 220 mm LED Backlights	62 x 62 & 80 x 80 mm LED Area Lights		
Page		324	324	326	328		
Color (wavelength)	Red	630 nm	625 nm	660 nm	62 x 62 mm: 630 nm 80 x 80 mm: 660 nm		
	White	5500 K	5500 K	—	5500 K		
	Blue	464 - 475 nm	470 nm	—	62 x 62 mm: 464-475 nm 80 x 80 mm: 470 nm		
	Green	520 - 540 nm	530 nm	—	62 x 62 mm: 520-540 nm 80 x 80 mm: 525 nm		
	Infrared	940 nm	940 nm	940 nm	62 x 62 mm: 940 nm 80 x 80 mm: 850 nm		
Supply Voltage & Current	Operating Voltage		24V dc ± 10%	24V dc ± 10%	24V dc ± 10%	24V dc ± 10%	
	Strobe Voltage		5V dc ± 10% @ 10 mA	5 - 24V dc (Active High or Low)	5V dc ± 10% @ 10 mA	5V dc ± 10% @ 10 mA	
	Current draw at Full Intensity	Infrared	62 x 62 mm: 24V dc @ 100 mA max 80 x 80 mm: 24V dc @ 180 mA max	350 mA max	70 x 70 mm: 24V dc @ 250 mA max 85 x 220 mm: 24V dc @ 500 mA max	62 x 62 mm: 24V dc @ 150 mA max 80 x 80 mm: 24V dc @ 250 mA max	
		All others	62 x 62 mm: 24V dc @ 130 mA max 80 x 80 mm: 24V dc @ 250 mA max			62 x 62 mm: 24V dc @ 200 mA max 80 x 80 mm: 24V dc @ 250 mA max	
Construction	Housing		Steel with black zinc plating	Anodized black aluminum	Steel with black zinc plating	Steel with black zinc plating	
	Window		Clear Acrylic	Clear Diffused Acrylic	White Acrylic	Clear Acrylic	
	Bracket		Included	Included with M models	Optional	Optional	
	Rating		IP20; NEMA 1	IP51; NEMA 2	IP40; NEMA 1	IP40; NEMA 1	
Connection	Model number suffix	M	0.3 m 3-pin pigtail Pico QD	0.3 m 3-pin pigtail Pico QD	0.3 m 3-pin pigtail Pico QD	2 m 3-pin pigtail Pico QD	
		W or Q	2 or 9 m 3-conductor attached cable with flying leads	5-pin 0.15 m pigtail Euro QD	2 or 9 m 3-conductor attached cable with flying leads	2 or 9 m 3-conductor attached cable with flying leads	
Useful Life (LED ON time) Hours (Strobing will increase life)		20,000	50,000	20,000	20,000		
Operating Temperature		0° to +50° C	0° to +50° C	0° to +50° C	0° to +50° C		
Effective Range	Minimum		3"	6"	—	3"	
	Maximum		62 mm: 12" 80 mm: 20"	48"	—	62 mm: 12" 80 mm: 20"	

70 mm High-Intensity LED Area Lights		LED Spot Lights	290 & 580 mm LED Linear Array Lights	High-Frequency Fluorescent Tubular Lights	50 & 100 mm LED On-Axis Lights	150 mm LED Low-Angle Ring Lights
327		328	329	329	330	331
625 nm		627 nm	625 nm	—	630 nm	640 nm
5500 K		5500 K	5500 K	4100 K	5500 K	—
470 nm		470 nm	470 nm	—	470 nm	—
530 nm		530 nm	530 nm	—	530 nm	—
940 nm		—	850 nm	—	850 nm	880 nm
24V dc ± 10%		10-30V dc	24V dc ± 10%	24V dc, 110V ac, 220V ac or 120/277V ac	24V dc ± 10%	24V dc ± 10%
5 - 24V dc (Active High or Low)		5V dc ± 10% @ 10 mA (Low)	5 - 24V dc (Active High or Low)	—	5V dc ± 10% @ 10 mA	5V dc ± 10% @ 10 mA
350 mA max		10-30V dc @ 360 mA max	290 mm: 24V dc @ 800 mA max 580 mm: 24V dc @ 1.6 A max	120V ac @ 0.15-0.26 A or 277V ac @ 0.07-0.11 A (Depending on bulb size/wattage)	50 mm: 150 mA 100 mm: 500 mA	350 mA max 500 mA max
Black Anodized Aluminum	Nickel-plated aluminum or 316 Stainless Steel	Black anodized aluminum	Nickel-plated aluminum or 316 Stainless Steel	Acrylic	Black anodized aluminum	Steel with black zinc plating
Clear Diffused Acrylic	Clear Acrylic, Clear Glass or Clear Diffused Acrylic	Glass Lens	Clear Acrylic, Clear Glass or Clear Diffused Acrylic	Clear Acrylic Tube	Optical Glass with anti-reflective coating	—
Optional		Optional	Optional	Optional	Optional	—
IP51; NEMA 2	IP68; NEMA 4X	IP68; NEMA 4X	IP68; NEMA 4X	IP68; NEMA 4X	IP40; NEMA 1	IP0; NEMA 0
2 m 3-pin pigtail Pico QD	—	2 m 3-pin pigtail Pico QD	—	—	0.6 m 3-pin pigtail Pico QD	2 m 3-pin pigtail Pico QD
0.15 m 5-pin pigtail Euro QD	5-pin Integral Euro QD	2 or 9 m 3-conductor attached cable with flying leads	5-pin Integral Euro QD	2.5 m attached cable (unterminated or wall plug)	—	2 or 9 m 3-conductor attached cable with flying leads
50,000		50,000	50,000	—	20,000	20,000
0° to +50° C		0° to +50° C	0° to +50° C	-18 ° C to +40 ° C	0° to +50° C	0° to +50° C
6"		0"	24"	4"	1"	0"
48"		18"	10' +	24"	6"	1"

Pro & P4
GENERAL PURPOSE
P4 DEDICATED FUNCTION
LIGHTING
LENSES
ACCESSORIES



Ring Lights

- Brightly illuminates smaller objects
- Centers the light on the image
- Mounts directly to the camera



LED High-Intensity Ring Light Model Key, 24V dc

Light	Color	Type of Light	Size	Housing Construction	Window	Relative Intensity	Intensity Adjustment	Connector Type
LED	R	R	70	X	D	4	- X	M

Color Legend:
 B = Blue
 G = Green
 I = Infrared
 R = Red
 W = White

Size Legend:
 70 mm

Housing Construction Legend:
 X = Not sealed

Window Legend:
 D = Diffused clear plastic

Intensity Adjustment Legend:
 X = Fixed
 P = Potentiometer

Connector Type Legend:
 Q = 0.15 m 5-pin Euro Pigtail QD†
 M = 0.3 m 3-pin Pico Pigtail QD*

* Pico QD model required for P4 sensors.
 Pico QD models include a built-in mounting bracket for use with P4 sensors.
 † Models require a mating cable (see page 415).
 Optional bracket SMBPPRH1 required for use with Pro sensors.(see page 408).

Data sheet part number: 134757

LED Pro Ring Lights, 24V dc



Models†		Color	Connection*	Data Sheet
80 x 80 mm	62 x 62 mm			
LEDRR80X80W	LEDRR62X62W	Red	2 m	108626
LEDWR80X80W	LEDWR62X62W	White		
LEDBR80X80W	LEDBR62X62W	Blue		
LEDGR80X80W	LEDGR62X62W	Green		
LEDIR80X80W	LEDIR62X62W	Infrared		

* For 9 m cable, add suffix W/30 to the 2 m model number (example, LEDRR80X80W W/30).
 † For replacement windows and diffusers (see page 332).



LED P4 Ring Lights, 24V dc



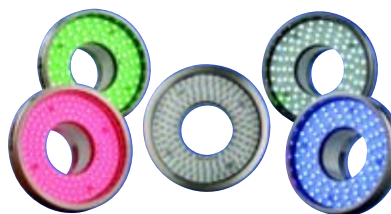
Models†		Color	Connection*	Data Sheet
80 x 80 mm	62 x 62 mm			
LEDRR80X80M	LEDRR62X62M	Red	0.3 m Threaded 3-pin Pico Pigtail QD	116941
LEDWR80X80M	LEDWR62X62M	White		
LEDBR80X80M	LEDBR62X62M	Blue		
LEDGR80X80M	LEDGR62X62M	Green		
LEDIR80X80M	LEDIR62X62M	Infrared		

* Splitter cable available for powering two lights (see page 410).
 † For replacement windows and diffusers (see page 332).



IP68 Sealed Pro Ring Lights

- Brightly illuminates smaller objects
- Centers the light on the image
- Mounts directly to the sealed camera
- Withstands challenging industrial and washdown environments (rated IP68)



LED IP68 Sealed Ring Lights, 24V dc

Size	Models [†]		Color	Housing	Connection*	Data Sheet
	Glass Window	Plastic Window				
90 mm dia.	LEDRR90S-G	LEDRR90S-P	Red	Nickel-plated Aluminum	3-pin Pico QD	128842
	LEDRR90SS-G	LEDRR90SS-P		Stainless Steel		
	LEDWR90S-G	LEDWR90S-P	White	Nickel-plated Aluminum		
	LEDWR90SS-G	LEDWR90SS-P		Stainless Steel		
	LEDBR90S-G	LEDBR90S-P	Blue	Nickel-plated Aluminum		
	LEDBR90SS-G	LEDBR90SS-P		Stainless Steel		
	LEDGR90S-G	LEDGR90S-P	Green	Nickel-plated Aluminum		
	LEDGR90SS-G	LEDGR90SS-P		Stainless Steel		
	LEDIR90S-G	LEDIR90S-P	Infrared	Nickel-plated Aluminum		
	LEDIR90SS-G	LEDIR90SS-P		Stainless Steel		

* Models require a mating cable (see page 410).

† Windows are factory replaceable, contact factory at 1-888-373-6767.

Pro & P4
GENERAL PURPOSE
P4 DEDICATED
FUNCTION
LIGHTING
LENSES
ACCESSORIES

Specialty Ring Lights



Size	Models	Description	Data Sheet
100 mm dia.	HFFW5100	110V ac Fluorescent	115969
	HFFW5100A220	220V ac Fluorescent	115970
	HFFBB	110V ac UV Fluorescent	115968

RFLBB UV fluorescent ring lamp replacement bulb, RFLW5100 fluorescent ring lamp replacement bulb.

NOTE: Specialty lights are not stocked and are non-returnable.

P4 & P4
GENERAL PURPOSE
P4 DEDICATED
FUNCTION
LIGHTING
LENSES
ACCESSORIES



Backlights

- Determines the shape and size of target objects
- Provides the most robust lighting for measuring and gauging
- Highlights through-holes in target objects



LED Backlights, 24V dc

Models [†]		Color	Connection*	Data Sheet
70 x 70 mm	85 x 220 mm			
LEDRB70X70W	LEDRB85X220W	Red	2 m	115349
LEDRB70X70M	LEDRB85X220M		2 m Threaded 3-pin Pico Pigtail QD	116947
LEDIB70X70W	LEDIB85X220W	Infrared	2 m	115349
LEDIB70X70M	LEDIB85X220M		2 m Threaded 3-pin Pico Pigtail QD	116947

* For 9 m cable, add suffix **W30** to the 2 m model number (example, **LEDRB70X70W W30**). QD models can be connected directly to P4 sensors; splitter cables available for powering two lights (see page 410).

† For replacement windows and diffusers (see page 332).



Specialty LED Backlights, 12V dc

Illumination Area	Models*	Description	Connection	Data Sheet		
50 x 50 mm	LEDRB50X50N	Red diffused	1.8 m with 9-pin D-sub connector	67426		
	LEDWB50X50N	White diffused				
	LEDBB50X50N	Blue diffused				
	LEDIB50X50N	Infrared diffused				
75 x 75 mm	LEDRB75X75N	Red diffused		1.8 m with 9-pin D-sub connector	67427	
	LEDWB75X75N	White diffused				
	LEDBB75X75N	Blue diffused				
	LEDIB75X75N	Infrared diffused				
100 x 100 mm	LEDRB100X100N	Red diffused			1.8 m with 9-pin D-sub connector	67428
	LEDWB100X100N	White diffused				
	LEDBB100X100N	Blue diffused				
	LEDIB100X100N	Infrared diffused				
100 x 200 mm	LEDRB100X200N	Red diffused	1.8 m with 9-pin D-sub connector			67431
	LEDIB100X200N	Infrared diffused				

* Specialty lights are not stocked and are non-returnable; they require an external power supply (see page 448).



Area Lights

- Illuminates specific surface angles
- Reflects glare from shiny surfaces away from camera
- Creates shadows to detect changes in depth



LED High-Intensity IP68 Sealed Area Light Model Key, 24V dc

Light	Color	Type of Light	Size	Housing Construction	Window	Relative Intensity	Intensity Adjustment	Connector Type
LED	R	A	70	A	D	4	- X	Q
B = Blue G = Green I = Infrared R = Red W = White		A = Area Light	70 mm	A = Nickel-plated Aluminum SS = 316 Stainless Steel	P = Plastic clear G = Glass clear D = Diffused clear plastic		X = Fixed P = Potentiometer	Q = 5-pin Euro† integral QD

Data sheet part number: [135621](#) † Models require a mating cable (see page 415).

Pro & P4
GENERAL PURPOSE
P4 DEDICATED FUNCTION
LIGHTING
LENSES
ACCESSORIES



LED High-Intensity Area Light Model Key, 24V dc

Light	Color	Type of Light	Size	Housing Construction	Window	Relative Intensity	Intensity Adjustment	Cable/ Connector
LED	R	A	70	X	D	4	- X	M
B = Blue G = Green I = Infrared R = Red W = White		A = Area Light	70 mm	X = Non-Sealed	D = Diffused clear plastic		X = Fixed P = Potentiometer	M = 2 m 3-pin Pico Pigtail QD* Q = 0.15 m 5-pin Euro Pigtail QD†

Data sheet part number: [134756](#) * Pico QD model required for P4 sensors.
† Models require a mating cable (see page 415).



LED Area Lights, 24V dc

Models [†]		Color	Connection*	Data Sheet 80 mm	Data Sheet 62 mm
80 x 80 mm	62 x 62 mm				
LEDRA80X80W	LEDRA62X62W	Red	2 m	115607	121779
LEDRA80X80M	LEDRA62X62M		2 m Threaded 3-pin Pico Pigtail QD	116949	121780
LEDWA80X80W	LEDWA62X62W	White	2 m	115607	121779
LEDWA80X80M	LEDWA62X62M		2 m Threaded 3-pin Pico Pigtail QD	116949	121780
LEDBA80X80W	LEDBA62X62W	Blue	2 m	115607	121779
LEDBA80X80M	LEDBA62X62M		2 m Threaded 3-pin Pico Pigtail QD	116949	121780
LEDGA80X80W	LEDGA62X62W	Green	2 m	115607	121779
LEDGA80X80M	LEDGA62X62M		2 m Threaded 3-pin Pico Pigtail QD	116949	121780
LEDIA80X80W	LEDIA62X62W	Infrared	2 m	115607	121779
LEDIA80X80M	LEDIA62X62M		2 m Threaded 3-pin Pico Pigtail QD	116949	121780



* For 9 m cable, add suffix **W/30** to the 2 m model number (example, **LEDRA80X80W W/30**). QD models can be connected directly to *P4* sensors; splitter cables available for powering two lights (see page 410).
[†] For replacement windows and diffusers (see page 332).

Specialty LED Area Lights, 12V dc



Size	Model*	Description	Connection	Data Sheet
100 x 100 mm	LEDRA100X100N	Red	1.8 m with 9-pin D-sub connector	67425
	LEDWA100X100N	White		
	LEDBA100X100N	Blue		
	LEDIA100X100N	Infrared		

* Specialty lights are not stocked and are non-returnable; they require an external power supply (see page 448).



Spot Lights

- Provides off-axis illumination of small areas
- Withstands washdown (rated IP68)



Sealed LED Spot Lights, 10 to 30V dc

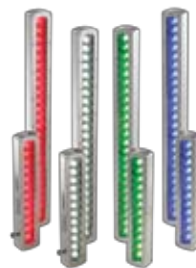
Size	Models	Color	Connection*	Data Sheet
30 mm	LEDRSW	Red	2 m	122987
	LEDRSM		2 m Threaded 3-pin Pico Pigtail QD	122986
	LEDWSW	White	2 m	122987
	LEDWSM		2 m Threaded 3-pin Pico Pigtail QD	122986
	LEDBSW	Blue	2 m	122987
	LEDBSM		2 m Threaded 3-pin Pico Pigtail QD	122986
	LEDGSW	Green	2 m	122987
	LEDGSM		2 m Threaded 3-pin Pico Pigtail QD	122986

* For 9 m cable, add suffix **W/30** to the model number (example **LEDRSW W/30**). QD models can be connected directly to the *P4* sensors; splitter cables available for powering two lights (see page 410).

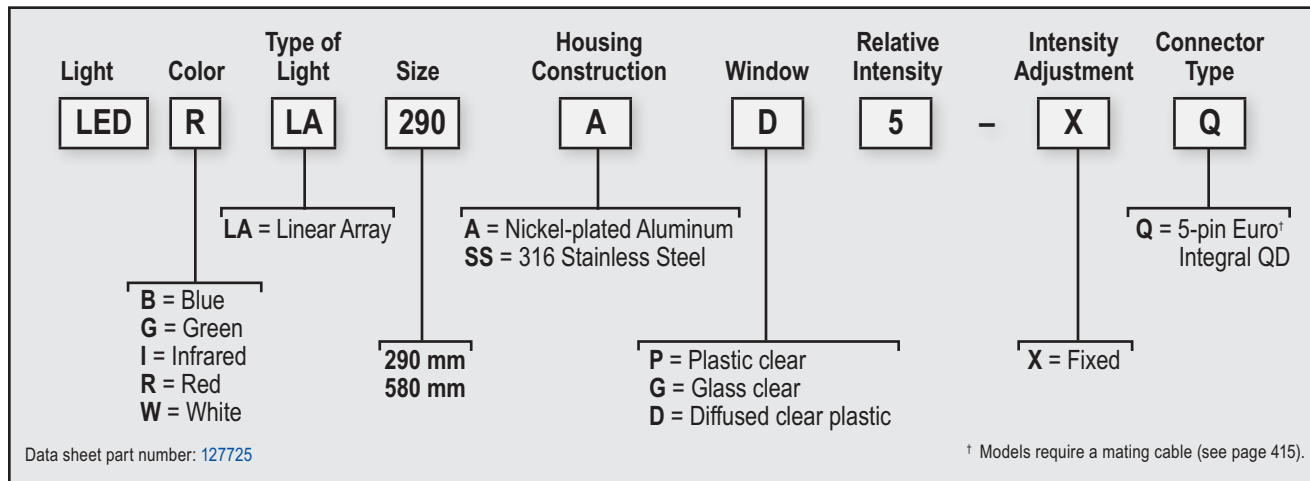


Linear Array Lights

- Maintenance-free LED illumination of large objects from far away
- Provides super high-intensity illumination of large areas
- Withstands washdown (rated IP68)



LED IP68 Sealed Linear Array Model Key, 24V dc



High-Frequency Fluorescent Tubular Lights

- Provides affordable, flicker-free even illumination of large objects
- Uses waterproof housings (rated IP67) with integrated mounting brackets



Sealed Fluorescent Tubular Lights

Length	Models		Voltage	Ballast	Data Sheet
	White	Black UV			
8"	HFFW8DC	HFFB8DC	24V dc	Integral	115387
8"	HFFW8AC110	HFFB8AC110	110V ac		
8"	HFFW8AC230	HFFB8AC230	230V ac		
12"	HFFW12DC	HFFB12DC	24V dc		
12"	HFFW12AC	HFFB12AC	120 to 277V ac		
14"	HFFW14DC	—	24V dc		
15"	HFFW15AC110	—	110V ac		
15"	HFFW15AC230	—	230V ac		
24"	HFFW24AC	—	120 to 277V ac		
36"	HFFW36AC	—	120 to 277V ac		
48"	HFFW48AC	—	120 to 277V ac	Remote	115387
8"	HFFW8ACR	HFFB8ACR	120 to 277V ac		
12"	HFFW12ACR	HFFB12ACR	120 to 277V ac		
15"	HFFW15ACR	—	120 to 277V ac		
24"	HFFW24ACR	—	120 to 277V ac		
36"	HFFW36ACR	—	120 to 277V ac		
48"	HFFW48ACR	—	120 to 277V ac		



Note: Replacement bulbs available, contact factory for information. All models have louvers and integral mounting flange; optional brackets are available for heavy-duty mounting (two brackets required for each light, see page 403).

Pro & P4
GENERAL PURPOSE
P4 DEDICATED
FUNCTION
LIGHTING
LENSES
ACCESSORIES

Pro & P4
GENERAL PURPOSE

P4 DEDICATED
FUNCTION

LIGHTING

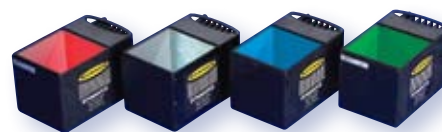
LENSES

ACCESSORIES



On-Axis Lights

- Provides more uniform illumination than a ring light
- Delivers collimated illumination in same optical path as camera
- Evenly illuminates on flat reflective material



LED On-Axis Lights, 24V dc

Models [†]		Color	Connection*	Data Sheet
100 x 100 mm	50 x 50 mm			
LEDRO100M	LEDRO50M	Red	0.6 m Threaded 3-pin Pico Pigtail QD	126059
LEDWO100M	LEDWO50M	White		
LEDBO100M	LEDBO50M	Blue		
LEDGO100M	LEDGO50M	Green		
LEDIO100M	LEDIO50M	Infrared		

* QD cables with flying leads are available for connecting to models other than P4 (see page 410).
 † For models with dust cover, add suffix -D (example, LEDRO100M-D).



Specialty LED On-Axis Lights, 12V dc

Size	Model*	Description	Connection	Data Sheet
25 mm dia.	LEDRO25N	Red	0.5 m with 9-pin D-sub connector	67437
	LEDWO25N	White		
	LEDBO25N	Blue		
75 mm dia.	LEDRO75N	Red	0.5 m with 9-pin D-sub connector	67439
	LEDRO75N-H	Red, high output		
	LEDWO75N	White		
	LEDBO75N	Blue		

* Specialty lights are not stocked and are non-returnable; they require an external power supply (see page 448).



Highly Diffused Lights

- Minimizes glare and shadows
- Illuminates curved surfaces softly and evenly
- Minimizes texture



Specialty LED Highly Diffused Lights, 12V dc

Size	Model*	Description	Connection	Data Sheet
150 mm dia.	LEDRD150N	Red, dome	1.8 m with 9-pin D-sub connector	66955
25 x 25 mm light aperture	LEDRS25N	Red, diffused on-axis	0.5 m with 9-pin D-sub connector	67441
59 x 75 mm light aperture	LEDRS75N	Red, diffused on-axis		67442
	LEDGS75N	Green, diffused on-axis		

* Specialty lights are not stocked and are non-returnable; they require an external power supply (see page 448).



Low-Angle Ring Lights

- Highlights surface irregularities
- Highlights changes in elevation
- Illuminates from an angle nearly perpendicular to object



LED Low-Angle Ring Lights, 24V dc

Size	Model	Color	Connection*	Data Sheet
150 mm dia.	LEDRI150-3W	Red	2 m	127582
	LEDRI150-3M		2 m Threaded 3-pin Pico Pigtail QD	
	LEDII150-3W	Infrared	2 m	
	LEDII150-3M		2 m Threaded 3-pin Pico Pigtail QD	

* For 9 m cable, add suffix W/30 to the 2 m model number (example, LEDRI150-3W W/30). QD models can be connected directly to P4 sensors.



Specialty LED Low-Angle Ring Lights, 12V dc

Size	Model*	Color	Connection	Data Sheet
100 mm dia.	LEDRI100N	Red	1.8 m with 9-pin D-sub connector	67432

* Specialty lights are not stocked and are non-returnable; they require an external power supply (see page 448).

Multi-Lights

- Provides multiple angles and highly diffused lighting



Specialty LED Multi-Lights, 12V dc

Size	Model*	Description	Connection	Data Sheet
50 mm dia.	LEDRM50N	Red low-angle & on-axis	1.8 m with 9-pin D-sub connector	67435
	LEDRM50N-H	Red low-angle & on-axis, high output		
75 mm dia.	LEDRM75N	Red low-angle & on-axis		67436
150 mm dia.	LEDRC150N	Red low-angle & on-axis multi-light		67443
200 mm dia.	LEDRC200N	Red low-angle & on-axis multi-light		67444

NOTE: Specialty lights are not stocked and are non-returnable; they require an external power supply (see page 448).



Laser Emitters for Structured Illumination

- Provides high-contrast illumination
- Senses surface height differences
- Provides 3D inspection with a 2D camera



QS18 Laser Emitters, 10 to 30V dc

Model	Description	Connection*	Data Sheet
QS186LE212	Extra Bright Horizontal Line (Class 2)	2 m	109415

* For 9 m cable, add suffix W/30 to the 2 m model number (example, QS186LE212 W/30).

Window Replacements and Lighting Diffusers

Pro & P4
GENERAL PURPOSE

P4 DEDICATED
FUNCTION

LIGHTING

LENSES

ACCESSORIES

	Models	Used With
Clear Plastic	LEDRCW	80 x 80 mm Ring Lights
	LEDRCWS	62 x 62 mm Ring Lights
	LEDAW	80 x 80 mm Area Lights
	LEDAWS	62 x 62 mm Area Lights
	LEDA70SW-P	70 mm Sealed High-Intensity Area Lights
	LEDLA290SW-P	290 mm Sealed Linear Array Lights
	LEDLA580SW-P	580 mm Sealed Linear Array Lights
Clear Plastic Diffuse	LEDRCDW	80 x 80 mm Ring Lights
	LEDRCDWS	62 x 62 mm Right Lights
	LEDR70CDW	70 mm High-Intensity Ring Lights
	LEDA70CDW	70 mm High-Intensity Area Lights
	LEDA70SCDW-P	70 mm Sealed High-Intensity Area Lights
	LEDLA290SCDW-P	290 mm Sealed Linear Array Lights
	LEDLA580SCDW-P	580 mm Sealed Linear Array Lights
Clear Glass	LEDLA290SW-G	290 mm Sealed Linear Array Lights
	LEDLA580SW-G	580 mm Sealed Linear Array Lights
	LEDA70SW-G	70 mm Sealed High-Intensity Area Lights

	Models	Used With
White Plastic	LEDBW	70 x 70 mm Red Backlights
	LEDBIW	70 x 70 mm Infrared Backlights
	LEDBWL	85 x 220 mm Red Backlights
	LEDBIWL	85 x 220 mm Infrared Backlights
	LEDRDW	80 x 80 mm Ring Lights
White Plastic Diffuse	LEDRDWS	62 x 62 mm Ring Lights
	LEDADW	80 x 80 mm Area Lights
	LEDADWS	62 x 62 mm Area Lights
	LEDLA290SWDW-P	290 mm Sealed Linear Array Lights
	LEDLA580SWDW-P	580 mm Sealed Linear Array Lights
	LEDA70SWDW-P	70 mm Sealed High-Intensity Area Lights

Filters



Model	Color	Description	Data Sheet
FLTI	Infrared (≥ 760 nm)	High-pass filter blocks visible light and passes infrared light. Included with all Banner Infrared light sources.	69461
FLTB	Blue (400-525 nm)	Band-pass filter improves quality by helping to reduce ambient light; it passes blue and infrared light.	115635
FLTG	Green (400-575 nm)	Band-pass filter improves quality by helping to reduce ambient light; it passes green and infrared light.	115634
FLTR	Red (≥ 600 nm)	High-pass filter improves quality by helping to reduce ambient light; it passes red and infrared light.	69628
LEDRRPFK	—	Polarizing filter kit for 80 x 80 Ring Lights	108945
LEDRRPFKS	—	Polarizing filter kit for 62 x 62 Ring Lights	108945
LEDAPFK	—	Polarizing filter kit for 80 x 80 Area Lights and 70 x 70 Backlights	113657
LEDAPFKS	—	Polarizing filter kit for 62 x 62 Area Lights	113657
LEDRPFK90	—	Polarizing filter kit for Sealed Ring Lights	129871
LEDFLTK	—	Kit with a variety of filters, diffusers and window replacements	—
LEDLAPFK290S	—	Polarizing filter kit for 290 mm Linear Array Lights	137942
LEDLAPFK580S	—	Polarizing filter kit for 580 mm Linear Array Lights	137942
LEDAPFK70	—	Polarizing filter kit for 70 mm High-Intensity Area Lights	137941
LEDRPFK70	—	Polarizing filter kit for 70 mm High-Intensity Ring Lights	137940
LEDAPFK70S	—	Polarizing filter kit for 70 mm IP68 High-Intensity Area Lights	137939

PresencePLUS® Standard Lenses



Model	Description	Format Size	Used With
LCF04	4 mm Lens	1/3"	All (except 1.3 megapixel models)
LCF08	8 mm Lens		
LCF12	12 mm Lens with Focus Locking		
LCF16	16 mm Lens with Focus Locking		
LCF25R	25 mm Lens with Focus and Aperture	1"	
LCF25LR	25 mm Lens with Focus and Aperture Locking, Metal Housing	2/3"	
LCF50L1R*	50 mm Lens with Focus and Aperture Locking		
LCF50L2R*	50 mm Lens with Focus and Aperture Locking, Metal Housing		
LCF75LR*	75 mm Lens with Focus and Aperture Locking, Metal Housing	1"	

*Lens models will not fit in opening of Banner Ring Lights.

PresencePLUS® High-Performance Lenses



Model	Description	Format Size	Used With
LCF03LT	3.5 mm Lens with Focus and Aperture Locking	1/2"	All (except 1.3 megapixel models)
LCF1040LT*	10 - 40 mm Lens with Zoom, and Focus and Aperture Locking		
LCF06LT	6.5 mm Lens with Fixed Focus and Aperture Locking	2/3"	
LCF08LT	8 mm Lens with Focus and Aperture Locking		
LCF12LT	12 mm Lens with Focus and Aperture Locking		
LCF16LT	16 mm Lens with Focus and Aperture Locking		
LCF25LT	25 mm Lens with Focus and Aperture Locking		
LCF50LT	50 mm Lens with Focus and Aperture Locking		
LCF75LT	75 mm Lens with Focus and Aperture Locking		
FLTUV	UV Lens Filter, Clear Glass		

*Lens models will not fit in opening of Banner Ring Lights.

PresencePLUS® Megapixel Lenses



Model	Description	Format Size	Used With
LCF08LMP	8 mm Lens with Focus and Aperture Locking	2/3"	All
LCF12LMP	12 mm Lens with Focus and Aperture Locking		
LCF16LMP	16 mm Lens with Focus and Aperture Locking		
LCF25LMP	25 mm Lens with Focus and Aperture Locking		
LCF35LMP	35 mm Lens with Focus and Aperture Locking		
LCF50LMP	50 mm Lens with Focus and Aperture Locking		

Extension kits for all PresencePLUS® C-mount lenses



Model	Description	Format Size	Used With
LEK	C-mount Lens Extension Kit (0.5, 1.0, 5.0, 10, 20 and 40 mm)	—	All lenses
LEKS	C-mount Lens Extension Kit (0.25 and 0.5 mm)		



PPM9



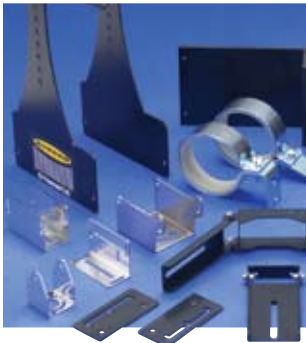
PPM8

Monitors



Model	Description	Data Sheet
PPM9	9" Black and White NTSC Video Monitor	—
PPM8	8" Flat Panel NTSC Video Monitor	133562

*Monitors require a BNC cable for connection to a PresencePLUS Sensor (see page 422).



Brackets [page 403](#)

- Broad offering of bracket styles for Pro and P4 sensors and Banner lights
- Swivel brackets for greater range of motion and flexibility in mounting
- Stainless steel, black corrosion resistant zinc or black ABS plastic brackets
- Column-mount brackets for flexible positioning of sensors and lights



Adjustable Mounting System [page 441](#)

- 3" and 6" column, base and knuckle kits for positioning of sensor and lights
- Bogen arm with clamp for added flexibility in mounting
- 2" pivoting knuckle assembly for positioning spot light



Cables [page 418](#)

- Cables for sensors, cameras, video, serial and Ethernet connections
- Splitter cable for powering two lights from one P4 sensor
- High-flex cables for robotic applications



Sensor Interface Modules and Power Supplies [page 447](#)

- Sensor interface modules for simplified wiring of P4 sensors in an electrical box
- Lighting interface for strobe operation of Banner lighting with any vision sensor
- Strobe control module for control of specialty strobe lights



Enclosures [page 438](#)

- Offers models for sensors and lights
- Provides protection in rugged or harsh environments
- Prevents tampering



Wireless

SureCross™ Networks page 335

- Consists of a radio frequency network built around a Gateway system controller, one or more remotely located Nodes and integrated I/O
- Installs where conduit/wiring is not practical
- Integrates with existing process and control networks
- Communicates on secure Frequency Hopping Spread Spectrum (FHSS) protocol
- Delivers two-way Rx/Tx communications with full acknowledgement
- Ensures optimal device location and peak RF performance with embedded Site Survey
- Accommodates 900 MHz or 2.4 GHz ISM frequencies
- Rated IP67; NEMA 6P for challenging environments and outdoor applications
- Available in models with Class I, Division 2 certification for hazardous locations
- Features 1 watt data radios for extended range of Modbus networks



DX80 page 336

- Includes a Gateway and one or more Nodes that operate on the same frequency
- Accommodates any combination of Nodes and FlexPower™ Nodes
- Offers discrete, analog/discrete, temperature and M-GAGE™ Nodes
- Directly connects to Modbus RTU, EtherNet/IP, Modbus TCP/IP and other industrial protocols



DX70 page 341

- Bridges one Gateway and Node on the same frequency
- Provides plug-and-play installation with direct mapping between Gateway and Node
- Offers discrete and analog I/O in same unit
- Provides real-time feedback with built-in signal strength indicator



DX91

- Certified for use in Class I, Division 2, Group A, B, C, D Hazardous Locations when properly installed in accordance with the National Electrical Code, the Canadian Electrical Code or applicable local code regulations



1 Watt Data Radio

- Wireless industrial device for extending the range of a Modbus network
- Multi-drop capabilities for connecting multiple devices
- Transceivers for reliable bidirectional communication between radios



Accessories page 344

- A wide selection of power supplies for Gateways, Nodes and sensors
- Modbus RTU slave modules for expanding Gateway I/O capacity
- A complete selection of cables for easy hookup
- Antennas, cables and accessories for virtually every location challenge

SureCross™ DX80 Wireless Network

To satisfy the performance demands for reliable sensing and actuation, Banner has reinvented wireless. The SureCross™ Wireless Network is the first wireless platform built from the ground up for industry—featuring proprietary RF design, power management with battery and solar options, and a host of low-power sensors designed to deliver robust remote monitoring and control capabilities.

SureCross offers easy, reliable communication between disparate products and processes in a single scalable and unified platform.

- Access hard-to-reach locations; install where wiring and conduit are not practical
- Digital and analog I/O in a single unit
- Easy to retrofit, expand and relocate as needed
- Reliable and secure Frequency Hopping Spread Spectrum (FHSS) protocol
- FlexPower™ supply options including battery and solar
- Easy plug-and-play deployment



DX80

DX70

ACCESSORIES



SureCross™ Gateway and Node Possibilities

- I/O can be tailored to accommodate up to 12 functions per device
- Open design supports inputs from sensors and devices from Banner and other manufacturers
- Multiple hard-wired network and protocol options at the Gateway make it easy to link to industrial host systems
- FlexPower devices enable sensing solutions never before possible



Configured kits with everything needed to solve many common applications quickly and easily (see page 337).



What types of sensors can be used on a SureCross wireless network?

- Photoelectric
- Capacitive
- Pressure
- RTD
- Ultrasonic
- Inductive
- Thermistor
- Level
- Contact Closures
- Thermocouple
- Distance
- Flow



How much I/O is provided by each SureCross Node?

- Up to 4 Analog IN (current, voltage)
- Up to 4 Analog OUT (current, voltage)
- Up to 8 Discrete IN (sinking, sourcing)
- Up to 8 Discrete OUT (sinking, sourcing)



Which communication protocols are supported by SureCross Gateways?

- Modbus RTU
- Modbus TCP/IP
- EtherNet/IP



What types of power options are available?

- 10 to 30V dc
- AC options
- FlexPower supply options:
FlexPower Battery Modules
FlexPower Solar Modules

SureCross™ DX80 Wireless Networks

- Network identity and device address rotary switches
- Menu and configuration push buttons
- RF link status and communications LEDs
- External antenna that rotates for mounting and positioning versatility
- DIN rail mountable or integral mounting holes for versatile mounting
- ½ inch NPT conduit entrance
- 5-pin Euro-style quick-disconnect
- LCD display of device information



- DX80
- DX70
- ACCESSORIES

SureCross™ DX80 Configured Kits—Discrete†

Model	Frequency**	Icon*	Gateway I/O	Node 1 I/O	Node 2 I/O	Node 3 I/O	Node 4 I/O	Data Sheet	
DX80K9M6EP1	900 MHz		Modbus Enabled 6 IN & 6 OUT	6 IN & 6 OUT	-	-	-	135535	
DX80K9M6ED1				4 IN & 8 OUT	8 IN & 4 OUT	-	-	134856	
DX80K9M6DP2				4 IN & 4 OUT	2 IN & 2 OUT	2 IN & 2 OUT	-	-	129307
DX80K9M6DP4				4 IN & 4 OUT	1 IN & 1 OUT	1 IN & 1 OUT	1 IN & 1 OUT	1 IN & 1 OUT	129308

SureCross™ DX80 Configured Kits—Analog & Discrete†

Model	Frequency**	Icon*	Gateway I/O	Node 1 I/O	Node 2 I/O	Data Sheet
DX80K9M6EM1	900 MHz		Modbus Enabled Discrete: 4 IN & 4 OUT Analog: 2 IN & 4 OUT	Discrete: 4 IN & 4 OUT Analog: 2 IN & 2 OUT	-	134862
DX80K9M6MP2				Discrete: 2 IN & 2 OUT Analog: 2 IN & 2 OUT	Discrete: 1 IN & 1 OUT Analog: 1 IN & 1 OUT	Discrete: 1 IN & 1 OUT Analog: 1 IN & 1 OUT

SureCross™ DX80 Configured Kits—FlexPower™

Model	Frequency**	Icon*	Gateway I/O	Node 1 I/O	Data Sheet
DX80K9M3PE1	900 MHz		Modbus Enabled Discrete: 2 OUT (sourcing)	Discrete: 1 IN configured for MINI-BEAM*** 1 IN (sinking) (DX81 FlexPower supply included; provides power for Node and MINI-BEAM)	129318
DX80K9M3GE1				Discrete: 2 OUT (sourcing) Analog: 2 OUT	Discrete: 2 IN (sinking) Analog: 2 IN (0-20 mA) dc Switched Power Outputs: Switch Configurable (DX81 FlexPower supply included; provides power for Node and one analog sensor)

* = Gateway = Node

** For 2.4 GHz frequency, replace 9 with 2 in the model number (example, DX80K2M6EM1).

*** Low power MINI-BEAM model SM312-75904 ordered separately (see page 343).

† Discrete outputs are sourcing unless otherwise noted. Analog outputs are 0-20 mA.



SureCross™ DX80 Gateways, 10 to 30V dc

Model	Frequency*	Gateway I/O	Antenna	Data Sheet
DX80G9M6W4P4M2M2	900 MHz	Modbus Enabled	Discrete: 4 IN & 4 OUT (sourcing) Analog: 2 IN & 2 OUT (0-20 mA)	Internal 131935
DX80G9M6S4P4M2M2			External	
DX80G9M6W4P4V2V2			Discrete: 4 IN & 4 OUT (sourcing) Analog: 2 IN & 2 OUT (0-10V dc)	Internal 134301
DX80G9M6S4P4V2V2			External	
DX80G9M6W8P4			Discrete: 8 IN & 4 OUT (sourcing)	Internal 132157
DX80G9M6S8P4				External
DX80G9M6W4P8			Discrete: 4 IN & 8 OUT (sourcing)	Internal 132158
DX80G9M6S4P8				External
DX80G9M6W6P6			Discrete: 6 IN & 6 OUT (sourcing)	Internal 132159
DX80G9M6S6P6				External
DX80G9M6W0P0M4M4			Analog: 4 IN & 4 OUT (0-20 mA)**	Internal 134302
DX80G9M6S0P0M4M4				External
DX80G9M6W6P6Z			M-GAGE™ Baseline Function for up to 6 M-GAGE Nodes	Internal 134303
DX80G9M6S6P6Z				External

SureCross™ DX80 Gateway Pro, 10 to 30V dc



Model	Frequency*	Protocol	Antenna	Data Sheet
DX80P9T6W	900 MHz	Modbus/TCP (default) or EtherNet/IP	Internal 131933	
DX80P9T6S			External	

Expandable Remote I/O



Model	I/O Functionality	Description	Housing	Data Sheet
DX85M4P4M2M2	Discrete: 4 IN & 4 OUT(sourcing) Analog: 2 IN & 2 OUT(0-20 mA)	Modbus RTU Slave Expansion I/O Modules; used to expand Gateway I/O capacity	IP67	131629
DX85M6P6	Discrete: 6 IN & 6 OUT(sourcing)			131599



* For 2.4 GHz frequency, replace 9 with 2 in the model number (example, DX80G2M6S4P4M2M2).

** For 0-10V dc analog models, replace M with V in the model number (example, DX80G9M6W0P0V4V4).



SureCross™ DX80 Nodes, 10 to 30V dc

Model	Frequency*	I/O	Antenna	Data Sheet
DX80N9X6W4P4M2M2	900 MHz	Discrete: 4 IN & 4 OUT (sourcing) Analog: 2 IN & 2 OUT (0-20 mA)	Internal	131936
DX80N9X6S4P4M2M2			External	
DX80N9X6W4P4V2V2		Discrete: 4 IN & 4 OUT (sourcing) Analog: 2 IN & 2 OUT (0-10V dc)	Internal	134323
DX80N9X6S4P4V2V2			External	
DX80N9X6W8P4		Discrete: 8 IN & 4 OUT (sourcing)	Internal	132160
DX80N9X6S8P4			External	
DX80N9X6W4P8		Discrete: 4 IN & 8 OUT (sourcing)	Internal	132161
DX80N9X6S4P8			External	
DX80N9X6W6P6		Discrete: 6 IN & 6 OUT (sourcing)	Internal	132162
DX80N9X6S6P6			External	
DX80N9X6W0P0M4M4		Analog: 4 IN & 4 OUT (0-20 mA)**	Internal	134322
DX80N9X6S0P0M4M4			External	

DX80

DX70

ACCESSORIES

SureCross™ DX80 FlexPower™ Nodes with Switched Power Outputs



Model	Frequency*	I/O	Antenna	Data Sheet
DX80N9X2W2N2M2X	900 MHz	Discrete: 2 IN (sinking) & 2 OUT (NMOS) Analog: 2 IN (0-20 mA) dc Switched Power Outputs: Switch Configurable	Internal	131296
DX80N9X2S2N2M2X			External	

SureCross™ DX80 FlexPower™ Nodes



Model	Frequency*	I/O	Antenna	Data Sheet
DX80N9X2W2N2T	900 MHz	Temperature: 3 IN Thermocouple † & 1 Integrated Thermistor for cold junction compensation Discrete: 2 IN (sinking) & 2 OUT (NMOS)	Internal	131297
DX80N9X2S2N2T			External	
DX80N9X2W0P0R		Temperature: 4 IN (3-wire RTD ††)	Internal	131597
DX80N9X2S0P0R			External	

* For 2.4 GHz frequency, replace 9 with 2 in the model number (example, DX80N2X6W4P4M2M2).

** For 0-10V dc analog models, replace M with V in the model number (example, DX80N9X6W0P0V4V4).

† Thermocouple units default to J-type. Other types configurable.

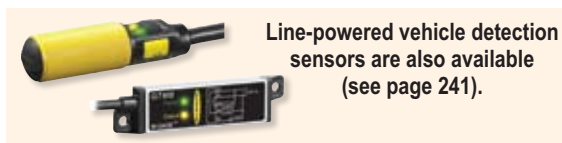
†† RTD units default to 3-wire 100 ohm platinum. Other types available.



SureCross™ DX80 FlexPower™ Nodes (cont'd)

Model	Frequency*	I/O	Antenna	Data Sheet
DX80N9X2W2N2M4	900 MHz	Discrete: 2 IN (sinking) & 2 OUT (NMOS) Analog: 4 IN (0-20 mA)	Internal	131762
DX80N9X2S2N2M4			External	
DX80N9X1W0P0Z		M-GAGE™ with internal battery	Internal	131598

* For 2.4 GHz frequency, replace 9 with 2 in the model number (example, DX80N2X2S2N2M4).



SureCross™ DX80 Specifications

General	<p>Power: +10 - 30V dc or 3.6 - 5.5V dc low power option Power Consumption: Less than 1.4 W (60 mA) at 24V dc Mounting: #10 or M5 (M5 hardware included) M5 Fasteners – Max. Tightening Torque: 0.56 N•m (5 in•lbf) Case Material: Polycarbonate Weight: 0.26 kg (0.57 lb.) Indicators: Two LED, bi-color Switches: Two push buttons Display: Six character LCD External Cable Glands: Four PG-7 type, one 1/2-inch NPT type Cable Glands – Max. Tightening Torque: 0.56 N•m (5 in•lbf)</p>		
Radio		900 MHz	2.4 GHz
	<p>Range, with Standard 2dB Antenna: Up to 4.8 kilometers (3 miles)* Frequency: 902 - 928 MHz ISM band Transmit Power: 21 dBm conducted</p> <p>Spread Spectrum Technology: FHSS (Frequency Hopping Spread Spectrum) Antenna Connector: Ext. reverse polarity SMA - 50 Ω Antenna – Max. Tightening Torque: 0.45 N•m (4 in•lbf)</p>	<p>Up to 3.2 kilometers (2 miles)* 2.4 - 2.4835 GHz ISM band 18 dBm conducted, ≤ 20 dBm EIRP FHSS (Frequency Hopping Spread Spectrum) Ext. reverse polarity SMA - 50 Ω 0.45 N•m (4 in•lbf)</p>	<p>Up to 3.2 kilometers (2 miles)* 2.4 - 2.4835 GHz ISM band 18 dBm conducted, ≤ 20 dBm EIRP FHSS (Frequency Hopping Spread Spectrum) Ext. reverse polarity SMA - 50 Ω 0.45 N•m (4 in•lbf)</p>
Environmental	<p>Rating: NEMA 6; IEC IP67** Operating Temperature: -40 to +85° C (electronics); -20 to +80° C (LCD) Operating Humidity: 95% max. relative (non-condensing) Shock and Vibration: IEC 68-2-6 and IEC 68-2-7 Shock: 30g, 11 milliseconds half sine wave, 18 shocks Vibration: 0.5 mm p-p, 10 - 60 Hz</p> <p>** Please refer to the SureCross™ DX80 Wireless I/O Network Product Manual, Banner part number 132607, for installation and waterproofing instructions.</p>		
Connection	5-pin Euro-style quick-disconnect fitting. QD cables included. See page 414.		
Compliance	<p>900 MHz Models: FCC ID TGUDX80 - This device complies with FCC Part 15, Subpart C, 15.247 IC:7044-A-DX8009 </p> <p>2.4 GHz Models: FCC ID UE300DX80-2400 - This device complies with FCC Part 15, Subpart C, 15.247 ETSI/EN: In accordance with EN 300 328: V1.7.1 (2006-05) IC:7044-A-DX8024 </p>		
Hookup Diagrams	See data sheet for hookup instructions		



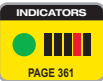
SureCross™ DX70 Wireless Network

- A network includes a Gateway and one Node that operate in the same frequency band.
- 900 MHz or 2.4 GHz frequency models are available to accommodate worldwide communication standards.
- Models include discrete and analog I/O.
- Input-to-output mapping is controlled by a configured Gateway.
- Open design supports inputs from sensors and devices made by Banner and other manufacturers.
- Frequency Hopping Spread Spectrum (FHSS) and Time Division Multiple Access (TDMA) architecture combine to ensure reliable data delivery.
- Rotary switch for network identity is easy to set and change.
- Gateways and Nodes require 10 to 30V dc line power.
- Models with internal or external antennas are available, depending on range.
- Wiring terminals are accessible without removal from mounting.

DX80

DX70

ACCESSORIES



SureCross™ DX70 Wireless Networks

- External or internal antenna that rotates for mounting and positioning versatility
- 1/2 inch NPT conduit entrance
- Network identity rotary switch
- Power indicator
- DIN-rail mountable or integral mounting holes for versatile mounting
- RF link status LED



SureCross™ DX70, 10 to 30V dc

Gateway Model	Node Model	Frequency*	I/O	Antenna**	Data Sheet
DX70G9X6S4P4M2M2	DX70N9X6S4P4M2M2	900 MHz	Discrete: 4 IN & 4 OUT (sourcing) Analog: 2 IN & 2 OUT (0-20 mA)	External	133214
DX70G9X6S4P8	DX70N9X6S8P4		Node Discrete: 8 IN & 4 OUT (sourcing)		133214
			Gateway Discrete: 4 IN & 8 OUT (sourcing)		

* For 2.4 GHz frequency, replace 9 with 2 in the model number (example, DX70G2X6S4P4M2M2).
 ** For internal antennas, replace S with W in the model number (example, DX70G9X6W4P4M2M2).



SureCross™ DX70 Specifications

General	<p>Power: +10 - 30V dc or 3.6 - 5.5V dc low power option Power Consumption: Less than 1.4 W (60 mA) at 24V dc Mounting: #10 or M5 (M5 hardware included) M5 Fasteners – Max. Tightening Torque: 0.56 N•m (5 in•lbf) Case Material: Polycarbonate Weight: 0.26 kg (0.57 lb.) Indicators: Power LED – Green/Red Signal LED – Yellow/Red Switches: Two push buttons Display: Six character LCD External Cable Glands: Two 1/2-inch NPT type Cable Glands – Max. Tightening Torque: 0.56 N•m (5 in•lbf)</p>		
Radio		900 MHz	2.4 GHz
	<p>Range, with Standard 2dB Antenna: Frequency: Transmit Power: Spread Spectrum Technology: Antenna Connector: Antenna – Max. Tightening Torque:</p>	<p>Up to 4.8 kilometers (3 miles)* 902 - 928 MHz ISM band 21 dBm conducted FHSS (Frequency Hopping Spread Spectrum) Ext. reverse polarity SMA - 50 Ω 0.45 N•m (4 in•lbf)</p>	<p>Up to 3.2 kilometers (2 miles)* 2.4 - 2.4835 GHz ISM band 18 dBm conducted, ≤ 20 dBm EIRP FHSS (Frequency Hopping Spread Spectrum) Ext. reverse polarity SMA - 50 Ω 0.45 N•m (4 in•lbf)</p>
	* Depending on the environment and line-of-sight, high gain antennas are available to increase the range.		
Environmental	<p>Rating: IEC IP67; NEMA 6** Operating Temperature: -40 to +85° C (electronics); -20 to +80° C (LCD) Operating Humidity: 95% max. relative (non-condensing) Shock and Vibration: IEC 68-2-6 and IEC 68-2-7 Shock: 30g, 11 milliseconds half sine wave, 18 shocks Vibration: 0.5 mm p-p, 10 - 60 Hz</p>		
	** Please refer to the SureCross™ DX70 data sheet, Banner part number 133214 for installation and waterproofing instructions.		
Compliance	<p>900 MHz Models: FCC ID TGUDX80 - This device complies with FCC Part 15, Subpart C, 15.247 IC: 7044A-DX8009 </p> <p>2.4 GHz Models: FCC ID UE300DX80-2400 - This device complies with FCC Part 15, Subpart C, 15.247 ETSI/EN: In accordance with EN 300 328: V1.7.1 (2006-05) IC: 7044A-DX8024 </p>		
Hookup Diagram	See data sheet for hookup instructions		

Sensors—Optimized for use with FlexPower™ Systems



Sensor Models	Supply Voltage	Description	Sensing Mode	Range	Output Type	Connection†	Data Sheet*
QT50ULBQ6-75390	FlexPower	U-GAGE Ultrasonic	-	200 mm to 8 m	0 to 10V dc or 4 to 20 mA	5-pin Euro QD	70137
SM312LPQD-76885		MINI-BEAM Photoelectric	Polar Retro	3 m	Bipolar NPN/PNP	4-pin Euro QD	134420
SM312DQD-75904		Diffuse	380 mm				



* Data sheet is for standard products, contact factory at 1-888-373-6767 for supporting literature.

† Mating cable required (see pages 412 and 415).

Mounting Hardware

Model	Description
BWA-HW-001	Replacement mounting hardware packet
BWA-HW-002	Replacement access hardware pack (5 plugs & 4 glands)

Power Supplies



Model	Voltage Supplied	Description	Connection	Housing	Data Sheet
AC PS24W	24V dc @ 500 mA	Converts 100 - 240V ac to 24V dc North America (wall plug)	5-pin Euro QD	Non-industrial (not sealed)	N/A
FlexPower™ DX81	FlexPower Battery Module to supply FlexPower Node	Module driven by one lithium primary battery**	5-pin Euro Pigtail QD	IP67	131596
		Module driven by six lithium primary batteries			131628

**Replacement lithium primary battery model number is BWA-BATT-001

Antennas



Antennas	Description	Frequency	Reference Guide
BWA-9Y6-A	6.5 dBd, Yagi, N Female	890-960 MHz	132113
BWA-9Y10-A	10.0 dBd, Yagi, N Female	890-960 MHz	
BWA-9O6-A	6.0 dBd, Fiberglass, Omni, N Female	902-928 MHz	
BWA-9O5-B	5.0 dBd/7.2 dBd Omni, with ground plate, N Female	902-928 MHz	
Cables	Description	Length	
BWC-1MRSMN2	LMR200, RSMA to N Male	2 m	
BWC-1MRSFRSB4	RG58, RSMA to RSMF Bulkhead	4 m	
BWC-4MNFN6	LMR400, N Male to N Female	6 m	
BWC-4MNFN15	LMR400, N Male to N Female	15 m	
Lightning Protectors	Description	Frequency	
BWC-LFNBMN	Bulkhead Lightning Suppressor, N type	900 MHz & 2.4 GHz	



Wireless Accessories

DX80

DX70

ACCESSORIES



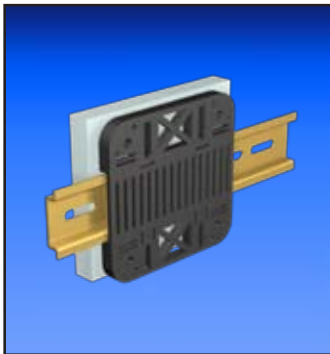
Cables page 412

- Quick-disconnect cordsets for Gateways, Nodes, Expandable Remote I/O, FlexPower™ devices, sensors and indicators
- Single-ended and double-ended cordsets
- A variety of lengths with right-angle or straight connectors
- Cordsets available for interfacing antennas



Power Supplies page 343

- Power supplies for Gateways, Nodes and sensors
- Models for converting ac voltage to dc
- FlexPower supplies with solar and battery options for FlexPower Nodes



Brackets page 374

- DIN-mount bracket for SureCross™ models
- Hardware for mounting to housing
- Black ABS thermoplastic



Antennas page 343

- Omni and Yagi antenna models for increasing the range of SureCross wireless networks
- Antenna extension and adapter cables for remote mounting options

EZ-LIGHT™

Sensors and Indicators

- K50 and K80 single-point pick-to-light sensors and push buttons for bin-picking, order fulfillment and operator guidance operations
- PVD one-piece light array for part assembly, park pick and error proofing
- PVA two-component light array for part-pick verification
- VTB verification touch buttons with illuminated base for indicating bin-picking sequence
- EZ-LIGHT™ indicators with up to 5 colors and 31 LED functions in one light



K50 & K80 page 346

- Highly visible 50 mm dome light in two housing styles.
- Single-point sensor with integrated pick light.
- Fixed-field background suppression, long-range retroreflective or push button models.
- Models for 30 mm, Flat or DIN-rail mounting.



VTB page 358

- Illuminated button base provides a bright, easy-to-see job light to guide assembly sequence.
- VTB buttons provide a cost effective and easy-to-install solution for areas that cannot accommodate a light screen.
- Ergonomic design requires no physical pressure to operate, reducing hand, wrist and arm stress.



PVD page 351

- Large highly visible job lights indicate the action to perform and signal errors.
- One-piece self-contained sensor requires no controller to operate.
- Sensor automatically operates in either diffuse or retroreflective mode, depending on the application.
- Two lengths fit existing bin sizes and configurations.



EZ-LIGHT™ Indicator Lights page 361

- Indicator lights show the status of remote or inaccessible sensors, emulating the sensor's indicators.
- Seven housing styles are available.
- A single light displays up to five colors, eliminating the need for multiple post or stack lights.



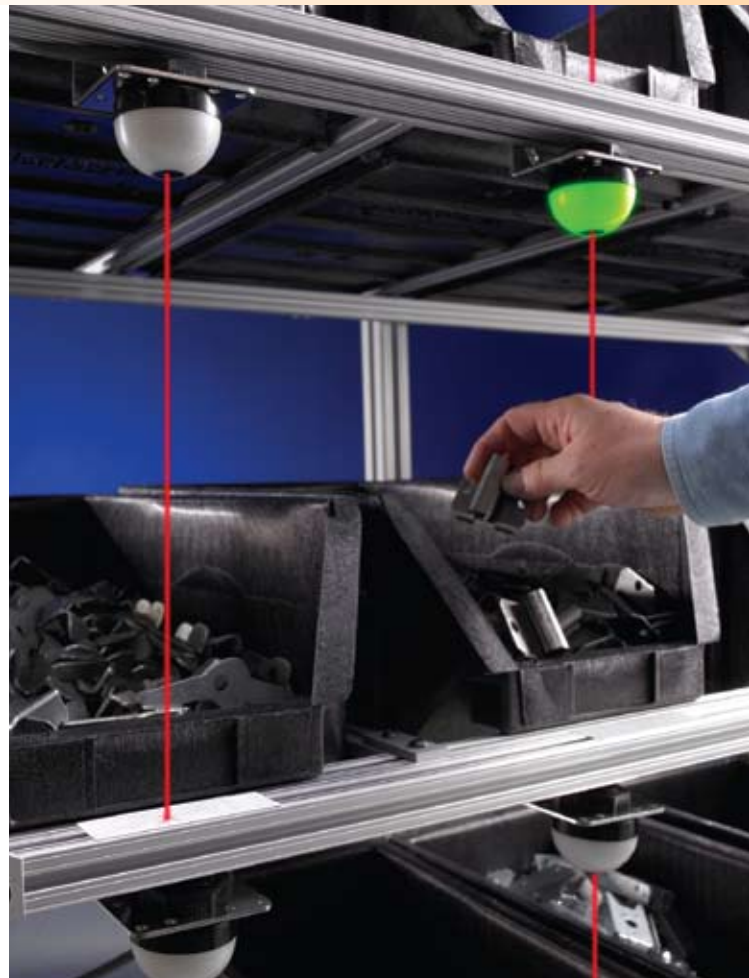
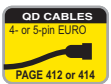
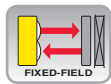
PVA page 354

- Highly visible LEDs on the emitter and receiver show the part-assembly sequence.
- Four lengths are available to fit common bin sizes.
- Range is up to 2 m.
- Array can also be used for detecting parts at least 35 mm in diameter.

EZ-LIGHT™ K50 & K80

Single Point, Pick-to-Light Sensor

- Requires no controller to operate; completely self-contained
- Indicates job pick status with a large translucent dome containing one, two or three colored lights
- Shows correct order for selecting parts using a green job light in all models
- Models available with a red light to indicate detection of operator action or mispick
- Features models with background suppression to avoid sensing background objects in the sensor field of view, reliable retroreflective (break beam) mode or pressure activated push buttons
- Offers choice of models for 30 mm, Flat or DIN rail mounting
- Ideal for use in abusive environments, featuring rugged, fully encapsulated IP67 construction; rated to IP69K depending on installation
- Offers AS-i module compatibility, depending on model
- Available without sensor for use as indicator light (EZ-LIGHT™ K50L & K80L, see page 361)
- Available with 2 m integral cable and a variety of quick-disconnect options



EZ-LIGHT™ K50 and K80 Sensors

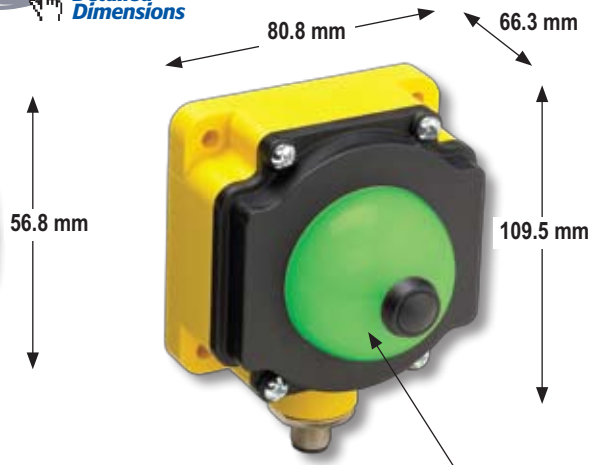
- Integral cable, or Euro-style integral or pigtail quick-disconnect
- Large 50 mm translucent dome
- 30 mm threaded mounting hub on K50
- Flat or DIN rail mounting on K80
- Push-button models
- Fully encapsulated housing rated to IP69K, depending on model
- 12 to 30V dc operation
- PNP or NPN output, depending on model
- Optional SA-K50A18 protective bracket (see page 376)



Detailed Dimensions



K50 Models



K80 Models



EZ-LIGHT™ K50 and K80 Standard–Single Color, 12-30V dc

- Job light is ON at all times while job input is active.
- Presence of hand initiates output change of state.



SENSORS
INDICATORS

Models	Sensing Mode/LED*	Housing	Range	Cable**	Output	Output Type	Job Light	Data Sheet
K50APLPGXD	 POLAR RETRO	50 mm dome/ 30 mm mount thermoplastic polyester	2 m	2 m	NO	PNP	Green	126441
K50APLPGXDQ				4-pin Euro QD				
K50RPLPGXD				2 m	NC			
K50RPLPGXDQ				4-pin Euro QD				
K50ANLPGXD				2 m	NO			
K50ANLPGXDQ				4-pin Euro QD				
K50RNLPGX				2 m	NC			
K50RNLPGXQ				4-pin Euro QD				
K50APFF50GXD	 FIXED-FIELD	50 mm dome/ 30 mm mount thermoplastic polyester	50 mm Cutoff	2 m	NO	PNP		
K50APFF50GXDQ				4-pin Euro QD				
K50RPF50GXD				2 m	NC			
K50RPF50GXDQ				4-pin Euro QD				
K50ANFF50GXD				2 m	NO			
K50ANFF50GXDQ				4-pin Euro QD				
K50RNFF50GXD				2 m	NC			
K50RNFF50GXDQ				4-pin Euro QD				
K50APFF100GXD	 FIXED-FIELD	50 mm dome/ 30 mm mount thermoplastic polyester	100 mm Cutoff	2 m	NO	PNP		
K50APFF100GXDQ				4-pin Euro QD				
K50RPF100GXD				2 m	NC			
K50RPF100GXDQ				4-pin Euro QD				
K50ANFF100GXD				2 m	NO			
K50ANFF100GXDQ				4-pin Euro QD				
K50RNFF100GXD				2 m	NC			
K50RNFF100GXDQ				4-pin Euro QD				
K50APBPGXD	 PUSH-BUTTON	50 mm dome/ 30 mm mount thermoplastic polyester	-	2 m	NO	PNP	126441	
K50APBPGXDQ				4-pin Euro QD				
K50RPPBPGXD				2 m	NC			
K50RPPBPGXDQ				4-pin Euro QD				
K50ANBPGXD				2 m	NO			
K50ANBPGXDQ				4-pin Euro QD				
K50RNBPBPGXD				2 m	NC			
K50RNBPBPGXDQ				4-pin Euro QD				
K80APBPGXD		50 mm dome/ Flat or DIN-mount thermoplastic polyester	-	-	2 m	NO		PNP
K80APBPGXDQ					4-pin Euro QD			
K80RPPBPGXD					2 m	NC		
K80RPPBPGXDQ					4-pin Euro QD			
K80ANBPGXD					2 m	NO		
K80ANBPGXDQ					4-pin Euro QD			
K80RNBPBPGXD					2 m	NC		
K80RNBPBPGXDQ					4-pin Euro QD			

* Visible Red LED Infrared LED NO = Normally Open, NC = Normally Closed
 ** Cabled models: For 9 m cable, add suffix **W30** to the 2 m model number (example, **K50APLPGXD W30**).
QD Models: A model with a QD requires a mating cable (see page 412).
 For 150 mm 4-pin Euro-style PVC pigtail, add suffix **QP** to 2 m model number (example, **K50APLPGXDQP**).

EZ-LIGHT™ K50 and K80 Specialty C-Series—Two Color, 12-30V dc

- Job light is Green while job input is active (unless hand is present.)
- Presence of hand (or pressing push button) initiates output change of state and turns light Red for visual verification that action was sensed.
- Aids in alignment of retroreflective models by providing Red signal when retroreflective target is not aligned or present.



Models	Sensing Mode/LED*	Housing	Range	Cable**	Output	Output Type	Job Light	Data Sheet
K50APLPGRCQ	POLAR RETRO	50 mm dome/ 30 mm mount thermoplastic polyester	2 m	4-pin Euro QD	NO	PNP	Green (Red)	126441
K50RPLPGRCQ					NC			
K50ANLPGRCQ					NO	NPN		
K50RNLPGRQCQ					NC			
K50APFF50GRCQ	FIXED-FIELD	50 mm dome/ 30 mm mount thermoplastic polyester	50 mm Cutoff	4-pin Euro QD	NO	PNP		126441
K50RPF50GRCQ					NC			
K50ANFF50GRCQ					NO	NPN		
K50RNFF50GRCQ					NC			
K50APFF100GRCQ			100 mm Cutoff	4-pin Euro QD	NO	PNP		
K50RPF100GRCQ					NC			
K50ANFF100GRCQ					NO	NPN		
K50RNFF100GRCQ					NC			
K50APPBGRCQ	PUSH-BUTTON	50 mm dome/ 30 mm mount thermoplastic polyester	-	4-pin Euro QD	NO	PNP	126441	
K50RPPBGRCQ					NC			
K50ANPBGRQCQ					NO	NPN		
K50RNPPBGRCQ					NC			
K80APPBGRCQ		50 mm dome/ Flat or DIN-mount thermoplastic polyester	-	4-pin Euro QD	NO	PNP		
K80RPPBGRCQ					NC			
K80ANPBGRQCQ					NO	NPN		
K80RNPPBGRCQ					NC			

* Visible Red LED Infrared LED NO = Normally Open, NC = Normally Closed

** Cabled models: For 2 m cable, remove Q from model number (example, K50APLPGRC) or 9 m cable, add suffix W/30 to the 2 m model number (example, K50APLPGRC W/30).

QD Models: A model with a QD requires a mating cable (see page 412)

For 150 mm 4-pin Euro-style PVC pigtail, replace suffix Q with QP (example, K50APLPGRCQP).

† For other color combinations, contact factory at 1-888-373-6767.

EZ-LIGHT™ K50 and K80 Specialty C-Series—Three Color, 12-30V dc



- Job light is ON at all times while job input is active (unless hand is present).
- Presence of hand (or pressing button) activates output and turns job light Yellow for visual verification that action was sensed.
- Presence of hand (or pressing button) while job input is not active turns light Red signaling mispick.

Models	Sensing Mode/LED*	Housing	Range	Cable**	Output†	Output Type	Job Light	Data Sheet
K50RPLPGRYC3QPMA	POLAR RETRO	50 mm dome/ 30 mm mount thermoplastic polyester	2 m	5-pin Euro PUR Pigtail QD	NC	PNP	Green/ Yellow/ Red	137551
K50APFF50GRYC3QPMA			50 mm Cutoff		NO			
K50APFF100GRYC3QPMA	100 mm Cutoff							
K50APPBGRYC3QPMA	FIXED-FIELD	-	-	5-pin Euro PUR Pigtail QD	NO			137551
K80APPBGRYC3QPMA		50 mm dome/ Flat or DIN-mount thermoplastic polyester	-					

* Visible Red LED Infrared LED NO = Normally Open, NC = Normally Closed

** 5-pin 150 mm Euro-style PUR pigtail QD models are listed. Other cable and connector options are available, contact factory at 1-888-373-6767.

A model with a QD requires a mating cable (see page 414).

† PNP models are listed. For other output types, contact factory at 1-888-373-6767.

EZ-LIGHT™ K50 and K80 Specialty E-Series—Two Color, 12-30V dc

- Job light is Green at all times while job input is active.
- Presence of hand (or pressing button) initiates output change of state.
- Presence of hand (or pressing button) while job input is inactive turns light Red, giving operator visual verification that sensor is functioning properly.



Models	Sensing Mode/LED*	Housing	Range	Cable**	Output	Output Type	Job† Light	Data Sheet
K50APLPGREQ	 POLAR RETRO	50 mm dome/ 30 mm mount thermoplastic polyester	2 m	4-pin Euro QD	NO	PNP	Green (Red)	126441
K50RPLPGREQ					NC			
K50ANLPGREQ					NO	NPN		
K50RNLPREQ					NC			
K50APFF50GREQ	 FIXED-FIELD	50 mm dome/ 30 mm mount thermoplastic polyester	50 mm Cutoff	4-pin Euro QD	NO	PNP		126441
K50RPF50GREQ					NC			
K50ANFF50GREQ					NO	NPN		
K50RNFF50GREQ					NC			
K50APFF100GREQ			100 mm Cutoff	4-pin Euro QD	NO	PNP		
K50RPF100GREQ					NC			
K50ANFF100GREQ					NO	NPN		
K50RNFF100GREQ					NC			
K50APPBGREQ	 PUSH-BUTTON	50 mm dome/ 30 mm mount thermoplastic polyester	-	4-pin Euro QD	NO	PNP	126441	
K50RPPBGREQ					NC			
K50ANPBGREQ					NO	NPN		
K50RNPBGREQ					NC			
K80APPBGREQ		50 mm dome/ Flat or DIN-mount thermoplastic polyester			NO	PNP		
K80RPPBGREQ					NC			
K80ANPBGREQ					NO	NPN		
K80RNPBGREQ					NC			

* Visible Red LED Infrared LED NO = Normally Open, NC = Normally Closed

** **Cabled models:** For 2 m cable, remove **Q** from model number (example, **K50APLPGRE**) or 9 m cable, add suffix **W/30** to the 2 m model number (example, **K50APLPGRE W/30**).

QD models: A model with a QD requires a mating cable (see page 412).

For 150 mm 4-pin Euro-style PVC pigtail, replace **Q** with **QP** (example, **K50APLPGREQP**).

† For other color combinations, contact factory at 1-888-373-6767.

EZ-LIGHT™ K50 and K80 Specifications	
Supply Voltage and Current	12 to 30V dc, (10% max. ripple) C3 models: less than 90 mA max. current @ 12V dc (exclusive of load) less than 60 mA max. current @ 30V dc (exclusive of load) All others: less than 60 mA max. current @ 12V dc (exclusive of load) less than 40 mA max. current @ 30V dc (exclusive of load) AS-i Compatible
Supply Protection Circuitry	Protected against reverse polarity and transient voltages
Output Configuration	PNP or NPN (depending on model)
Output Rating	150 mA max. OFF-state leakage current: less than 1 μ A @ 30V dc ON-state voltage: less than 2V @ 10 mA dc; less than 2.5V @ 150 mA dc
Output Protection Circuitry	Protected against false pulse on power-up and continuous overload or short circuit of output
Output Response Time	C3 models: 5 milliseconds ON/OFF All others: 3 milliseconds ON/OFF
Indicators	C3 models: Entire translucent dome provides indicator light. Job ("Pick") indicator –Green Pick Sensed indicator –Yellow Mispick indicator –Red All others: Entire translucent dome provides indicator light; either Job or Pick Sensed indicator inhibits the other light, depending on model. Job ("Pick") indicator –Green Pick Sensed indicator –Red or OFF, depending on model
Job Light Enable Input	Input impedance: 8000 Ω Sinking –Input low less than 1.0V Sourcing –Input high greater than 7V
Construction	Base and translucent dome: polycarbonate Lens: polycarbonate or acrylic Push Button: thermoplastic
Environmental Rating	Fully encapsulated; IEC IP67 Integral QD models: DIN 4005 (IP69K) when using IP69K rated cables Pigtail and cable models: IP69K when mounted with conduit
Connections	C3 models: 5-pin 150 mm PUR pigtail Euro-style QD (QPMA). QD cables are ordered separately. See page 414. All others: 2 m or 9 m 4-wire attached cable, 4-pin integral Euro-style QD (Q) or 4-pin 150 mm PVC pigtail Euro-style QD (QP), depending on model. QD cables are ordered separately. See page 412.
Ambient Light Immunity	Up to 5,000 lux
EMI/RFI Immunity	Immunity to EMI and RFI noise sources per IEC 947-5-2
Operating Conditions	Temperature: -20° to +50° C Relative Humidity: 90% at 50° C (non-condensing)
Hookup Diagrams	IN01 (p. 541) C3 models: Not available at time of printing

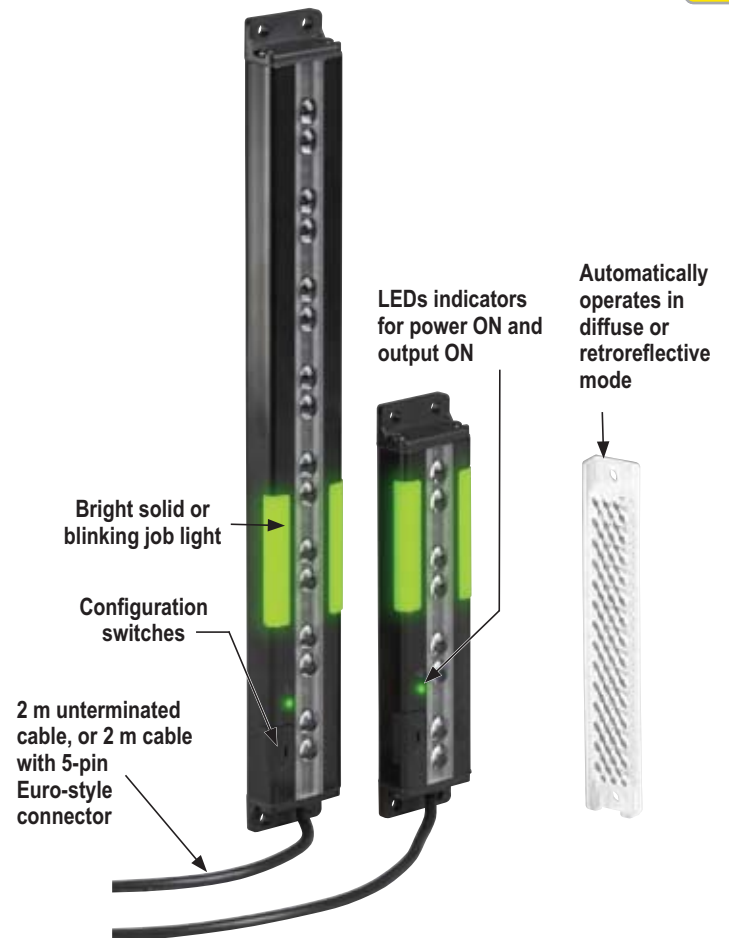
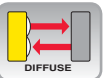
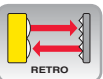


EZ-LIGHT™ PVD

One-Piece Pick-to-Light Sensor

- Large green job light indicates action to perform, and red job light indicates an error.
- Two lengths are available to fit existing bins and configurations: 100 and 225 mm.
- Easy-to-use sensor suits many part assembly, pick-to-light and error-proofing applications.
- One-piece self-contained sensor requires no controller.
- Sensor automatically operates in either diffuse or retroreflective mode, depending on the application.
- Setup and adjustment are automated, and a wide beam pattern provides easy alignment.
- A choice of protective mounting brackets are available.

SENSORS
INDICATORS

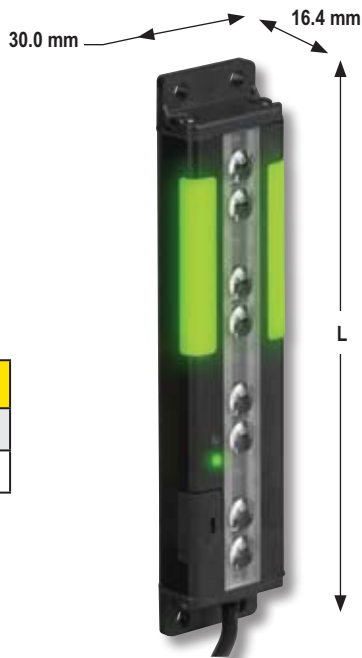


EZ-LIGHT™ PVD Sensors

- 100 or 225 mm to fit existing bin sizes and configurations
- Bright solid or blinking job light
- Automatic operation in diffuse or retroreflective mode
- One-piece self-contained sensor with no controller
- 2 m unterminated cable, or 2 m cable with 5-pin Euro-style connector



Models	Length (L)
PVD100	137.8 mm
PVD225	266.4 mm



EZ-LIGHT™ PVD, 12-30V dc



Model	Sensing Mode/LED*	Range	Array	Cable**	Output	Data Sheet
PVD100	 RETRO	Retroreflective Mode: up to 2 m	100 mm (4 Beams)	2 m	NPN/PNP	113230
PVD100Q				5-pin Euro Pigtail QD		
PVD225	 DIFFUSE	Diffuse Mode: up to 400 mm	225 mm (8 Beams)	2 m		
PVD225Q				5-pin Euro Pigtail QD		


* Visible Red LED

** For 9 m cable, add W/30 to the 2 m model number (example, PVD100 W/30). A model with a QD requires a mating cable (see page 414).

EZ-LIGHT™ PVD Specifications

Sensing Range	Retroreflective applications: 2 m, using 25 mm wide retroreflective tape Diffuse applications: 400 mm, with 18% reflectivity gray card target
Sensing Beam	630 nm, Visible red
Beam Spacing	28.6 mm
Sensing Height	4-channel models: 111 mm 8-channel models: 240 mm
Supply Voltage and Current	Input Voltage: 12 to 30V dc (10% max. ripple @ 10% duty cycle) Input Current: less than 40 mA @ 24V dc and less than 70 mA @ 12V dc (exclusive of load)
Supply Protection Circuitry	Protected against reverse polarity and transient over-voltage
Sensing Resolution	Retroreflective: 51 mm at 406 mm range, 100 mm at 2 m Diffuse: 55 mm dia. at 400 mm range
Output Configuration	User-selectable via DIP switch: 1 open-collector PNP (current sourcing) or 1 open-collector NPN (current sinking)



EZ-LIGHT™ PVD Specifications (cont'd)	
Output Rating	150 mA max. OFF-state leakage current: less than 10 μ A ON-state saturation voltage: NPN: less than 1.0V dc at 150 mA PNP: less than 2.0V dc at 150 mA
Output Protection Circuitry	Protected against false pulse at power-up and short circuit of outputs
Output Response Time	400 milliseconds (Includes standard 100 milliseconds ON-delay and 100 milliseconds OFF-delay)
Delay at Power-Up	Less than 1.0 second
Indicators	Green: LED to indicate power ON/OFF Yellow: LED to indicate output ON/OFF Job Light: (Diffused Green LED) Turned ON and OFF by applying an external signal to the Job input (white wire). The job lights will be active high or active low, depending on user selection of DIP switch 4. Error Light: (Diffused Red LED) Turned ON and OFF by detection of an output event when job light is not ON.
Adjustments	4 DIP switches, located behind access panel († denotes default setting): 1. PNP† / NPN output 2. Normally Open operation† / Normally Closed 3. Job light ON solid† / Job light flashing 4. Job light input high† / Job light input low
Construction	Black painted aluminum housing; acrylic lenses; thermoplastic polyester end caps; thermoplastic elastomer programming switch cover; stainless steel mounting brackets and hardware
Environmental Rating	NEMA 2; IEC IP62
Connections	5-conductor PVC-jacketed 2 m cable which is either unterminated or terminated with a 5-pin Euro-style quick-disconnect connector, depending on model. Cable diameter is 3.3 mm. See page 414.
Operating Conditions	Temperature: 0° to +50° C Relative humidity: 90% relative humidity @ 50° C (non-condensing)
Certifications	
Hookup Diagrams	IN02 (p. 541)

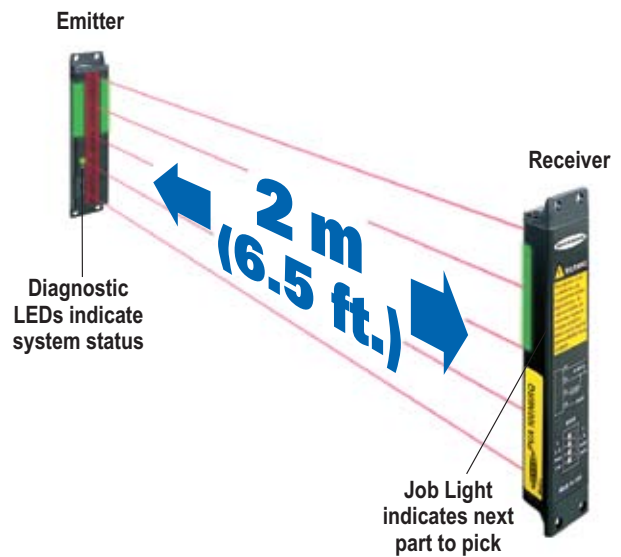
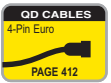
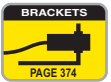
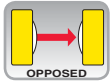
EZ-LIGHT™ PVA

Pick-to-Light Parts Verification Array

- Highly visible job lights on each emitter and receiver guide assemblers through the correct part-gathering sequence.
- Reduced chance of missed parts and parts assembled in the wrong order increases quality and decreases production costs.
- Sensor can also be used to sense objects larger than 35 mm in diameter.
- Emitter and receiver interface easily with the existing process controller, saving installation time, wiring costs and maintenance.
- Diagnostic LEDs indicate setup and system errors at a glance, and the wide field of view makes alignment easy.
- Operating range is up to 2 m.
- Compact system is only 30 mm wide by 15 mm deep.
- Four lengths are available: 100, 225, 300 and 375 mm.
- A choice of protective brackets are available.

SENSORS

INDICATORS





Models	No. of Beams	Length (L)
PVA100	5	137.8 mm
PVA225	10	266.4 mm
PVA300	13	341.4 mm
PVA375	16	416.6 mm

EZ-LIGHT™ PVA Sensors

- Four array lengths to fit common bin sizes
- Dual-LED indicator system
- Asynchronous emitter and receiver with no controller
- 2 m attached cable or 4-pin Euro-style quick-disconnect

SENSORS
INDICATORS

EZ-LIGHT™ PVA, 12-30V dc



Models	Description	Sensing Mode/LED*	Range	Array Length & Response Time	Cable**	Job Light Input	Receiver Output	Data Sheet
PVA100N6	Emitter/Receiver Pair	<p>OPPOSED</p>	2 m	100 mm (5 Beams) 20 ms	2 m	0V dc	NPN	52088
PVA100N6E	Emitter					+5 to 30V dc	PNP	
PVA100N6R	Receiver							
PVA100P6	Emitter/Receiver Pair							
PVA100P6E	Emitter							
PVA100P6R	Receiver							
PVA100N6Q	Emitter/Receiver Pair				2 m 4-pin Euro Pigtail QD			
PVA100N6EQ	Emitter					+5 to 30V dc	PNP	
PVA100N6RQ	Receiver							
PVA100P6Q	Emitter/Receiver Pair							
PVA100P6EQ	Emitter							
PVA100P6RQ	Receiver							
PVA225N6	Emitter/Receiver Pair	<p>OPPOSED</p>	2 m	225 mm (10 Beams) 40 ms	2 m			0V dc
PVA225N6E	Emitter					+5 to 30V dc	PNP	
PVA225N6R	Receiver							
PVA225P6	Emitter/Receiver Pair							
PVA225P6E	Emitter							
PVA225P6R	Receiver							
PVA225N6Q	Emitter/Receiver Pair				2 m 4-pin Euro Pigtail QD			0V dc
PVA225N6EQ	Emitter					+5 to 30V dc	PNP	
PVA225N6RQ	Receiver							
PVA225P6Q	Emitter/Receiver Pair							
PVA225P6EQ	Emitter							
PVA225P6RQ	Receiver							

* Infrared LED
 ** A model with a pigtail QD requires a mating cable (see page 412).





EZ-LIGHT™ PVA, 12-30V dc (cont'd)

SENSORS

INDICATORS

Models	Description	Sensing Mode/LED*	Range	Array Length & Response Time	Cable**	Job Light Input	Receiver Output	Data Sheet
PVA300N6	Emitter/Receiver Pair		2 m	300 mm (13 Beams) 52 ms	2 m	0V dc	NPN	52088
PVA300N6E	Emitter					+5 to 30V dc	PNP	
PVA300N6R	Receiver							
PVA300P6	Emitter/Receiver Pair							
PVA300P6E	Emitter							
PVA300P6R	Receiver							
PVA300N6Q	Emitter/Receiver Pair				2 m 4-pin Euro Pigtail QD			
PVA300N6EQ	Emitter					+5 to 30V dc	PNP	
PVA300N6RQ	Receiver							
PVA300P6Q	Emitter/Receiver Pair							
PVA300P6EQ	Emitter							
PVA300P6RQ	Receiver							
PVA375N6	Emitter/Receiver Pair		2 m	375 mm (16 Beams) 64 ms	2 m			0V dc
PVA375N6E	Emitter					+5 to 30V dc	PNP	
PVA375N6R	Receiver							
PVA375P6	Emitter/Receiver Pair							
PVA375P6E	Emitter							
PVA375P6R	Receiver							
PVA375N6Q	Emitter/Receiver Pair				2 m 4-pin Euro Pigtail QD			0V dc
PVA375N6EQ	Emitter					+5 to 30V dc	PNP	
PVA375N6RQ	Receiver							
PVA375P6Q	Emitter/Receiver Pair							
PVA375P6EQ	Emitter							
PVA375P6RQ	Receiver							


* Infrared LED

** A model with a pigtail QD requires a mating cable (see page 412).

EZ-LIGHT™ PVA Specifications

Beam Spacing	25.0 mm															
Sensing Height	100, 225, 300 or 375 mm, depending on emitter and receiver models															
Supply Voltage and Current	12 to 30V dc (10% max. ripple) at less than 62 mA for the emitter and 50 mA for the receiver (exclusive of load)															
Supply Protection Circuitry	Protected against reverse polarity															
Output Configuration	Receivers have one solid-state dc output, programmable for light or dark operate: Models PVA...N6R have current sinking (NPN) open-collector transistor Models PVA...P6R have current sourcing (PNP) open-collector transistor															
Output Rating	150 mA max. OFF-state leakage current: less than 2 µA ON-state saturation voltage: less than 1V dc at 10 mA and less than 1.5V dc at 100 mA															
Output Response Time	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Sensor Size</th> <th>Standard</th> <th>With Crosstalk from Adjacent Units</th> </tr> </thead> <tbody> <tr> <td>100 mm</td> <td>20 milliseconds</td> <td>30 milliseconds max.</td> </tr> <tr> <td>225 mm</td> <td>40 milliseconds</td> <td>60 milliseconds max.</td> </tr> <tr> <td>300 mm</td> <td>52 milliseconds</td> <td>78 milliseconds max.</td> </tr> <tr> <td>375 mm</td> <td>64 milliseconds</td> <td>96 milliseconds max.</td> </tr> </tbody> </table>	Sensor Size	Standard	With Crosstalk from Adjacent Units	100 mm	20 milliseconds	30 milliseconds max.	225 mm	40 milliseconds	60 milliseconds max.	300 mm	52 milliseconds	78 milliseconds max.	375 mm	64 milliseconds	96 milliseconds max.
Sensor Size	Standard	With Crosstalk from Adjacent Units														
100 mm	20 milliseconds	30 milliseconds max.														
225 mm	40 milliseconds	60 milliseconds max.														
300 mm	52 milliseconds	78 milliseconds max.														
375 mm	64 milliseconds	96 milliseconds max.														
Output Protection Circuitry	Protected against false pulse at power-up and continuous overload or short circuit of outputs															



EZ-LIGHT™ PVA Specifications (cont'd)	
Sensing Resolution	35 mm min. diameter
Status Indicators	<p>Emitter: One Green LED to indicate power ON/OFF One Red LED to indicate frequency selected</p> <p>Receiver: One Green LED to indicate power ON/OFF One Yellow LED to indicate output state</p> <p>Emitter & Receiver: Both have two highly visible “job lights” which are turned ON/OFF by applying an external signal to the white wire. The job lights may be programmed for steady or flashing green.</p>
Construction	Black painted aluminum housing; acrylic lenses; PBT polyester end caps; thermoplastic elastomer programming switch cover; stainless steel mounting brackets and hardware
Environmental Rating	IEC IP62; NEMA 2
Connections	<p>Emitter: 3-conductor PVC-jacketed 2 m cable which is either unterminated or terminated with a 4-pin Euro-style quick-disconnect connector, depending on model. Cable diameter is 3.3 mm.</p> <p>Receiver: 4-conductor PVC-jacketed 2 m cable which is either unterminated or terminated with a 4-pin Euro-style quick-disconnect connector, depending on model. Cable diameter is 3.3 mm.</p>
Operating Temperature	0° to +50° C
Certifications	
Hookup Diagrams	Emitters: IN04 (p. 541) All others: IN03 (p. 541)

SENSORS
INDICATORS

EZ-LIGHT™ VTB

Pick-to-Light Verification Optical Touch Buttons

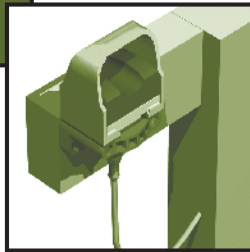
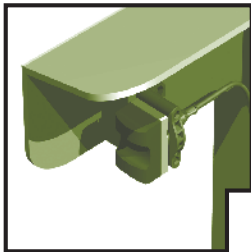
- The assembler touches the bin's corresponding VTB button after taking a part, verifying that the correct part has been taken and activating the light of the next bin in the sequence.
- Reduced occurrence of parts missed or assembled out of order increases assembler efficiency.
- Button also can be used as an automated "call for parts" system—the assembler touches a bin's VTB button when the part supply runs low, to light the VTB base and notify the supplier.
- Visual illuminated instruction eliminates language barriers; multilingual workforces learn new assembly procedures quickly.
- Optical buttons require no physical pressure to operate, reducing hand, wrist and arm stress.
- Four job light options are available.

BRACKETS
PAGE 374

OD CABLES
4- & 5-Pin Euro
PAGE 412 & 414



Side Mount, Shielded
by Mounting Bracket



Top Mount, with
Field Cover in Place





EZ-LIGHT™ VTB Buttons


- Bright, easy-to-see job light in illuminated base
- Immune to ambient light, EMI and RFI interference
- Translucent white polycarbonate base/job light
- 2 m or 9 m attached cable, or Euro-style quick-disconnect fitting
- Ergonomically designed touch area
- Dual indicator LEDs
- Four job light colors

EZ-LIGHT™ VTB, 12-30V dc



Models	Job Light(s) Color	Cable*	Upper Housing	Output Type	Job Light Input	Data Sheet	
VTBN6	Green	2 m	Polysulfone	NPN	0V dc	67570	
VTBN6Q		4-Pin Euro QD					
VTBN6R	Red	2 m					
VTBN6RQ		4-Pin Euro QD					
VTBN6B	Blue	2 m					
VTBN6BQ		4-Pin Euro QD					
VTBN6GR	Green & Red	2 m					
VTBN6GRQ		5-Pin Euro QD					
VTBN6L	Green	2 m					Polycarbonate
VTBN6LQ		4-Pin Euro QD					
VTBN6RL	Red	2 m					
VTBN6RLQ		4-Pin Euro QD					
VTBN6BL	Blue	2 m					
VTBN6BLQ		4-Pin Euro QD					
VTBN6GRL	Green & Red	2 m					
VTBN6GRLQ		5-Pin Euro QD					
VTBP6	Green	2 m	Polysulfone	PNP	+10 to 30V dc	67570	
VTBP6Q		4-Pin Euro QD					
VTBP6R	Red	2 m					
VTBP6RQ		4-Pin Euro QD					
VTBP6B	Blue	2 m					
VTBP6BQ		4-Pin Euro QD					
VTBP6GR	Green & Red	2 m					
VTBP6GRQ		5-Pin Euro QD					
VTBP6L	Green	2 m					Polycarbonate
VTBP6LQ		4-Pin Euro QD					
VTBP6RL	Red	2 m					
VTBP6RLQ		4-Pin Euro QD					
VTBP6BL	Blue	2 m					
VTBP6BLQ		4-Pin Euro QD					
VTBP6GRL	Green & Red	2 m					
VTBP6GRLQ		5-Pin Euro QD					

* For 9 m cable, add W/30 to the 2 m model number (example, VTBN6 W/30). A model with a QD requires a mating cable (see pages 412 and 414).

EZ-LIGHT™ VTB Specifications	
Supply Voltage and Current	12 to 30V dc (10% max. ripple) Single-color models: Less than 120 mA max. current @ 12V dc (exclusive of load) Less than 70 mA max. current @ 30V dc (exclusive of load) Two-color models: Less than 67 mA max. current @ 12V dc (exclusive of load) Less than 40 mA max. current @ 24V dc (exclusive of load) Less than 35 mA max. current @ 30V dc (exclusive of load)
Supply Protection Circuitry	Protected against transient voltages (fast-transient and over-voltage) and reverse polarity
Output Configuration	Choose 1 current sinking (NPN) open collector transistor or 1 current sourcing (PNP) open collector transistor, depending on model
Output Rating	Max. load: 150 mA ON-state saturation voltage: less than 1.5V @ 150 mA OFF-state leakage current: less than 10 µA
Output Protection	All models protected against false pulse on power-up (outputs held OFF for 1 second at power-up). Models with solid-state outputs have overload and short-circuit protection.
Response Time	100 milliseconds ON/OFF
Indicators	2 Red LED indicators: Power ON and Output Conducting Base: Lights green, red, blue, or green and red as a job light when input line is enabled. One-color models may be wired for flashing rather than solid color operation.
Construction	Totally encapsulated, non-metallic enclosure. Black polysulfone or red polycarbonate upper housing (see Application Note below); translucent white polycarbonate base. Electronics fully epoxy-encapsulated.
Environmental Rating	IEC IP66 ; NEMA 1, 3, 4, 4X, 12 and 13
Connections	2 m or 9 m attached cable, or 4-pin (single color) or 5-pin (two color) Euro-style QD fitting. QD cables are ordered separately. See pages 412 and 414.
Ambient Light Immunity	Up to 120,000 lux (direct sunlight)
EMI/RFI Immunity	Immune to EMI and RFI noise sources, per IEC 947-5-2.
Operating Conditions	Temperature: -20° to +50° C Relative humidity: 90% @ +50° C (non-condensing)
Application Notes	Environmental considerations for models with polysulfone upper housings: The polysulfone upper housing will become brittle with prolonged exposure to outdoor sunlight. Avoid contact with strong alkalis. Clean periodically using mild soap solution and a soft cloth. Environmental considerations for models with polycarbonate upper housings: Avoid prolonged exposure to hot water and moist, high-temperature environments above 66° C. Avoid contact with aromatic hydrocarbons (such as xylene and toluene), halogenated hydrocarbons and strong alkalis. Clean periodically using mild soap solution and a soft cloth.
Certifications	
Hookup Diagrams	NPN Single-Color Models: IN05 (p. 542) PNP Single-Color Models: IN06 (p. 542) Two-Color Models: IN07 (p. 542)



EZ-LIGHT™ Indicators

- Displays the status of remote or inaccessible sensors
- Replaces cumbersome post or stack lights with a single compact, unobtrusive and inexpensive unit
- Provides operator guidance and indication of equipment status
- Available in seven styles/housings for any manufacturing environment
- Displays 1, 2, 3, 4 or 5 colors, depending on model
- Eliminates bulb replacement with long-lasting LEDs
- Compatible with PLC or other logic-level control outputs
- Rated to IP69K, depending on installation (except audible indicator)
- Available in audible models with steady or pulsed sound indication
- Includes segmented display models with labels for sending nonlingual messages or monitoring multiple locations



I/O block compatible models!



Multi-Color, General-Purpose page 362

- Green/Red/Yellow multi-function display standard, other colors available
- 30 or 50 mm dome, 18 mm barrel, and 8, 18 or 30 mm T-style housing
- Models with ac or dc supply voltage



Multi-Color, Multi-Function page 364

- Multiple color and/or flashing frequencies
- Three, four or five color models
- 50 mm dome, 18 mm barrel and 30 mm T-style housing



Two-Color Sensor Emulators page 365

- Green and Yellow remote indicators
- 30 or 50 mm dome, 18 mm barrel, and 8, 18 or 30 mm T-style housing



Audible page 365

- Green/Red/Yellow with audible indication
- Two decible levels with steady or pulsed tone



Segmented Displays page 366

- One, two, three or four color display
- K80L housing for Flat or DIN mounting
- Optional labels for enhanced segment identification

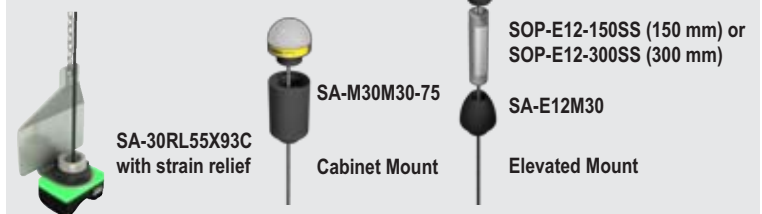


Daylight Visible page 366

- Up to 3 colors in one housing
- 50 mm diameter with flat profile and 30 mm mounting base
- Intense levels of light output for outdoor applications

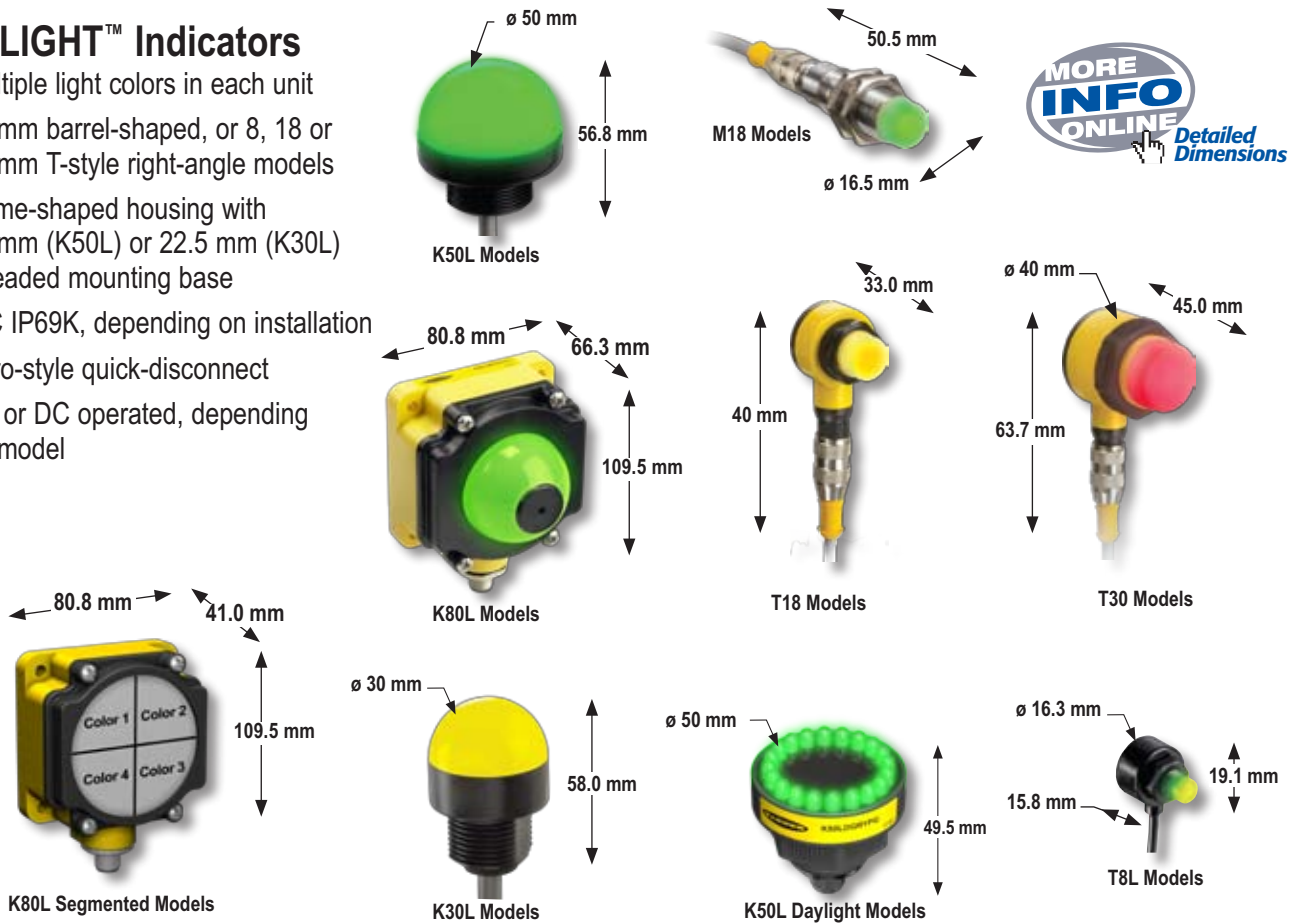
EZ-LIGHT™ Mounting Systems page 442

- Replaces elevated stack and tower lights
- Allows cabinet and flat surface mounting with single drilled hole
- Provides strain relief when hanging devices with 30 mm mounting hub





EZ-LIGHT™ Indicators

- Multiple light colors in each unit
- 18 mm barrel-shaped, or 8, 18 or 30 mm T-style right-angle models
- Dome-shaped housing with 30 mm (K50L) or 22.5 mm (K30L) threaded mounting base
- IEC IP69K, depending on installation
- Euro-style quick-disconnect
- AC or DC operated, depending on model



EZ-LIGHT™ Indicators—Multi-Color, General-Purpose, DC Voltage



Model		Construction	Connection*	LED Function**	Inputs	Data Sheet
	T8LGRXPQP	8 mm mount polycarbonate	4-pin Euro Pigtail QD	2 Color: Green, Red	PNP	121899
	T8LGRXNQP				NPN	
	T8LGXYPQP			2 Color: Green, Yellow	PNP	
	T8LGXYNQP				NPN	
	T8LXRYPQP			2 Color: Red, Yellow	PNP	
	T8LXRYNQP				NPN	
	M18GRYPQ	18 mm mount nickel-plated brass	4-pin Euro QD	3 Color: Green, Red, Yellow	PNP	121899
	M18GRYNQ				NPN	
	M18GRXPQ			2 Color: Green, Red	PNP	
	M18GRXNQ				NPN	
	M18GXYPQ			2 Color: Green, Yellow	PNP	
	M18GXYNQ				NPN	
	M18XRYPQ			2 Color: Red, Yellow	PNP	
	M18XRYNQ				NPN	

* A model with a QD requires a mating cable (see page 412).
T8L models: 150 mm PVC Pigtail QD models are listed. For 2 m cable, omit suffix **QP** from model number (example, **T8LGRXP**).
Other Models: Integral QD models are listed. For 150 mm PVC pigtail with QD, replace **Q** with **QP** in model number (example, **M18GRXPQP**).
 For 2 m cable, omit suffix **Q** from model number (example, **M18GRXP**).
 ** Single-color models are available. Colors are independently selectable. Contact factory for other colors and color combinations.



EZ-LIGHT™ Indicators—Multi-Color, General-Purpose, DC Voltage (cont'd)



SENSORS
INDICATORS

Model		Construction	Connection*	LED Function**	Inputs	Data Sheet
	T18GRYPQ	18 mm mount thermoplastic polyester	4-pin Euro QD	3 Color: Green, Red, Yellow	PNP	121899
	T18GRYNQ				NPN	
	T18GRXPQ			2 Color: Green, Red	PNP	
	T18GRXNQ				NPN	
	T18GXYPQ			2 Color: Green, Yellow	PNP	
	T18GXYNQ				NPN	
	T18XRYPQ			2 Color: Red, Yellow	PNP	
	T18XRYNQ				NPN	
	T30GRYPQ	30 mm mount thermoplastic polyester	4-pin Euro QD	3 Color: Green, Red, Yellow	PNP	121899
	T30GRYNQ				NPN	
	T30GRXPQ			2 Color: Green, Red	PNP	
	T30GRXNQ				NPN	
	T30GXYPQ			2 Color: Green, Yellow	PNP	
	T30GXYNQ				NPN	
	T30XRYPQ			2 Color: Red, Yellow	PNP	
	T30XRYNQ				NPN	
	K30LGRYPQ	30 mm dome/ 22 mm mount thermoplastic polyester	4-pin Euro QD	3 Color: Green, Red, Yellow	PNP	121899
	K30LGRYNQ				NPN	
	K30LGRXPQ			2 Color: Green, Red	PNP	
	K30LGRXNQ				NPN	
	K30LGXYPQ			2 Color: Green, Yellow	PNP	
	K30LGXYNQ				NPN	
	K30LXRYPQ			2 Color: Red, Yellow	PNP	
	K30LXRYNQ				NPN	
	K50LGRYPQ	50 mm dome/ 30 mm mount thermoplastic polyester	4-pin Euro QD	3 Color: Green, Red, Yellow	PNP	121899
	K50LGRYNQ				NPN	
	K50LGRXPQ			2 Color: Green, Red	PNP	
	K50LGRXNQ				NPN	



* Integral QD models are listed. For 150 mm PVC pigtail with QD, replace **Q** with **QP** in model number (example, T18GRXPQP).
 A model with a QD requires a mating cable (see page 412).
 For 2 m cable, omit suffix **Q** from model number (example, T18GRXP).

** Single-color models are available. Colors are independently selectable. Contact factory for other colors and color combinations.



EZ-LIGHT™ Indicators—Multi-Color, General-Purpose, DC Voltage (cont'd)



Model		Construction	Connection*	LED Function**	Inputs	Data Sheet
	K50LGXYPQ	50 mm dome/ 30 mm mount thermoplastic polyester	4-pin Euro QD	2 Color: Green, Yellow	PNP	121899
	K50LGXYNQ				NPN	
	K50LXRYPQ			2 Color: Red, Yellow	PNP	
	K50LXRYNQ				NPN	
	K80LGRYPQ	50 mm dome/ Flat or DIN-mount thermoplastic polyester	4-pin Euro QD	3 Color: Green, Red, Yellow	PNP	121899
	K80LGRYNQ				NPN	
	K80LGRXPQ			2 Color: Green, Red	PNP	
	K80LGRXNQ				NPN	
	K80LGXYPQ			2 Color: Green, Yellow	PNP	
	K80LGXYNQ				NPN	
	K80LXRYPQ			2 Color: Red, Yellow	PNP	
	K80LXRYNQ				NPN	

* A model with a QD requires a mating cable (see page 412).





K80L Models: Integral QD models are listed. For terminal-wired models, omit suffix **Q** from model number (example, **K80LGRXP**).

K50L Models: Integral QD models are listed. For 150 mm PVC pigtail with QD, replace **Q** with **QP** in model number (example, **K50LGRXPQP**). For 2 m cable, omit suffix **Q** from model number (example, **K50LGRXP**).

** Single-color models are available. Colors are independently selectable. Contact factory for other colors and color combinations.

EZ-LIGHT™ Indicators—Multi-Color, Multi-Function, DC Voltage



Model		Construction	Connection*	LED Function**	Inputs	Data Sheet
	M18GRY2PQ	18 mm mount nickel-plated brass	4-pin Euro QD†	3 Color: Choose Green, Red or Yellow ON, flashing or alternating	PNP	121902
	M18GRY2NQ				NPN	
	T30GRY2PQ	30 mm mount thermoplastic polyester	4-pin Euro QD†	3 Color: Choose Green, Red or Yellow ON, flashing or alternating	PNP	121902
	T30GRY2NQ				NPN	
	K50LGRY2PQ	50 mm dome/ 30 mm mount thermoplastic polyester	4-pin Euro QD†	3 Color: Choose Green, Red or Yellow ON, flashing or alternating	PNP	121902
	K50LGRY2NQ				NPN	
	K50LGRYB4PQ		5-pin Euro QD	4 Color: Choose Green, Red, Yellow or Blue ON, flashing or alternating	PNP	137329
	K50LGRYB4NQ				NPN	
	K50LGRYBWPQ		8-pin Euro QD	5 Color: Choose Green, Red, Yellow, Blue or White ON, flashing or alternating	PNP	131413
	K50LGRYBWNQ				NPN	
	K80LGRY2PQ	50 mm dome/ Flat or DIN-mount thermoplastic polyester	4-pin Euro QD†	3 Color: Choose Green, Red or Yellow ON, flashing or alternating	PNP	121902
	K80LGRY2NQ				NPN	
	K80LGRYB4PQ		5-pin Euro QD	4 Color: Choose Green, Red, Yellow or Blue ON, flashing or alternating	PNP	137329
	K80LGRYB4NQ				NPN	
	K80LGRYBWPQ		8-pin Euro QD	5 Color: Choose Green, Red, Yellow, Blue or White ON, flashing or alternating	PNP	131413
	K80LGRYBWNQ				NPN	

* A model with a QD requires a mating cable (see pages 412, 414 and 416).

K80L Models: Integral QD models are listed. For terminal-wired models, omit suffix **Q** from model number (example, **K80LGRY2P**).

Other Models: Integral QD models are listed. For 150 mm PVC pigtail with QD, replace **Q** with **QP** in model number (example, **M18GRY2PQP**). For 2 m cable, omit suffix **Q** from model number (example, **M18GRY2P**).

** Contact factory for other colors and color combinations.

† If cables other than Banner 4-pin Euro QD are used, a 5-pin cable may be required.



EZ-LIGHT™ Indicators–2-Color for Sensor Emulation, DC Voltage

Model		Construction	Connection*	LED Function**	Inputs	Data Sheet
	T8LGYX7PQP	8 mm mount nickel-plated brass	4-pin Euro Pigtail QD	Use with discrete output of photoelectric and proximity sensors to duplicate the sensor's Green and Yellow indicator function. When the sensor is powered, the Green LED is ON. When the sensor's output is energized, the Yellow LED is ON.	PNP	121900
	T8LGYX7NQ				NPN	
	M18GYX7PQ	18 mm mount thermoplastic polyester	4-pin Euro QD		PNP	
	M18GYX7NQ				NPN	
	T18GYX7PQ	18 mm mount thermoplastic polyester	4-pin Euro QD		PNP	
	T18GYX7NQ				NPN	
	T30GYX7PQ	30 mm mount thermoplastic polyester	4-pin Euro QD		PNP	
	T30GYX7NQ				NPN	
	K30LGYX7PQ	30 mm dome/ 22 mm mount thermoplastic polyester	4-pin Euro QD		PNP	
	K30LGYX7NQ				NPN	
	K50LGYX7PQ	50 mm dome/ 30 mm mount thermoplastic polyester	4-pin Euro QD		PNP	
	K50LGYX7NQ				NPN	
	K80LGYX7PQ	50 mm dome/Flat or DIN-mount thermoplastic polyester	4-pin Euro QD		PNP	
	K80LGYX7NQ				NPN	

* A model with a QD requires a mating cable; splitter cables available for powering two indicators (see page 412).
T8L models: 150 mm PVC Pigtail QD models are listed. For 2 m cable, omit suffix **QP** from model number (example, **T8LGYX7P**).
K80L Models: Integral QD models are listed. For terminal-wired models, omit suffix **Q** from model number (example, **K80LGRX7P**).
Other Models: Integral QD models are listed. For 150 mm PVC pigtail with QD, replace **Q** with **QP** in model number (example, **M18GYX7PQP**). For 2 m cable, omit suffix **Q** from model number (example, **M18GYX7P**).
 ** Contact factory for other colors and color combinations.

EZ-LIGHT™ Indicators–Audible, DC Voltage



Model		Construction	Connection*	LED Function**	Audible Tone†	Inputs	Data Sheet
	K50LGRA1YPQ	50 mm dome/ 30 mm mount thermoplastic polyester	5-pin Euro QD	3 Color: Green, Red, Yellow	Steady (75 dB)	PNP	135242
	K50LGRA1YNQ					NPN	
	K50LGRA2YPQ				Pulsed (75 dB)	PNP	
	K50LGRA2YNQ					NPN	
	K50LGRAL1YPQ				Loud Steady (95 dB)	PNP	
	K50LGRAL1YNQ					NPN	
	K80LGRA1YPQ	50 mm dome/ Flat or DIN-mount thermoplastic polyester	5-pin Euro QD		Steady (75 dB)	PNP	
	K80LGRA1YNQ					NPN	
	K80LGRA2YPQ				Pulsed (75 dB)	PNP	
	K80LGRA2YNQ					NPN	
	K80LGRAL1YPQ				Loud Steady (95 dB)	PNP	
	K80LGRAL1YNQ					NPN	

* Integral QD models are listed. For 150 mm PVC pigtail with QD, replace **Q** with **QP** in model number (example, **K50LGRA1YPQP**). A model with a QD requires a mating cable (see page 414).
K50L Models: For 2 m cable, omit suffix **Q** from model number (example, **K50LGRA1YP**).
K80L Models: For terminal-wired models, omit suffix **Q** from model number (example, **K80LGRA2YPQ**).
 ** Contact factory for other colors and color combinations.
 † Typical decibel level is at a distance of 1 m.

SENSORS
INDICATORS



EZ-LIGHT™ Indicators—Segmented Displays, DC Voltage

Model		Construction	Connection*	LED Colors**	Inputs	Data Sheet
	K80L4GRYB1PQ	Flat or DIN-mount thermoplastic polyester	5-pin Euro QD	Color 1: Green Color 2: Red Color 3: Yellow Color 4: Blue	PNP	132728
	K80L4GRYB1NQ				NPN	
	K80L3THGRYX1PQ			Color 1: Green Color 2: Red Color 3: Yellow	PNP	
	K80L3THGRYX1NQ				NPN	
	K80L2HGRXX1PQ			Color 1: Green Color 2: Red	PNP	
	K80L2HGRXX1NQ				NPN	
	K80L1WXXX1PQ			White	PNP	

* Integral QD models are listed. For 150 mm PVC pigtail with QD, replace **Q** with **QP** in model number (example, **K80L4GRYB1PQP**). For terminal-wired models, omit suffix **Q** from model number (example, **K80L4GRYB1P**). A model with a QD requires a mating cable (see page 414).

** Contact factory for other colors and segment combinations.



EZ-LIGHT™ Segmented Indicator Label Kits

Model	Description	Size
SALK-K80L4	4-segment transparent laser label (Includes 30 labels and 1 protective cover label)	8.5" x 11"
SALK-K80L4-0	1-segment transparent laser label (Includes 30 labels)	

EZ-LIGHT™ Indicators—Daylight Visible, DC Voltage



Model†	Construction	Connection*	LED Function**	Inputs	Data Sheet
	30 mm mount thermoplastic polyester	4-Pin Euro QD	3 Color: Green, Red, Yellow	PNP	137330
				NPN	
			1 Color: Green	PNP	
			1 Color: Red	PNP	
			1 Color: Yellow	PNP	
K50DS	thermoplastic polyester		Sun Shield	—	137330



* Integral QD models are listed. For 150 mm PVC pigtail with QD, replace **Q** with **QP** in model number (example, **K50LDGRYPQP**). For 2 m cable, omit suffix **Q** from model number (example, **K50LDGRYP**). A model with a QD requires a mating cable (see page 412).

** Contact factory for other colors and color combinations.

† Optional sun shield model **K50DS** is available for enhanced visibility in desert sun brightness levels.



EZ-LIGHT™ Indicators—Multi-Color, General-Purpose, 85-130V ac

Model	Construction	Connection*	LED Function**	Inputs	Data Sheet
 K50LGRYA120Q	50 mm dome/ 30 mm mount thermoplastic polyester	5-pin Micro QD	3 Color: Green, Red, Yellow	85-130V ac	134548
 K80LGRYA120Q	50 mm dome/ Flat or DIN-mount thermoplastic polyester	5-pin Micro QD	3 Color: Green, Red, Yellow	85-130V ac	

* Integral QD models are listed. For a 2 m cable, omit **Q** from model number (example, **K50LGRYA120**). For 150 mm PVC pigtail with QD, replace **Q** with **QP** in model number (example, **K50GRYA120QP**). A model with a QD requires a mating cable (see page 419).

** Contact factory for other colors and color combinations.

EZ-LIGHT™ Indicator Specifications

Supply Voltage and Current	<p>DC models: T8L models: 10 to 30V dc @ 20 mA max. per LED color K30L, M18 and T18 General-Purpose models: 10 to 30V dc @ 25 mA max. per LED color M18 models: 10 to 30V dc Multi-Function: @ 40 mA max. Emulators: @ 30 mA max. T30 models: 10 to 30V dc Multi-Function: @ 50 mA max. Emulators: @ 45 mA max. All others: @ 40 mA max. per LED color K50L and K80L models: 18 to 30V dc Multi-Function: @ 50 mA max. Emulators: @ 45 mA max. All others: @ 40 mA max. per LED color (alarm) Segmented display: 18 to 30V dc @ 35mA max. per LED color; @ 90 mA max. with all LEDs ON AC models: 85 to 130V dc @ 15 mA max.</p>
Indicators	<p>Multi-Color, General-Purpose: LEDs are independently selected: Green, Red, Yellow; 1, 2 or 3 colors, depending on model. Multi-Color, Multi-Function: LEDs are independently selected: Green, Red, Yellow, Blue or White, ON steady or flashing; up to 5 colors, depending on model. 2-color for Sensor Emulation: Green and Yellow, when connected to sensor. Audible: LEDs or audible independently selected: Green, Red, Yellow. Segmented and Daylight Visible: LEDs are independently selected: colors and operation, depending on model.</p>
Input Response Time	3-Color, 7-Function only: Indicator ON: 250 milliseconds max. Indicator OFF: 10 milliseconds max.
Indicator Flash Rate	<p>Multi-Color Multi-Function models only: Single color: 1 second flash rate (500 milliseconds ON); 3-color: 1.5 second rotation rate (500 milliseconds per color); 4-Color: 2 second rotation rate (500 milliseconds per color)</p>
Oscillation Frequency (Audible only)	<p>A1 models: 30 kHz ± 50 Hz A2 models: 3 kHz ± 500 Hz; pulse rate 3 Hz ± 20% AL1 models: 2.7 kHz ± 50 Hz</p>
Environmental Rating	<p>Audible: IEC IP50 T8L models: IEC IP67 (not encapsulated) K80L models: IEC IP67 (encapsulated electronics) All others: Fully encapsulated, IEC IP67</p>
Connections	<p>DC models: QD cables are ordered separately. See pages 412-414 and 416. Multi-Color, General Purpose, and Daylight Visible: K80L Models: 4-pin Euro-style integral QD (Q). Terminal-wired models available for use with bulk cable; compression fitting is optional. Contact factory for cable information. T8L Models: 2 m attached cable or 150 mm PVC pigtail with 4-pin Euro-style QD (QP), depending on model Other Models: 2 m attached cable, 4-pin Euro-style integral QD (Q), or 150 mm PVC pigtail with 4-pin Euro-style QD (QP), depending on model Multi-Color, Multi-Function: K80L Models: 4-pin (3-color), 5-pin (4-color) or 8-pin (5-color) Euro-style integral QD (Q). Terminal-wired models available for use with bulk cable; compression fitting is optional. Contact Factory for cable information. Other Models: 2 m attached cable, or 4-pin (3-color), 5-pin (4-color), or 8-pin (5-color) integral QD (Q) or 150 mm PVC pigtail Euro-style QD (QP). K80L Segmented and Audible models: 5-pin Euro-style integral QD (Q) or 150 mm PVC pigtail with 5-pin Euro-style QD (QP). Terminal-wired models available for use with bulk cable; compression fitting is optional. Contact factory for cable information. AC models: 2 m attached cable, 5-pin Micro-style integral QD (Q) or 150 mm PVC pigtail with 5-pin Micro-style QD (QP), depending on model. See page 419.</p>
Operating Temperature	Audible models: -20° to +50° C All others: -40° to +50° C
Wiring Diagrams	IN08-IN15 (p. 542-544)

EZ-LIGHT™ K80L

Versatile Indicator Lights for Flat Mounting in Industrial Applications.



Features

- ▶ Multi-color, multi-function, flat mount industrial indicator
- ▶ Replaces cumbersome post and stack lights or soldered panel indicators and oil-tight lights
- ▶ Makes wiring easy with its integrated wiring chamber with pre-wired/field configurable terminal block
- ▶ IP67 sealed, water- and oil-tight housing for direct machine mounting in washdown environments
- ▶ Provides compact, low-profile design with a highly visible thermoplastic dome
- ▶ Uses 10 to 30V dc supply voltage compatible with PLC or other logic-level control outputs
- ▶ Displays up to five distinct colors; dome has no color when not energized

Connecting & Mounting Versatility

- ▶ Mounts easily on flat surfaces including machines, walls and DIN rails
- ▶ Features 360° mounting for top, bottom, left or right cable entry
- ▶ Offers choice of models for Euro-style QD, cable gland, or conduit (rigid or seal-tite) connection



bannerengineering.com

*Patents pending

Numerous EZ-LIGHT Configurations.

General Purpose EZ-LIGHT K80L

- ▶ Single housing displays multiple colors.
- ▶ Red, yellow and green steady display is standard; custom colors available.
- ▶ NPN or PNP models are available.
- ▶ Dome has no color when not energized.



7-Function EZ-LIGHT K80L

- ▶ Lights illuminate in multiple colors and preconfigured flashing sequences.
- ▶ Preconfigured functions include red, yellow, green glowing steady or flashing, and red-yellow-green flash cycle.
- ▶ Custom colors and configurations are available.

2-Color Sensor Function Emulator

- ▶ Two-color, remote indicator shows sensor status where sensor visibility is obscured or limited.
- ▶ Green light indicates POWER ON; yellow indicates OUTPUT ENERGIZED.
- ▶ Simple, seamless installation uses a 4-pin Euro-style "Y" splitter cable at the sensor; no programming required.
- ▶ It accepts NPN or PNP outputs directly from the sensor.

Easy Installation. Easy Wiring.

- ▶ Base designed for four-point flat mounting or DIN-rail mounting.
- ▶ Removable top cover for easy access to integrated wiring chamber; easy damage replacement, or color/function swap without disturbing base wiring.
- ▶ Available pre-wired to 4-pin Euro-style quick-disconnect coupling, or unwired/conduit-ready using internal threading.



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BANNER®

more sensors, more solutions

BRACKETS

CABLES

RETROREFLECTORS

ENCLOSURES/
LENS SHIELDS

MISCELLANEOUS

Sensing Accessories

Mounting Brackets

page 370

- Using the right bracket ensures optimum performance from your Banner sensors.
- Stainless steel and reinforced thermoplastic polyester mounts reduce installation time and lower total installed cost.
- Choice includes angled, through-hole brackets and split-clamp models that mount to a flat surface.
- Versatile swivel-mount models mount flat and have an adjustable ball to position the sensor at any angle.
- Custom brackets can be designed for your unique applications.



Quick-Disconnect (QD) Cables

page 410

- Allow sensors to be replaced or moved quickly, minimizing downtime.
 - Pico- (M8), Euro- (M12), and Mini-styles are available for dc powered sensors.
 - Micro- and Mini-styles are available for ac powered sensors.
 - Choose straight or right-angle connectors.



Retroreflectors and Tape

page 425

- Banner offers a complete line of high-quality acrylic targets, high-temperature targets and adhesive-backed retroreflective tapes (not shown).
- Numerous sizes, shapes and mounting options meet your application requirements.
- New high-reflectivity models dramatically increase sensing ranges, with reflectivity factors up to 3x.
- Maximum temperature ratings range from 50° to 480° C.
- Various mounting options are available.



Harsh Duty Enclosures & Lens Shields

page 436

- Lens shields protect emitter/receiver from impact and contamination.
- Tubular enclosures guard entire EZ-ARRAY™ emitter/receiver in washdown environments.
- Heated enclosures protect MINI-ARRAY® emitter/receiver in outdoor environments.



Miscellaneous

Stands and Mounting Systems	page 441
Apertures and Aperture Kits	443
Replacement Lens Assemblies	445
Alignment Tools	446
Power Supplies & Interface Modules	447

BRACKETS














CABLES

RETROREFLECTORS

ENCLOSURES/
LENS SHIELDS

MISCELLANEOUS

Banner Bracket Selection Chart

Sensor	Used With						
WORLD-BEAM® Q12 page 46 	SMBQ12A page 393	SMBQ12T page 394					
T8 page 49 	SMB8MM page 383						
MINI-BEAM®2 page 52 	SMBQS12PD page 396	SMBQ12S page 396					
M12 page 55 	SMBQS12PD page 396						
VS1 page 58 	SMBVS1S page 400	SMBVS1SC page 400	SMBVS1T page 401	SMBVS1TC page 401			
VS2 page 61 	SMBVS2RA page 401						
VS3 page 64 	SMBVS3S page 401	SMBVS3T page 402					
VS4 page 67 	SMBVS4SRA page 402						
WORLD-BEAM® QS18 page 70 	SMB18A page 377	SMB18FA page 377	SMB18FM page 377	SMB18Q page 377	SMB18SF page 378	SMB18UR page 378	SMB3018SC page 378
	SMB30SK page 380	SMB30SUS page 380	SMB312PD page 381	SMB312S page 380	SMB4050YL page 381	SMB46A page 381	SMB46L page 382
	SMB46S page 382	SMB46U page 382	SMBAMS18P page 384	SMBAMS18RA page 384	SMBQS18A page 397	SMBQS18AF page 397	SMBQS18DIN page 397
	SMBQS18RA page 397	SMBQS18Y page 398	SMBQS18YL page 398	SMH241F page 402			
MINI-BEAM® page 79 	SMB18A page 377	SMB18FA page 377	SMB18Q page 377	SMB18SF page 378	SMB18UR page 378	SMB3018SC page 378	SMB30SK page 380
	SMB30SUS page 380	SMB312B page 380	SMB312PD page 381	SMB312S page 380	SMB46L page 382	SMB46S page 382	SMB46U page 382
	SMBAMS18P page 384	SMBAMS18RA page 384	SMH241F page 402				
WORLD-BEAM® Q20 page 92 	SMBQ20 page 394	SMBQ20L page 395	SMBQ20LV page 395	SMBQ20U page 395			
S18 page 95 	SMB18A page 377	SMB18FA page 377	SMB18FM page 377	SMB18Q page 377	SMB18SF page 378	SMB18UR page 378	SMB3018SC page 378
	SMB30SK page 380	SMB312PD page 381	SMB46A page 381	SMBAMS18P page 384	SMBAMS18RA page 384		
M18 page 95 	SMB18A page 377	SMB18FA page 377	SMB18FM page 377	SMB18Q page 377	SMB18SF page 378	SMB18UR page 378	SMB3018SC page 378
	SMB30SK page 380	SMB312PD page 381	SMB30SK page 380	SMB312PD page 381	SMBAMS18P page 384	SMBAMS18RA page 384	

BRACKETS
CABLES
RETROREFLECTORS
ENCLOSURES/
LENS SHIELDS
MISCELLANEOUS

Banner Bracket Selection Chart

Sensor		Used With						
T18 page 101		SMB1815SF page 376	SMB18A page 377	SMB18FA page 377	SMB18FM page 377	SMB18Q page 377	SMB18SF page 378	SMB18UR page 378
		SMB3018SC page 378	SMB30SK page 380	SMB312PD page 381	SMBAMS18P page 384	SMBAMS18RA page 384	SMBT18Y page 400	
Q25 page 106		SMB18A page 377	SMB18FA page 377	SMB18Q page 377	SMB18SF page 378	SMB18UR page 378	SMB3018SC page 378	SMB30SK page 380
		SMB312PD page 381						
WORLD-BEAM® QS30 page 112		SMB30A page 378	SMB30FA page 379	SMB30MM page 379	SMB30Q page 379	SMB30SC page 382	SMB46L page 382	SMB46S page 382
		SMBAMS30P page 384	SMBAMSRAB page 387	SMBQS30L page 398	SMBQS30LT page 398	SMBQS30Y page 399	SMBQS30YL page 399	
S30 page 121		SMB30A page 378	SMB30FA page 379	SMB30MM page 379	SMB30Q page 379	SMB30SC page 379	SMBAMS30P page 384	SMBAMS30RA page 385
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T30 page 129		SMB1815SF page 376	SMB30SC page 379	SMB30A page 378	SMB30FA page 379	SMB30MM page 379	SMB30Q page 379	
		SMBAMS30P page 384	SMBAMS30RA page 385					
Q40 page 133		SMB30A page 378	SMB30FA page 379	SMB30MM page 379	SMB30Q page 379	SMB30SC page 379	SMBAMS30P page 384	SMBAMS30RA page 385
PicoDot® page 137		SMB46A page 381	SMB46L page 382	SMB46S page 382	SMB46U page 382			
QM42/QMT42 page 140		SMB3018SC page 378	SMB30SK page 380	SMB30SUS page 380	SMB312S page 381	SMB42T page 381	SMB46L page 382	SMB46S page 382
		SMB46U page 382	SMH241F page 402					
Q45 page 146		SMB30A page 378	SMB30FA page 379	SMB30MM page 379	SMB30Q page 379	SMB30SC page 379	SMB30UR page 380	SMBAMS30P page 384
		SMBAMS30RA page 385						
OMNI-BEAM™ page 159		SMB30A page 378	SMB30FA page 379	SMB30MM page 379	SMB30Q page 379	SMB30SC page 379	SMB30UR page 380	SMBAMS30P page 384
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RETROREFLECTORS

ENCLOSURES/
LENS SHIELDS

MISCELLANEOUS

Banner Bracket Selection Chart (cont'd)

Sensor		Used With						
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R55F page 183		DIN-35-... page 375	SMBR55F01 page 399	SMBR55FRA page 399				
FI22 page 186		N/A						
LX page 212		SMBLX page 390	SMBLXR page 391					
SLM page 216		N/A						
SL10/SL30 page 219		SMBSL page 400						
C-GAGE® SLC1 page 222		N/A						
R58E page 225		SMB55A page 382	SMB55F page 383	SMB55RA page 383	SMB55S page 383			
QC50/QCX50 page 228		SMBQC50 page 396						
QL50/QL55 page 230		SMB55A page 382	SMB55F page 383	SMB55RA page 383	SMB55S page 383			
OTB/LTB/STB page 234		SMB30A page 378	SMB30FA page 379	SMB30MM page 379	SMB30Q page 379	SMB30SC page 379	SMBAMS30P page 384	SMBAMS30RA page 385
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BRACKETS













CABLES

RETROREFLECTORS

ENCLOSURES/
LENS SHIELDS









MISCELLANEOUS

Banner Bracket Selection Chart

Sensor	Used With						
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	SMB30SK page 380	SMB312PD page 381	SMBAMS18P page 384	SMBAMS18RA page 384			
QS18U page 269 	SMB18A page 377	SMB18FA page 377	SMB18FM page 377	SMB18Q page 377	SMB18SF page 378	SMB18UR page 378	SMB3018SC page 378
	SMB30SK page 380	SMB30SUS page 380	SMB312PD page 381	SMB312S page 381	SMB46A page 381	SMB46L page 382	SMB46S page 382
	SMB46U page 382	SMBAMS18P page 384	SMBAMS18RA page 384	SMBQS18A page 397	SMBQS18RA page 397	SMBQS18Y page 398	SMH241F page 402
U-GAGE® T30U page 272 	SMB1815SF page 376	SMB30A page 378	SMB30FA page 379	SMBAMS30P page 384	SMBAMS30RA page 385		
U-GAGE® Q45U page 276 	SMB30A page 378	SMB30FA page 379	SMB30MM page 379	SMB30Q page 379	SMB30SC page 379	SMB30UR page 380	SMBAMS30P page 384
	SMBAMS30RA page 385						
U-GAGE® Q45UR page 280 	SMB18A page 377	SMB18FA page 377	SMB18Q page 377	SMB18SF page 378	SMB18UR page 378	SMB3018SC page 378	SMB30A page 378
	SMB30FA page 379	SMB30MM page 379	SMB30Q page 379	SMB30SC page 379	SMB30SK page 380	SMB30UR page 380	SMB312PD page 381
	SMBAMS18P page 384	SMBAMS18RA page 384	SMBAMS30P page 384	SMBAMS30RA page 385			
U-GAGE® T18U page 284 	SMB1815SF page 376	SMB18A page 377	SMB18FA page 377	SMB18Q page 377	SMB18SF page 378	SMB18UR page 378	SMB3018SC page 378
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A-GAGE® EZ-ARRAY™ page 288 	EZA-MBK-20 page 375						
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Banner Bracket Selection Chart (cont'd)

Sensor	Used With						
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	SMBAMS30PL52R page 385	SMBAMS30RA page 385	SMBAMS30RLJ page 385	SMBAMS30RLS page 385			
EZ-LIGHT™ PVA page 354 	SMBPVA1 page 391	SMBPVA2 page 391	SMBPVA.. page 392	SMBPVA..A page 392	SMBPVA..AB page 392	SMBPVA..C page 392	SMBPVA6 page 392
	SMBPVA7 page 393	SMBPVA8 page 393	SMBPVA9 page 393				
EZ-LIGHT™ PVD page 351 	SMBPVA1 page 391	SMBPVA11 page 391	SMBPVA2 page 391	SMBPVA..C page 392	SMBPVA6 page 392	SMBPVA7 page 393	SMBPVA8 page 393
	SMBPVA9 page 393	SMBPVD..A page 394	SMBPVD..AB page 394				
EZ-LIGHT™ T8L page 361 	SMB8MM page 383						
EZ-LIGHT™ T18/M18 page 361 	SMB1815SF page 376	SMB18A page 377	SMB18FA page 377	SMB18Q page 377	SMB18SF page 378	SMB18UR page 378	SMB3018SC page 378
	SMB30SK page 380	SMB312PD page 381	SMBAMS18P page 384	SMBAMS18RA page 384	SMBT18Y page 400		
EZ-LIGHT™ T30/K50L page 361 	SMB1815SF page 376	SMB30A page 378	SMB30FA page 379	SMB30MM page 329	SMB30Q page 379	SMB30SC page 379	SMBAMS30P page 384
	SMBAMS30PL52R page 385	SMBAMS30PL52 page 384	SMBAMS30RA page 385	SMBAMS30RLJ page 385	SMBAMS30RLS page 385		
EZ-LIGHT™ K80L page 361 	SMBDX80DIN page 387						
SureCross™ DX80/DX85/DX70 page 335 	SMBDX80DIN page 387						

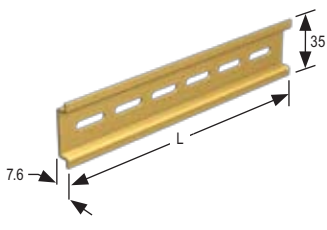
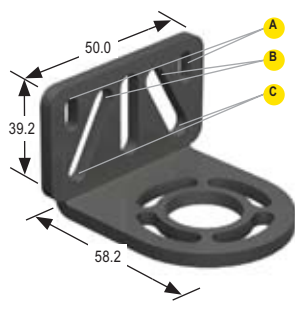

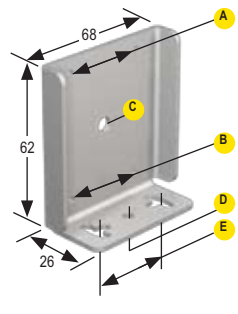







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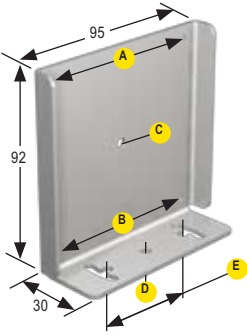
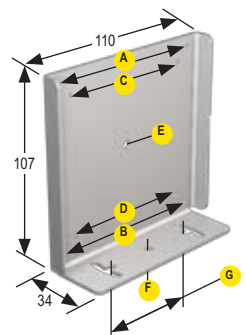
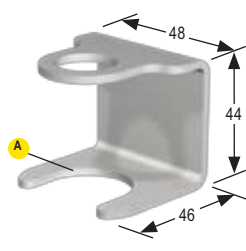
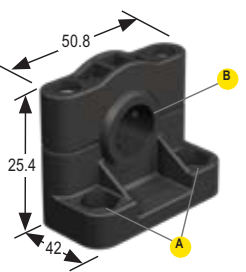






RETROREFLECTORS

ENCLOSURES/
LENS SHIELDS

MISCELLANEOUS

DIN-35..	EZA-MBK-20	MSMB-3	RMB50								
 <p>All measurements in mm</p>	 <p>All measurements in mm</p>	 <p>All measurements in mm</p>	 <p>All measurements in mm</p>								
<table border="1"> <thead> <tr> <th>Model</th> <th>Length (L)</th> </tr> </thead> <tbody> <tr> <td>DIN-35-70</td> <td>70</td> </tr> <tr> <td>DIN-35-105</td> <td>105</td> </tr> <tr> <td>DIN-35-140</td> <td>140</td> </tr> </tbody> </table>	Model	Length (L)	DIN-35-70	70	DIN-35-105	105	DIN-35-140	140	<p>Hole center spacing: A = 44.4, B = 20.0, C = 40.0 Hole size: A = 10.2 x 5.4, B = 27.6 x 7.0, C = 25.0 x 7.0</p>	<p>Hole center spacing: A, B = 44.5 Hole size: A, B = 10.2 x 4.8</p>	<p>Hole center spacing: A, B = 34.0, A to B = 52.0, E = 26.0 Hole size: A, B = \varnothing 0.5, C = \varnothing 6.3, D = \varnothing 4.5, E = 13.8 X 4.5</p>
Model	Length (L)										
DIN-35-70	70										
DIN-35-105	105										
DIN-35-140	140										
<p>Hole center spacing: 35.1 Hole size: 25.4 x 5.3</p>	<ul style="list-style-type: none"> Two-bracket kit for one emitter or receiver Adapter brackets for mounting to engineered/slotted aluminum framing such as 80/20™ and Unistrut™ 	<ul style="list-style-type: none"> Two-bracket replacement kit for the emitter or receiver 11-ga. cold-rolled steel with black corrosion-resistant zinc chromate finish 	<ul style="list-style-type: none"> Protective mounting bracket for retroreflective targets 14-ga. 316 stainless steel Stainless steel M3 x 0.5 hardware included 								
<ul style="list-style-type: none"> DIN rail is Available in 70, 105 & 140 mm lengths 											
Sensors	Sensors	Sensors	Round Targets								
 <p>Used with</p>	 <p>Used with</p>	 <p>Used with</p>	 <p>Used with</p>								
D10 D12 R55F	EZ-ARRAY	High-Resolution MINI-ARRAY MINI-ARRAY	BRT-50D BRT-50R								
Controllers			Square Targets								
 <p>Used with</p>			 <p>Used with</p>								
MINI-ARRAY High-Resolution MINI-ARRAY			BRT-2X2								
			Rectangular Targets								
			 <p>Used with</p>								
			BRT-60X40C								

BRACKETS
CABLES
RETROREFLECTORS
ENCLOSURES/
LENS SHIELDS
MISCELLANEOUS

RMB85	RMB100	SA-K50A18	SMB1815SF	
 <p>All measurements in mm</p>	 <p>All measurements in mm</p>	 <p>All measurements in mm</p>	 <p>All measurements in mm</p>	
<p>Hole center spacing: A, B, A to B = 77.0, E = 46.0 Hole size: A, B = \varnothing 0.5, C = \varnothing 4.8, D = \varnothing 4.5, E = 19.0 x 4.5</p>	<p>Hole center spacing: A, B, A to B = 92.0, C, D, C to D = 77.0, G = 56.0 Hole size: A, B, C, D = \varnothing 0.5, E = \varnothing 4.8, F = \varnothing 4.5, G = 21.5 x 4.5</p>	<p>Hole size: A = \varnothing 30.5</p>	<p>Hole center spacing: A = 36.0 Hole size: A = \varnothing 5.0, B = \varnothing 15.0</p>	
<ul style="list-style-type: none"> • Protective mounting bracket for retroreflective targets • 14-ga. 316 stainless steel • Stainless steel M3 x 0.5 hardware included 	<ul style="list-style-type: none"> • Protective mounting bracket for retroreflective targets • 14-ga. 316 stainless steel • Stainless steel M3 x 0.5 hardware included 	<ul style="list-style-type: none"> • Protective mounting bracket for EZ-LIGHT™ K50 sensors • 12-ga cold-rolled steel 	<ul style="list-style-type: none"> • Swivel with set screws for mounting sensors by the cable hub • Black reinforced thermoplastic polyester • Stainless steel swivel locking hardware and hex wrench included 	
<p>Round Targets</p>	<p>Round Targets</p>	<p>Base Mount</p>	<p>Base Mount</p>	
 <p>Used with</p>	 <p>Used with</p>	 <p>Used with</p>	 <p>Used with</p>	
<p>BRT-3</p>	<p>BRT-3 BRT-84</p>	<p>K50</p>	<p>T18 T18U T30</p>	<p>T30U EZ-LIGHT T18 EZ-LIGHT T30</p>
<p>Square Targets</p>	<p>Square Targets</p>			
 <p>Used with</p>	 <p>Used with</p>			
<p>BRT-77X77C</p>	<p>BRT-77X77C BRT-92X92C BRT-92X92CB</p>			

BRACKETS

CABLES

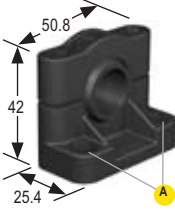
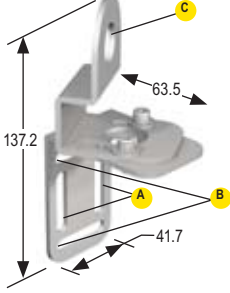
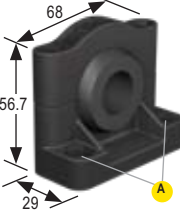
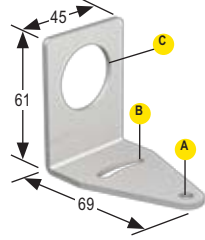









RETROREFLECTORS

ENCLOSURES/
LENS SHIELDS

MISCELLANEOUS

SMB18A		SMB18FA		SMB18FM		SMB18Q	
All measurements in mm		All measurements in mm		All measurements in mm		All measurements in mm	
Hole center spacing: A to B = 24.2 Hole size: A = \varnothing 4.6, B = 17.0 x 4.6, C = \varnothing 18.5		A = 3/8 - 16 x 50.8 Hole size: B = \varnothing 18.1		N/A		Hole center spacing: A to B = 24.2 Hole size: A = \varnothing 4.6, B = 17.0 x 4.6, C = \varnothing 19.0	
<ul style="list-style-type: none"> Right-angle mounting bracket with a curved slot for versatile orientation 12-ga. stainless steel, 18 mm sensor mounting hole Clearance for M4 (#8) hardware 		<ul style="list-style-type: none"> Swivel bracket with tilt and pan movement for precision adjustment 18 mm sensor mounting hole 12-ga. 304 stainless steel 		<ul style="list-style-type: none"> Two-piece thermoplastic through-mount bracket Mounting nut (M22 x 1.5) and outer flange (M22 x 1.5 external, M18 x 1 internal) 		<ul style="list-style-type: none"> Right-angle flanged bracket 18 mm sensor mounting hole 12-ga. stainless steel 	
Barrel Mount		Barrel Mount		Barrel Mount		Barrel Mount	
<p>Used with</p>		<p>Used with</p>		<p>Used with</p>		<p>Used with</p>	
QS18 MINI-BEAM M18 S18 T18 T-GAGE M18T S18U	QS18U Q45UR M18C2 Q45UR S18C2 T18U EZ-LIGHT T18 EZ-LIGHT M18	QS18 MINI-BEAM S18/M18/T18 S18U QS18U Q45UR M18C2	Q45UR S18C2 T18U T-GAGE M18T EZ-LIGHT M18 EZ-LIGHT T18	QS18 M18 S18 T18	T-GAGE M18T S18U QS18U	QS18 MINI-BEAM S18 M18 T18 S18U	QS18U Q45UR S18C2 Q45UR M18C2 T18U EZ-LIGHT T18 EZ-LIGHT M18
Base Mount		Bracket-to-Bracket				Base Mount	
<p>Used with</p>		<p>Used with</p>				<p>Used with</p>	
Q25		SMBQS18A	SMBQS18Y			Q25	
		Base Mount					
		<p>Used with</p>					
		Q25					

BRACKETS
CABLES
RETROREFLECTORS
ENCLOSURES/
LENS SHIELDS
MISCELLANEOUS

SMB18SF		SMB18UR		SMB3018SC		SMB30A	
							
All measurements in mm		All measurements in mm		All measurements in mm		All measurements in mm	
Hole center spacing: A = 36.0 Hole size: A = \varnothing 5.3		Hole center spacing: A = 25.4, B = 46.7 Hole size: A, B = 6.9 x 32.0, C = \varnothing 18.3		Hole center spacing: A = 50.8 Hole size: A = \varnothing 7.0		Hole center spacing: A to B = 40.0 Hole size: A = \varnothing 6.3, B = 27.3 x 6.3, A = \varnothing 30.5	
<ul style="list-style-type: none"> • 18 mm swivel bracket with M18 x 1 internal thread • Black thermoplastic polyester • Stainless steel swivel locking hardware included 		<ul style="list-style-type: none"> • 2-piece universal swivel bracket • 300 series stainless steel • Stainless steel swivel locking hardware included • Mounting hole for 18 mm sensor 		<ul style="list-style-type: none"> • 18 mm swivel side or barre mount bracket • Black reinforced thermoplastic polyester • Stainless steel swivel locking hardware included 		<ul style="list-style-type: none"> • Right-angle bracket with curved slot for versatile orientation • Clearance for M6 (1/4") hardware • Mounting hole for 30 mm sensor • 12-ga. stainless steel 	
Barrel Mount		Barrel Mount		Barrel Mount		Barrel Mount	
							
Used with		Used with		Used with		Used with	
QS18 MINI-BEAM S18 M18 T18 T-GAGE M18T S18U	QS18U Q45UR S18C2 Q45UR M18C2 T18U EZ-LIGHT T18 EZ-LIGHT M18	QS18* MINI-BEAM S18 M18 T18 T-GAGE M18T S18U	QS18U* Q45UR S18C2 Q45UR M18C2 T18U EZ-LIGHT T18 EZ-LIGHT M18	M18/S18/T18 S18U Q45UR S18C2	Q45UR M18C2 T18U EZ-LIGHT T18	QS30 SM30/SM130 S30	T30 T30U EZ-LIGHT T30
Base Mount		Base Mount		Side Mount		Base Mount	
							
Used with		Used with		Used with		Used with	
Q25		Q25		QS18 MINI-BEAM	QM42/QMT42 QS18U	Q40 Q45 OMNI-BEAM OTB/LTB VTB STB Q45U	Q45UR QT50R QT50U K50 EZ-LIGHT K50L
		* Contact factory to verify compatibility with integral QD models.					
				Used with			
				Q25			

BRACKETS

CABLES

RETROREFLECTORS

ENCLOSURES/
LENS SHIELDS

MISCELLANEOUS

SMB30FA		SMB30MM		SMB30Q		SMB30SC	
All measurements in mm		All measurements in mm		All measurements in mm		All measurements in mm	
<p>A = 3/8 -16 x 50.8 Hole size: B = \varnothing 30.1</p>		<p>Hole center spacing: A = 51.0, A to B = 25.4 Hole size: A = 42.6 x 7.0, B = \varnothing 6.4, B = \varnothing 30.1</p>		<p>Hole center spacing: A to B = 40.0 Hole size: A = \varnothing 6.3, B = 13.1 x 6.3, A = \varnothing 30.1</p>		<p>Hole center spacing: A to B = 50.8 Hole size: A = \varnothing 7.0</p>	
<ul style="list-style-type: none"> Swivel bracket with tilt and pan movement for precision adjustment Mounting hole for 30 mm sensor 12-ga. 304 stainless steel 		<ul style="list-style-type: none"> 12-ga. stainless steel bracket with curved mounting slots for versatility and orientation Clearance for M6 (1/4") hardware Mounting hole for 30 mm sensor 		<ul style="list-style-type: none"> Right-angle flanged mounting bracket with curved slot for versatile orientation 12-ga. stainless steel Mounting hole for 30 mm sensor 		<ul style="list-style-type: none"> Swivel bracket with 30 mm mounting hole for sensor Black reinforced thermoplastic polyester Stainless steel mounting and swivel locking hardware included 	
Barrel Mount		Barrel Mount		Barrel Mount		Barrel Mount	
Used with		Used with		Used with		Used with	
QS30 SM30/SMI30 S30	T30 T30U EZ-LIGHT T30	QS30 S30 SM30/SMI30	EZ-LIGHT T30 T30	QS30 SM30/SMI30 S30	T30 EZ-LIGHT T30	QS30 SM30/SMI30 S30	T30 EZ-LIGHT T30
Base Mount		Base Mount		Base Mount		Base Mount	
Used with		Used with		Used with		Used with	
Q40 Q45 Q45U Q45UR QT50U OMNI-BEAM	OTB/LTB VTB STB K50 QT50R EZ-LIGHT K50L	Q40 Q45 OMNI-BEAM OTB/LTB VTB STB	QT50U Q45U Q45UR QT50R K50 EZ-LIGHT K50L	Q40 Q45 OMNI-BEAM OTB/LTB VTB STB	Q45U Q45UR K50 EZ-LIGHT K50L	Q40 Q45 OMNI-BEAM OTB/LTB VTB STB	QT50U Q45U Q45UR QT50R K50 EZ-LIGHT K50L

BRACKETS
 CABLES
 RETROREFLECTORS
 ENCLOSURES/
 LENS SHIELDS
 MISCELLANEOUS

SMB30SK		SMB30SUS	SMB30UR	SMB312B
All measurements in mm		All measurements in mm	All measurements in mm	All measurements in mm
Hole center spacing: A = 50.8 Hole size: A = \varnothing 7.0, B = \varnothing 18.0		Hole center spacing: A to B = 50.8 Hole size: A = \varnothing 7.0	Hole center spacing: A to B = 31.8, B to C = 19.0, A to C = 50.8, D = 50.8 Hole size: A, B, C = 6.9 x 32.0, D = 73 x 6.9	Hole center spacing: A to B = 17.3, B to C = 17.7, A to C = 35.0 Hole size: A = \varnothing 6.9, B = 4.3 x 10.5, C = 3.1 x 15.2
<ul style="list-style-type: none"> • Flat-mount swivel bracket with extended range of motion • Black reinforced thermoplastic polyester and 316 stainless steel • Stainless steel swivel locking hardware included 		<ul style="list-style-type: none"> • Side-mount swivel bracket with extended range of motion • Black reinforced thermoplastic polyester • Stainless steel swivel locking hardware included 	<ul style="list-style-type: none"> • 2-piece universal swivel bracket for limit-switch style sensors • 300 series stainless steel • Stainless steel swivel locking hardware included 	<ul style="list-style-type: none"> • Right-angle • Stainless steel base mounting bracket • Includes mounting foot
Barrel Mount		Side Mount	Side Mount	Base Mount
Used with		Used with	Used with	Used with
QS18 MINI-BEAM S18/M18/T18 T18U S18U QS18U	Q45UR S18C2 Q45UR M18C2 EZ-LIGHT T18 EZ-LIGHT M18 T-GAGE M18T	QS18 MINI-BEAM QM42/QMT42 QS18U	Q45 OMNI-BEAM Q45U Q45UR	MINI-BEAM
Base Mount				
Used with				
Q25				
Side Mount				
Used with				
QM42/QMT42				

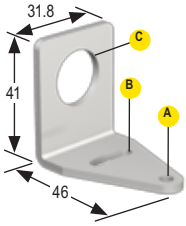
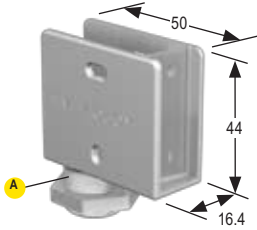
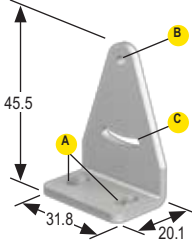
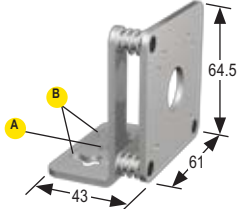
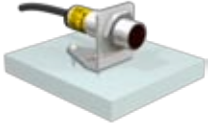
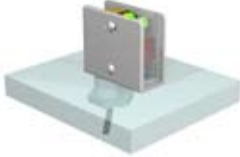




BRACKETS

CABLES

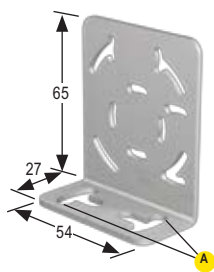
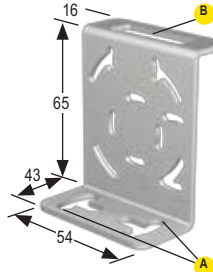
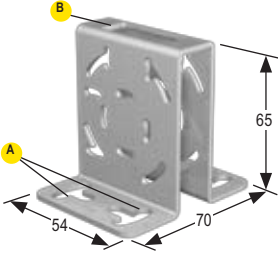
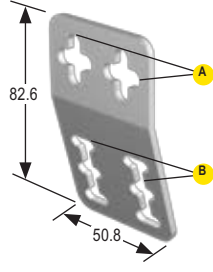




RETROREFLECTORS

ENCLOSURES/
LENS SHIELDS

MISCELLANEOUS

SMB312PD		SMB4050YL	SMB42T	SMB46A
		<p><i>Coming soon!</i></p> 		
All measurements in mm		All measurements in mm	All measurements in mm	All measurements in mm
<p>Hole center spacing: A to B = 24.2 Hole size: A = \varnothing 4.6, B = 17.0 x 4.6, A = \varnothing 18.5</p>		<p>A = \varnothing 18.0</p>	<p>Hole center spacing: A = 20.3, B to C = 5.1 Hole size: A = 4.3 x 7.5, B = \varnothing 3.0, C = 3.0 x 15.3</p>	<p>Hole center spacing: A to B = 18.5, B = 30.5 Hole size: A = \varnothing 6.6, B = 7.1 x 20.3</p>
<ul style="list-style-type: none"> • 18 mm mounting hole for sensor • Stainless steel barrel-mounting bracket <p>NOTE: Not for use with plastic fiber optic sensors</p>		<ul style="list-style-type: none"> • Heavy-duty die-cast bracket for industrial protection • Replaceable window for use with some sensor models • M18 vertical mounting option * Nut and lock washer included 	<ul style="list-style-type: none"> • Stainless steel 2-axis side-mounting bracket • Nut strap included for replacing two M3 mounting nuts 	<ul style="list-style-type: none"> • 2-piece 12-ga. stainless steel bracket assembly with precision sensor alignment adjustment • 2 mm hex key included
Barrel Mount		Base Mount	Side Mount	Barrel Mount
				
Used with		Used with	Used with	Used with
QS18 MINI-BEAM S18 M18 T18 S18U T-GAGE M18T	QS18U Q45UR S18C2 Q45UR M18C2 T18U EZ-LIGHT T18 EZ-LIGHT M18	QS18 (except AF)	QM42/QMT42	QS18 Lasers S18 Laser Emitter QS18U T-GAGE M18T
Base Mount				
				
Used with				
Q25				
				
		Used with		
		PicoDot		

BRACKETS
 CABLES
 RETROREFLECTORS
 ENCLOSURES/
 LENS SHIELDS
 MISCELLANEOUS

SMB46L		SMB46S		SMB46U		SMB55A	
							
All measurements in mm		All measurements in mm		All measurements in mm		All measurements in mm	
Hole center spacing: A = 16.0 Hole size: A = 16.5 x 18.7		Hole center spacing: A = 16.0 Hole size: A = 16.5 x 18.7, B = 34.0 x 10.0		Hole center spacing: A = 16.0 Hole size: A = 16.5 x 18.7, B = 34.0 x 13.0		Hole center spacing: A = 24.1, B = 27.9 Hole size: A = 12.7 x 11.4, B = 24.8 x 7.6	
<ul style="list-style-type: none"> • Right-angle • L bracket • 14-ga. 316 stainless steel 		<ul style="list-style-type: none"> • Right-angle • S bracket • 14-ga. 316 stainless steel 		<ul style="list-style-type: none"> • Right-angle • U bracket for sensor protection • 14-ga. 316 stainless steel 		<ul style="list-style-type: none"> • 15° offset bracket • 12-ga. stainless steel 	
Side Mount		Side Mount		Side Mount		Side Mount	
							
Used with		Used with		Used with		Used with	
QS18 MINI-BEAM QS30	PicoDot QM42/QMT42 QS18U	QS18 MINI-BEAM QS30	PicoDot QM42/QMT42 QS18U	QS18 MINI-BEAM PicoDot	QM42 QS18U	R58E QL55	

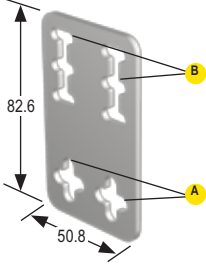
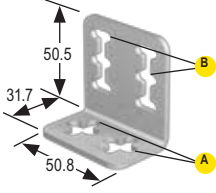
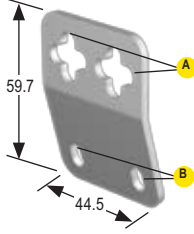
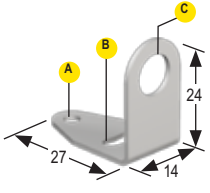



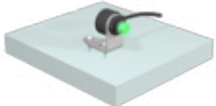
BRACKETS

CABLES

RETROREFLECTORS

ENCLOSURES/
LENS SHIELDS

MISCELLANEOUS

SMB55F	SMB55RA	SMB55S	SMB8MM
 <p>All measurements in mm</p>	 <p>All measurements in mm</p>	 <p>All measurements in mm</p>	 <p>All measurements in mm</p>
<p>Hole center spacing: A = 24.1, B = 27.9 Hole size: A = 12.7 x 11.4, B = 24.8 x 7.6</p>	<p>Hole center spacing: A = 24.1, B = 27.9 Hole size: A = 12.7 x 11.4, B = 24.8 x 7.6</p>	<p>Hole center spacing: A = 30.5, B = 28.0 Hole size: A = 12.7 x 11.4, B = 5.2 x 8.9</p>	<p>Hole center spacing: A to B = 14.0 Hole size: A = \varnothing 3.5, B = 8.3 x 3.5, C = \varnothing 8.4</p>
<ul style="list-style-type: none"> • Flat-mount bracket • 12-ga. stainless steel 	<ul style="list-style-type: none"> • Right-angle bracket • 12-ga. stainless steel 	<ul style="list-style-type: none"> • 15° offset bracket • 12-ga. stainless steel 	<ul style="list-style-type: none"> • Right-angle bracket • 300 series stainless steel
Side Mount	Side Mount	Side Mount	Barrel Mount
 <p>Used with</p>	 <p>Used with</p>	 <p>Used with</p>	 <p>Used with</p>
R58E QL55	R58E QL55	R58E QL55	T8 IT23S (Glass Fiber) BT23S (Glass Fiber) EZ-LIGHT T8L

SMBAMS18P		SMBAMS18RA		SMBAMS30P		SMBAMS30PL52	
<p>All measurements in mm</p>		<p>All measurements in mm</p>		<p>All measurements in mm</p>		<p>All measurements in mm</p>	
<p>Hole center spacing: A = 26.0, A to B = 13.0 Hole size: A = 26.8 x 7.0, B = ø 6.5, C = ø 19.0</p>		<p>Hole center spacing: A = 26.0, A to B = 13.0 Hole size: A = 26.8 x 7.0, B = ø 6.5, C = ø 19.0</p>		<p>Hole center spacing: A = 26.0, A to B = 13.0 Hole size: A = 26.8 x 7.0, B = ø 6.5, C = ø 31.0</p>		<p>Hole center spacing: A = 26.0, A to B = 13.0 Hole size: A = 26.8 x 7.0, B = ø 6.5, C = ø 31.0</p>	
<ul style="list-style-type: none"> • Flat SMBAMS series bracket with 18 mm hole for mounting sensors • Articulation slots for 90+° rotation • 12-ga. 300 series stainless steel 		<ul style="list-style-type: none"> • Right-angle SMBAMS series bracket with 18 mm hole for mounting sensors • Articulation slots for 90+° rotation • 12-ga. 300 series stainless steel 		<ul style="list-style-type: none"> • Flat SMBAMS series bracket • 30 mm hole for mounting sensors • Articulation slots for 90+° rotation • 12-ga. 300 series stainless steel 		<ul style="list-style-type: none"> • Flat bracket with 70 x 40 mm label • Flat SMBAMS series bracket • 30 mm hole for mounting sensors • Articulation slots for 90+° rotation • 12-ga. cold rolled stainless steel 	
Barrel Mount		Barrel Mount		Barrel Mount		Barrel Mount	
<p>Used with</p>		<p>Used with</p>		<p>Used with</p>		<p>Used with</p>	
QS18 MINI-BEAM S18 M18 T18 T-GAGE M18T S18U	T18U Q45UR S18C2 Q45UR M18C2 QS18U EZ-LIGHT T18 EZ-LIGHT M18	QS18 MINI-BEAM S18 M18 T18 T-GAGE M18T S18U	T18U QS18U Q45UR S18C2 Q45UR M18C2 EZ-LIGHT T18 EZ-LIGHT M18	QS30 S30 SM30/SMI30	T30 T30U EZ-LIGHT T30	EZ-LIGHT T30	
				Base Mount		Base Mount	
				<p>Used with</p>		<p>Used with</p>	
				Q40 Q45 OMNI-BEAM OTB/LTB VTB STB	QT50R QT50U Q45U Q45UR K50 EZ-LIGHT K50L	VTB K50 EZ-LIGHT K50L	

BRACKETS

CABLES

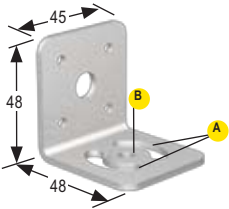
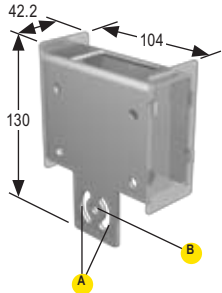
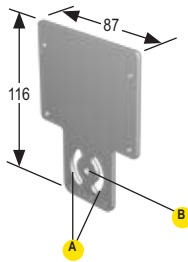
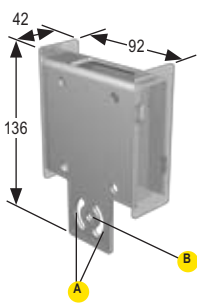




RETROREFLECTORS

ENCLOSURES/
LENS SHIELDS

MISCELLANEOUS

SMBAMS30PL52R	SMBAMS30RA	SMBAMS30RLJ	SMBAMS30RLS
<p>All measurements in mm</p>	<p>All measurements in mm</p>	<p>All measurements in mm</p>	<p>All measurements in mm</p>
<p>Hole center spacing: A = 26.0, A to B = 13.0 Hole size: A = 26.8 x 7.0, B = ø 6.5, C = ø 31.0</p>	<p>Hole center spacing: A = 26.0, A to B = 13.0 Hole size: A = 26.8 x 7.0, B = ø 6.5, C = ø 31.0</p>	<p>Hole center spacing: A = 26.0, A to B = 13.0 Hole size: A = 26.8 x 7.0, B = ø 6.5, C = ø 31.0</p>	<p>Hole center spacing: A = 26.0, A to B = 13.0 Hole size: A = 26.8 x 7.0, B = ø 6.5, C = ø 31.0</p>
<ul style="list-style-type: none"> • Space for 60 x 58 mm next to 30 mm mounting hole • Flat SMBAMS series bracket with 30 mm hole for mounting sensors • Articulation slots for 90+° rotation • 12-ga. cold rolled stainless steel 	<ul style="list-style-type: none"> • Right-angle SMBAMS series bracket • 30 mm hole for mounting sensors • Articulation slots for 90+° rotation • 12-ga. cold rolled stainless steel 	<ul style="list-style-type: none"> • Right-angle bracket with 70 x 40 mm space for label • Right-angle SMBAMS series bracket with 30 mm hole for mounting sensor • Articulation slots for 90+° rotation • 12-ga. 300 series stainless steel 	<ul style="list-style-type: none"> • Right-angle SMBAMS series bracket with 30 mm hole for mounting sensor • 62 x 26 mm space for label • Articulation slots for 90+° rotation • 12-ga. cold rolled stainless steel
Barrel Mount	Barrel Mount	Barrel Mount	Barrel Mount
<p>Used with</p>	<p>Used with</p>	<p>Used with</p>	<p>Used with</p>
EZ-LIGHT T30	QS30 S30 SM30/SMI30	T30 T30U EZ-LIGHT T30	EZ-LIGHT T30L
Base Mount	Base Mount		Base Mount
<p>Used with</p>	<p>Used with</p>	<p>Used with</p>	<p>Used with</p>
VTB K50 EZ-LIGHT K50L	Q40 Q45 OMNI-BEAM OTB/LTB VTB STB	Q45U Q45UR QT50U QT50R K50 EZ-LIGHT K50L	VTB K50 EZ-LIGHT K50L

BRACKETS
CABLES
RETROREFLECTORS
ENCLOSURES/
LENS SHIELDS
MISCELLANEOUS

SMBAMSBRA	SMBAMSLT3IP	SMBAMSLT3P	SMBAMSQ60IP
 <p>All measurements in mm</p>	 <p>All measurements in mm</p>	 <p>All measurements in mm</p>	 <p>All measurements in mm</p>
<p>Hole center spacing: A = 26.0, A to B = 13.0 Hole size: A = 26.8 x 7.0, B = \varnothing 6.5</p>	<p>Hole center spacing: A = 26.0, A to B = 13.0 Hole size: A = 26.8 x 7.0, B = \varnothing 6.5</p>	<p>Hole center spacing: A = 26.0, B = 13.0 Hole size: A = 26.8 x 7.0, B = \varnothing 6.5</p>	<p>Hole center spacing: A = 26.0, B = 13.0 Hole size: A = 26.8 x 7.0, B = \varnothing 6.5</p>
<ul style="list-style-type: none"> • Right-angle base piece for SMBAMS series of versatile mounting hardware • Four point hole pattern to integrate with articulation slots in SMBAMS series brackets • 12-ga. 300 series stainless steel 	<ul style="list-style-type: none"> • Industrial protection SMBAMS series bracket for LT3 with replaceable window • Articulation slots for 90+° rotation • 12-ga. 300 series stainless steel 	<ul style="list-style-type: none"> • Flat SMBAMS series bracket for mounting LT3 • Articulation slots for 90+° rotation • 12-ga. 300 series stainless steel 	<ul style="list-style-type: none"> • Industrial protection SMBAMS series bracket for Q60, with protection and replaceable window • Articulation slots for 90+° rotation • 12-ga. 300 series stainless steel
<p>Bracket-to-Bracket</p>	<p>Side Mount</p>	<p>Side Mount</p>	<p>Side Mount</p>
 <p>Used with</p>	 <p>Used with</p>	 <p>Used with</p>	 <p>Used with</p>
<p>SMBAMSBRA* SMBAMS18P SMBAMS18RA SMBAMS30P SMBAMS30PL52 SMBAMS30PL52R SMBAMS30RLJ</p>	<p>SMBAMS30RLS SMBAMS30RA SMBAMSLT3IP SMBAMSLT3P SMBAMSQ60IP SMBAMSQ60P</p>	<p>LT3</p>	<p>LT3</p>
<p>* Multiple SMBAMSBRA base brackets can be integrated together to allow for additional points of articulation</p>		<p>Q60</p>	

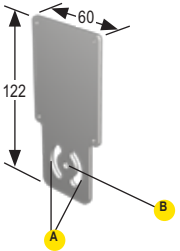
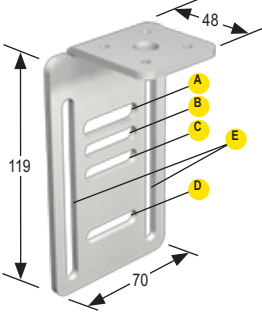
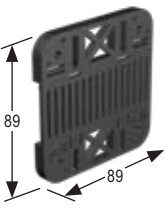
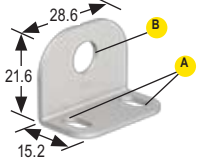



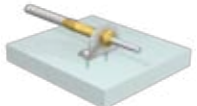
BRACKETS

CABLES

RETROREFLECTORS

ENCLOSURES/
LENS SHIELDS

MISCELLANEOUS

SMBAMSQ60P	SMBAMSRAB	SMBDX80DIN	SMBF
 <p>All measurements in mm</p>	 <p>All measurements in mm</p>	 <p>All measurements in mm</p>	 <p>All measurements in mm</p>
<p>Hole center spacing: A = 26.0, B = 13.0 Hole size: A = 26.8 x 7.0, B = ø 6.5</p>	<p>Hole center spacing: A to B = 12.0, B to C = 11.0, A to C = 23.0, A to D = 55.0, E to E = 50.8 Hole size: A, B, C, D = 6.9 x 32.0 E = 6.9 x 89.4</p>	N/A	<p>Hole center spacing: A = 19.1 Hole size: A = 8.0 x 4.6, A = ø 8.3</p>
<ul style="list-style-type: none"> • Flat SMBAMS series bracket for mounting Q60 • Articulation slots for 90+° rotation • 12-ga. 300 series stainless steel 	<ul style="list-style-type: none"> • 10-ga. (3.4 mm) cold-rolled steel with zinc finish • Retrofit WORLD-BEAM QS30 in place of MULTI-BEAM, MAXI-BEAM, Q45, OMNI-BEAM and VALU-BEAM sensors 	<ul style="list-style-type: none"> • Black reinforced thermoplastic • Bracket for mounting on 35 mm DIN rail 	<ul style="list-style-type: none"> • Right-angle bracket for glass fiber optic with 5/16" 24 threaded tip • 18-ga. stainless steel
Side Mount	Base Mount	Side Mount	Barrel Mount
 <p>Used with</p>	 <p>Used with</p>	 <p>Used with</p>	 <p>Used with</p>
Q60	<p>QS30*</p> <p>* Requires a SMBAMS30RA bracket (sold separately)</p>	<p>K80 EZ-LIGHT K80L DX80 DX70</p>	<p>DX85 DX81 DX90 DX91</p>
			Glass fiber with 5/16" - 24 threaded tip

BRACKETS
CABLES
RETROREFLECTORS
ENCLOSURES/
LENS SHIELDS
MISCELLANEOUS

SMBFP3	SMBFP4	SMBFP4N	SMBFP6
All measurements in mm	All measurements in mm	All measurements in mm	All measurements in mm
Hole center spacing: A = 19.1 Hole size: A = 6.5 x 3.6, B = \varnothing 3.2	Hole center spacing: A = 19.1 Hole size: A = 6.5 x 3.6, B = \varnothing 4.2	Hole center spacing: A = 12.0 Hole size: A = 4.8 x 5.0, B = \varnothing 4.2	Hole center spacing: A = 19.1 Hole size: A = 6.5 x 3.6, B = \varnothing 6.2
<ul style="list-style-type: none"> • Right-angle bracket for glass fiber optic with 5/16" 24 threaded tip • 18-ga. stainless steel 	<ul style="list-style-type: none"> • Right-angle bracket for plastic fiber optic with 4 mm threaded tip • 18-ga. stainless steel 	<ul style="list-style-type: none"> • Low-profile right-angle bracket for plastic fiber optics with 4 mm threaded tip • 18-ga. stainless steel 	<ul style="list-style-type: none"> • Low-profile right-angle bracket for plastic fiber optics with 6 mm threaded tip • 18-ga. stainless steel
Barrel Mount	Barrel Mount	Barrel Mount	Barrel Mount
Used with	Used with	Used with	Used with
Plastic fiber with M3 tip	Plastic fiber with M4 tip	Plastic fiber with M4 tip	Plastic fiber with M6 tip

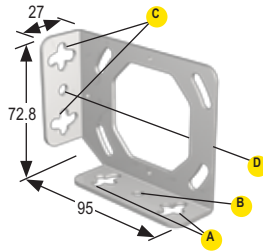
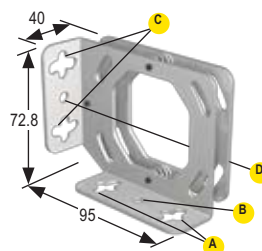
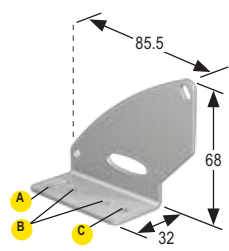
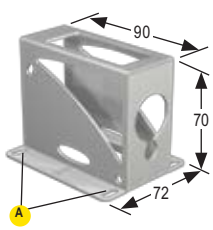




BRACKETS

CABLES

RETROREFLECTORS

ENCLOSURES/
LENS SHIELDS

MISCELLANEOUS

SMBLG	SMBLGA	SMBLT31	SMBLT32
 <p>All measurements in mm</p>	 <p>All measurements in mm</p>	 <p>All measurements in mm</p>	 <p>All measurements in mm</p>
<p>Hole center spacing: A = 56.0, A to B = 20.0, C = 44.5, C to D = 14.0 Hole size: A = 19.1 x 14.2, B = \varnothing 6.3, C = 19.3 x 15.3, D = \varnothing 6.3</p>	<p>Hole center spacing: A = 56.0, A to B = 20.0, C = 44.5, C to D = 14.0 Hole size: A = 19.1 x 14.2, B = \varnothing 6.3, C = 19.3 x 15.3, D = \varnothing 6.3</p>	<p>Hole center spacing: A to C = 47.5, B to B = 24.1 Hole size: A = 13.2 x 5.0, B = \varnothing 4.0, C = \varnothing 5.0</p>	<p>Hole center spacing: A = 80.0 Hole size: A = 5.0 x 12.0</p>
<ul style="list-style-type: none"> • LG series sensor mounting bracket • 304 stainless steel 	<ul style="list-style-type: none"> • LG series adjustable bracket assembly • Precision adjustment screws • 304 stainless steel 	<ul style="list-style-type: none"> • Right-angle bracket • 300 stainless steel 	<ul style="list-style-type: none"> • Full protection bracket • 300 stainless steel • Mounting hardware included
Side Mount	Side Mount	Side Mount	Side Mount
 <p>Used with</p>	 <p>Used with</p>	 <p>Used with</p>	 <p>Used with</p>
LG5 LG10	LG5 LG10	LT3	LT3

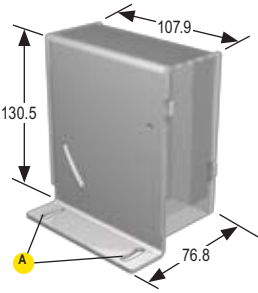
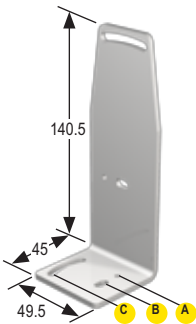

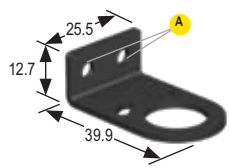




BRACKETS

CABLES

RETROREFLECTORS

ENCLOSURES/
LENS SHIELDS

MISCELLANEOUS

SMBLT3IP	SMBLT7	SMBLT7F	SMBLX
 <p>All measurements in mm</p>	 <p>All measurements in mm</p>	 <p>All measurements in mm</p>	 <p>All measurements in mm</p>
<p>Hole center spacing: A = 82.5 Hole size: A = 6.0 x 20.5</p>	<p>Hole center spacing: A to C = 31.8 Hole size: A = \varnothing 3.1, B = 5.0 x 9.0, C = 5.2 x 28.0</p>	<p>N/A</p>	<p>Hole center spacing: A = 12.7 Hole size: A = \varnothing 4.3</p>
<ul style="list-style-type: none"> • Protective bracket with replaceable window • Stainless steel construction • Includes replacement windows 	<ul style="list-style-type: none"> • Right-angle bracket • 300 stainless steel • Fine-adjust accessory available (model SMBLT7F) 	<ul style="list-style-type: none"> • Fine-adjust accessory for bracket SMBLT7 • Mounting hardware included • SMBLT7 required (sold separately) • Cold rolled steel 	<ul style="list-style-type: none"> • End-cap brackets; set of 2 • Zinc-plated cold rolled steel
<p>Side Mount</p>	<p>Side Mount</p>	<p>Bracket-to-Bracket</p>	<p>Base Mount</p>
 <p>Used with</p>	 <p>Used with</p>	 <p>Used with</p>	 <p>Used with</p>
<p>LT3</p>	<p>LT7</p>	<p>LT7*</p>	<p>LX</p>
		<p>*Shown mounted on SMBLT7 (sold separately)</p>	

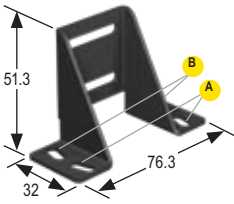
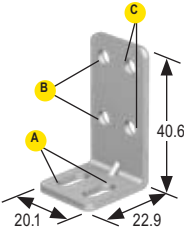
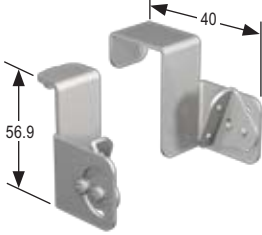
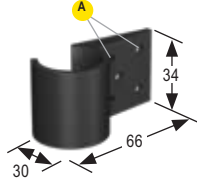






BRACKETS

CABLES

RETROREFLECTORS

ENCLOSURES/LENS SHIELDS

MISCELLANEOUS

SMBLXR	SMBPVA1	SMBPVA11	SMBPVA2
 <p>All measurements in mm</p>	 <p>All measurements in mm</p>	 <p>All measurements in mm</p>	 <p>All measurements in mm</p>
<p>Hole center spacing: A, B = 63.5, A to B = 10.2 Hole size: A, B = 5.2 x 11.6</p>	<p>Hole center spacing: A = 10.2, B to B = 18.0, B to C = 10.2 Hole size: A = 10.0 x 4.8, B, C = ø 4.6</p>	<p>NA</p>	<p>Hole center spacing: A = 18.8 Hole size: A = ø 4.4</p>
<ul style="list-style-type: none"> • Back-mount bracket for secure one-end mounting • Zinc-plated cold rolled steel 	<ul style="list-style-type: none"> • Right-angle bracket for PVA and PVD products • 303 stainless steel • Replacement brackets included with sensors 	<ul style="list-style-type: none"> • Pair of two-piece swivel brackets for mounting sensor to 5/16" metal rack system • Articulation slot for ±90° rotation • May be used with SMBPVA..C bracket 	<ul style="list-style-type: none"> • Set of 4 molded brackets • Snaps onto standard 28 mm diameter pipe • 2 required per PVA or PVD sensor
Side Mount	Side Mount	Side Mount	Side Mount
 <p>Used with</p>	 <p>Used with</p>	 <p>Used with</p>	 <p>Used with</p>
LX	PVA PVD	PVD	PVA PVD
		Bracket-to-Bracket	Bracket-to-Bracket
		 <p>Used with</p>	 <p>Used with</p>
		SMBPVD..A SMBPVD..AB	SMBPVA..A SMBPVA..AB SMBPVD..A SMBPVD..AB

BRACKETS

CABLES

RETROREFLECTORS

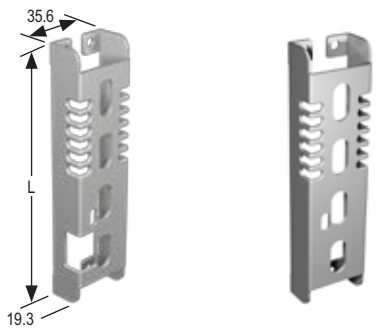
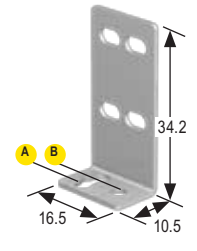
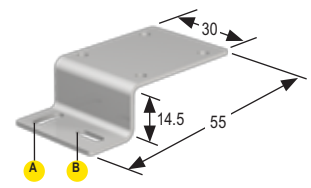




ENCLOSURES/ LENS SHIELDS

MISCELLANEOUS

SMBPVA..., SMBPVA..A, SMBPVA..AB					SMBPVA..C			SMBPVA6	
All measurements in mm					All measurements in mm			All measurements in mm	
Models	DIP Switch Access	Light Protected	Length (L)	Used With	Models	L1	L2	Hole center spacing: A, B, A to B = 18.0 Hole size: A = \varnothing 3.2	
SMBPVA5	Yes	No	139.7	PVA100	SMBPVA5C	188.7	139.5	Hole center spacing: A to C = 20.0, B to C = 18.0, D = 13.0, E = 32.0 Hole size: A = \varnothing 7.3, B, C, D, E = \varnothing 5.2	
SMBPVA5A	Yes	Yes			SMBPVA10C	317.2	268.0		
SMBPVA5AB	No	Yes			SMBPVA10	Yes	No	268.2	PVA225
SMBPVA10A	Yes	Yes	SMBPVA10AB	No	Yes				
SMBPVA13	Yes	No	343.3	PVA300	SMBPVA13A	Yes	Yes		
SMBPVA13AB	No	Yes			SMBPVA16	Yes	No		
SMBPVA16A	Yes	Yes			418.2	PVA375	SMBPVA16AB	NO	Yes
SMBPVA16AB	NO	Yes							
<ul style="list-style-type: none"> Protects sensor from impact; provides DIP-switch and/or indicator light exposure (depending on model) Heavy-duty cold-rolled steel-zinc finish May be used with SMBPVA..C for mounting to SMBPVA7 or SMBPVA8 brackets 					<ul style="list-style-type: none"> Back-mounted bracket for mounting to SMBPVA7 or SMBPVA8 brackets Cold-rolled steel with zinc finish 				
Side Mount					Side Mount				
Used with					Used with				
PVA (see chart)					PVA PVD				
Bracket-to-Bracket					Bracket-to-Bracket				
Used with					Used with				
SMBPVA..2 SMBPVA..7*		SMBPVA..8* SMBPVA..C bracket			SMBPVA7* SMBPVA8* SMBPVA... SMBPVA...A		SMBPVA...AB SMBPVD...A SMBPVD...AB		
*Protective bracket must be mounted to a SMBPVA..C bracket.					*Sensor must be mounted to a SMBPVA..C bracket.				

BRACKETS
 CABLES
 RETROREFLECTORS
 ENCLOSURES/
 LENS SHIELDS
 MISCELLANEOUS

SMBPVA7	SMBPVA8	SMBPVA9	SMBQ12A
<p>All measurements in mm</p>	<p>All measurements in mm</p>	<p>All measurements in mm</p>	<p>All measurements in mm</p>
N/A	N/A	<p>Hole center spacing: A = 18.0 Hole size: A = \varnothing 5.0</p>	<p>Hole center spacing: A to B = 7.6 Hole size: A = 3.5 x 8.1, B = \varnothing 3.2</p>
<ul style="list-style-type: none"> • One-piece bracket for mounting to 28 mm (11/8") dia. pipe • Black-painted steel • Requires SMBPVA..C for mounting at an angle $\pm 90^\circ$ 	<ul style="list-style-type: none"> • Heavy-duty 2-part bracket mounts to 28 mm (11/8") dia. pipe • Cold-rolled steel with zinc finish • Requires SMBPVA..C for mounting 	<ul style="list-style-type: none"> • Pair of 2-piece swivel brackets • Mount directly to sensor or to PVD/PVA protective brackets • Designed for mounting sensor to "look down" 	<ul style="list-style-type: none"> • Adjustable right-angle bracket • 20-ga. 300 series stainless steel
Side Mount	Bracket to Bracket	Side Mount	Side Mount
<p>Used with</p>	<p>Used with</p>	<p>Used with</p>	<p>Used with</p>
<p>PVA* PVD* SMBPVA5C SMBPVA10C</p>	<p>PVA* PVD* SMBPVA5C SMBPVA10C</p>	<p>PVA PVD</p>	<p>Q12</p>
<p>*Sensor must be mounted to SMBPVA..C bracket. (sold separately)</p>	<p>*Sensor must be mounted to SMBPVA..C bracket. (sold separately)</p>	<p>Bracket to Bracket</p>	
		<p>Used with</p>	
		<p>SMBPVA... SMBPVA..A SMBPVA...AB SMBPVD...A SMBPVD...AB</p>	

SMBPVD..A & SMBPVA..AB	SMBQ12T	SMBQ20H																
 <p style="text-align: center;">All measurements in mm</p>	 <p style="text-align: center;">All measurements in mm</p>	 <p style="text-align: center;">All measurements in mm</p>																
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Models</th> <th style="width: 25%;">DIP Switch Access</th> <th style="width: 25%;">Length (L)</th> <th style="width: 25%;">Used With</th> </tr> </thead> <tbody> <tr> <td>SMBPVD100A</td> <td>Yes</td> <td rowspan="2">140</td> <td rowspan="2">PVD100</td> </tr> <tr> <td>SMBVD100AB</td> <td>No</td> </tr> <tr> <td>SMBPVD225A</td> <td>Yes</td> <td rowspan="2">269</td> <td rowspan="2">PVD225</td> </tr> <tr> <td>SMBPVD225AB</td> <td>No</td> </tr> </tbody> </table>	Models	DIP Switch Access	Length (L)	Used With	SMBPVD100A	Yes	140	PVD100	SMBVD100AB	No	SMBPVD225A	Yes	269	PVD225	SMBPVD225AB	No	<p>Hole center spacing: A to B = 7.6 Hole size: A = 3.5 x 8.1, B = \varnothing 3.2</p>	<p>Hole center spacing: A to B = 20.0 Hole size: A = 2.8 x 9.3, B = 8.4 x 4.5</p>
Models	DIP Switch Access	Length (L)	Used With															
SMBPVD100A	Yes	140	PVD100															
SMBVD100AB	No																	
SMBPVD225A	Yes	269	PVD225															
SMBPVD225AB	No																	
<ul style="list-style-type: none"> • Heavy-duty protection brackets; DIP-switch access • Cold-rolled steel with zinc finish • May be used with SMBPVA..C for mounting to SMBPVA7 or SMBPVA8 brackets 	<ul style="list-style-type: none"> • Right-angle bracket • 20-ga. 300 series stainless steel 	<ul style="list-style-type: none"> • Sensor horizontal flange mount • \pm 10° swivel • Stainless steel 																
Side Mount	Side Mount	Side Mount																
 <p>Used with</p>	 <p>Used with</p>	 <p>Used with</p>																
PVD100 (see chart)	Q12	Q20																
Bracket-to-Bracket																		
 <p>Used with</p>																		
SMBPVA9 SMBPVA2 SMBPVA..C SMBPVA7* SMBPVA8*																		
<p>* Protective bracket must be mounted to a SMBPVA..C bracket.</p>																		

- BRACKETS
- CABLES
- RETROREFLECTORS
- ENCLOSURES/ LENS SHIELDS
- MISCELLANEOUS

SMBQ20L	SMBQ20LV	SMBQ20U	SMBQ50
All measurements in mm	All measurements in mm	All measurements in mm	All measurements in mm
<p>Hole center spacing: A to B = 20.0</p> <p>Hole size: A = 2.8 x 9.3, B = 8.4 x 4.5</p>	<p>Hole center spacing: A = 12.0</p> <p>Hole size: A = \varnothing 3.0 x 9.4</p>	<p>Hole center spacing: A = 26.5</p> <p>Hole size: A = 3.0 x 12.6</p>	<p>Hole center spacing: A to B = 24.1</p> <p>Hole size: A = \varnothing 4.5, B = 8.4 x 4.5</p>
<ul style="list-style-type: none"> • Right-angle bracket • $\pm 5^\circ$ tip, $\pm 5^\circ$ swivel • Stainless steel 	<ul style="list-style-type: none"> • Right-angle bracket • $\pm 10^\circ$ tip • Stainless steel 	<ul style="list-style-type: none"> • Protective bracket • $\pm 22.5^\circ$ swivel • Stainless steel 	<ul style="list-style-type: none"> • Right-angle bracket • 14-ga. 304 stainless steel
Side Mount	Side Mount	Side Mount	Side Mount
Used with	Used with	Used with	Used with
Q20	Q20	Q20	Q50

SMBQ60	SMBQC50	SMBQS12PD	SMBQS12S
<p>All measurements in mm</p>	<p>All measurements in mm</p>	<p>All measurements in mm</p>	<p>All measurements in mm</p>
<p>Hole center spacing: A to B = 24.1 Hole size: A = \varnothing 4.5, B = 8.4 x 4.5</p>	<p>Hole center spacing: A to B = 18.0, B to B = 36.0 Hole size: A = \varnothing 4.0, B = 4.0 x 13.3</p>	<p>Hole center spacing: A to B = 14.0 Hole size: A = \varnothing 3.5, B = 3.5 x 10.6, C = \varnothing 13.0</p>	<p>Hole center spacing: A = 14.0 Hole size: A = 3.5 x 7.0</p>
<ul style="list-style-type: none"> • Right-angle bracket • 14-ga. 304 stainless steel 	<ul style="list-style-type: none"> • Multi-directional stainless steel right-angle bracket • Variety of mounting options 	<ul style="list-style-type: none"> • Right-angle, nose-mount bracket • 16-ga. 300 series stainless steel 	<ul style="list-style-type: none"> • Right-angle side-mount bracket • 16-ga. 300 series stainless steel
Side Mount	Side Mount	Barrel Mount	Side Mount
<p>Used with</p>	<p>Used with</p>	<p>Used with</p>	<p>Used with</p>
Q60	QC50 QCX50	MINI-BEAM2 M12	MINI-BEAM2

BRACKETS

CABLES

RETROREFLECTORS

ENCLOSURES/
LENS SHIELDS

MISCELLANEOUS

SMBQS18A	SMBQS18AF	SMBQS18DIN	SMBQS18RA
<p>All measurements in mm</p>	<p>All measurements in mm</p>	<p>All measurements in mm</p>	<p>All measurements in mm</p>
<p>Hole size: A = \varnothing 16.4</p>	<p>Hole center spacing: A to B = 20.3 Hole size: A = 4.3 x 9.4, B = \varnothing 4.3</p>	<p>N/A</p>	<p>Hole center spacing: A to B = 20.3 Hole size: A = 4.3 x 9.4, B = \varnothing 4.3</p>
<ul style="list-style-type: none"> • Wrap-around protection bracket • Die-cast bracket • Base fits 18 mm threaded hole • Metal hex nut, lock washer and grommet included 	<ul style="list-style-type: none"> • Right-angle mounting bracket • 14-ga. 304 stainless steel 	<ul style="list-style-type: none"> • Right-angle bracket assembly for mounting on 35 mm DIN rail • 300 series stainless steel and glass filled nylon; zinc-plated screws 	<ul style="list-style-type: none"> • Right-angle mounting bracket • 14-ga. 304 stainless steel
<p>Side Mount</p>	<p>Side Mount</p>	<p>Side Mount</p>	<p>Side Mount</p>
<p>Used with</p>	<p>Used with</p>	<p>Used with</p>	<p>Used with</p>
<p>QS18 QS18U</p>	<p>QS18AF (Only)</p>	<p>QS18</p>	<p>QS18 (except QS18AF) QS18U</p>

SMBQS18Y	SMBQS18YL	SMBQS30L	SMBQS30LT
<p>All measurements in mm</p>	<p>All measurements in mm</p>	<p>All measurements in mm</p>	<p>All measurements in mm</p>
<p>Hole size: A = \varnothing 16.4</p>	<p>Hole size: A = \varnothing 16.3</p>	<p>Hole center spacing: A to B = 35.0 Hole size: A = \varnothing 4.3, B = 4.25 x 16.3</p>	<p>Hole center spacing: A to B = 35.0 Hole size: A = \varnothing 4.3, B = 4.25 x 16.3</p>
<ul style="list-style-type: none"> • Die-cast bracket for 18 mm holes • Includes metal hex nut and lock washer • Allows $\pm 8^\circ$ for cabled sensors 	<ul style="list-style-type: none"> • Heavy-duty die-cast bracket for industrial protection • Replaceable window • M18 vertical mount-option • Nut and lock washer included 	<ul style="list-style-type: none"> • Right-angle bracket for cable sensor models • Clearance for M4 (#8) hardware • $\pm 12^\circ$ tilt adjustment • 14-ga. stainless steel 	<ul style="list-style-type: none"> • Tall right-angle bracket for QD models • $\pm 8^\circ$ tilt adjustment • 14-ga. stainless steel
Side Mount	Side Mount	Side Mount	Side Mount
<p>Used with</p>	<p>Used with</p>	<p>Used with</p>	<p>Used with</p>
<p>QS18 QS18U</p>	<p>QS18AF (Class 2 Laser Only)</p>	<p>QS30</p>	<p>QS30 with integral QDs</p>

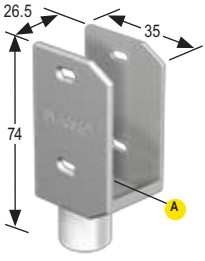
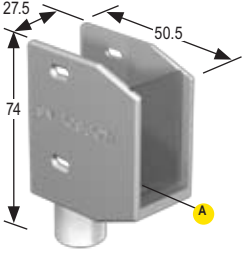
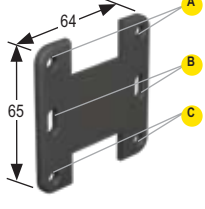
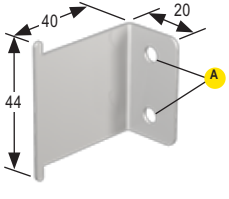




BRACKETS

CABLES

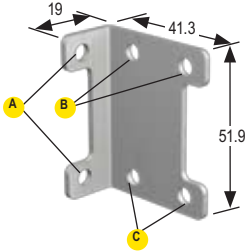
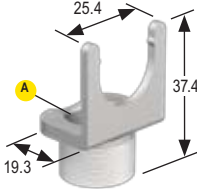
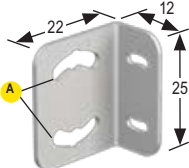
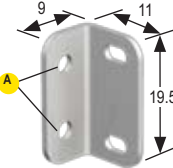




RETROREFLECTORS

ENCLOSURES/
LENS SHIELDS

MISCELLANEOUS

SMBQS30Y	SMBQS30YL	SMBR55F01	SMBR55FRA
 <p>All measurements in mm</p>	 <p>All measurements in mm</p>	 <p>All measurements in mm</p>	 <p>All measurements in mm</p>
<p>Hole size: A = \varnothing 16.4</p>	<p>Hole size: A = \varnothing 16.4</p>	<p>Hole center spacing: A, B, C = 50.8, A to B, B to C = 25.3 Hole size: A, C = \varnothing 5.6, B = 11.3 x 5.6</p>	<p>Hole center spacing: A = 20.0 Hole size: A = \varnothing 5.4</p>
<ul style="list-style-type: none"> • Heavy-duty die-cast bracket • M18 vertical mount option • $\pm 8^\circ$ tilt adjustment with cabled units • Includes nuts and lock washer 	<ul style="list-style-type: none"> • Heavy-duty die-cast bracket designed for industrial protection • Replaceable window • M18 vertical mount option • Includes nuts and lock washer 	<ul style="list-style-type: none"> • Flat-mounting bracket • Eliminates need for DIN rail • Molded PBT polyester 	<ul style="list-style-type: none"> • 19-ga. stainless steel • Side-mounting bracket • Eliminates need for DIN rail
Side Mount	Side Mount	Side Mount	Side Mount
 <p>Used with</p>	 <p>Used with</p>	 <p>Used with</p>	 <p>Used with</p>
QS30	QS30 (DC only)	R55F D10 D12	R55F D10 D12

BRACKETS
 CABLES
 RETROREFLECTORS
 ENCLOSURES/
 LENS SHIELDS
 MISCELLANEOUS

SMBSL	SMBT18Y	SMBVS1S	SMBVS1SC
 <p>All measurements in mm</p>	 <p>All measurements in mm</p>	 <p>All measurements in mm</p>	 <p>All measurements in mm</p>
<p>Hole center spacing: A = 40.0, B, C = 21.6, B to C = 39.9 Hole size: A, B, C = \varnothing 5.5</p>	<p>Hole size: A = \varnothing 15.3</p>	<p>Hole center spacing: A = 16.8 Hole size: A = 3.5 x 12.3</p>	<p>Hole center spacing: A = 10.0 Hole size: A = \varnothing 2.8</p>
<ul style="list-style-type: none"> • Right-angle bracket • 304 stainless steel • Hardware included 	<ul style="list-style-type: none"> • Die-cast bracket for 18 mm holes • Includes metal hex nut • For use with Euro-style QD connectors and cabled versions 	<ul style="list-style-type: none"> • Short right-angle bracket • 18-ga. stainless steel 	<ul style="list-style-type: none"> • Short right-angle bracket • 18-ga. stainless steel
<p>Side Mount</p>	<p>Barrel Mount</p>	<p>Side Mount</p>	<p>Side Mount</p>
 <p>Used with</p>	 <p>Used with</p>	 <p>Used with</p>	 <p>Used with</p>
<p>SL10 SL30</p>	<p>T18 T18U EZ-LIGHT T18</p>	<p>VS1</p>	<p>VS1</p>

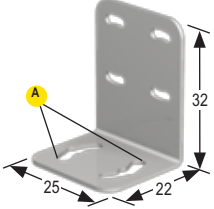
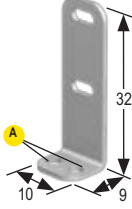
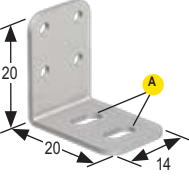
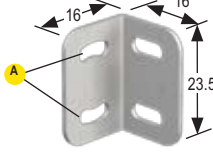

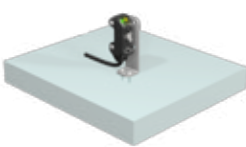


BRACKETS

CABLES

RETROREFLECTORS

ENCLOSURES/
LENS SHIELDS

MISCELLANEOUS

SMBVS1T	SMBVS1TC	SMBVS2RA	SMBVS3S
 <p>All measurements in mm</p>	 <p>All measurements in mm</p>	 <p>All measurements in mm</p>	 <p>All measurements in mm</p>
<p>Hole center spacing: $\text{A} = 16.8$ Hole size: $\text{A} = 3.5 \times 12.3$</p>	<p>Hole center spacing: $\text{A} = 5.5$ Hole size: $\text{A} = \varnothing 2.8$</p>	<p>Hole center spacing: $\text{A} = 80$. Hole size: $\text{A} = 3.2 \times 6.0$</p>	<p>Hole center spacing: $\text{A} = 13.5$ Hole size: $\text{A} = 3.2 \times 7.7$</p>
<ul style="list-style-type: none"> • Tall right-angle bracket • Stainless steel 	<ul style="list-style-type: none"> • Tall right-angle compact bracket • 300 stainless steel 	<ul style="list-style-type: none"> • Right-angle bracket • Stainless steel 	<ul style="list-style-type: none"> • Right-angle bracket • 300 stainless steel
Side Mount	Side Mount	Side Mount	Side Mount
 <p>Used with</p>	 <p>Used with</p>	 <p>Used with</p>	 <p>Used with</p>
VS1	VS1	VS2	VS3

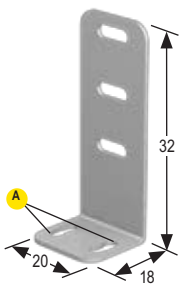
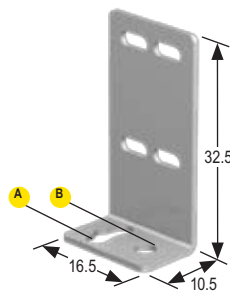
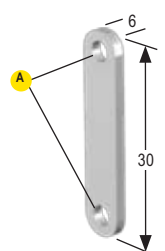



BRACKETS

CABLES

RETROREFLECTORS

ENCLOSURES/
LENS SHIELDS

MISCELLANEOUS

SMBVS3T	SMBVS4SRA	SMH241F
 <p>All measurements in mm</p>	 <p>All measurements in mm</p>	 <p>All measurements in mm</p>
<p>Hole center spacing: A = 13.5 Hole size: A = 3.2 x 7.7</p>	<p>Hole center spacing: A to B = 8.5 Hole size: A = 3.2 x 8.0, B = \varnothing 3.2</p>	<p>Hole center spacing: A = 24.0 Hole size: A = \varnothing 2.5</p>
<ul style="list-style-type: none"> • Tall right-angle bracket • 300 stainless steel 	<ul style="list-style-type: none"> • Tall right-angle bracket • 300 series stainless steel 	<ul style="list-style-type: none"> • Nut strap replaces two M3 mounting nuts and washers • 16-ga. stainless steel
Side Mount	Side Mount	Side Mount
 <p>Used with</p>	 <p>Used with</p>	 <p>Used with</p>
VS3	VS4	QS18 MINI-BEAM QM42/QMT42 QS18U

BRACKETS










CABLES

RETROREFLECTORS

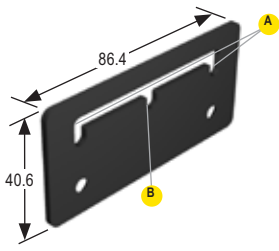
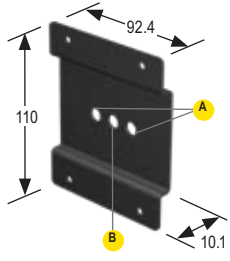
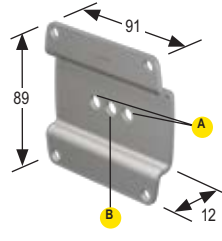
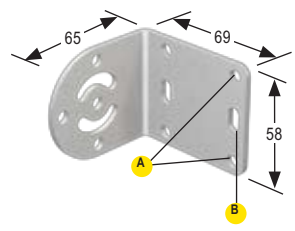




ENCLOSURES/
LENS SHIELDS

MISCELLANEOUS

Banner Vision Bracket Selection Chart

Sensor	Used With						
PresencePLUS® Pro page 312 	SMBPPDH page 407	SMBPPDE page 407	SMBPPLU page 407	SMBPPRA page 408	SMBPPU page 408	SMBPPSU page 408	
PresencePLUS® P4 page 312 	SMBP4RAB page 406	SMBP4RAS page 406					
Ring Lights page 324 	SMBPPRHI page 408						
Backlights Page 326 	SMBABM page 404	SMBACM page 404					
Area Lights page 327 	SMBABM page 404	SMBACM page 404	SMBASCM page 404	SMBP42ASM page 405	SMBP4ASM page 405	SMBVLG62X62S page 409	SMBVLG62X62RA page 409
Spot Lights page 328 	SMBP4ASM page 405	SMBPPLK page 407					
Linear Array page 329 	SMBLASRA page 404						
Tubular Fluorescent page 329 	SMBWFTLS page 409	SMBWFTLR page 409					
On-Axis Lights page 330 	SMBP40AL100 page 405	SMBP4OAL50 page 405	SMBPPOAL100 page 406	SMBPPOAL50 page 406			

- BRACKETS
- CABLES
- RETROREFLECTORS
- ENCLOSURES/
LENS SHIELDS
- MISCELLANEOUS

SMBABM	SMBACM	SMBASCM	SMBLASRA
 <p>All measurements in mm</p>	 <p>All measurements in mm</p>	 <p>All measurements in mm</p>	 <p>All measurements in mm</p>
<p>Hole center spacing: A = 61.0, A to B = 30.5 Hole size: A, B = 9.1 x 2.3</p>	<p>Hole center spacing: A = 30.0, A to B = 15.0 Hole size: ø 5.0</p>	<p>Hole center spacing: A = 25.4, A to B = 12.7 Hole size: A = ø 5.0</p>	<p>Hole center spacing: A, B, A to B = 45.0 Hole size: A = ø 6.6, B = 6.6 x 12.4</p>
<ul style="list-style-type: none"> • Surface-mount bracket for mounting light from front • Black corrosion-resistant zinc finish • Hardware included 	<ul style="list-style-type: none"> • Column-mount bracket with locking pivot • Black corrosion-resistant zinc finish • Hardware included 	<ul style="list-style-type: none"> • Column-mount bracket with locking pivot • 316 Stainless steel • Stainless steel hardware included 	<ul style="list-style-type: none"> • Right-angle metal bracket • May be used individually or two used in combination • 316 stainless steel bracket and hardware
 <p>Used with</p>	 <p>Used with</p>	 <p>Used with</p>	 <p>Used with</p>
<p>Area Lights (80 x 80 mm) Backlights (70 x 70 mm)</p>	<p>Area Lights (80 x 80 mm) Backlights (70 x 70 mm)</p> <p>Note: Shown with optional SMBPPK6 mounting kit (see page 441).</p>	<p>Area Light (70 mm)</p> <p>Note: Shown with optional SMBPPK6 mounting kit (see page 441).</p>	<p>Sealed Linear Array</p>

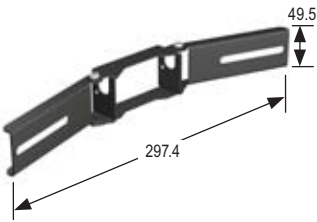

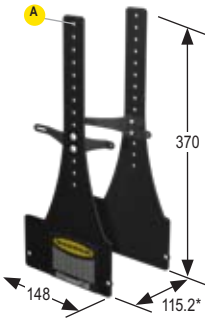
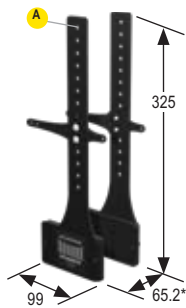




BRACKETS

CABLES

RETROREFLECTORS

ENCLOSURES/
LENS SHIELDS

MISCELLANEOUS

SMBP42ASM	SMBP4ASM	SMBP4OAL100	SMBP4OAL50
 <p>All measurements in mm</p>	 <p>All measurements in mm</p>	 <p>All measurements in mm</p>	 <p>All measurements in mm</p>
N/A	N/A	Hole center spacing: $\text{A} = 15.0$ Hole size: $\text{A} = \varnothing 5.3$	Hole center spacing: $\text{A} = 15.0$ Hole size: $\text{A} = \varnothing 5.3$
<ul style="list-style-type: none"> • For mounting two lights to P4 sensor housing • Black corrosion-resistant zinc finish • Hardware included 	<ul style="list-style-type: none"> • For mounting light to P4 sensor housing • Black corrosion-resistant zinc finish • Hardware included 	<ul style="list-style-type: none"> • For mounting On-Axis light to P4 housing • Centers lens on light opening • Black zinc-plated steel • Hardware included 	<ul style="list-style-type: none"> • For mounting On-Axis light to P4 housing • Centers lens on light opening • Black zinc-plated steel • Hardware included
 <p>Used with</p>	 <p>Used with</p>	 <p>Used with</p>	 <p>Used with</p>
Area Light (80 x 80 mm)* Area Light (62 x 62 mm) Spot Lights	Area Light (80 x 80 mm)* Area Light (62 x 62 mm) Spot Lights	On-Axis (100 mm) * Dimensions include 100 mm light (sold separately)	On-Axis (50 mm) * Dimensions include 50 mm light (sold separately)
* Requires one SMBACM bracket with each light (see page 404)	* Requires one SMBACM bracket with each light (see page 404)		

SMBPPOAL100	SMBPPOAL50	SMBP4RAB	SMBP4RAS
<p>All measurements in mm</p>	<p>All measurements in mm</p>	<p>All measurements in mm</p>	<p>All measurements in mm</p>
<p>Hole center spacing: A = 15.0 Hole size: A = \varnothing 5.3</p>	<p>Hole center spacing: A = 15.0 Hole size: A = \varnothing 5.3</p>	<p>Hole center spacing: A = 47.0 Hole size: A = 3.3 x 19.1</p>	<p>Hole center spacing: A = 43.5 Hole size: A = 6.8 x 2.5</p>
<ul style="list-style-type: none"> • For mounting On-Axis light to <i>Pro</i> housing • Centers lens on light opening • Black zinc-plated steel • Hardware included 	<ul style="list-style-type: none"> • For mounting On-Axis light to <i>Pro</i> housing • Centers lens on light opening • Black zinc-plated steel • Hardware included 	<ul style="list-style-type: none"> • Heavy duty, black corrosion-resistant zinc finish • 8° of rotation on image-axis • Hardware included 	<ul style="list-style-type: none"> • Right-angle swivel bracket • 70° rotation on image's x-axis and 20° on the y-axis • Black corrosion-resistant zinc finish • Hardware included
<p>Used with</p>	<p>Used with</p>	<p>Used with</p>	<p>Used with</p>
<p>On-Axis 100 mm</p>	<p>On-Axis 50 mm</p>	<p>P4 (right-angle)</p>	<p>P4 (right-angle)</p>
<p>* Dimensions include 100 mm light (sold separately)</p>	<p>* Dimensions include 50 mm light (sold separately)</p>		

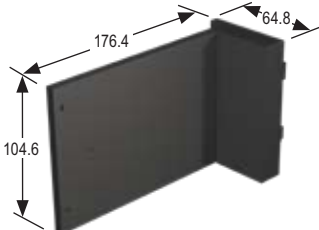
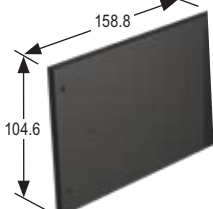
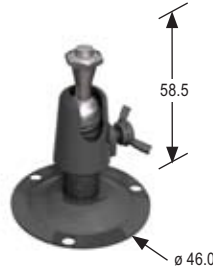
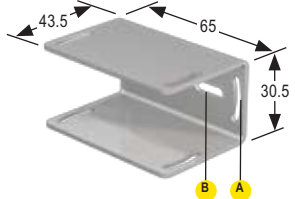




BRACKETS

CABLES

RETROREFLECTORS

ENCLOSURES/
LENS SHIELDS

MISCELLANEOUS

SMBPPDE	SMBPPDH	SMBPPLK	SMBPPLU
 <p>All measurements in mm</p>	 <p>All measurements in mm</p>	 <p>All measurements in mm</p>	 <p>All measurements in mm</p>
N/A	N/A	N/A	<p>Hole center spacing: A = 58.5, B = 30.0 Hole Size: A = 18.7 x 3.4, B = 14.3 x 4.4</p>
<ul style="list-style-type: none"> • DIN-rail edge mounting bracket to save linear track space • Black ABS plastic • Hardware included 	<ul style="list-style-type: none"> • DIN-rail flat mounting for easy viewing of LED's • Black ABS plastic • Hardware included 	<ul style="list-style-type: none"> • 2" pivoting assebmly 	<ul style="list-style-type: none"> • Highly stable U-Shaped bracket • Bright corrosion-resistant finish • Hardware included
 <p>Used with</p>	 <p>Used with</p>	 <p>Used with</p>	 <p>Used with</p>
<i>PresencePLUS Pro Controller</i>	<i>PresencePLUS Pro Controller</i>	Spot Lights	<i>PresencePLUS Pro Camera</i>

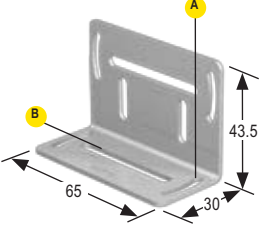
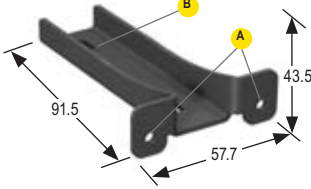
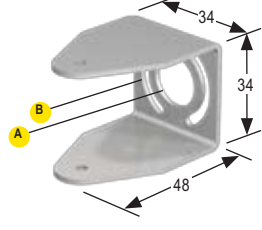
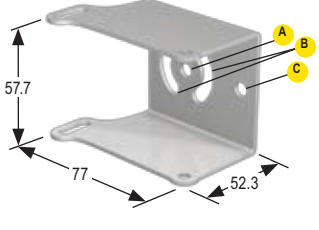



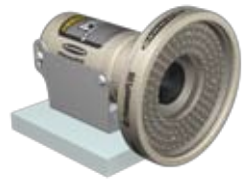
BRACKETS

CABLES

RETROREFLECTORS

ENCLOSURES/
LENS SHIELDS

MISCELLANEOUS

SMBPPRA	SMBPPRHI	SMBPPU	SMBPPSU
 <p>All measurements in mm</p>	 <p>All measurements in mm</p>	 <p>All measurements in mm</p>	 <p>All measurements in mm</p>
<p>Hole center spacing: A = 58.5 Hole Size: A = 18.7 x 3.4, B = 44.5 x 4.4</p>	<p>Hole center spacing: A = 44.5, B = 52.3 Hole size: A = \varnothing 3.8, B = 3.6 x 6.4</p>	<p>Hole center spacing: B = 25.0 Hole size: A = \varnothing 16.0, B = 3.3 x 25.0</p>	<p>Hole center spacing: A to C = 31.8, B = 25.0 Hole size: A = \varnothing 6.5, B = 20.2 x 7.0, C = \varnothing 6.5</p>
<ul style="list-style-type: none"> • Right-angle bracket with single-side mounting for difficult-to-access sites • Bright corrosion-resistant finish • Hardware included 	<ul style="list-style-type: none"> • Black anodized aluminum bracket • For mounting light to <i>Pro</i> camera • Hardware included 	<ul style="list-style-type: none"> • U-Shaped swivel bracket for variable rotation • Bright corrosion-resistant finish • Hardware included 	<ul style="list-style-type: none"> • 316 Stainless Steel • 10° of rotation on image's y-axis • Hardware included
 <p>Used with</p>	 <p>Used with</p>	 <p>Used with</p>	 <p>Used with</p>
<i>PresencePLUS Pro Camera</i>	Ring Light (70 mm)	<i>PresencePLUS Pro Camera</i>	Sealed <i>PresencePLUS Pro Camera</i>

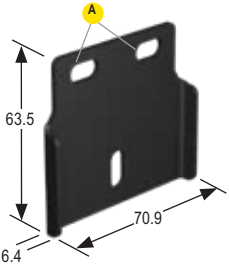
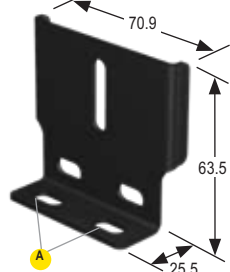

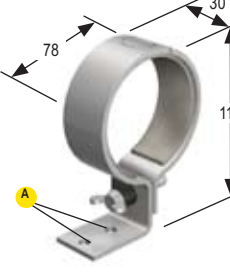




BRACKETS

CABLES

RETROREFLECTORS

ENCLOSURES/
LENS SHIELDS

MISCELLANEOUS

SMBVLA62X62S	SMBVLA62X62RA	SMBWFTLS	SMBWFTLR
 <p>All measurements in mm</p>	 <p>All measurements in mm</p>	 <p>All measurements in mm</p>	 <p>All measurements in mm</p>
<p>Hole center spacing: A = 36.4 Hole size: A = 13.1 x 6.6</p>	<p>Hole center spacing: A = 36.4 Hole size: A = 13.1 x 6.6</p>	<p>Hole center spacing: A = 27.0 Hole size: A = ø 6.5</p>	<p>Hole center spacing: A = 27.0 Hole size: A = ø 6.5</p>
<ul style="list-style-type: none"> • Surface-mount bracket for mounting light from front • In-line bracket • 14-ga. steel, black zinc-plated 	<ul style="list-style-type: none"> • For mounting a light at a right angle • 14-ga. steel, black zinc-plated 	<ul style="list-style-type: none"> • In-line bracket • Mounts around light • Bright zinc-coated steel construction 	<ul style="list-style-type: none"> • Right-angle bracket • Mounts around light • Bright zinc-coated steel construction
 <p>Used with</p>	 <p>Used with</p>	 <p>Used with</p>	 <p>Used with</p>
<p>Area Lights (62 x 62 mm)</p>	<p>Area Lights (62 x 62 mm)</p>	<p>Tubular Fluorescent Lights</p>	<p>Tubular Fluorescent Lights</p>

BRACKETS

CABLES

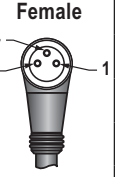
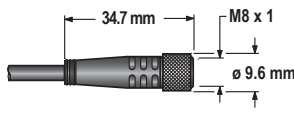
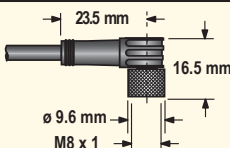
RETROREFLECTORS

ENCLOSURES/
LENS SHIELDS

MISCELLANEOUS

3-Pin Threaded Pico-Style Cables

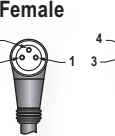
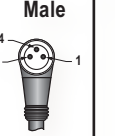
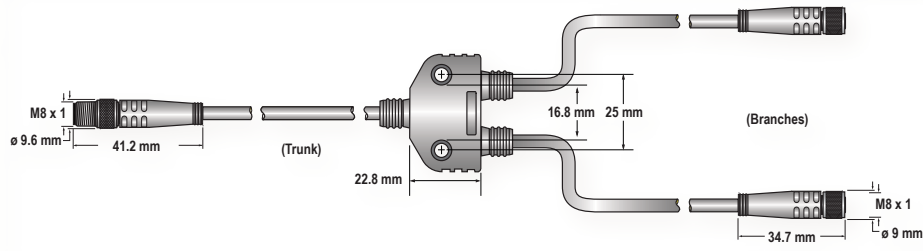
Cable: PVC jacket, 3 x 24 AWG
Conductors: PUR (polyurethane) body, nickel-plated brass coupling nut, gold-plated contacts
Voltage/Current Rating: 125V ac/300V dc, 4.0 A
Temperature: +105° C

Pinout	Style	Model	Length	Dimensions	Used With
 <p>Female</p> <p>1=Brown 3=Blue 4=Black</p>	Straight	PKG3M-2	2 m		<ul style="list-style-type: none"> • T8 • VS1 • VS2 • VS3 • VS4 • SLM • IP68 Sealed Ring Lights (Nickel-plated) • IP68 Sealed Ring† Lights (stainless steel) • On-axis Lights
		PKG3M-4†	4 m		
		PKG3M-7†	7 m		
		PKG3M-9	9 m		
		PKG3M-10†	10 m		
Right-Angle	PKW3M-2	2 m			
	PKW3M-9	9 m			

† IP68 stainless steel models require a cable with a stainless steel connector. For a stainless steel connector, add **V** to the model number (example, **PKG3M-4V**).


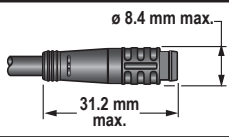
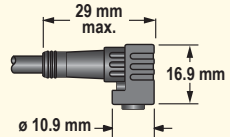
3-Pin Pico-Style Splitter Cables

Cable: PVC jacket, 3 x 24 AWG
Conductors: PUR (polyurethane) body, nickel-plated brass coupling nut, gold-plated contacts
Voltage/Current Rating: 125V ac/300V dc, 4.0 A
Temperature: +105° C

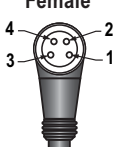
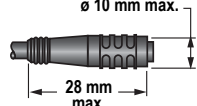
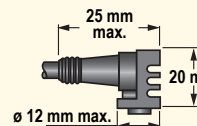
Connections				
Pinout	Model	Branches	Trunks	Used With
 <p>Female</p> <p>1=Brown 3=Blue 4=Black</p>	CSB-M831M831	3-Pin Pico QD 2 x 0.2 m Female	0.2 m Male	<ul style="list-style-type: none"> • Ring Lights • Spot Lights • Area Lights • Backlights
 <p>Male</p> <p>1=Brown 3=Blue 4=Black</p>				
				

4-Pin Snap-on Pico-Style Cables

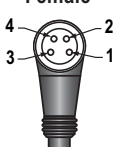
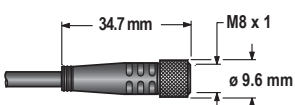
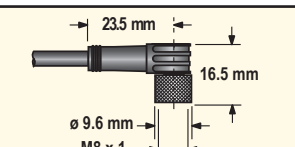
Cable: PVC jacket, 3 x 26 AWG
Conductors: PUR (polyurethane) body, snap lock, POM locking sleeve (right-angle only), gold-plated contacts
Voltage/Current Rating: 125V ac/300V dc, 4.0 A
Temperature: +105° C

Pinout	Style	Model	Length	Dimensions	Used With
 <p>Female</p> <p>1 = Brown 2 = White 3 = Blue 4 = Black</p>	Straight	PKG4-2	2 m		<ul style="list-style-type: none"> • MINI-BEAM 2 • QS12 • QS18 • Q20 • D12 • D10A
	Right-Angle	PKW4Z-2	2 m		

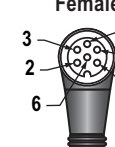
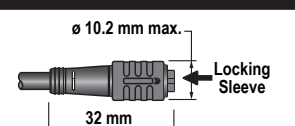
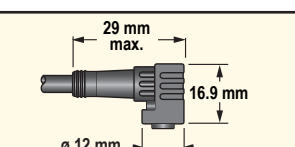
4-Pin Snap-On Pico-Style Cables with Shield
Cable: PVC jacket, 4 x 26 AWG with 26 AWG drain wire
Conductors: PUR (polyurethane) body, snap lock, POM locking sleeve (right-angle only), nickel-plated brass coupling nut, gold-plated contacts
Voltage/Current Rating: 125V ac/300V dc, 4.0 A
Temperature: +105° C

Pinout	Style	Model	Length	Dimensions	Used With
Female  1 = Brown 2 = White 3 = Blue 4 = Black	Straight	PKG4S-2	2 m		• QS18U
	Right-Angle	PKW4ZS-2	2 m		

4-Pin Threaded Pico-Style Cables
Cable: PVC jacket, 4 x 26 AWG
Conductors: PUR (polyurethane) body, nickel-plated brass coupling nut, gold-plated contacts
Voltage/Current Rating: 125V ac/dc, 4.0 A
Temperature: +105° C

Pinout	Style	Model	Length	Dimensions	Used With
Female  1 = Brown 2 = White 3 = Blue 4 = Black	Straight	PKG4M-2	2 m		• Q12 • Q20
		PKG4M-9	9 m		
	Right-Angle	PKW4M-2	2 m		
		PKW4M-9	9 m		

6-Pin Snap-On Pico-Style Cables
Cable: PVC jacket, 6 x 26 AWG
Conductors: PUR (polyurethane) body, POM locking sleeve, gold-plated contacts
Voltage/Current Rating: 125V ac/dc, 2.0 A
Temperature: +105° C

Pinout	Style	Model	Length	Dimensions	Used With
Female  1 = Brown 4 = Black 2 = White 5 = Gray 3 = Blue 6 = Pink	Straight	PKG6Z-2	2 m		• D10 • FI22
		PKG6Z-9	9 m		
	Right-Angle	PKW6Z-2	2 m		
		PKW6Z-9	9 m		

BRACKETS
 CABLES
 RETROREFLECTORS
 ENCLOSURES/
 LENS SHIELDS
 MISCELLANEOUS

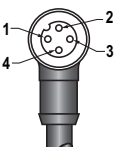
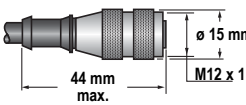
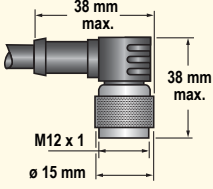
4-Pin Euro-Style Cables

Cable: PVC jacket, PUR (polyurethane) connector body, nickel-plated brass coupling nut

Conductors: 22 or 20 AWG high-flex stranded, gold-plated contacts

Voltage Rating: 250V ac/300V dc

Temperature: -40° to +90° C

Pinout	Style	Model	Length	Dimensions	Used With
 <p>Female</p> <p>1 = Brown 2 = White 3 = Blue 4 = Black</p>	Straight	MQDC-406	2 m		<ul style="list-style-type: none"> • Q12 • M12 • QS18 • Q20 • OMNI-BEAM (QDH suffix) • Q45 dc sensors (Q5 suffix) • MINI-BEAM dc SM312 sensors • S18, M18, T18, Q25, S30, T30, Q40 • QM42 • QL50/QL55 • SLM • T18U • K50 • K80 • PVA • VTB and STB • EZ-LIGHT
		MQDC-415	5 m		
		MQDC-430	9 m		
	Right-Angle	MQDC-406RA	2 m		
		MQDC-415RA	5 m		
		MQDC-430RA	9 m		

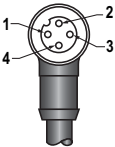
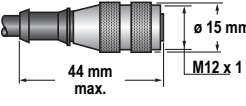
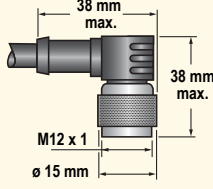
4-Pin Euro-Style Cables with Shield

Cable: PVC jacket, PUR (polyurethane) connector body, nickel-plated brass coupling nut

Conductors: 22 or 20 AWG high-flex stranded, gold-plated contacts

Voltage Rating: 250V ac/300V dc

Temperature: -40° to +90° C

Pinout	Style	Model	Length	Dimensions	Used With
 <p>Female</p> <p>1 = Brown 2 = White 3 = Blue 4 = Black</p>	Straight	MQDEC2-406	2 m		<ul style="list-style-type: none"> • QS18U
		MQDEC2-415	5 m		
		MQDEC2-430	9 m		
	Right-Angle	MQDEC2-406RA	2 m		
		MQDEC2-415RA	5 m		
		MQDEC2-430RA	9 m		

BRACKETS

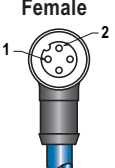
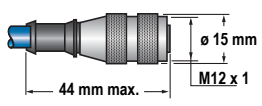
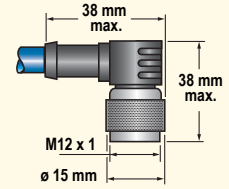
CABLES

RETROREFLECTORS

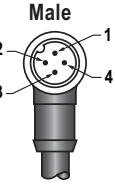
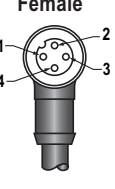

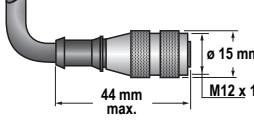
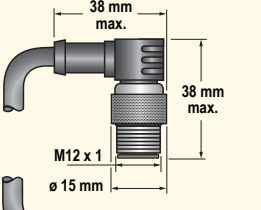
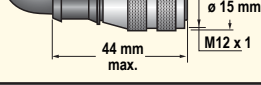
ENCLOSURES/
LENS SHIELDS

MISCELLANEOUS

4-Pin Euro-Style Cables (for use with NAMUR sensors)
Cable: PVC jacket, PUR (polyurethane) connector body, nickel-plated brass coupling nut
Conductors: 22 or 20 AWG high-flex stranded, gold-plated contacts
Voltage Rating: 250V ac/300V dc
Temperature: -40° to +90° C

Pinout	Style	Model	Length	Dimensions	Used With
 <p>Female 1 = Brown 2 = Blue</p>	Straight	MQD9-406	2 m		<ul style="list-style-type: none"> MINI-BEAM & Q45 NAMUR sensors
		MQD9-415	5 m		
	Right-Angle	MQD9-406RA	2 m		
		MQD9-415RA	5 m		

4-Pin Euro-Style Cables–Double Ended
Cable: PVC jacket, PUR (polyurethane) connector body, nickel-plated brass coupling nut
Conductors: 22 or 20 AWG high-flex stranded, gold-plated contacts
Voltage Rating: 250V ac/300V dc
Temperature: -40° to +90° C

Pinout	Style	Model	Length	Dimensions	Used With
 <p>Male 1 = Brown 2 = White 3 = Blue 4 = Black</p>  <p>Female 1 = Brown 2 = White 3 = Blue 4 = Black</p>	Male Straight/ Female Straight	MQDEC-403SS	1 m	 	<ul style="list-style-type: none"> M12 QS18 Q20 OMNI-BEAM (QDH suffix) Q45 dc sensors (Q5 suffix) MINI-BEAM dc SM312 sensors S18, M18, T18, Q25, S30, T30, Q40 QM42 T18U K50 K80 PVA VTB and STB EZ-LIGHT
		MQDEC-406SS	2 m		
		MQDEC-412SS	4 m		
		MQDEC-420SS	7 m		
		MQDEC-430SS	10 m		
		MQDEC-450SS	15 m		
	Male Right-Angle/ Female Straight	MQDEC-403RS	1 m	 	
		MQDEC-406RS	2 m		
		MQDEC-412RS	4 m		
		MQDEC-420RS	7 m		
		MQDEC-430RS	10 m		
		MQDEC-450RS	15 m		

BRACKETS
 CABLES
 RETROREFLECTORS
 ENCLOSURES/
 LENS SHIELDS
 MISCELLANEOUS

4-Pin Euro-Style Splitter Cables

Cable: PVC jacket, PUR (polyurethane) connector body, nickel-plated brass coupling nut
Conductors: 22 AWG high-flex stranded, gold-plated contacts
Voltage Rating: 250V ac/300V dc
Temperature: -40° to +90° C

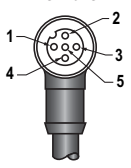
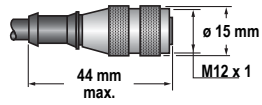
Connections				
Pinout	Model	Branches	Trunk	Used With
<p>Male</p> <p>Female</p> <p>1 = Brown 2 = White 3 = Blue 4 = Black</p>	CSB-M1240M1240*	4-Pin Euro QD No Branch Female	No Trunk Male	<ul style="list-style-type: none"> Sensors w/4-Pin Euro QD EZ-LIGHT
	CSB-M1241M1241	4-Pin Euro QD 2 x 0.3 m Female	0.3 m Male	
	CSB-M1248M1241		2.5 m Male	
	CSB-M12415M1241		5.0 m Male	
	CSB-M12425M1241		8.0 m Male	
	CSB-UNT425M1241		8.0 m Unterminated	
Dimensions				

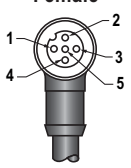
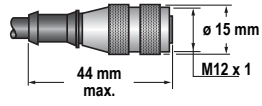
* CSB-M1240M1240 replaces model number MDCVB4T.

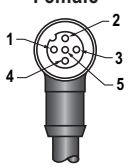
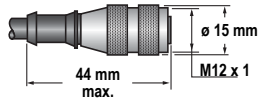
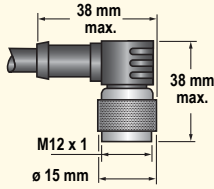
5-Pin Euro-Style Cables

Cable: PVC jacket, PUR (polyurethane) connector body, nickel-plated brass coupling nut
Conductors: 22 or 20 AWG high-flex stranded, gold-plated contacts
Voltage Rating: 250V ac/300V dc
Temperature: -40° to +90° C

Pinout	Style	Model	Length	Dimensions	Used With
<p>Female</p> <p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray</p>	Straight	MQDC1-501.5	0.5 m		<ul style="list-style-type: none"> MINI-BEAM Expert QS30 PicoDot Q45 Laser Retro R55F SL30 & SL30E SL10 & SL10E VTB (2-color) SLC1 Q60 PVD STB K50 K80 DX80 DX81 DX85 EZ-LIGHT
		MQDC1-515	5 m		
		MQDC1-530	9 m		
	Right-Angle	MQDC1-506RA	2 m		
		MQDC1-515RA	5 m		
		MQDC1-530RA	9 m		

5-Pin Euro-Style Cables						
Cable: PVC jacket, PUR (polyurethane) connector body, nickel-plated brass coupling nut Conductors: 20 AWG high-flex stranded, gold-plated contacts Voltage Rating: 250V ac/300V dc Temperature: -40° to +90° C						
Pinout	Style	Model	Length	Dimensions	Used With	
Female  <p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray</p>	Straight	MQDC20-506	2 m		<ul style="list-style-type: none"> • High Intensity Area Lights • High Intensity Ring Lights • Sealed Linear Array Lights NOTE: Except stainless steel models	
		MQDC20-515	5 m			
		MQDC20-530	9 m			

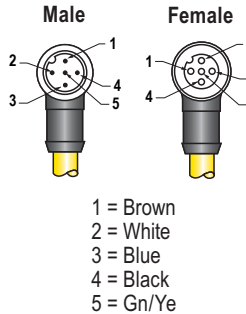
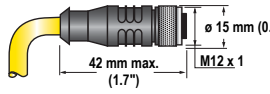
5-Pin Euro-Style Cables with Stainless Steel Connector						
Cable: PVC jacket, PUR (polyurethane) connector body, 316 stainless steel coupling nut Conductors: 20 AWG high-flex stranded, gold-plated contacts Voltage Rating: 250V ac/300V dc Temperature: -40° to +90° C						
Pinout	Style	Model	Length	Dimensions	Used With	
Female  <p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray</p>	Straight	MQDC20SS-506	2 m		<ul style="list-style-type: none"> • Sealed High Intensity Area Lights • Sealed Linear Array Lights NOTE: Stainless steel models	
		MQDC20SS-515	5 m			
		MQDC20SS-530	9 m			

5-Pin Euro-Style Cables with Shield						
Cable: PVC jacket, PUR (polyurethane) connector body, nickel-plated brass coupling nut Conductors: 22 or 20 AWG high-flex stranded, gold-plated contacts Voltage Rating: 250V ac/300V dc Temperature: -40° to +90° C						
Pinout	Style	Model	Length	Dimensions	Used With	
Female  <p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray</p>	Straight	MQDEC2-506	2 m		<ul style="list-style-type: none"> • Q50 • R58E • M-GAGE Q7M • M-GAGE S18M • QT50U dc sensors • S18U • T30U • Q45U • Q45UR • T-GAGE M18T • LX • QT50R 	
		MQDEC2-515	5 m			
		MQDEC2-530	9 m			
	Right-Angle	MQDEC2-506RA	2 m			
		MQDEC2-515RA	5 m			
		MQDEC2-530RA	9 m			

BRACKETS
CABLES
RETROREFLECTORS
ENCLOSURES/
LENS SHIELDS
MISCELLANEOUS

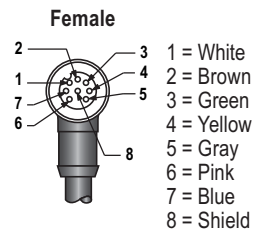
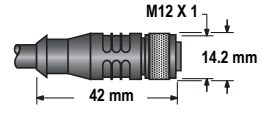
5-Pin Euro-Style Cables–Double Ended

Cable: PVC jacket, PUR (polyurethane) connector body, nickel-plated brass coupling nut
Conductors: 22 or 20 AWG high-flex stranded, gold-plated contacts
Voltage Rating: 250V ac/300V dc
Temperature: -40° to +90° C

Pinout	Style	Model	Length	Dimensions	Used With
 <p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gn/Ye</p>	Female Straight/ Male Straight	DEE2R-51D	0.3 m		<ul style="list-style-type: none"> • MINI-BEAM <i>Expert</i> • QS30 • PicoDot • Q45 Laser Retro • R55F • SL30 & SL30E • SL10 & SL10E • SLC1 • Q60 • PVD • STB • VTB (2-color) • DX85 • DX81
		DEE2R-53D	1.0 m		
		DEE2R-58D	2.4 m		
		DEE2R-515D	4.5 m		
		DEE2R-525D	8.0 m		
		DEE2R-550D	15.0 m		
		DEE2R-575D	23.0 m		
		DEE2R-5100D	30.0 m		

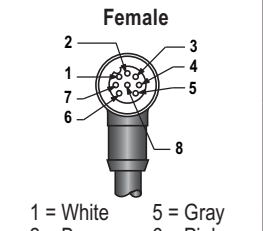
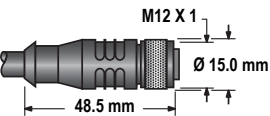
8-Pin Euro-Style Cables with Shield

Cable: PVC jacket, PUR (polyurethane) connector body, nickel-plated brass coupling nut
Conductors: 22 or 20 AWG high-flex stranded, gold-plated contacts
Voltage Rating: 250V ac/300V dc
Temperature: -40° to +90° C

Pinout	Style	Model	Length	Dimensions	Used With
 <p>1 = White 2 = Brown 3 = Green 4 = Yellow 5 = Gray 6 = Pink 7 = Blue 8 = Shield</p>	Straight	MQDC-806	2 m		<ul style="list-style-type: none"> • LT3 • LG5 • LG10
		MQDC-815	5 m		
		MQDC-830	9 m		

8-Pin Euro-Style Cables with Shield

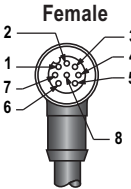
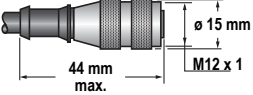
Cable: PVC jacket, PUR (polyurethane) connector body, nickel-plated brass coupling nut
Conductors: 24 AWG high-flex stranded, gold-plated contacts
Voltage Rating: 30V ac/36V dc
Temperature: -40° to +105° C

Pinout	Style	Model	Length	Dimensions	Used With
 <p>1 = White 2 = Brown 3 = Green 4 = Yellow 5 = Gray 6 = Pink 7 = Blue 8 = Red</p>	Straight	MAQDC-815	5 m		<ul style="list-style-type: none"> • EZ-ARRAY Emitters/Receivers
		MAQDC-830	9 m		
		MAQDC-850	15 m		

BRACKETS
CABLES
RETROREFLECTORS
ENCLOSURES/LENS SHIELDS
MISCELLANEOUS

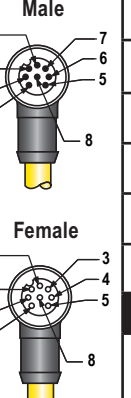
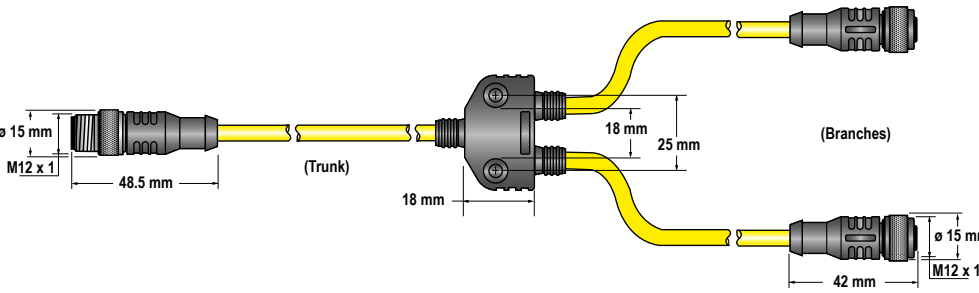
8-Pin Euro-Style Cables with Open-Shield

Cable: PVC jacket, PUR (polyurethane) connector body, nickel-plated brass coupling nut
Conductors: 22 or 20 AWG high-flex stranded, gold-plated contacts
Voltage Rating: 250V ac/300V dc
Temperature: -40° to +90° C

Pinout	Style	Model	Length	Dimensions	Used With
 <p>Female</p> <p>1 = White 5 = Gray 2 = Brown 6 = Pink 3 = Green 7 = Blue 4 = Yellow 8 = Red</p>	Straight	MQDC2S-806	2 m		<ul style="list-style-type: none"> • QC50 • QCX50 • EZ-LIGHT
		MQDC2S-815	5 m		
		MQDC2S-830	9 m		

8-Pin Euro-Style Splitter Cables

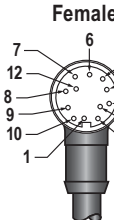

Cable: PVC jacket, PUR (polyurethane) connector body, nickel-plated brass coupling nut
Conductors: 22 AWG high-flex stranded, gold-plated contacts
Voltage Rating: 250V ac/300V dc
Temperature: -40° to +90° C

Connections				
Pinout	Model	Branches	Trunk	Used With
 <p>Male</p> <p>Female</p> <p>1 = Brown 2 = Or/Bk 3 = Orange 4 = White 5 = Black 6 = Blue 7 = Gn/Ye 8 = Violet</p>	CSB-M1280M1280	8-Pin Euro QD No Branch Female	No Trunk Male	<ul style="list-style-type: none"> • EZ-ARRAY Emitters/Receivers
	CSB-M1281M1281	8-Pin Euro QD 2 x 0.3 m Female	0.3 m Male	
	CSB-M1288M1281		2.5 m Male	
	CSB-M12815M1281		5.0 m Male	
	CSB-M12825M1281		8.0 m Male	
	CSB-UNT825M1281		8.0 m Unterminated	
Dimensions				
				



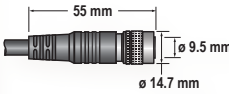
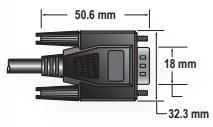
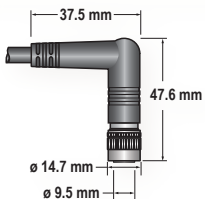
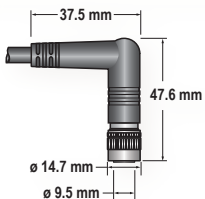
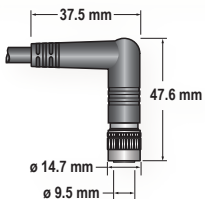


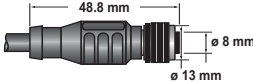
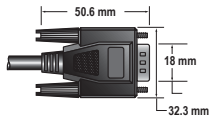
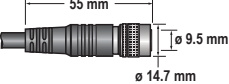
- BRACKETS
- CABLES
- RETROREFLECTORS
- ENCLOSURES/LENS SHIELDS
- MISCELLANEOUS

12-Pin M16 Cable

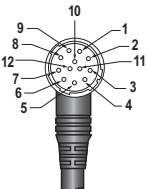
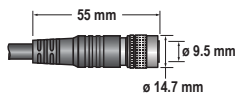
Cable: PVC jacket, nickel-plated brass coupling nut
 Conductors: 22 AWG
 Voltage Rating: 250V ac Temperature: -30° to +80° C

Pinout	Style	Model	Length	Dimensions	Used With	
1 = White 2 = Brown 3 = Green 4 = Yellow 5 = Gray 6 = Pink 7 = Red 8 = Black 9 = Violet 10 = Gy/Pk 11 = Rd/Bu 12 = Blue	 <p>Female</p>	Straight	MQDC-1210ST	3 m		• LT7
			MQDC-1230ST	10 m		

12-Pin QD to DB15

Pinout	Style	Model	Length	Dimensions 12-Pin QD	Dimensions DB15	Used With
 	Straight/DB15	PPC06	2 m			• Pro
		PPC23	7 m			
	Straight (High-Flex)/DB15	PPC06HF	2 m			
		PPC23HF	7 m			
	Right-Angle/DB15	PPC06RA	2 m			
		PPC10RA	3 m			
Right-Angle (High-Flex)/DB15	PPC23RA	7 m				
	PPC06RAHF	2 m				
 	Straight/DB15	PPC13S	4 m			• Sealed Pro
		PPC23S	7 m			
	Straight/DB15	P4C06SIM	2 m			
P4C23SIM		7 m				
P4C32SIM		10 m				

12-Pin QD

Pinout	Style	Model	Length	Dimensions	Used With	
1 = Yellow 2 = Gray 3 = Orange 4 = Pink 5 = Black 6 = Red 7 = White 8 = Light Blue 9 = Purple 10 = Green 11 = Blue 12 = Brown Shield = Bare Metal	 <p>Female QD</p>	Straight	P4C06	2 m		• P4 • PPSIM with terminal strip to P4
			P4C23	7 m		
			P4C32	10 m		
			P4C50	16 m		
			P4C75	23 m		

BRACKETS

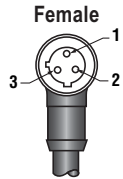
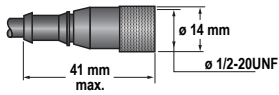
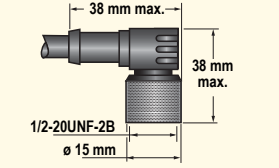
CABLES

RETROREFLECTORS

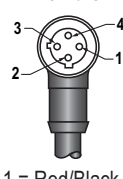
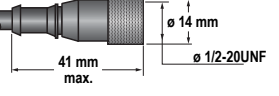
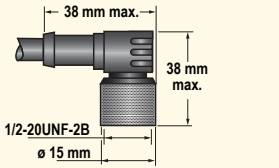
ENCLOSURES/
LENS SHIELDS

MISCELLANEOUS

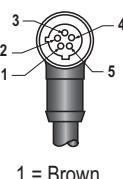
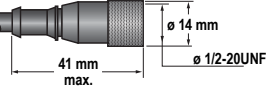
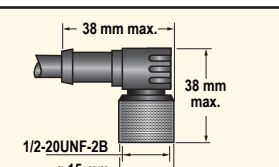
3-Pin Micro-Style Cables
Cable: PVC jacket, 3 x 22 AWG
Conductors: PUR (polyurethane) body, nickel-plated coupling nut, gold-plated contacts
Voltage/Current Rating: 250V ac/dc, 4.0 A
Temperature: +105° C

Pinout	Style	Model	Length	Dimensions	Used With
 <p>1 = Green 2 = Red/Black 3 = Red/White</p>	Straight	MQDC-306	2 m		<ul style="list-style-type: none"> • MINI-BEAM ac SM2A312 sensors
		MQDC-315	5 m		
		MQDC-330	9 m		
	Right-Angle	MQDC-306RA	2 m		
		MQDC-315RA	5 m		
		MQDC-330RA	9 m		

4-Pin Micro-Style Cables
Cable: PVC jacket, 4 x 22 AWG
Conductors: PUR (polyurethane) body, nickel-plated brass coupling nut, gold-plated contacts
Voltage/Current Rating: 250V ac/dc, 4.0 A
Temperature: +105° C

Pinout	Style	Model	Length	Dimensions	Used With
 <p>1 = Red/Black 2 = Red/White 3 = Red 4 = Green</p>	Straight	MQAC-406	2 m		<ul style="list-style-type: none"> • Q45 ac series (suffix Q1) • S18, M18, T18, Q25, S30, T30 & Q40 ac sensors (suffix Q1) • Q60
		MQAC-415	5 m		
		MQAC-430	9 m		
	Right-Angle	MQAC-406RA	2 m		
		MQAC-415RA	5 m		
		MQAC-430RA	9 m		

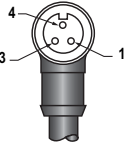
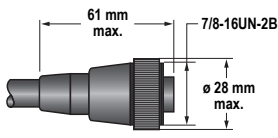
5-Pin Micro-Style Cables with Shield
Cable: PVC jacket, 5 x 22 AWG with 22 AWG drain wire
Conductors: PUR (polyurethane) body, nickel-plated brass coupling nut, gold-plated contacts
Voltage Rating: 250V ac/dc, 4.0 A
Temperature: +105° C

Pinout	Style	Model	Length	Dimensions	Used With
 <p>1 = Brown 2 = White 3 = Yellow 4 = Black 5 = Blue</p>	Straight	MQVR3S-506	2 m		<ul style="list-style-type: none"> • QT50U ac/dc sensors • EZ-LIGHT ac indicators
		MQVR3S-515	5 m		
		MQVR3S-530	9 m		
	Right-Angle	MQVR3S-506RA	2 m		
		MQVR3S-515RA	5 m		
		MQVR3S-530RA	9 m		

BRACKETS
 CABLES
 RETROREFLECTORS
 ENCLOSURES/
 LENS SHIELDS
 MISCELLANEOUS

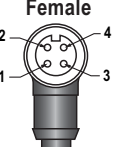
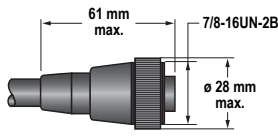
3-Pin Mini-Style Cables

Cable: PVC jacket, PUR (polyurethane) connector body, nylon coupling nut
Conductors: 18 AWG high-flex stranded. PVC insulation, gold-plated contacts
Voltage Rating: 250V ac/300V dc
Temperature: -40° to +80° C

Pinout	Style	Model	Length	Dimensions	Used With
 <p>Female</p> <p>1 = Brown 3 = Blue 4 = Black</p>	Straight	MBCC-306	2 m		<ul style="list-style-type: none"> • Q45
		MBCC-312	4 m		
		MBCC-330	9 m		
	Straight	SMICC-306	2 m		<ul style="list-style-type: none"> • SMI30 Intrinsically safe dc sensors
		SMICC-312	4 m		
		SMICC-330	9 m		
<p>1=Red/Black 3=Red/White 4=Green</p>	Straight	SM30CC-306	2 m	<ul style="list-style-type: none"> • SM30 2-wire ac sensors 	
		SM30CC-312	4 m		

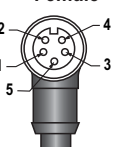
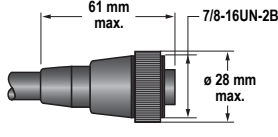
4-Pin Mini-Style Cables

Cable: PVC jacket, PUR (polyurethane) connector body, nylon coupling nut
Conductors: 18 AWG high-flex stranded. PVC insulation, gold-plated contacts
Voltage/Current Rating: 250V ac/300V dc
Temperature: -40° to +80° C

Pinout	Style	Model	Length	Dimensions	Used With
 <p>Female</p> <p>1 = Brown 2 = White 3 = Blue 4 = Black</p>	Straight	MBCC-406	2 m		<ul style="list-style-type: none"> • Q45 dc sensors (suffix Q) • OMNI-BEAM dc power blocks • SM30 dc sensors • OTB w/solid-state output • STB with solid-state output
		MBCC-412	4 m		
		MBCC-430	9 m		

5-Pin Mini-Style Cables

Cable: PVC jacket, PUR (polyurethane) connector body, nylon coupling nut
Conductors: 22 or 20 AWG high-flex stranded, gold-plated contacts
Voltage Rating: 250V ac/300V dc
Temperature: -40° to +90° C

Pinout	Style	Model	Length	Dimensions	Used With
 <p>Female</p> <p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Yellow</p>	Straight	MBCC-506	2 m		<ul style="list-style-type: none"> • Q45 Laser Retro • OMNI-BEAM ac power blocks • OMNI-BEAM dc w/ e/m relay • OTB & LTB w/SPDT relay • Q45 5-wire ac • STB with e/m relay
		MBCC-512	4 m		
		MBCC-530	9 m		

BRACKETS

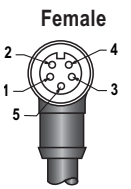
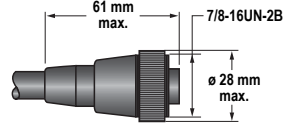
CABLES

RETROREFLECTORS

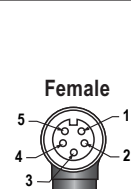
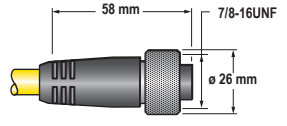
ENCLOSURES/
LENS SHIELDS

MISCELLANEOUS


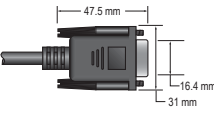
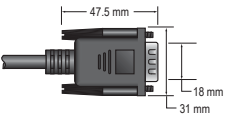

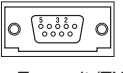
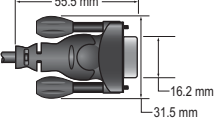
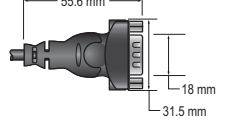
5-Pin Mini-Style Cables with Shield
Cable: PVC jacket, PUR (polyurethane) connector body, nylon coupling nut
Conductors: 18 AWG high-flex stranded, PVC insulation, gold-plated contacts
Voltage Rating: 250V ac/300V dc
Temperature: -40° to +80° C

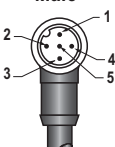
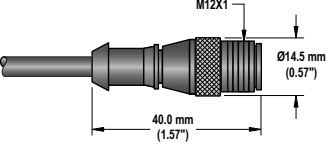
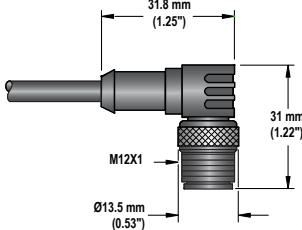
Pinout	Style	Model	Length	Dimensions	Used With
 <p>Female</p> <p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Yellow</p>	Straight	MBCC2-506	2 m		<ul style="list-style-type: none"> • QT50U • Q45U • Q45UR
		MBCC2-512	4 m		
		MBCC2-530	9 m		


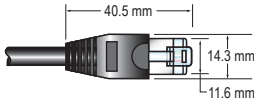
5-Pin Mini-Style Cables with Shield and “Twisted Pair”
Cable: PVC jacket, PUR (polyurethane) connector body, nickel-plated brass coupling nut
Conductors: 18 AWG high-flex stranded, PVC insulation, gold-plated contacts
Voltage Rating: 250V ac/300V dc
Temperature: -40° to +80° C


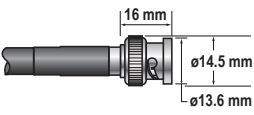
Pinout	Style	Model	Length	Dimensions	Used With
 <p>Female</p> <p>1 = Black 2 = Blue 3 = Drain 4 = Brown 5 = White</p>	Straight	QDC-515C	5 m		<ul style="list-style-type: none"> • MINI-ARRAY • High-Resolution MINI-ARRAY
		QDC-525C	8 m		
		QDC-550C	15 m		
		MAQDC-575C	22 m		
		MAQDC-5100C	30 m		
		MAQDC-5125C	38 m		
		MAQDC-5150C	45 m		

- BRACKETS
- CABLES
- RETROREFLECTORS
- ENCLOSURES/ LENS SHIELDS
- MISCELLANEOUS

DB9 Communication Cordsets						
End View	Style	Model	Length	Dimensions		Used With
 Male	Male DB9/ Female DB9	DB9P06	2 m	 Female	 Male	• Pro
 Female		DB9P15	5 m			
		DB9P30	9 m			
 Female 2 = Transmit (TX) 3 = Receive (RX) 5 = Ground (GRD)	Male DB9/ Female DB9	MASC	2 m	 Female	 Male	• MINI-ARRAY • High-Resolution MINI-ARRAY

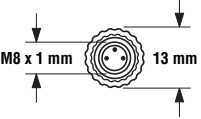
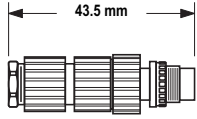
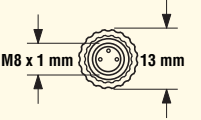
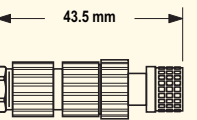
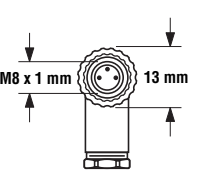
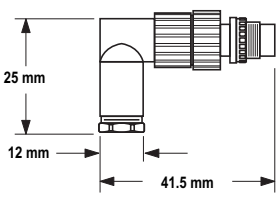
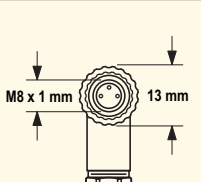
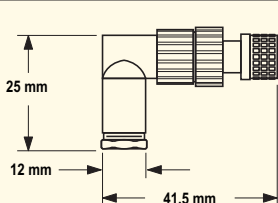
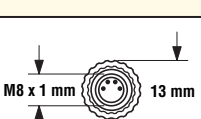
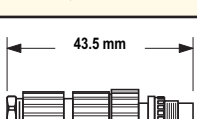
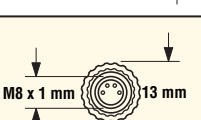
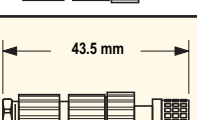
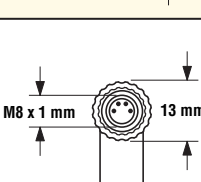
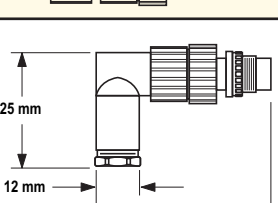
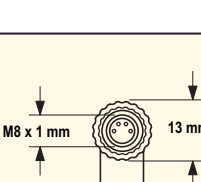
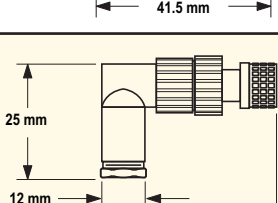
Communication Cordsets						
End View	Style	Model	Length	Dimensions		Used With
 Male 1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray	Straight	MQDMC-506	2 m		• EZ-ARRAY to INTUSB485-1 USB Serial Adapter	
		MQDMC-515	5 m			
		MQDMC-530	9 m			
	Right-Angle	MQDMC-506RA	2 m			
		MQDMC-515RA	5 m			
		MQDMC-530RA	9 m			

RJ45 Ethernet Cordsets						
End View	Style	Model	Length	Dimensions		Used With
 Male	Cat5e Shielded	STP07	2.1 m		• Pro • P4	
	Cat5e Crossover Shielded	STPX07				
	Cat5e Shielded	STP25	7.3 m			
	Cat5e Crossover Shielded	STPX25				
	Cat5e Shielded	STPX75	23 m			

BNC Coaxial Video Cordsets						
Pinout	Style	Model	Length	Dimensions		Used With
 Male	Video Coaxial with BNC	BNC06	2 m		• Pro • P4	
		BNC15	5 m			
		BNC30	9 m			

BRACKETS
 CABLES
 RETROREFLECTORS
 ENCLOSURES/
 LENS SHIELDS
 MISCELLANEOUS

Pico-Style Field-Wireable Connectors (M8)
Contacts: Gold-plated, rated 60V ac/dc max., 4 A max.
Cable Diameter: 4.0 to 5.0 mm
Temperature: -25° to +70° C
Environmental Rating: NEMA 6P, IP67

Pinout	Style	Model	Dimensions
	3-Pin Male Straight	FIC-M8M3	
	3-Pin Female Straight	FIC-M8F3	
	3-Pin Male Right-Angle	FIC-M8M3A	
	3-Pin Female Right-Angle	FIC-M8F3A	
	4-Pin Male Straight	FIC-M8M4	
	4-Pin Female Straight	FIC-M8F4	
	4-Pin Male Right-Angle	FIC-M8M4A	
	4-Pin Female Right-Angle	FIC-M8F4A	

- BRACKETS
- CABLES
- RETROREFLECTORS
- ENCLOSURES/ LENS SHIELDS
- MISCELLANEOUS

Euro-Style Field-Wireable Connectors (M12)

Contacts: Gold-plated; 4-pin models rated 250V ac/dc max., 4 A max.; 5-pin models rated 50V ac/dc max., 4 A max.

Cable Diameter: 4.0 to 5.0 mm

Temperature: -25° to +90° C

Environmental Rating: NEMA 6P, IP67

Pinout	Style	Model	Dimensions
	4-Pin Male Straight	FIC-M12M4	
	4-Pin Female Straight	FIC-M12F4	
	4-Pin Male Right-Angle	FIC-M12M4A	
	4-Pin Female Right-Angle	FIC-M12F4A	
	5-Pin Male Straight	FIC-M12M5	
	5-Pin Female Straight	FIC-M12F5	
	5-Pin Male Right-Angle	FIC-M12M5A	
	5-Pin Female Right-Angle	FIC-M12F5A	

BRACKETS

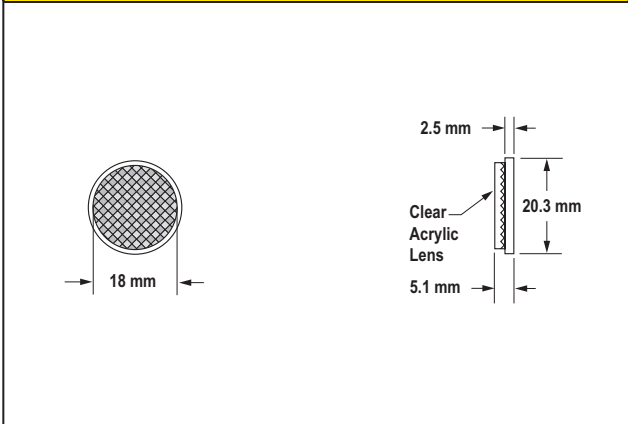
CABLES

RETROREFLECTORS

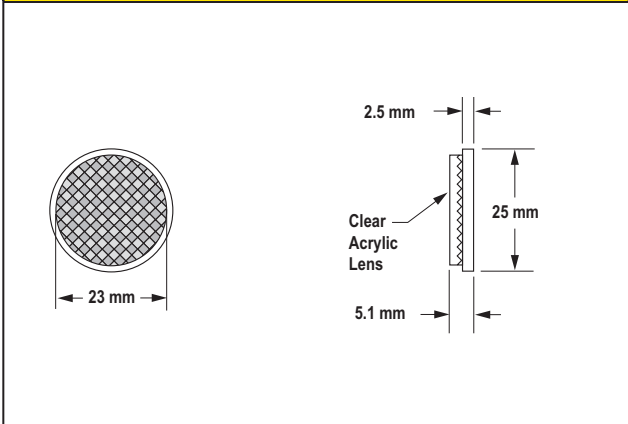
ENCLOSURES/
LENS SHIELDS

MISCELLANEOUS

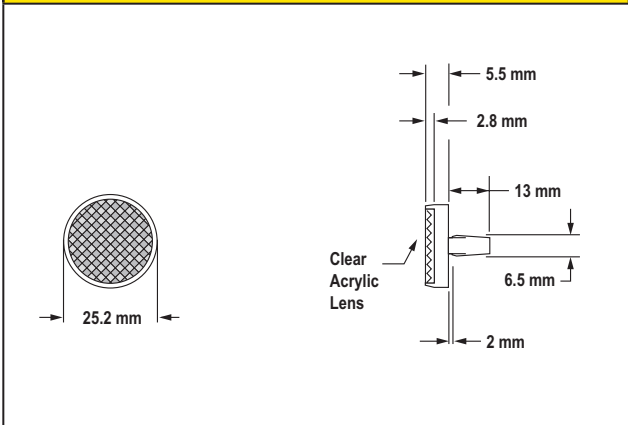
BRT-6
Description: Round, acrylic target
Reflectivity Factor: 1.0
Max. Temperature: 65° C



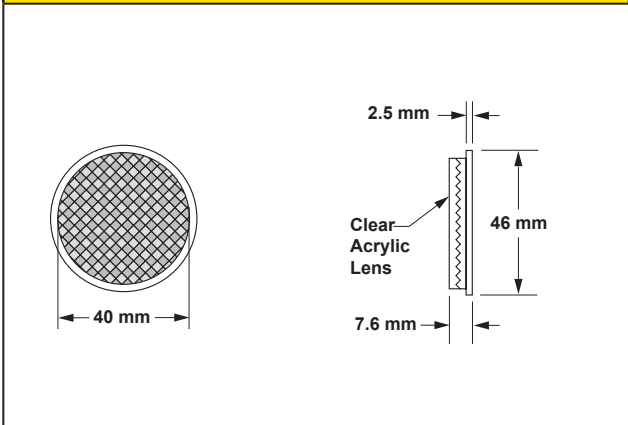
BRT-1
Description: Round, acrylic target
Reflectivity Factor: 1.0
Max. Temperature: 65° C



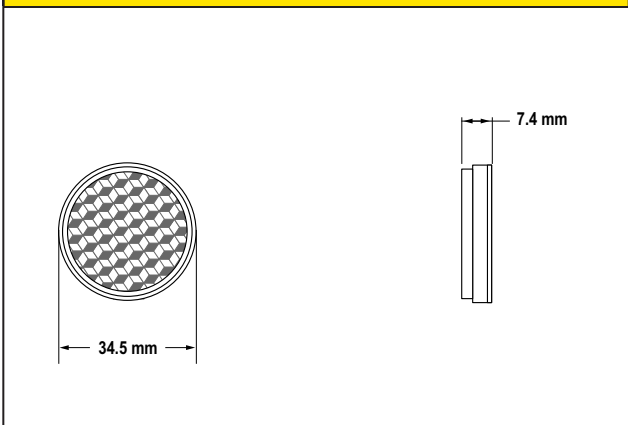
BRT-25R
Description: Round, rivet-secured acrylic target
Reflectivity Factor: 1.0
Max. Temperature: 50° C



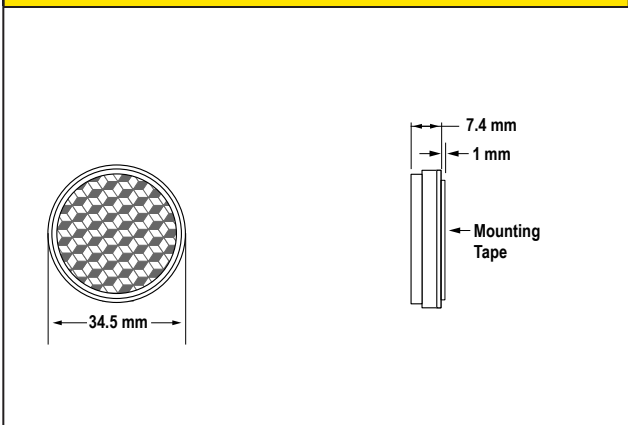
BRT-1.5
Description: Round, acrylic target
Reflectivity Factor: 1.0
Max. Temperature: 65° C



BRT-34
Description: Round, acrylic target
Reflectivity Factor: 1.2
Max. Temperature: 65° C



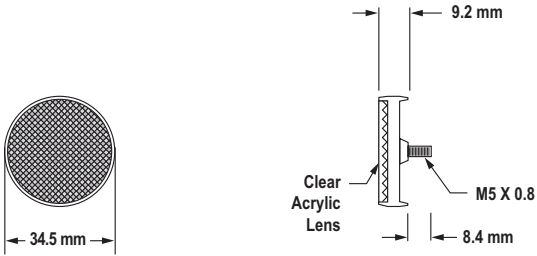
BRT-34T
Description: Round, acrylic target includes mounting tape
Reflectivity Factor: 1.2
Max. Temperature: 65° C



- BRACKETS
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- MISCELLANEOUS

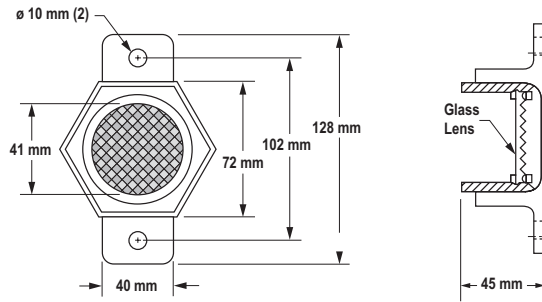
BRT-35DM

Description: Round, acrylic target with mounting stud
 Reflectivity Factor: 1.2
 Max. Temperature: 50° C
 Other: This target has micro-prism geometry.



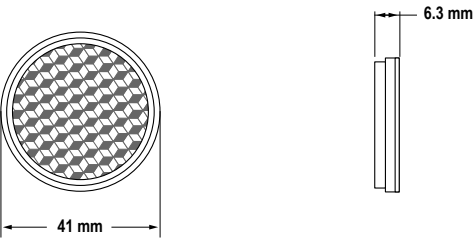
BRT-41AHT

Description: Round, borosilicate (Pyrex type) glass target
 Reflectivity Factor: 1.0
 Max. Temperature: 200° C



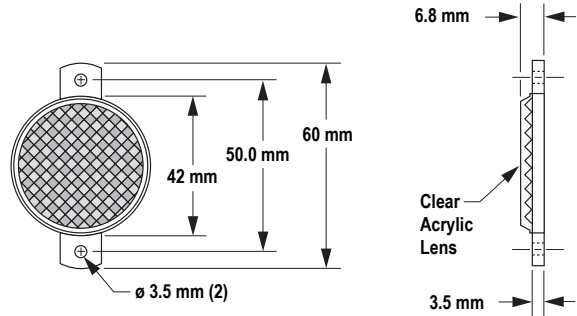
BRT-42

Description: Round, acrylic target
 Reflectivity Factor: 1.0
 Max. Temperature: 65° C



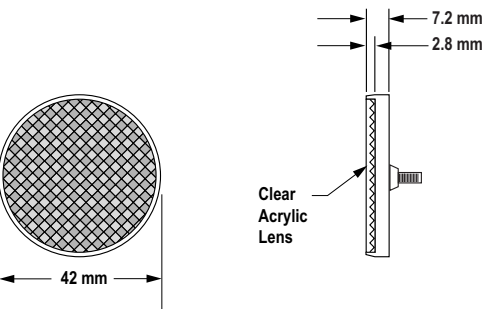
BRT-42A

Description: Round, acrylic target
 Reflectivity Factor: 1.0
 Max. Temperature: 50° C



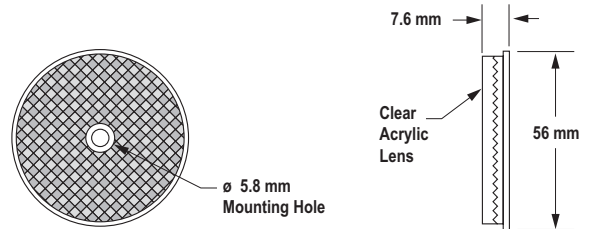
BRT-42D

Description: Round, acrylic target with mounting stud
 Reflectivity Factor: 1.0
 Max. Temperature: 50° C



BRT-2A

Description: Round, acrylic target
 Reflectivity Factor: 1.0
 Max. Temperature: 65° C



BRACKETS

CABLES

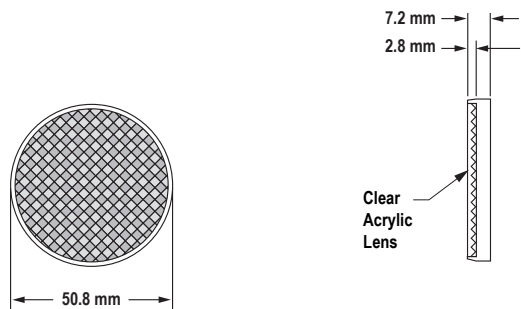
RETROREFLECTORS

ENCLOSURES/
LENS SHIELDS

MISCELLANEOUS

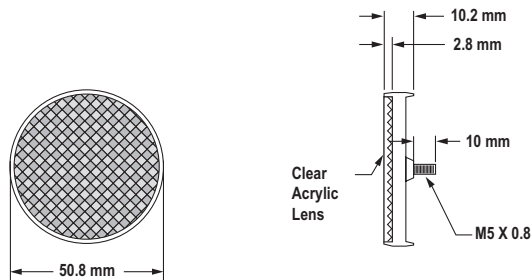
BRT-50

Description: Round, acrylic target
 Reflectivity Factor: 1.0
 Max. Temperature: 65° C



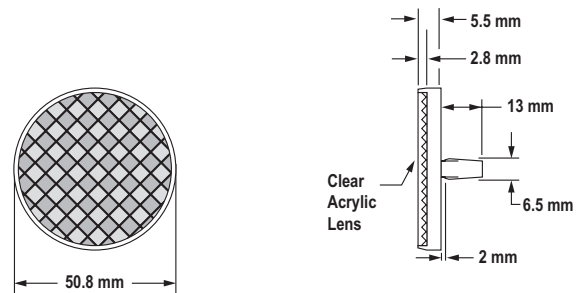
BRT-50D

Description: Round, acrylic target with mounting stud
 Reflectivity Factor: 1.0
 Max. Temperature: 65° C
 Other: Optional brackets are available. See page 376.



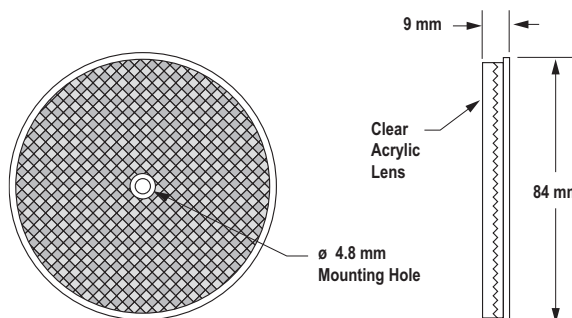
BRT-50R

Description: Round, rivet-secured acrylic target
 Reflectivity Factor: 1.0
 Max. Temperature: 50° C
 Other: Optional brackets are available. See page 376.



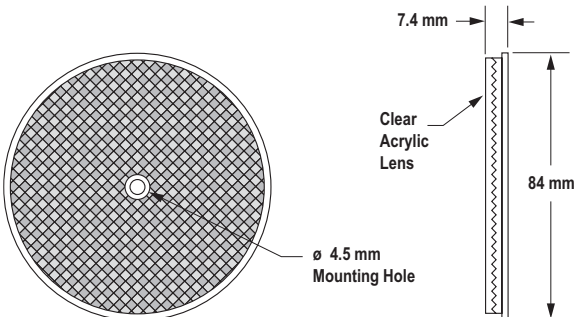
BRT-3

Description: Round, acrylic target
 Reflectivity Factor: 1.0
 Max. Temperature: 65° C
 Other: Optional brackets are available. See page 376.



BRT-84

Description: Round, acrylic target
 Reflectivity Factor: 1.4
 Max. Temperature: 65° C
 Other: Optional brackets are available. See page 376.



- BRACKETS
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- MISCELLANEOUS

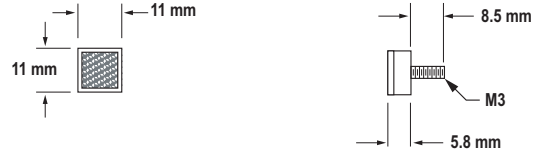
BRT-11X11M

Description: Square, acrylic target
 Reflectivity Factor: 1.2
 Max. Temperature: 65° C
 Other: This target has micro-prism geometry.



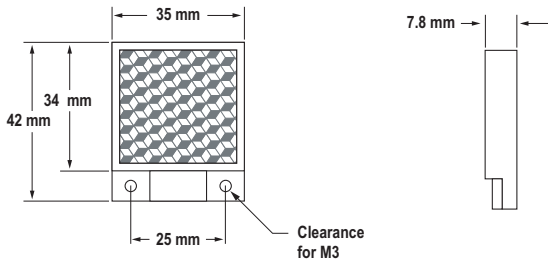
BRT-11X11MD

Description: Square, acrylic target with mounting stud
 Reflectivity Factor: 1.2
 Max. Temperature: 65° C
 Other: This target has micro-prism geometry.



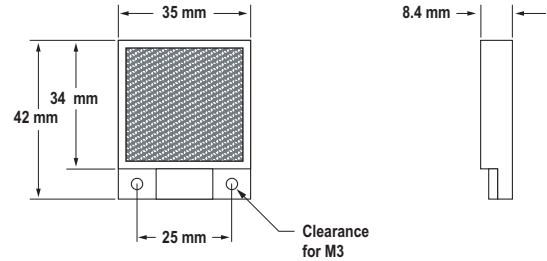
BRT-35X35B

Description: Square, acrylic target
 Reflectivity Factor: 1.3
 Max. Temperature: 65° C



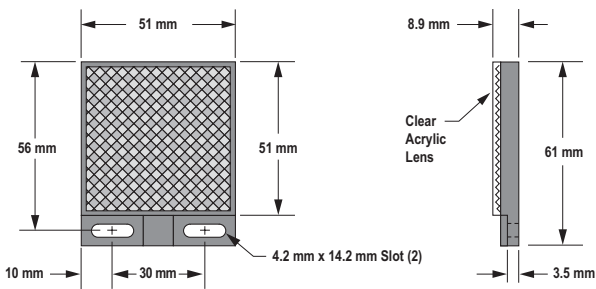
BRT-35X35BM

Description: Square, acrylic target
 Reflectivity Factor: 1.2
 Max. Temperature: 65° C
 Other: This target has micro-prism geometry.



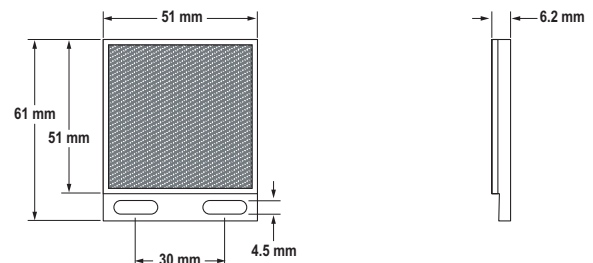
BRT-2X2

Description: Square, acrylic target
 Reflectivity Factor: 1.0
 Max. Temperature: 50° C
 Others: Optional brackets are available. See page 376.



BRT-51X51BM

Description: Square, acrylic target
 Reflectivity Factor: 1.5 Max. Temperature: 50° C
 Other: This target has micro-prism geometry. Optional brackets are available on page 376. Replaces reflector BRT-36X40BM.



BRACKETS

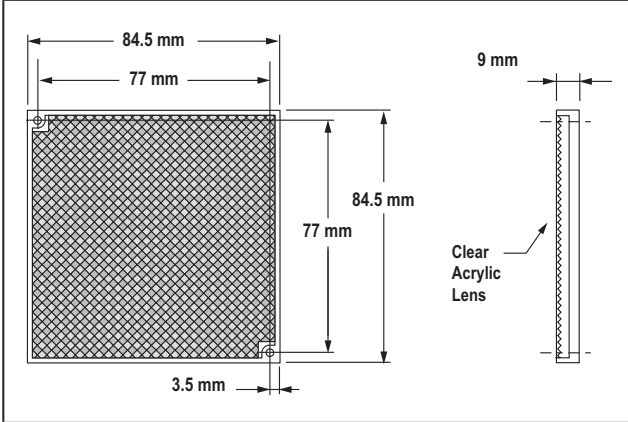
CABLES

RETROREFLECTORS

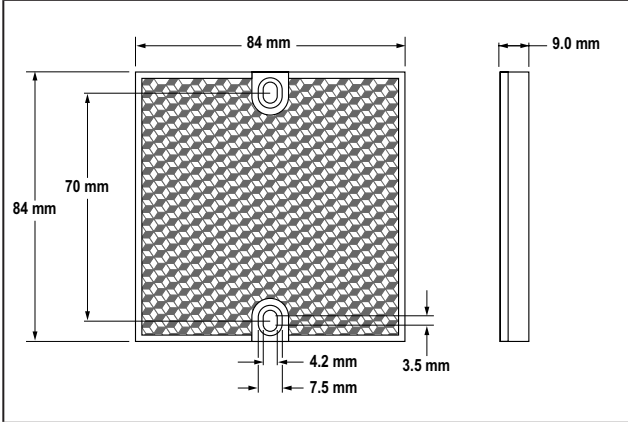
ENCLOSURES/
LENS SHIELDS

MISCELLANEOUS

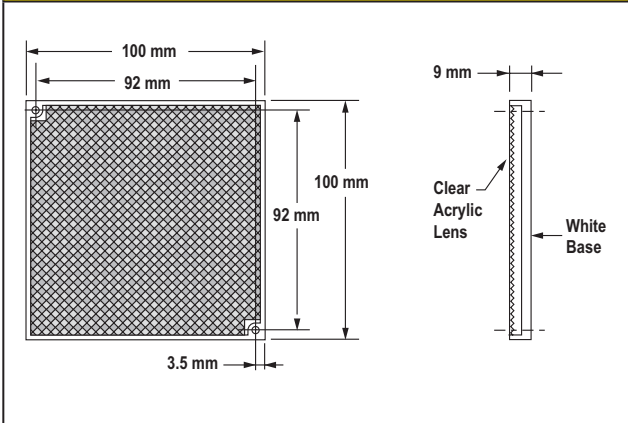
BRT-77X77C
 Description: Square, acrylic target
 Reflectivity Factor: 2.0
 Max. Temperature: 50° C
 Other: Optional brackets are available. See page 376.



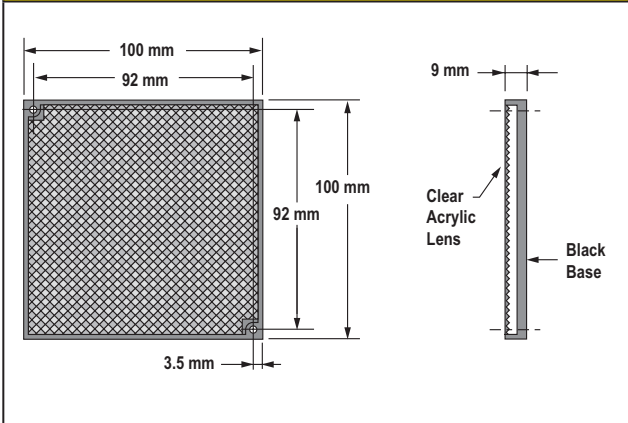
BRT-84X84A
 Description: Square, acrylic target
 Reflectivity Factor: 2.0
 Max. Temperature: 50° C



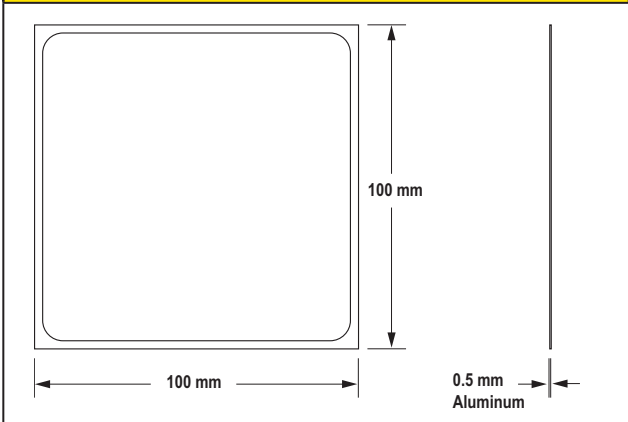
BRT-92X92C
 Description: Square, acrylic target
 Reflectivity Factor: 3.0
 Max. Temperature: 50° C
 Other: Optional brackets are available. See page 376.



BRT-92X92CB
 Description: Square, acrylic target with black mounting base
 Reflectivity Factor: 3.0
 Max. Temperature: 50° C
 Other: Optional brackets are available. See page 376.



BRT-4HT
 Description: Square, aluminum target
 Reflectivity Factor: 0.15
 Max. Temperature: 480° C
 Other: This target is not recommended for polarized retroreflective sensors.



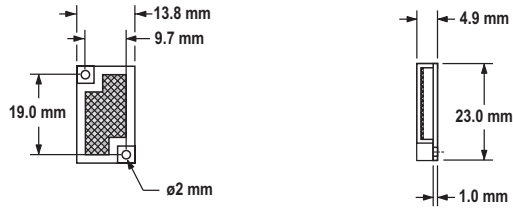
BRT-250 • 250 x 250 mm
BRT-540 • 540 x 540 mm
BRT-700 • 700 x 700 mm
 Other: Square reflector with rigid aluminum backing for use with LT7



- BRACKETS
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- MISCELLANEOUS

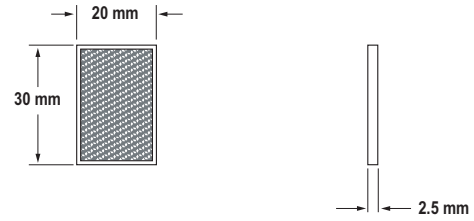
BRT-23X14CM

Description: Rectangular, acrylic target
 Reflectivity Factor: 1.2
 Max. Temperature: 65° C
 Other: This target has micro-prism geometry.



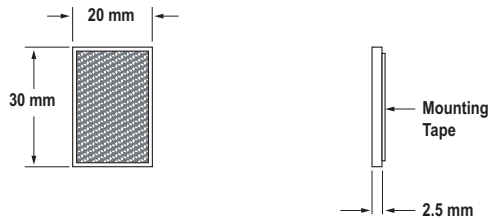
BRT-30X20M

Description: Rectangular, acrylic target
 Reflectivity Factor: 1.2
 Max. Temperature: 65° C



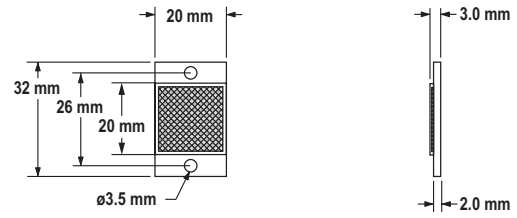
BRT-30X20MT

Description: Rectangular, acrylic target includes mounting tape
 Reflectivity Factor: 1.2
 Max. Temperature: 65° C



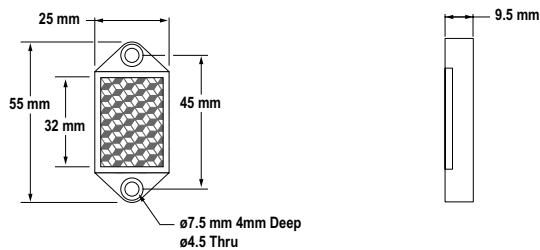
BRT-32X20AM

Description: Rectangular, thin profile acrylic target
 Reflectivity Factor: 1.2
 Max. Temperature: 65° C
 Other: This target has micro-prism geometry.



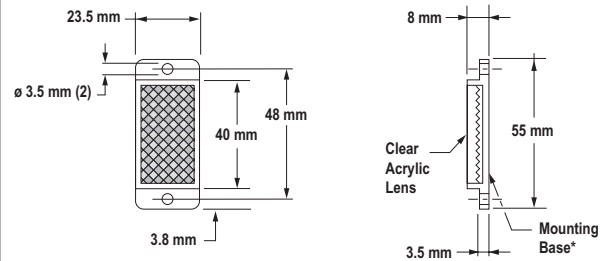
BRT-32X22A

Description: Rectangular, acrylic target
 Reflectivity Factor: 1.3
 Max. Temperature: 65° C



**BRT-35X20A
 BRT-35X20AB**

Description: Rectangular, acrylic target*
 Reflectivity Factor: 1.4
 Max. Temperature: 50° C



BRACKETS

CABLES

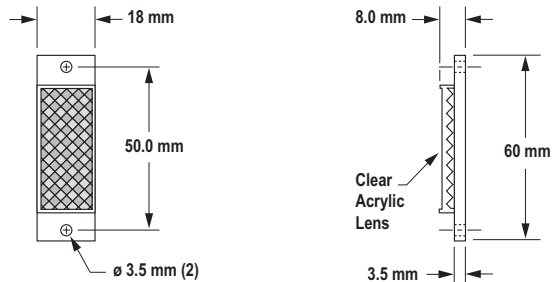
RETROREFLECTORS

ENCLOSURES/
 LENS SHIELDS

MISCELLANEOUS

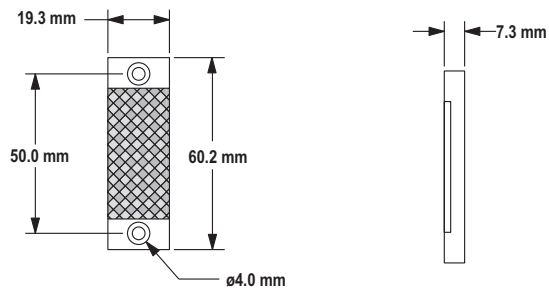
BRT-40X18A

Description: Rectangular, acrylic target
 Reflectivity Factor: 1.0
 Max. Temperature: 50° C



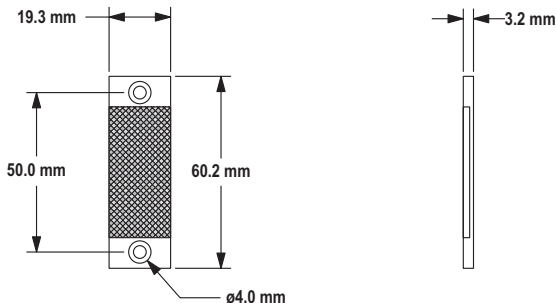
BRT-40X19A

Description: Rectangular, acrylic target
 Reflectivity Factor: 1.3
 Max. Temperature: 50° C



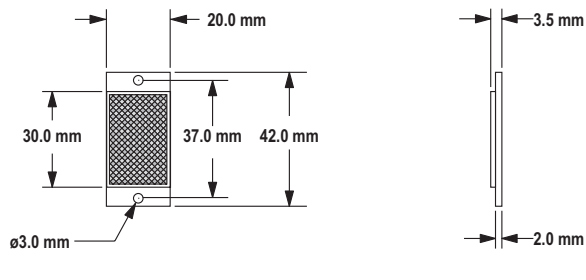
BRT-40X19AM

Description: Rectangular, thin profile acrylic target
 Reflectivity Factor: 1.2
 Max. Temperature: 50° C
 Other: This target has micro-prism geometry.



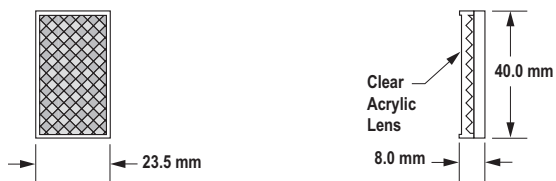
BRT-40X20AM

Description: Rectangular, thin profile acrylic target
 Reflectivity Factor: 1.2
 Max. Temperature: 50° C
 Other: This target has micro-prism geometry.



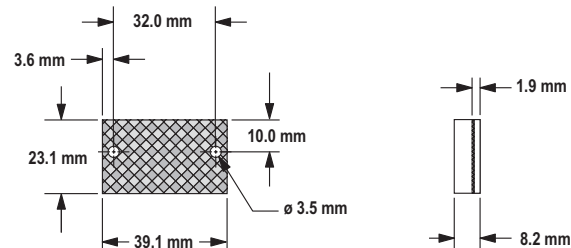
BRT-40X23

Description: Rectangular, acrylic target
 Reflectivity Factor: 1.4
 Max. Temperature: 50° C



BRT-40X23A

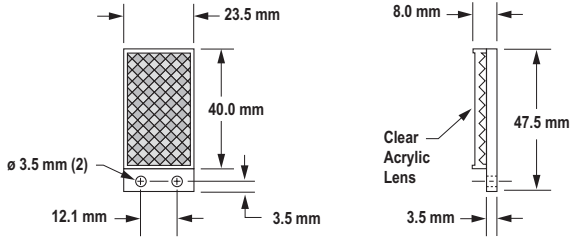
Description: Rectangular, acrylic target
 Reflectivity Factor: 1.4
 Max. Temperature: 50° C



BRACKETS
 CABLES
 RETROREFLECTORS
 ENCLOSURES/
 LENS SHIELDS
 MISCELLANEOUS

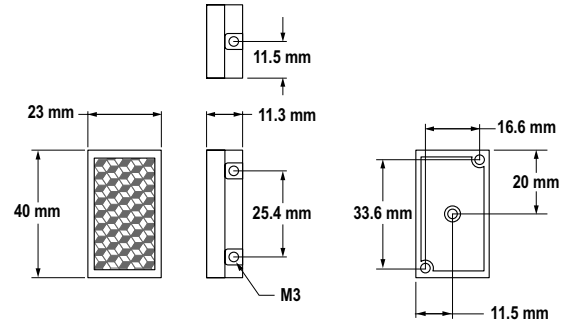
BRT-40X23B

Description: Rectangular, acrylic target
 Reflectivity Factor: 1.4
 Max. Temperature: 50° C



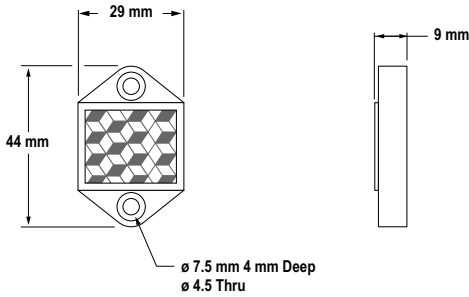
BRT-40X23ABC

Description: Rectangular, acrylic target
 Reflectivity Factor: 1.4
 Max. Temperature: 50° C



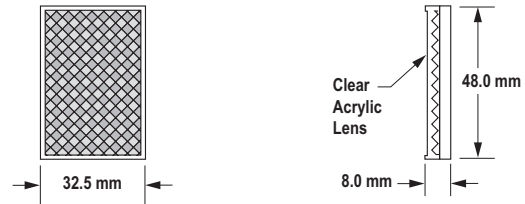
BRT-44X29A6

Description: Rectangular, acrylic target
 Reflectivity Factor: 1.1
 Max. Temperature: 50° C
 Other: 6 mm facets; close to the face retroreflective sensing with bifurcated lens.



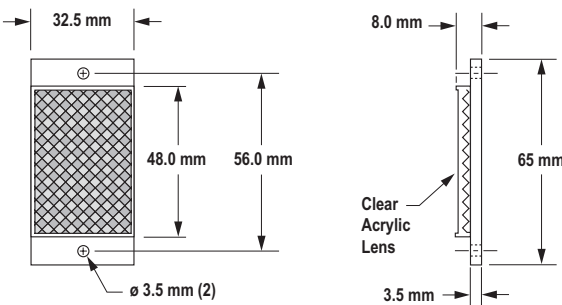
BRT-48X32

Description: Rectangular, acrylic target
 Reflectivity Factor: 1.0
 Max. Temperature: 50° C



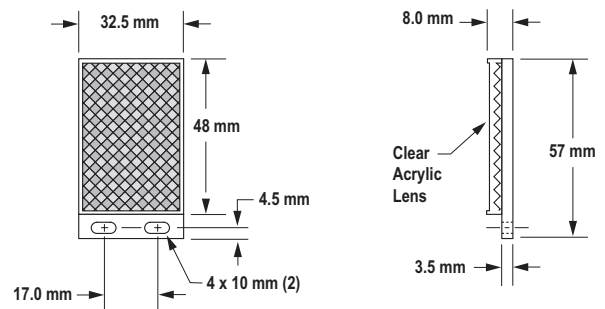
BRT-48X32A

Description: Rectangular, acrylic target
 Reflectivity Factor: 1.0
 Max. Temperature: 50° C



BRT-48X32B

Description: Rectangular, acrylic target
 Reflectivity Factor: 1.0
 Max. Temperature: 50° C



BRACKETS

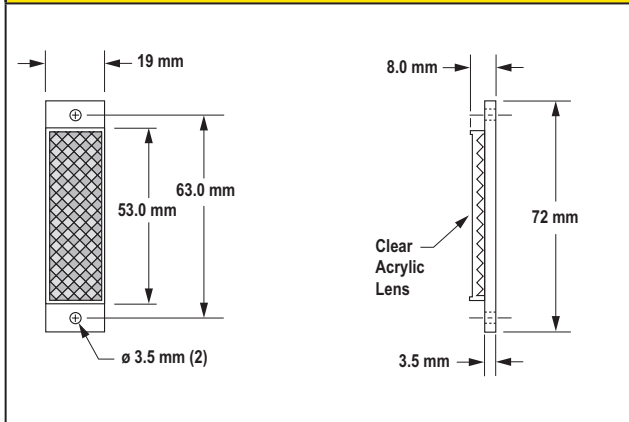
CABLES

RETROREFLECTORS

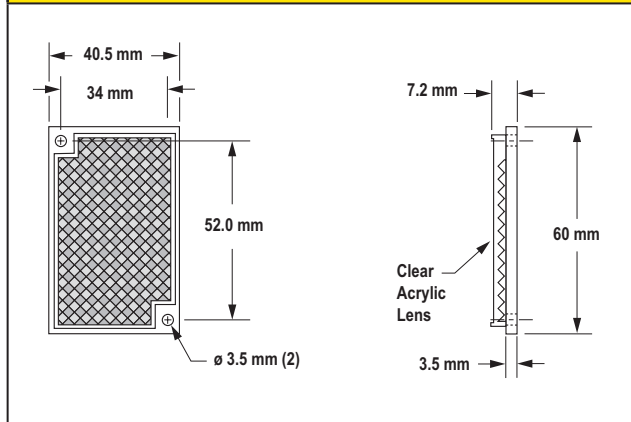
ENCLOSURES/
LENS SHIELDS

MISCELLANEOUS

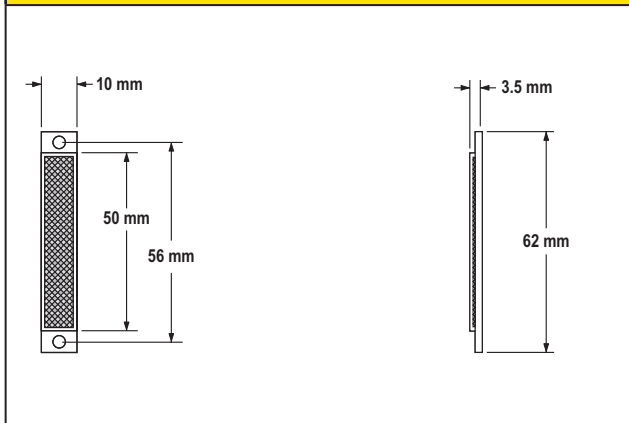
BRT-53X19A
 Description: Rectangular, acrylic target
 Reflectivity Factor: 1.4
 Max. Temperature: 50° C



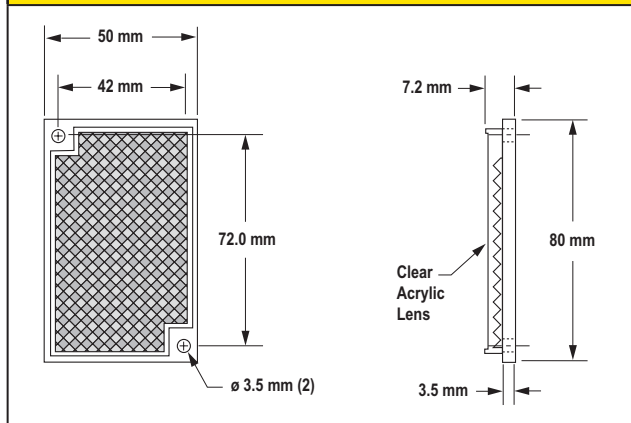
BRT-60X40C
 Description: Rectangular, acrylic target
 Reflectivity Factor: 1.4 Max. Temperature: 50° C
 Other: This target has micro-prism geometry. Optional brackets are available. See page 376.



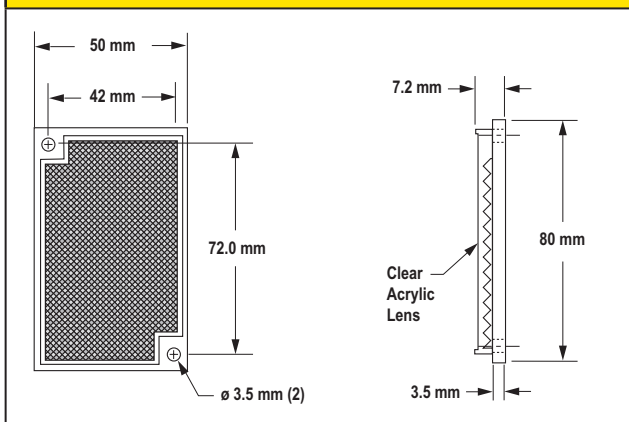
BRT-62X10AM
 Description: Rectangular, thin profile acrylic target
 Reflectivity Factor: 1.2
 Max. Temperature: 65° C
 Other: This target has micro-prism geometry.



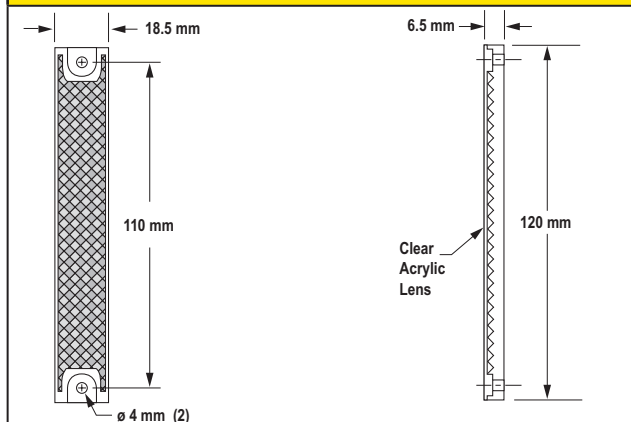
BRT-80X50C
 Description: Rectangular, acrylic target
 Reflectivity Factor: 1.4
 Max. Temperature: 65° C



BRT-80X50CM
 Description: Rectangular, acrylic target
 Reflectivity Factor: 1.4
 Max. Temperature: 65° C
 Other: This target has micro-prism geometry.



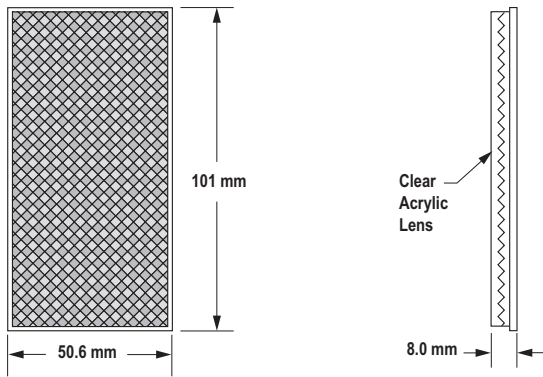
BRT-100X18A
 Description: Rectangular, acrylic target
 Reflectivity Factor: 1.4
 Max. Temperature: 50° C



- BRACKETS
- CABLES
- RETROREFLECTORS
- ENCLOSURES/
LENS SHIELDS
- MISCELLANEOUS

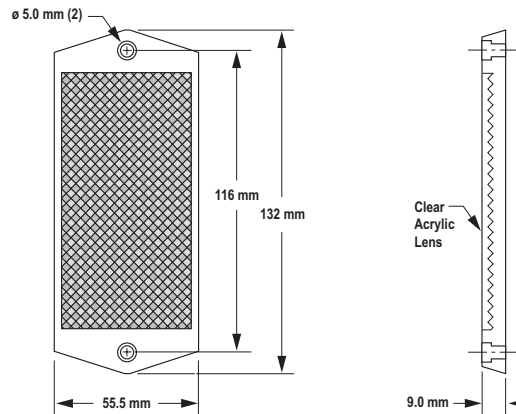
BRT-100X50

Description: Rectangular, acrylic target
 Reflectivity Factor: 1.5
 Max. Temperature: 50° C



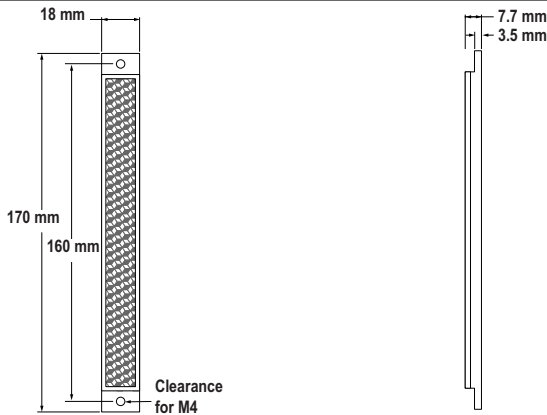
BRT-100X55A

Description: Rectangular, acrylic target
 Reflectivity Factor: 1.5
 Max. Temperature: 50° C



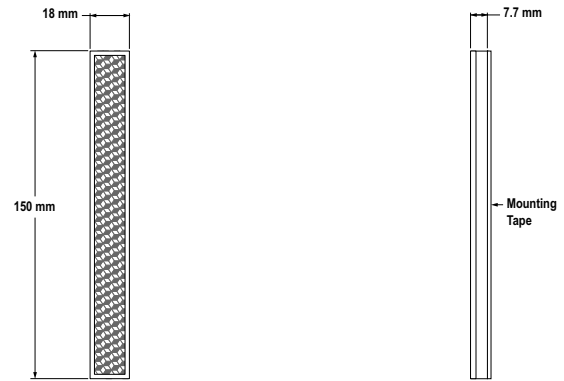
BRT-150X18A

Description: Rectangular, acrylic target
 Reflectivity Factor: 1.4
 Max. Temperature: 65° C



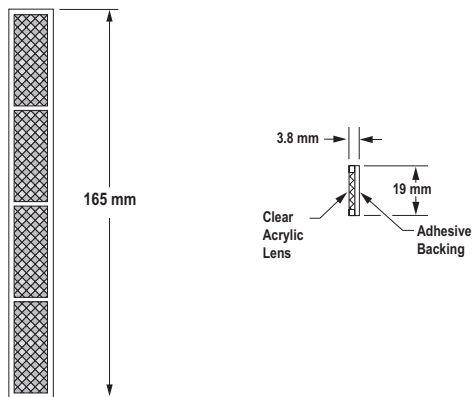
BRT-150X18T

Description: Rectangular, acrylic target includes mounting tape.
 Reflectivity Factor: 1.4
 Max. Temperature: 65° C



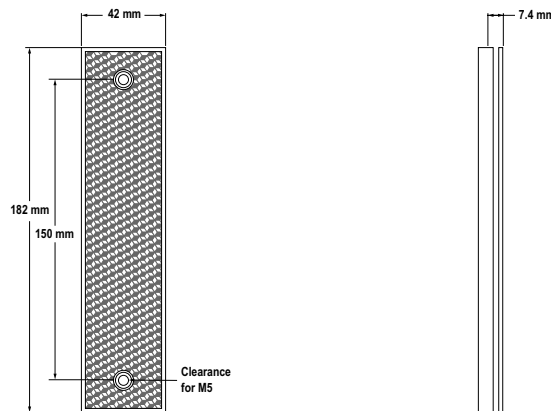
BRT-L

Description: Rectangular, acrylic target
 Reflectivity Factor: 0.8
 Max. Temperature: 65° C



BRT-180X40A

Description: Rectangular, acrylic target
 Reflectivity Factor: 1.4
 Max. Temperature: 50° C



BRACKETS

CABLES


RETROREFLECTORS

ENCLOSURES/
LENS SHIELDS

MISCELLANEOUS

Retroreflective Tape

NOTE: Sensing range and signal strength at any given sensor-to-target distance will vary due to target reflectivity and target area. A "Reflectivity Factor" is included for each target model to help predict sensor performance, relative to the excess gain curve plotted for target model BRT-3. Consider, also, target area when predicting performance. Changing to a high reflectivity reflector (like BRT-92X92C) may also extend sensor range and/or reduce the need for frequent reflector maintenance. A high reflectivity factor AND large surface area are needed for maximum range.

Model	Reflectivity Factor	Maximum Temperature	Size	Unit	
BRT-THG-3X3-10	0.7	60° C	75 x 75 mm	10 per pack	
BRT-THG-4X4-5	0.7	60° C	100 x 100 mm	5 per pack	
BRT-THG-8.5X11-2	0.7	60° C	216 x 280 mm	2 per pack	
BRT-THG-18X36	0.7	60° C	457 x 914 mm	Single sheet	
BRT-THG-1-100	0.7	60° C	25 mm wide	2.5 m length	
BRT-THG-2-100	0.7	60° C	50 mm wide	2.5 m length	
BRT-THG-3-100	0.7	60° C	75 mm wide	2.5 m length	
BRT-THT-100†	0.07	175° C	25 mm wide	2.5 m length	
BRT-TVHG-2X2*	0.8	60° C	50 x 50 mm	4 per pack	
BRT-TVHG-8X10P	0.8	60° C	203 x 254 mm	1 per pack	

NOTE: Retroreflective material has a pressure-sensitive adhesive. For maximum adhesion, surfaces must be clean and dry before applying. For best results, use full size; target may be trimmed as necessary.

- † These targets are not recommended for polarized retroreflective sensors.
- * These are sealed micro-prism style pieces and may not be cut.
Suitable for use with Laser sensors, VS3 sensors and SME312LPC model sensors.
Not suggested for close range (less than 102 mm) except with VS3 sensors.

- BRACKETS
- CABLES
- RETROREFLECTORS
- ENCLOSURES/
LENS SHIELDS
- MISCELLANEOUS

Tubular Enclosures

- Available for A-GAGE® EZ-ARRAY™ or MINI-ARRAY®
- Ideal for high-power washdown environments
- Made of clear FDA-grade polycarbonate tubing, with acetal end caps
- Includes stainless mounting brackets and hardware
- Rated NEMA 4X; IP67



EZA-TE Tubular Enclosures

Model	Used With		Enclosure Height (L)	Data Sheet
	Emitter/Receiver Model	Emitter/Receiver Array Length		
EZA-TE-150	EZ-ARRAY	EA5..-150	150 mm	117107
EZA-TE-300		EA5..-300	300 mm	
EZA-TE-450		EA5..-450	450 mm	
EZA-TE-600		EA5..-600	600 mm	
EZA-TE-750		EA5..-750	750 mm	
EZA-TE-900		EA5..-900	900 mm	
EZA-TE-1050		EA5..-1050	1050 mm	
EZA-TE-1200		EA5..-1200	1200 mm	
EZA-TE-1500		EA5..-1500	1500 mm	
EZA-TE-1800		EA5..-1800	1800 mm	

NOTE: Use of the enclosure affects the sensing range of the emitter/receiver used: when in pairs, range can be reduced by 50%.

MSA-TE Tubular Enclosures



Model	Used With		Enclosure Height (L)	Data Sheet
	Emitter/Receiver Model	Emitter/Receiver Array Length		
MSA-TE-4	MINI-ARRAY	BMEL616A/BMRL616A	133 mm	109307
		BMEL632A/BMR632A	143 mm	
	High-Resolution MINI-ARRAY	MAHE6A/MAHR6A	163 mm	
MSA-TE-8	MINI-ARRAY	BMEL1216A/BMRL1216A	286 mm	
		BMEL1232A/BMR1232A	295 mm	
	High-Resolution MINI-ARRAY	MAHE13A/MAHR13A	325 mm	
MSA-TE-12	MINI-ARRAY	BMEL1816A/BMRL1816A	438 mm	
		BMEL1832A/BMRL1832A	448 mm	
MSA-TE-16	High-Resolution MINI-ARRAY	MAHE19A/MAHR19A	488 mm	
MSA-TE-20	MINI-ARRAY	BMEL2416A/BMRL2416A	591 mm	
		BMEL2432A/BMRL2432A	600 mm	
	High-Resolution MINI-ARRAY	MAHE26A/MAHR26A	600 mm	
MSA-TE-24	MINI-ARRAY	BMEL3016A/BMRL3016A	743 mm	
		BMEL3032A/BMRL3032A	752 mm	
MSA-TE-28	High-Resolution MINI-ARRAY	MAHE32A/MAHR32A	813 mm	

NOTE: Use of the enclosure affects the sensing range of the emitter/receiver used: when in pairs, range can be reduced by 50%.



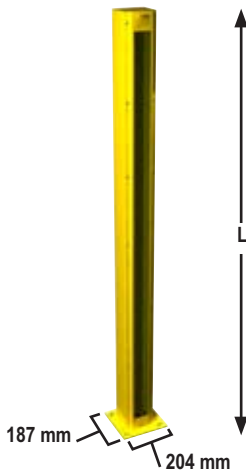
BRACKETS
CABLES
RETROREFLECTORS
ENCLOSURES/LENS SHIELDS
MISCELLANEOUS



MSA-TE Tubular Enclosures (cont'd)

Model	Used With		Enclosure Height (L)	Data Sheet
	Emitter/Receiver Model	Emitter/Receiver Array Length		
MSA-TE-32	MINI-ARRAY	BMEL3616A/BMRL3616A	895 mm	109307
		BMEL3632A/BMRL3632A	905 mm	
	High-Resolution MINI-ARRAY	MAHE38A/MAHR38A	975 mm	
MSA-TE-36	MINI-ARRAY	BMEL4216A/BMRL4216A	1048 mm	
		BMEL4232A/BMRL4232A	1057 mm	
MSA-TE-40	High-Resolution MINI-ARRAY	MAHE45A/MAHR45A	1138 mm	
MSA-TE-44	MINI-ARRAY	BMEL4816A/BMRL4816A	1200 mm	
		BMEL4832A/BMRL4832A	1210 mm	
MSA-TE-48	High-Resolution MINI-ARRAY	MAHE51A/MAHR51A	1300 mm	

NOTE: Use of the enclosure affects the sensing range of the emitter/receiver used: when in pairs, range can be reduced by 50%.



Heated Enclosures

- Available for A-GAGE® MINI-ARRAY® or High-Resolution MINI-ARRAY®
- Protects emitter/receiver in outdoor environments
- Includes humidistat and resistance wires to keep window free of condensation, snow or ice
- Provides choice of stainless steel or aluminum housings



MINI-ARRAY® and High-Resolution MINI-ARRAY® Heated Enclosures



Models*	Material	Finish**	Array Length	Overall Enclosure Height (L)	Clear Window Height	Data Sheet
BMHE4A/BMHL4G	Aluminum	Painted	133 to 1210 mm	1.7 m	1.5 m	55557
BMHE5A/BMHL5G	Aluminum	Painted	1505 to 1514 mm	2.0 m	1.8 m	
BMHE6A/BMHL6G	Aluminum	Painted	1810 to 1819 mm	2.2 m	2.0 m	
BMHE4SS/BMHL4GSS	Stainless Steel	Painted	133 to 1210 mm	1.7 m	1.5 m	
BMHE5SS/BMHL5GSS	Stainless Steel	Painted	1505 to 1514 mm	2.0 m	1.8 m	
BMHE6SS/BMHL6GSS	Stainless Steel	Painted	1810 to 1819 mm	2.2 m	2.0 m	
BMHE4SSN/BMHL4GSSN	Stainless Steel	Non-painted	133 to 1210 mm	1.7 m	1.5 m	
BMHE5SSN/BMHL5GSSN	Stainless Steel	Non-painted	1505 to 1514 mm	2.0 m	1.8 m	
BMHE6SSN/BMHL6GSSN	Stainless Steel	Non-painted	1810 to 1819 mm	2.2 m	2.0 m	

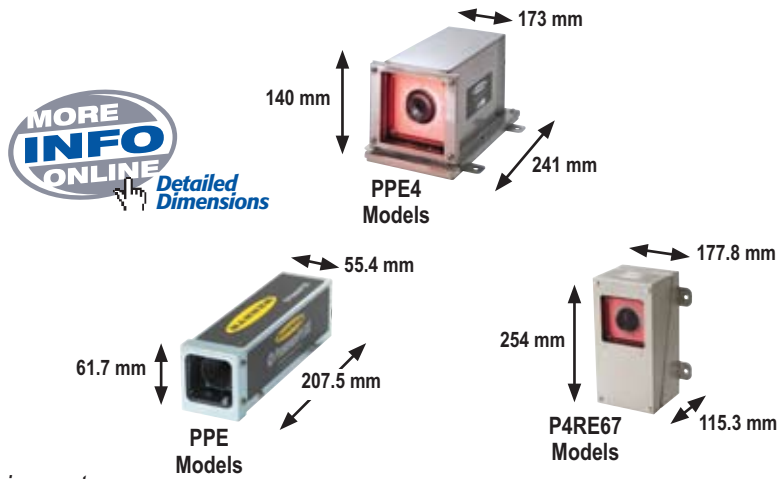
* Enclosures require a power supply (see page 447).

** Standard color is Federal Safety Yellow (Federal Standard color# 23538). Contact Factory for other colors.



PresencePLUS® Enclosure Kits

- Protects sensor, ring light or both
- Keeps dust and dirt off lens and light
- Prevents accidental bumps and scratches
- Discourages vandalism and tampering
- Helps maintain lens focus by enclosing the lens and sensor
- Available in models that protect camera and light during washdown
- Offers choice of models with glass or plastic viewport



PresencePLUS® Enclosure Kits



Model	Description	Used With	Data Sheet
P4RE67-G	Heavy-duty stainless-steel enclosure kit—glass viewport; NEMA 6 rated	P4 (right-angle) & Ring Light	121996
P4RE67-P	Heavy-duty stainless-steel enclosure kit—polycarbonate viewport; NEMA 6 rated		
PPE-G	Heavy-duty cold-rolled steel industrial protection kit—glass viewport; NEMA 1 rated	Pro Camera & Lens	115342
PPE-P	Heavy-duty cold-rolled steel industrial protection kit—polycarbonate viewport; NEMA 1 rated		
PPE-RG	Replacement viewport—glass	PPE-G	—
PPE-RP	Replacement viewport—polycarbonate	PPE-P	
SMBPPES	Straight Mounting bracket	PPE-P & PPE-G	—
SMBPPEA	Right-angle mounting bracket		
SMBPPEF	Front mounting bracket		
PPE4-G	Heavy-duty stainless-steel enclosure kit—glass viewport; NEMA 4 rated	Pro Camera & Ring Light	111362
PPE4-P	Heavy-duty stainless-steel enclosure kit—polycarbonate viewport; NEMA 4 rated		

- BRACKETS
- CABLES
- RETROREFLECTORS
- ENCLOSURES/ LENS SHIELDS
- MISCELLANEOUS

Lens Shields

- Covers the lens of the emitter/receiver to prevent damage
- Available for EZ-ARRAY™, MINI-ARRAY® and High-Resolution MINI-ARRAY®
- Installs easily
- Made of rugged polycarbonate



A-GAGE® EZ-ARRAY™ Lens Shields



Model	Installation	Used With		Lens Shield Length (L)	Data Sheet
		Emitter/Receiver Model	Emitter/Receiver Array Length		
EZS-150EA	Adhesive	EA5..150	150 mm	218 mm	61960
EZSS-150EA	Snap-on			196 mm	127944
EZS-300	Adhesive	EA5..300	300 mm	368 mm	61960
EZSS-300	Snap-on			346 mm	127944
EZS-450	Adhesive	EA5..450	450 mm	518 mm	61960
EZSS-450	Snap-on			496 mm	127944
EZS-600	Adhesive	EA5..600	600 mm	667 mm	61960
EZSS-600	Snap-on			645 mm	127944
EZS-750	Adhesive	EA5..750	750 mm	817 mm	61960
EZSS-750	Snap-on			795 mm	127944
EZS-900	Adhesive	EA5..900	900 mm	967 mm	61960
EZSS-900	Snap-on			945 mm	127944
EZS-1050	Adhesive	EA5..1050	1050 mm	1116 mm	61960
EZSS-1050	Snap-on			1094 mm	127944
EZS-1200	Adhesive	EA5..1200	1200 mm	1266 mm	61960
EZSS-1200	Snap-on			1244 mm	127944
EZS-1500	Adhesive	EA5..1500	1500 mm	1565 mm	61960
EZSS-1500	Snap-on			1543 mm	127944
EZS-1800	Adhesive	EA5..1800	1800 mm	1865 mm	61960
EZSS-1800	Snap-on			1843 mm	127944
EZSS-2100	Snap-on	EA5..2100	2100 mm	2144 mm	127944
EZSS-2400	Snap-on	EA5..2400	2400 mm	2444 mm	127944

NOTE: When shields are installed on both the emitter and receiver, maximum operating range is reduced by 20%.

A-GAGE® MINI-ARRAY® Lens Shields



Model	Installation	Used With		Lens Shield Length (L)	Data Sheet
		Emitter/Receiver Model	Emitter/Receiver Array Length		
MSS12	Adhesive	MINI-ARRAY	BMEL1216A/BMRL1216A	341 mm	44418
			BMEL1232A/BMRL1232A		
MSS24			BMEL2416A/BMRL2416A	643 mm	
			BMEL2432A/BMRL2432A		

NOTE: When shields are installed on both the emitter and receiver, maximum operating range is reduced by 20%.

* Other shield lengths are available, contact factory at 1-888-373-6767.





A-GAGE® MINI-ARRAY® Lens Shields (cont'd)

Model	Installation	Used With		Lens Shield Length (L)	Data Sheet
		Emitter/Receiver Model	Emitter/Receiver Array Length		
MSS36	Adhesive	MIN-ARRAY	BMEL3616A/BMRL3616A	895 mm	948 mm
			BMEL3632A/BMRL3632A	905 mm	
MSS48			BMEL4816A/BMRL4816A	1200 mm	1253 mm
			BMEL4832A/BMRL4832A	1210 mm	

NOTE: When shields are installed on both the emitter and receiver, maximum operating range is reduced by 20%.
 * Other shield lengths are available, contact factory at 1-888-373-6767.



LX Lens Shields

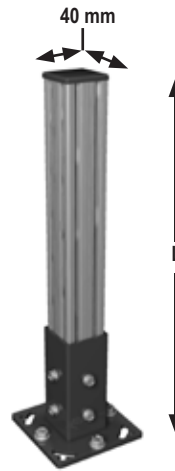
Model	Installation	Used With		Lens Shield Length (L)	Data Sheet
		Emitter/Receiver Model	Array Length		
LXS3	Adhesive	LX3 models	67 mm	98.3 mm	113743
LXS6		LX6 models	143 mm	174.5 mm	
LXS12		LX12 models	295 mm	326.9 mm	

NOTE: When shields are installed on both the emitter and receiver, maximum operating range is reduced by 20%.

- BRACKETS
- CABLES
- RETROREFLECTORS
- ENCLOSURES/ LENS SHIELDS
- MISCELLANEOUS

MSA Stands

- Supports emitters and receivers
- Available without stand base, for attaching to a surface
- Available in four heights
- Assembles easily
- Includes mounting hardware.



MSA Stands

Model*	Description	Stand Height (L)	Data Sheet
MSA-S24-1	EZ-ARRAY, MINI-ARRAY and High-Resolution MINI-ARRAY	610 mm	43687
MSA-S42-1		1067 mm	
MSA-S66-1		1676 mm	
MSA-S84-1		2132 mm	

* Available without base by adding suffix **NB** to model number (example, **MSA-S24-1NB**)

Adjustable Mounting Systems

- Provides flexible mounting and positioning of sensors and lights
- Includes 3" and 6" column mounting kits for mounting area lights and backlights
- Features Bogen Arm and clamp for use with P4 and Pro sensors
- Offers 2" mounting knuckle assembly for spot lights





MSA Stands

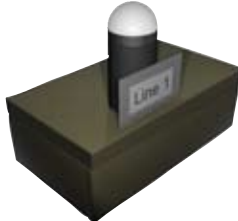

Model	Description	Used With
SMBPPK3	3" Column, Base, and Knuckle Kit	Pro P4 Vision Lights
SMBPPK6	6" Column, Base, and Knuckle Kit	
SMBPPK	Mounting Bracket Knuckle	
SMBPPKE3	3" Column	
SMBPPKE6	6" Column	
SMBPPKB	Mounting Bracket Base	
SMBPPLK	2" Mounting Knuckle Assembly	
SMBPPF1	Bogen Arm with Single Knob	
SMBPPFB	Bogen Arm Clamp	

BRACKETS
CABLES
RETROREFLECTORS
ENCLOSURES/
LENS SHIELDS
MISCELLANEOUS


Elevated Use—Stand-off Pipe, Brackets and Adapters

	Model	Description	Length	Used With
	SA-M30E12	Thermoplastic Acetal adapter and cover (M30 to 1/2" NPSM/DN15)	—	SOP-E12-150SS SOP-E12-300SS
	SOP-E12-150SS	Stainless steel pipe (1/2" NPSM/DN15)	150 mm	K50L K80L
	SOP-E12-300SS		300 mm	
	SA-E12M30	Thermoplastic Acetal mounting base (1/2" NPSM/DN15 to M30)	—	SOP-E12-150SS SOP-E12-300SS
	SMBE12USS	Stainless steel bracket for wall or other flat surfaces	—	

Elevated Use—Cabinet Mounts and Extensions

	Model	Description	Length	Used With
	SA-M30M30-75	Thermoplastic Acetal standoff with 30 mm mounting base for cabinet mounting or use with most 30 mm brackets	75 mm	K50L
	SA-30RL55X93	Zinc coated, oversized right-angle legend plate for identification labels	—	SA-M30M30-75
	SA-M22M22-50	Thermoplastic Acetal standoff with 22.5 mm mounting base for cabinet mounting	50 mm	K30L

Elevate Use—Hanging Bracket

	Model	Description	Length	Used With
	SA-30RL55X93C	Zinc coated bracket with strain relief	—	K50 Push Button VTB

BRACKETS

CABLES

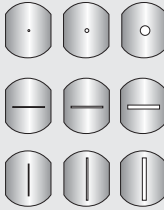
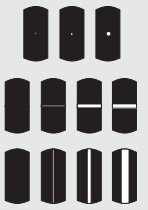






RETROREFLECTORS

ENCLOSURES/
LENS SHIELDS

MISCELLANEOUS

Apertures and Aperture Kits

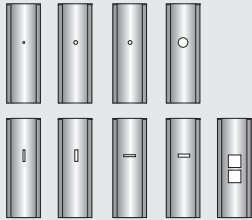
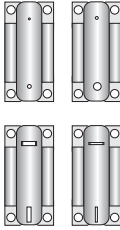

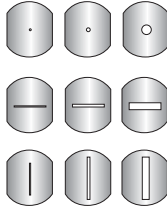
Opposed-mode sensors may be fitted with apertures which narrow or shape the effective beam of the sensor to more closely match the size or profile of the object to be sensed. A common example is the use of “line” or “slit” type aperture when wire or thread is being sensed.

Model	Aperture Description	Units	Product	Used With
APQS18-020	Circular, 0.5 mm dia.	6		QS18 Opposed-mode
APQS18-040	Circular, 1.0 mm dia.	6		
APQS18-100	Circular, 2.5 mm dia.	6		
APQS18-020H	Horizontal, slotted, 0.5 x 6.4 mm	6		
APQS18-040H	Horizontal, slotted, 1.0 x 6.4 mm	6		
APQS18-100H	Horizontal, slotted, 2.5 x 6.4 mm	6		
APQS18-020V	Vertical, slotted, 0.5 x 12.7 mm	6		
APQS18-040V	Vertical, slotted, 1.0 x 12.7 mm	6		
APQS18-100V	Vertical, slotted, 2.5 x 12.7 mm	6		
APQS18-DVHX2	Kit with 2 of each aperture	18		
APQ20-0.5	Circular, 0.5 mm dia.	2		
APQ20-1	Circular, 1 mm dia.	2		
APQ20-2	Circular, 2 mm dia.	2		
APQ20-0.5V	Vertical, slotted, 0.5 mm	2		
APQ20-1V	Vertical, slotted, 1 mm	2		
APQ20-2V	Vertical, slotted, 2 mm	2		
APK-Q20	Kit with 2 of each aperture	12		
AP31-020	Circular, 0.5 mm dia.	20		MINI-BEAM Opposed-mode
AP31-040	Circular, 1.0 mm dia.	20		
AP31-100	Circular, 2.5 mm dia.	20		
AP31-020H	Horizontal, slotted, 0.5 x 6.4 mm	20		
AP31-040H	Horizontal, slotted, 1.0 x 6.4 mm	20		
AP31-100H	Horizontal, slotted, 2.5 x 6.4 mm	20		
AP31-200H	Horizontal, slotted, 5.1 x 6.4 mm	20		
AP31-020V	Vertical, slotted, 0.5 x 12.7 mm	20		
AP31-040V	Vertical, slotted, 1.0 x 12.7 mm	20		
AP31-100V	Vertical, slotted, 2.5 x 12.7 mm	20		
AP31-200V	Vertical, slotted, 5.1 x 12.7 mm	20		
AP31-DVHX2	Kit with 2 of each aperture	22		
AP18SC*	Kit includes 3 round apertures of: 0.5, 1.0 & 2.5 mm dia.	3		S18 & M18
AP18SR*	Kit includes 3 rectangular apertures of: 0.5, 1.0 & 2.5 mm dia.	3		S18 & M18
AP18SCN*	Kit includes 3 round apertures of: 0.5, 1.0 & 2.5 mm dia.	3		T18
AP18SRN*	Kit includes 3 rectangular apertures of: 0.5, 1.0 & 2.5 mm dia.	3		T18
APG18S	Kit with glass lens to protect plastic sensor lens from chemical environments	1		S18, M18 & T18
* Kits include Teflon® FEP® lens, o-ring and thread-on housing.				
APG30S	Kit includes: a thread-on stainless steel housing, a flat glass lens, two quad-ring seals, and 3 round and 3 slotted aperture disks	1		SM30

* Teflon® is a registered trademark of Dupont™.




Apertures and Aperture Kits (cont'd)

Model	Aperture Description	Units	Product	Used With
APQ12-.5	Circular, 0.5 mm dia.	10		Q12 Opposed-mode
APQ12-1	Circular, 1.0 mm dia.	10		
APQ12-1.5	Circular, 1.5 mm dia.	10		
APQ12-2	Circular, 2.0 mm dia.	10		
APQ12-.5H	Horizontal, slotted, 0.5 mm dia.	10		
APQ12-1H	Horizontal, slotted, 1.0 mm dia.	10		
APQ12-.5V	Vertical, slotted, 0.5 mm dia.	10		
APQ12-1V	Vertical, slotted, 1.0 mm dia.	10		
APQ12-4S	Protective jacket, 4 mm square	10		
APKQ12	Kit containing 2 of each aperture	18		
APVS2-0204	Circular, 2 openings, 0.5 & 1.0 mm dia.	2		VS2 Opposed-mode
APVS2-0608	Circular, 2 openings, 1.5 and 2.0 mm dia.	2		
APVS2-02R	Horizontal (1) and vertical (1), slotted, 0.5 mm wide	2		
APVS2-04R	Horizontal (1) and vertical (1), slotted, 1.0 mm wide	2		
APVS4-0206	Circular, 2 openings, 0.5 & 1.5 mm dia.	2		VS4 Opposed-mode
APVS4-0408	Circular, 2 openings, 1.0 & 2.0 mm dia.	2		
APQS30-040	Circular, 1.0 mm dia.	6		QS30 Opposed-mode
APQS30-100	Circular, 2.5 mm dia.	6		
APQS30-200	Circular, 5 mm dia.	6		
APQS30-040H	Horizontal, slotted, 1 x 12 mm	6		
APQS30-100H	Horizontal, slotted, 2.5 x 12 mm	6		
APQS30-200H	Horizontal, slotted, 5 x 12 mm	6		
APQS30-040V	Vertical, slotted, 1 x 17 mm	6		
APQS30-100V	Vertical, slotted, 2.5 x 17 mm	6		
APQS30-200V	Vertical, slotted, 5 x 17 mm	6		
APQS30-DVHX2	Kit with 3 of each aperture	18		

Ultrasonic Wave Guides

Guide attaches to 18 mm threaded barrel of ultrasonic sensors to focus ultrasonic sensing beam.



Model	Size	Style	Product	Used With	Data Sheet
UWG18-5.0	5.0 mm inside dia.	Barrel		QS18U S18U	130153
USWG18-6.4	6.4 mm inside dia.	Barrel			

Replacement Lens Assemblies

Lens assemblies are field-replaceable. In addition, some lenses may be used to convert from one sensing mode to another, or to change the sensing range of a particular sensor. The possible conversions are listed in the table below.

Model	Replacement Lens for	Possible Sensing Mode or Range Changes	Used With
UC-300AG	LVAG	Change LV to LVAG	MINI-BEAM
UC-300BZ	W and DBZ	Change D to DBZ and F to DBZ	
UC-300C.7	C, CV and CVG	Change CV2 to CV	
UC-300C2	C2 and CV2	Change CV to CV2	
UC-300E	E and R	—	
UC-300EL	EL and RL	Extend range of E/R	
UC-300EPD	EPD	—	
UC-300F	F and FV	Change D to F and DBZ to F	
UC-300FP	FP (old style)	—	
UC-300FP2	FP	—	
UC-300L	LV and D	Change F to D, LVAG to LV and DBZ to D	
UC-300LP	LP	—	
UC-300RPD	RPD	—	
UC-45L	E, R, DL, DX and LV	N/A	Q45
UC-45LL	LL		
UC-45LLP	LLP		
UC-45LP	LP		
UC-45D	D		
UC-45F	F and FV		
UC-45FP	FP		
UC-45C	CV		
UC-45C4	CV4		
OUC-C	CV, CVB and CVG	N/A	OMNI-BEAM
OUC-D	D		
OUC-F	F, FAC, FV, FVB, FVG, FX, EF and RF		
OUC-FP	FP, FPB and FPG		
OUC-L	DX, LV, E and R		
OUC-LAG	LVAG and LVAGC		
UC-R55	R58E	N/A	R58E

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Laser Alignment Tools

Model	Description	Supply Voltage	Used With	Data Sheet
LAT-1	 <ul style="list-style-type: none"> Simplifies the alignment of any opposed-mode sensor pair Class 2 visible red laser beam Aluminum housing with black anodized finish Rated NEMA 1; IEC IP50 	9V battery for 20 hours of continuous use	Opposed-mode sensors	54599
LAT-1-SS			EZ-ARRAY	
LAT-2	 <p>LAT-2 shown with LT7</p> <ul style="list-style-type: none"> Allows for long distance alignment greater than 50 m Clip-on attachment for sensor 	—	LT7	120244
LAT1812	 <ul style="list-style-type: none"> Enables easy sensor alignment at long distances Kit includes one SMB1812 bracket and M12 laser emitter (Class 2 visible red laser) Clip-on attachment for 18 mm threaded barrel sensors 	10 to 30V dc	18 mm threaded barrel sensors	—
LAT3012	 <ul style="list-style-type: none"> Enables easy sensor alignment at long distances Kit includes one SMB3012 bracket and M12 laser emitter (Class 2 visible red laser) Clip-on attachment for 30 mm threaded barrel sensors 	10 to 30V dc	30 mm threaded barrel sensors	—

BEAM-TRACKER™ Alignment Tool

The BEAM-TRACKER is a low-cost, wireless, battery-operated, and completely self-contained photoelectric diagnostic sensor. It is a quick and simple way to evaluate photoelectric system performance. It receives light from all modulated photoelectric emitters and transmits light to receivers to check the system operation. It has a built-in frequency emitter that will be detected by any Banner photoelectric receiver, as well as by those of most other photoelectric manufacturers. It is a valuable tool for locating the center of the beam when installing long-range opposed-mode photoelectric sensor pairs and for locating sources of severe EMI and RFI noise.



Model	Supply Voltage	Beam	Construction	Data Sheet
BT-1	9V battery for 10 hours of continuous use	70 kHz infrared	Cyclac® T case	03490

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Portable Demo Box

The Portable Demo Box is used to power dc self-contained photoelectric sensors for testing purposes. It is battery-powered and features bicolor LEDs which indicate sensor output status and output type (NPN or PNP). It is designed for a 4-pin Euro-style connector, but cable adapters are available to convert to Pico-style or Mini-style connectors. A 4-pin wiring barrier is mounted on the top of the box to allow connection of cabled dc sensors.

Model	Supply Voltage	Cable Type	Cable Adapters	Data Sheet
 DBQ5	3 - 9V battery	4-pin Euro	Euro-to-Pico p/n 39536 Euro-to-Mini p/n 39537	—


Test Power Supply

Test power supply is a 1 amp power supply used to power P4 sensors and lighting for proving an application without integration into a control panel.

Model	Input	Input	Trigger Option	Used With	Data Sheet
 P4D1	100-240V ac	North America (AC plug)	<ul style="list-style-type: none"> • 24V dc NPN Sensor • Continuous pulse • Single pulse 	P4 Vision Lighting	—


Portable Programming Box

The handheld Portable Programming Box communicates with the M-GAGE™ and T-GAGE®, enabling you to remotely configure a sensor that is underground or otherwise inaccessible.

Model	Supply Voltage	Optional 115V ac Adapter	Used With	Data Sheet
 DPB1	2 - 9V battery	SP-DPB1	M-GAGE T-GAGE	—

A-GAGE® MINI-ARRAY® Series Power Supplies for Heated Enclosures





Models	Used With	Primary	Secondary	Data Sheet
 BMHPS4	Two BMHE4 Enclosures	105 to 130V ac	23V ac	56831
BMHPS5	Two BMHE5 Enclosures	105 to 130V ac	27V ac	
BMHPS6	Two BMHE6 Enclosures	105 to 130V ac	35V ac	
BMHPS14	One BMHE4 Enclosure	105 to 130V ac	23V ac	
BMHPS15	One BMHE5 Enclosure	105 to 130V ac	27V ac	
BMHPS16	One BMHE6 Enclosure	105 to 130V ac	35V ac	

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Continuous Power Supplies

12 or 24V dc power supplies provide power to dc sensors and specialty lights.




Model	Input	Input Cord	Outputs	Output Cable	Used With	Data Sheet	
PSDINA-24-4 (DIN-rail mountable)	 100-240V ac 50/60 Hz	—	24V dc @ 4 A max.	—	dc Sensors Vision Lights	134840	
PSA-12	 100-250V ac 50/60 Hz	North America (NEMA 5-15)	12V dc $\pm 5\%$ with voltage regulation of $\pm 1\%$ 3.5 A max.	1.8 m Terminated with 9-pin D-sub connector (female pins)	Continuous LED Lights	67445	
PSA-12E		Cont. Europe (Schuko CEE 7)					
PSA-24		100-250V ac 50/60 Hz	North America (NEMA 5-15)	24V dc $\pm 5\%$ with voltage regulation of $\pm 1\%$ 2.2 A max.	1.8 m Terminated with 9-pin D-sub connector (female pins)	Continuous LED Lights	67447
PSA-24E			Cont. Europe (Schuko CEE 7)				
PSC-24*		115-250V ac 50/60 Hz (Auto Select)	North America (NEMA 5-15)	24V dc $\pm 5\%$ with voltage regulation of $\pm 1\%$ 2.2 A max.	1.8 m 2-wire Unterminated	SCM Strobe Control Module	67446
PSC-24E*			Cont. Europe (Schuko CEE 7)				

* These products are not stocked and are non-returnable.

Lighting Variable Power Supplies*

Variable power supplies provide power to two separate Banner continuous LED lights.



Model	Input	Input Cord	Outputs	Output Cable	Used With	Data Sheet
PS2V-12	 100-140V ac 60 Hz	North America (NEMA 5-15)	2-channels 6-12V dc	1.8 m Terminated with 9-pin D-sub connector (female pins)	Continuous LED Lights	67449
PS2V-12E		Cont. Europe (Schuko CEE 7)	2 A max. per channel			

* These products are not stocked and are non-returnable.


Lighting Power Supply Extension Cables*

Model	Length	Input Cord	Used With
DB906	1.8 m	Cable powers one continuous light (one end male pins and one end female; both ends terminated with 9-pin D-sub connector)	Continuous LED Lights
DB910	3.0 m		
DB9Y	1.8 m	Cable powers two continuous lights with one supply (9 m trunk with male connector and 9 m branches with female connector; ends terminated with 9-pin D-sub connector)	Continuous LED Lights
DB906S	1.8 m	Cable powers one strobed light (one end male pins and one end female; both ends terminated with 9-pin D-sub connector)	Strobed LED Lights
DB910S	3.0 m		
DB9YS	1.8 m	Cable powers one strobed light (9 m trunk with male connector and 9 m branches with female connector; ends terminated with 9-pin D-sub connector)	Strobed LED Lights

* These products are not stocked and are non-returnable.



USB Serial Adapter

Model	Description	Power	Used With	Data Sheet
INTUSB485-1	 For connection of 5-pin communication cable to computer USB port	USB Cable	EZ-ARRAY	130144

Power Supplies and Interface Modules

The power supplies provide a low-cost interface between ac power supply and dc-operated sensors. They can source up to 100 milliamps. All models are available with integral TEACH push button and remote TEACH function. The interface module is a passive module that allows additional status indicators to be located in the user's control cabinet. It provides remote indication and TEACH capability.



Model	Description	Sensor Input	Input Supply	Sensor Supply	Data Sheet
PS24-1N	Power Supply e/m relay output, status lights, and TEACH button	NPN	24V ac	15V dc	123566
PS24-1P		PNP			
PS115-1N		NPN	115V ac		
PS115-1P		PNP			
SIM-525T	Passive Interface Module Status lights and TEACH button	—	10-30V dc	—	123240

Sensor Interface Modules

Low-cost modules provide a dc powered interface for PresencePLUS® P4 vision sensors.



Model	Input	Outputs	Connections	Used With	Data Sheet
PPSIM-NT	10-30V dc	Current Sinking (NPN)	Two 13-pin Terminals	PresencePLUS P4	126330
PPSIM-NC			One 13-pin Terminals One DB-15 Connector		
PPSIM-PT		Current Sourcing (PNP)	Two 13-pin Terminals		126330
PPSIM-PC			One 13-pin Terminals One DB-15 Connector		

Light Interface Modules

Low-cost interface module allows strobe operation of Banner vision lighting with any vision sensor or system.



Model	Input	Strobe Output	Used With	Data Sheet
PPLIM	24V dc	5V @ 10 mA max.	Vision lighting	128190

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Basics of Photoelectric Sensing

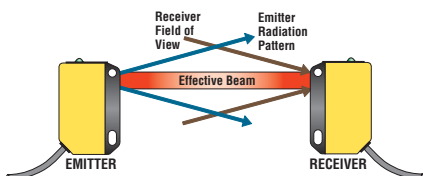
A photoelectric sensor is an optical control used in a variety of automated processes. It works by detecting a visible or invisible beam of light, and responding to a change in the received light intensity.



Effective beam: "Working" part of a photoelectric beam.

Radiation pattern: Total area of sensing energy emission.

Field of view: Area of response.



Components of a Sensor

Emitter contains the light source, usually an LED, and an oscillator which modulates the LED at a high rate of speed. The emitter sends a modulated light beam to the receiver.

Receiver decodes the light beam and switches an output device that interfaces with the load.

Types of Sensors



1. **Self-contained sensors:** One-piece photoelectric sensors that contain both the optics and the electronics. These sensors perform their own modulation, demodulation, amplification and output switching.



2. **Remote systems:** Sensing systems in which the amplification and the optical sensing are divided. The opto-elements contain only the optical components, allowing the sensing heads to be extremely small. The amplifier module contains the power input, amplification and output switching. This allows the sensitive electronics to be located away from the sensing event.



3. **Fiber optic systems:** Sensing systems in which fiber optic cables are used with either remote or self-contained sensors. Fiber optic devices have no electrical circuitry and no moving parts, and can be used to safely pipe light into and out of hostile environments.

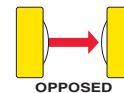


Sensing Modes

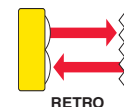


One way to tell sensors apart is by their **sensing mode**, the method in which a sensor sends and receives light. Photoelectric sensors are divided into three basic sensing modes: opposed, retroreflective and proximity.

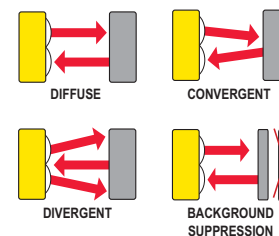
Opposed mode: The sensor's emitter and receiver are housed in two separate units. The emitter is placed opposite the receiver. An object is detected when it breaks the effective beam.



Retroreflective mode: The sensor contains both the emitter and receiver elements. The effective beam is established between the emitter, the retroreflector and the receiver. As with an opposed-mode sensor, an object is sensed when it interrupts or breaks the effective beam.



Proximity mode: These sensors contain both emitter and receiver elements. A proximity-mode sensor detects an object when emitted light is reflected off the object, back to the sensor.



Range

The range is the specified operating distance of a sensor or sensing system.

- **Opposed mode:** The distance from the emitter to the receiver.
- **Retroreflective mode:** The distance from the sensor to the retroreflector.
- **Proximity mode:** The distance from the sensor to the object being sensed.

Contrast



Contrast is the ratio of the amount of light falling on a receiver in the "light" state, compared to the "dark" state. Increasing contrast in any sensing situation will increase the reliability of the sensing system.

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Beam Pattern



A beam pattern is plotted on a 2-dimensional graph to illustrate how the sensor responds to its emitter or sensing target. Use the beam pattern to estimate placement of the sensing system with respect to adjacent objects.

Excess Gain



Excess gain is a measurement of the amount of light falling on a receiver, over and above the amount of light required to operate the sensor.

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Sensing Modes



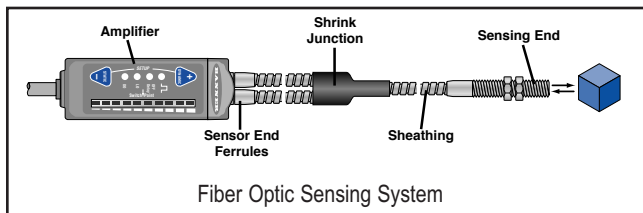
CONFIGURATION	FEATURES	EXCESS GAIN	BEAM PATTERN
<p>OPPOSED</p>	<ul style="list-style-type: none"> • Most reliable mode for opaque targets • High excess gain results in long sensing range • Good performance in contaminated environments • High tolerance to misalignment 		
<p>RETROREFLECTIVE</p>	<ul style="list-style-type: none"> • Convenient when space is limited • High excess gain results in long sensing range 		
<p>DIFFUSE</p>	<ul style="list-style-type: none"> • Convenient when space is limited • Used in applications requiring reflectivity monitoring 		
<p>DIVERGENT</p>	<ul style="list-style-type: none"> • Convenient when space is limited • Good performance in detecting clear materials at close range • Used in applications requiring reflectivity monitoring • Reliable in detection of shiny or vibrating surfaces 		
<p>CONVERGENT</p>	<ul style="list-style-type: none"> • Used for accurate positioning • Excellent in small colormark or small object detection applications • Used for accurate counting of radiused objects • High excess gain allows detection of objects having low reflectivity 		
<p>BACKGROUND SUPPRESSION</p>	<ul style="list-style-type: none"> • Definite range limit used to ignore backgrounds • High excess gain allows detection of objects having low reflectivity • Good at detecting targets of varying reflectivity 		

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Fiber Optics

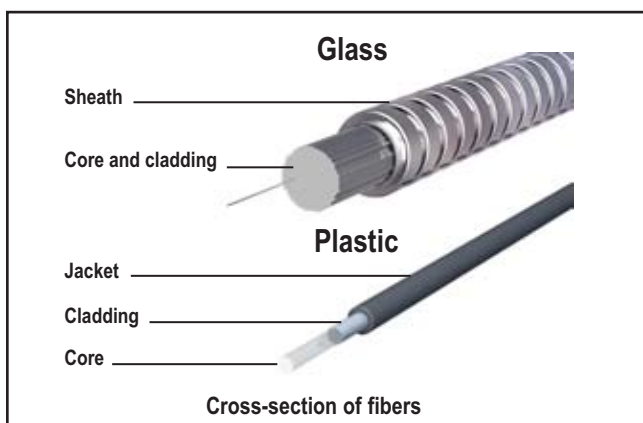


Fibers are transparent strands of optical quality glass or plastic that can be as thin as a strand of hair. In photoelectric sensing, these fibers are used to transmit and/or receive light from the LED of an attached sensor.



Glass or Plastic Fibers

Fiber optics are available in **glass** or **plastic**. Glass fibers are arranged in bundles and plastic fibers are usually packaged as monofilaments.



Core – Thin glass or plastic center of the fiber through which light travels.

Cladding – Outer optical material surrounding the core that reflects light back into the core.

Jacket – Layer around plastic fiber to protect from damage and moisture.

Sheathing – Layer of stainless steel or PVC tubing to protect glass fiber bundles from damage.

Uses for Fibers

- **Tight sensing locations:** Size and flexibility of fibers allow positioning and mounting in tight spaces.
- **Vibration and shock:** Low mass fibers are able to withstand high levels of vibration and mechanical shock.
- **Extreme environments:** Fibers can be constructed to survive in corrosive or extreme moisture environments.
- **Explosion-proof design:** Fibers can safely pipe light into and out of hazardous areas.
- **High temperatures:** Glass fibers can tolerate extreme temperatures.
- **Custom sensing end design:** Fiber sensing heads can be “shaped” to the physical and optical requirements of a specific application.
- **Noise immunity:** A fiber is a passive mechanical part that is completely immune to electrical noise.

Fiber Optics & Sensing Modes

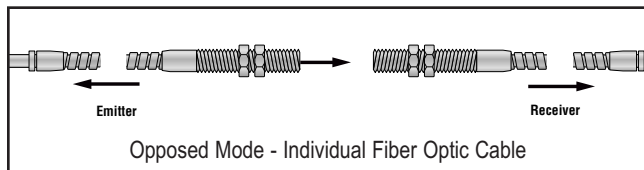


Job Aid: Types of Sensors

The configuration of the fiber optic assembly and the type of amplifier used will determine the sensing mode.

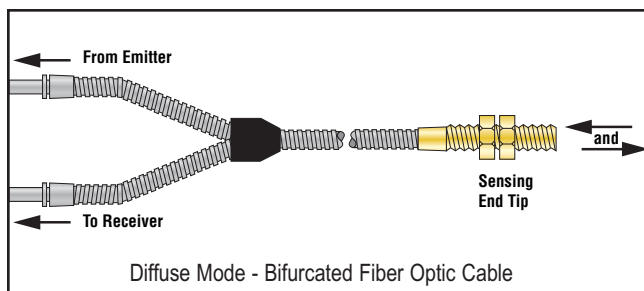
Opposed-mode fiber assembly

Guides light from an emitter to a sensing location, or from the sensing location back to the receiver. Opposed-mode fiber sensing requires two individual fiber optic cables.



Diffuse-mode fiber assembly

Conducts emitted light and the received light within one fiber optic assembly. This lets a single sensor both illuminate and view an object through the same fiber optic assembly.



Considerations

- Larger bundle or core size leads to longer range and larger effective beam.
- Light signal attenuation occurs with longer fiber lengths.
- Optical fibers that have been ground and polished cannot be shortened, spliced or otherwise modified.
- Range and gain depend on both the amplifier and the fiber.
- Due to light transmission properties, plastic fibers are recommended for use only with visible light sensors.
- Glass fibers should not be subject to bending, pinching, repeated flexing, or high levels of radiation.

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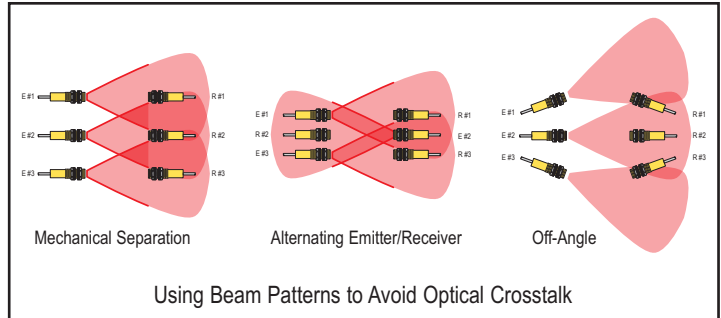
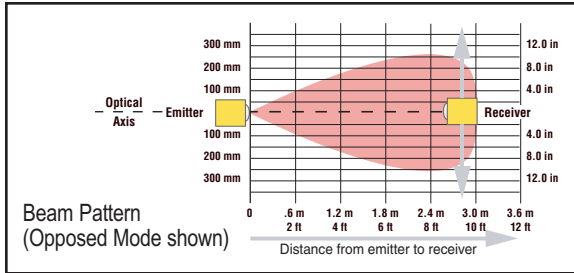
Beam Patterns



A beam pattern is plotted on a 2-dimensional graph to illustrate how the photoelectric receiver is designed to respond to its emitter. Maximum light energy occurs along the sensor's optical axis. The light energy decreases towards the beam pattern boundaries. The horizontal axis usually shows the range of the sensor.

Uses for Beam Patterns

- Predict general radiation pattern given a specific target.
- Predict how multiple sensors can be mounted on a line without generating crosstalk.
- Provide accurate depiction of a light pattern a few feet from the sensor.



Reading a Beam Pattern



<p>OPPOSED MODE</p>	<p>Distance from emitter to receiver</p>	<p>Uses: To predict how closely adjacent, parallel opposed-mode sensor pairs can be placed to each other without generating optical crosstalk.</p> <p>Horizontal: Scale shows separation distance between the emitter and receiver.</p> <p>Vertical: The balloon-shaped plot defines the boundary of the receiver's response to the emitter. The receiver response is measured on either side of the optical axis.</p>
<p>RETROREFLECTIVE MODE</p>	<p>Distance from the sensor to retroreflector</p> <p>Retroreflective beam patterns are plotted using a model BRT-3 (75 mm) retroreflector (except where otherwise specified).</p>	<p>Uses: To show the area within which the sensor will respond to the retroreflector. The size of the beam pattern is proportional to the size and the reflective efficiency of the retroreflector.</p> <p>Horizontal: The scale shows the related distance between the retroreflective sensor and the retroreflector.</p> <p>Vertical: The scale depicts the farthest distance on either side of the sensor's optical axis where a retroreflector can establish a beam with the sensor.</p> <p>Blind Spot: If a beam pattern shows an area of no response at close range, it is indicating that the sensor has a "blind spot" area, where a retroreflector should not be located.</p>
<p>PROXIMITY MODE</p>	<p>Distance from sensor to target surface</p> <p>Proximity-mode beam patterns are plotted using an 8 x 10 90% reflective white Kodak test card.</p>	<p>Uses: To show the boundary within which the edge of a light-colored diffuse surface will be detected as it moves past the sensor. The sensor's optical axis is represented as "0" on the vertical scale.</p> <p>Horizontal: The scale shows the distance from the sensor to the target's surface.</p> <p>Vertical: The scale shows the width of the sensor response measured on either side of the optical axis.</p>

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Excess Gain (EG)



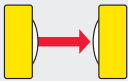
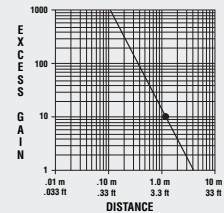
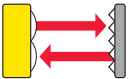
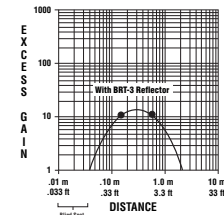
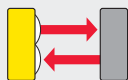
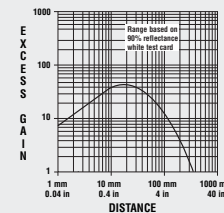
Excess gain is a measurement of the sensing light energy over and above the minimum amount required to operate the sensor's amplifier. This extra sensing energy is used to overcome signal attenuation caused by contaminants in the sensing environment.

Choose a sensor that will give you the optimal excess gain for your application. In most sensing situations, high excess gain relates directly to sensing reliability.

Measuring Excess Gain

$$\text{Excess Gain} = \frac{\text{Light energy falling on receiver element}}{\text{Sensor's amplifier threshold}}$$

Reading an Excess Gain Curve

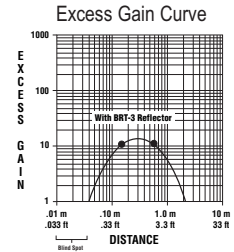
<p>OPPOSED MODE</p> 	<p>The excess gain of an opposed-mode sensor pair is directly related to sensing distance. If the sensing distance is doubled, the excess gain is reduced by a factor of one-fourth, so the curve is always a straight line, when plotted on a log-log scale.</p>		<p>Reading an Opposed Mode Curve</p> <p>If an environment is moderately dirty (with 10x minimum excess gain required), sensors can be mounted up to approximately 1.2 meters apart.</p>
<p>RETROREFLECTIVE MODE</p> 	<p>The shape of a retroreflective excess gain curve is significantly influenced by the size of the retroreflector. The larger the retroreflector, the larger the shape and size of the curve.</p>		<p>Reading a Retro Mode Curve</p> <p>If an environment is moderately dirty (with 10x minimum excess gain required), a BRT-3 retroreflector can be mounted 0.15 to 0.5 meters away from the sensor for reliable sensing.</p>
<p>PROXIMITY MODE</p> 	<p>Excess gain for proximity-mode sensors is usually lower than that of other photoelectric sensing modes, because proximity modes depend on light reflected off the surface of a target. The curves are plotted using a Kodak 90% reflectance white test card as the reference material. Other materials are ranked compared to the test card in the table below.</p>		<p>Reading a Proximity Mode Curve</p> <p>Use the online Relative Reflectivity Chart to estimate the excess gain required. Multiply the excess gain required to sense the material by the excess gain level required for the environment.</p>

Threshold: The level of sensing energy required to cause the sensor's output to switch "on" or "off."

Excess gain of one (1x) is the measured voltage at the amplifier threshold level. Excess gain charts are useful when comparing sensors for an application, as direct measurement of amplifier voltage is often impractical.

Excess Gain Curve

An excess gain curve is plotted on an X/Y axis. It shows the excess gain available for a particular sensor or sensing system as a function of distance. Excess gain curves are plotted for conditions of perfectly clean air and maximum receiver gain.



Excess Gain Guidelines

Excess gain of one (1x) describes the measured sensing energy at the amplifier threshold level. These guidelines show how much excess gain is required to overcome environmental conditions.

EG	General Conditions
1.5x	Clean air: No dirt buildup on lenses or reflectors.
5x	Slightly dirty: Slight buildup of dust, dirt, oil, moisture, etc. on lenses or reflectors. Lenses are cleaned on a regular schedule.
10x	Moderately dirty: Obvious contamination of lenses or reflectors (but not obscured). Lenses cleaned occasionally or when necessary.
50x	Very dirty: Heavy contamination of lenses. Heavy fog, mist, dust, smoke, or oil film. Minimal cleaning of lenses.

Relative Reflectivity



When using a proximity sensor, refer to the Relative Reflectivity chart to determine how reflectivity of different target surfaces will affect the excess gain requirements. Here are some sample targets.

Material	General Reflectivity	Minimum Excess Gain Required
Stainless steel, microfinish	400%	0.2
Natural aluminum, unfinished	140%	0.6
Kraft paper, cardboard	70%	1.3
Clear plastic bottle	40%	2.3
Tissue paper (1 ply)	35%	2.6
Rough wood pallet (clean)	20%	4.5

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Contrast

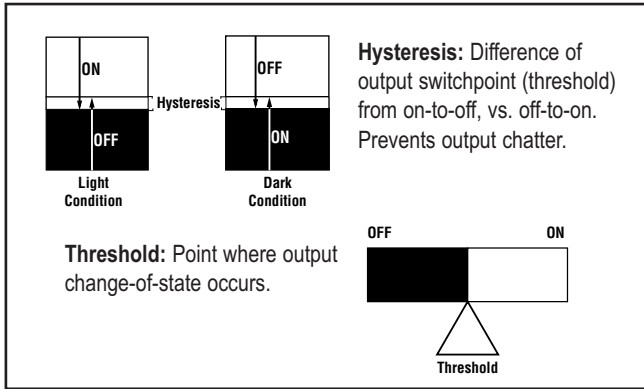


- GOOD**
- BETTER**
- BEST**

Contrast is also referred to as the light-to-dark ratio. While most sensors do not allow direct measurement of light signals, contrast can be estimated. The higher the contrast ratio, the better and more accurately your sensor will detect its target.

Contrast can be defined as:

$$\text{Contrast} = \frac{\text{Received light in the light condition}}{\text{Received light in the dark condition}}$$

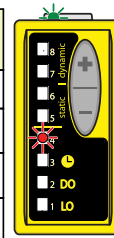


Contrast Guidelines

Follow these contrast guidelines to improve sensing reliability:

1. Choose a sensor or lensing option that will optimize contrast in any photoelectric sensing situation.
2. Adjust alignment and gain for maximum contrast during sensor installation.
3. If light and dark conditions are separated by 1/3 or more of the adjustment range of a sensor's sensitivity potentiometer, contrast is sufficient. Most Banner sensors intended for low-contrast applications are microprocessor-driven and will provide feedback of relative contrast.

Bargraph LED Number	Relative Contrast/ Recommendation
6 to 8	Excellent: Very stable operation.
4 to 5	Good: Minor sensing variables will not affect sensing reliability.
2 to 3	Low: Minor sensing variables will affect sensing reliability.
1	Marginal: Consider an alternate sensing scheme.



Bargraph sensors offer relative feedback in low-contrast applications.

Adjusting Sensitivity



Field-adjust the sensitivity of a sensor in order to maximize the contrast in an application.

TECHNIQUE	PROCESS	CONCEPT
<p>Potentiometer Adjustment</p> <p>Manually adjust sensitivity with the potentiometer.</p>	<ol style="list-style-type: none"> 1. Adjust potentiometer to minimum. 2. Present the light and dark sensing conditions individually, turning the potentiometer slowly clockwise, until the alignment indicator just comes on. Note the settings. 3. Adjust the potentiometer to approximately midway between the two settings. 	<p>Operating sensitivity setting (midway between light and dark thresholds)</p>
<p>SET Mode Adjustment</p> <p>Sensor's microprocessor automates sensitivity adjustment.</p>	<p>Present the dark sensing condition, and press the SET button. The sensor automatically sets the operating sensitivity below the switchpoint threshold for the dark condition.</p>	<p>Operating sensitivity setting (automatically set by sensor)</p>
<p>TEACH Mode Adjustment</p> <p>Sensor's microprocessor optimizes sensitivity adjustment between two user-set reference points.</p>	<ol style="list-style-type: none"> 1. Present the light sensing condition, and single-click the TEACH button. 2. Present the dark sensing condition, and (again) single-click the TEACH button. 3. The sensor automatically sets the operating sensitivity. 	<p>Operating sensitivity setting (automatically set by sensor)</p>

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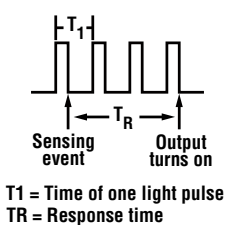
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Response Time MORE INFO ONLINE

Response time is the maximum time required for the sensor to respond to a change in the input signal. It is the time from when the sensor sees its target to when it gives an output signal to the load. Response time is the time between the leading (or trailing) edge of the sensing event and the output's change of state.



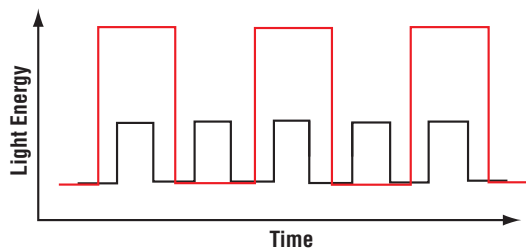
Importance

Response time can help determine how long a fast-moving object must stay in the sensor's field of view in order to be detected. It is especially important when your application requires detection of:

- High-speed events
- Small objects moving at high speeds
- Narrow gaps between objects
- Brief intervals between sensing events

Modulation

The speed of response of a modulated photoelectric sensor is limited by its frequency of modulation. There is a direct trade-off between sensor response time and sensing range (excess gain). High-speed sensors are modulated faster, thus yielding shorter range. If an LED is pulsed less often, it can be pulsed with a higher current, thereby producing more light energy.



Fast Response Yields Lower Excess Gain

Repeatability

The repeatability specification is used in applications where customers need to know the precise position of a moving part.

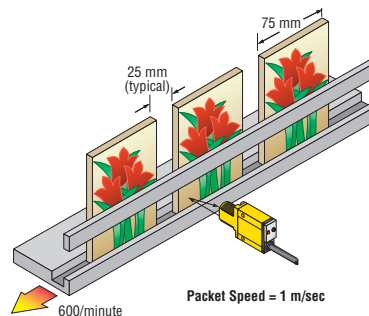
The sensor's output is allowed to switch only after a few modulated light pulses are counted. The response time before a modulated sensor turns on is equal to the time required for the sensor to count that number of pulses, and the sensor output changes state as soon as the sensor counts enough light pulses of the correct frequency.

Since the sensing event can occur at any time during a modulation cycle, the actual time between the sensing event and the sensor's output change can vary by up to one modulation cycle. This variation is the sensor's repeatability.

Calculating Response Time

You can determine a sensor's required response time when you know the size, speed and spacing of the objects to be detected.

$$\text{Response Time} = \frac{\text{Object width (or gap between objects)}}{\text{Object velocity}}$$



Calculate Response Time for Seed Packets with a Convergent Sensor

Application Example

To calculate the required sensor response time, the production line speed is first converted to the speed of, in this case, a seed packet. When calculating the speed of the seed packet, take into account the space between the packets.

1. Determine how many packets are being processed per second:
600 packets/minute = 10 packets per second
2. Determine the distance of linear travel: 75 mm (packet width) + 25 mm (space between packets) = 100 mm
3. Calculate speed of packet = 100 mm/packet x 10 packets/sec

$$\text{Packet Speed} = 1 \text{ m/sec}$$

Light condition: Sensing condition characterized by higher level of received sensing energy.

Knowing the speed of the object (1 m/sec), it is possible to calculate the time during which the sensor "sees" a packet of seeds.

$$\frac{\text{Object width (75 mm)}}{\text{Object velocity (1 m/sec)}} = .075 \text{ sec}$$

$$\text{Time of each packet passing the sensor} = 75 \text{ ms}$$

Calculating Light Condition

Dark condition: Sensing condition characterized by lower level of light energy (or none).

$$\frac{\text{Space width (25 mm)}}{\text{Object velocity (1 m/sec)}} = .025 \text{ sec}$$

$$\text{Time of each space passing the sensor} = 25 \text{ ms}$$

Calculating Dark Condition

In this application, the time between the packets is much less than the time during which the sensor "sees" a packet. As a result, the dark (or "off") time between packets is the more important consideration.

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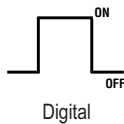
Outputs MORE INFO ONLINE *Outputs*

The output circuit is the section of the sensor that interfaces to the external load. Output also refers to the useful energy delivered by the sensor.

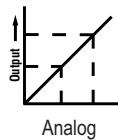
Knowing the voltage and current requirements of the load is crucial to selecting the best sensor. Sensors with analog outputs always interface to circuits or devices which operate at low levels of dc voltage and current. Sensors with digital outputs interface to either ac or dc loads.

Digital/Analog Output

The output of a sensor is either digital or analog. A **digital**, or switched, output has only two states: "ON" and "OFF." On and off commonly refer to the status of the load that the sensor output is controlling.



An **analog** sensor is one that varies over a range of voltage (or current) and is proportional to some sensing parameter. Analog sensors provide a metered or gradual response.



Response Time

The response time of sensors with digital output depends largely on the sensor's output switching device. In general, sensors with solid-state outputs provide faster switching.

Sensors with electromechanical relays can only provide slow switching; the relay switching speed is the largest component of the specified sensor response time.

Light Operate/Dark Operate MORE INFO ONLINE *Training Note: Light Operate/ Dark Operate*

The sensor should be active when the application requires it. With digital photoelectric sensors, the input and the output are characterized by one of two sensing terms: Light Operate and Dark Operate.

Light Operate (LO): A condition where a photoelectric sensor output energizes its load when the sensor "sees" a sufficient amount of its own modulated light.

The sensor "sees" light.

Dark Operate (DO): The complement of LO, where the sensor output energizes its load when it no longer "sees" the modulated light.

The sensor "sees" dark.

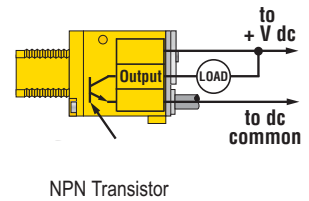
Contact Configuration Types

Solid-State Relays

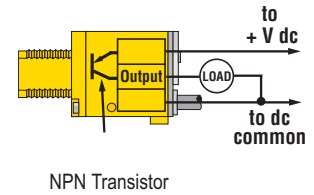
Switching is accomplished by elements such as a transistor or SCR, without moving parts, heated filament or vacuum gaps.

Complementary outputs: The dual-output configuration of a sensing device, where one output is Normally Open and the other is Normally Closed. In this case, both outputs have the same switchpoint, but only one output conducts at a time.

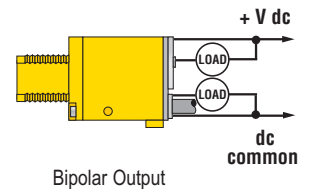
NPN output (sinking): Output switch configured with its collector open and its emitter connected to ground (dc common). The load is connected between the output (collector) and the positive of the dc supply.



PNP output (sourcing): Output switch configured with its collector open and its emitter connected to the positive of the sensor supply voltage. The load is connected between the output (collector) and ground (dc common).

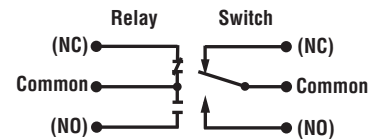


Bipolar outputs: The dual-output configuration of a dc sensing device, where one output switch is a sinking device (NPN) and the other output switch is a sourcing device (PNP). Both outputs have the same switchpoint.



E/M Relays

Used when a sensor provides direct control of a load that draws more current than can be handled by a solid-state relay. Double-throw contacts are used in interfaces that require complementary switching. E/M relays are useful when a string of sensor outputs are wired together in series for AND logic. Some E/M relay configurations include SPST, SPDT, DPST and DPDT.



Normally Open (NO): Designation for contacts of a switch or relay that are not connected when at rest. When activated, the contacts close (become connected).

Normally Closed (NC): Designation for contacts of a switch or relay that are connected when at rest. When activated, the contacts open (separate).

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Vision Sensors

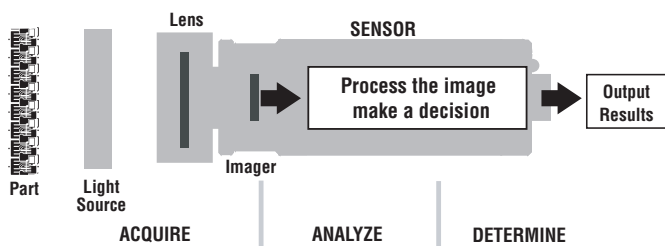
Vision sensing is electronic imaging, applied in a manufacturing setting for the purpose of control: Process control, machine tool control, robot control or quality control. Vision sensing is used to improve production processes and quality. Vision sensing is comprised of two major elements: A **hardware** element (camera, controller and lighting) and a **software** element (control system, graphical user interface and image algorithms).

Process



Visual inspection is a three-step process:

1. The sensor **acquires** an image of the part.
2. The microprocessor **analyzes** the image.
3. Another microprocessor **determines** if the inspection passes or fails, and reports the results to the manufacturing line. The part is then either passed to the next process, or it is rejected and removed.



Inspection



"Visual inspection" refers to the process of acquiring an image, analyzing that image based on set parameters and reporting the results. For some Banner vision sensors, inspections are set up using a remote PC. A digital camera captures images and the sensor software analyzes the images using vision tools to pass or fail the product.

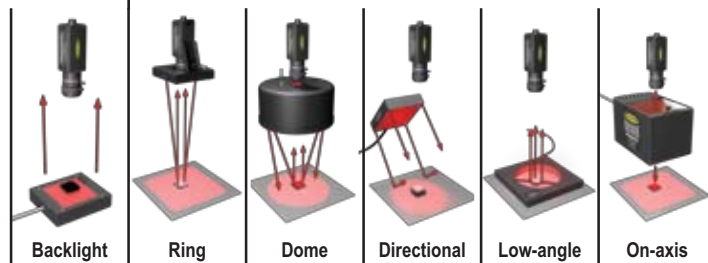
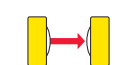
Vision tools are specific software algorithms used to analyze an image. Each vision sensor uses a specific **tool set** to extract and isolate certain features within the image in order to determine whether a part passes or fails an inspection.

Parts



1. Light Source: The light source is a critical component of any vision inspection system. Lighting is the most powerful tool for creating contrast to amplify the feature of interest, while minimizing other features of the part. Selecting the best light source depends on the shape, surface texture, color and opacity of the part.

Opposed Mode

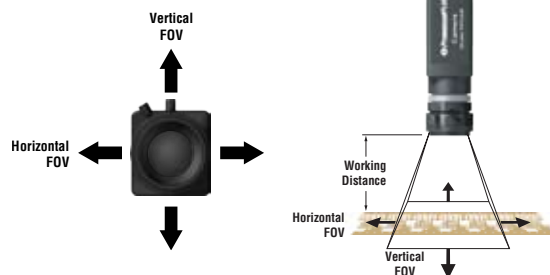


Proximity Mode



2. Lens: The lens focuses the light onto the sensor's imager. The main consideration for selecting a lens is focal length. To determine the focal length, the field of view and working distance must be determined. The field of view is the area of the inspection captured on the sensor's imager. The working distance is the distance between the back of the lens and the target object.

Field of View and Working Distance



3. Sensor: The sensor contains the imager, microprocessors and I/O.

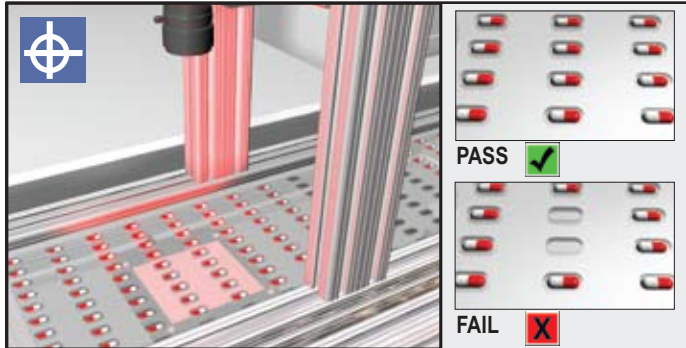
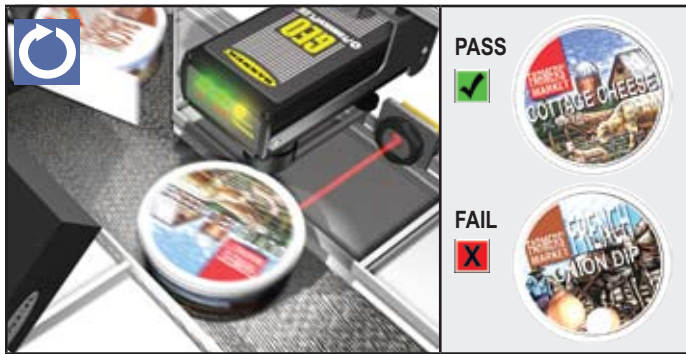
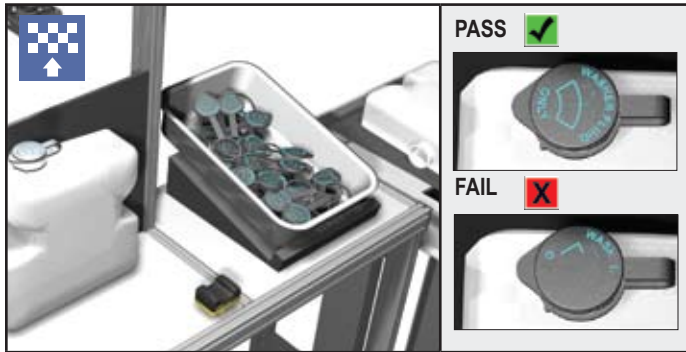
The **imager** has an array of tiny light-sensitive cells that converts the target into an image.

Microprocessors analyze the image and make determinations about it based on user-determined tolerances and criteria.

The sensor exports the inspection results through some type of **I/O**, e.g. Discrete or Ethernet.

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Applications Examples



ANALYSIS TOOLS measure and evaluate the results of the vision tools.



Measure: Measures distance and angles between two prescribed points, lines or curves



Math: Performs arithmetic functions on any tool or constant



Test: Evaluates results of selected vision and analysis tools to determine whether an inspection passes or fails; performs logical operations; and activates outputs



Communication: Sends images or results of selected location, vision and analysis tools over the Ethernet or RS-232 serial communication ports to industrial Ethernet or PC networks

Vision Tools



Vision tools are software algorithms used to analyze an image. A vision sensor uses a set of tools to create an inspection. Using one or several tools, a user can extract and isolate certain features of an image in order to determine whether a part passes or fails an inspection. Several inspections involving different vision tools can be performed on a single image.

LOCATION TOOLS compensate for translational and rotational movement.



Locate: Determines translation and rotation by detecting relative movement of edges



Pattern Find: Determines translation and rotation by detecting relative movement of a pattern



GEO Find: Determines translation and rotation movement of a part up to 360° by detecting relative movement of a pattern

VISION TOOLS analyze the image.



Color Match: Inspects for matching hue and intensity



Average Color: Tests or communicates color content values sensed in a selected area



Average Gray Scale: Determines the gray scale intensity value of an area



Blob: Determines the presence, connectivity, size, shape and location of selected features



Edge: Determines the presence, number, classification and location of edges



Object: Determines the presence, number, classification, size and location of objects



Pattern Count: Determines the presence, number and location of pattern(s)



GEO Count: Detects the presence and location of a target pattern in any orientation



Bar Code: Finds, decodes and grades 2D and 1D linear bar codes



Bead Tool: Monitors a track of material for width, consistency and location



OCR/OCV: Reads and verifies optical characters

Vision Lighting



A vision sensor captures and then analyzes an electronic image. The quality of the images depends on the image's contrast. Dedicated lighting can guarantee constant, consistent light conditions that can be manipulated to create a high-contrast image.

Here are some factors to consider when choosing lighting:

1. Lighting geometry
2. Techniques
3. Optical properties of the part

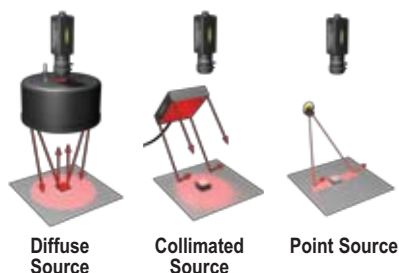
Lighting Geometry



The geometry of propagation refers to how light energy leaves the source. Light can come from a point, diffuse, or collimated source.

When you understand how to manipulate lighting geometry, you can:

- Eliminate glare
- Eliminate hot spots
- Minimize unimportant features

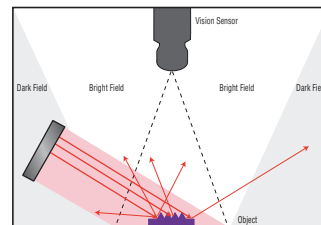


Lighting Techniques

Lighting techniques refer to how the light source is mounted in relation to the target object and the sensor.

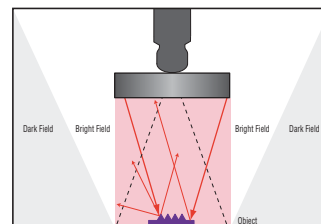
Dark-Field: Illuminate objects with indirect light.

- Casts shadows
- Highlights height changes
- Textured surfaces are bright



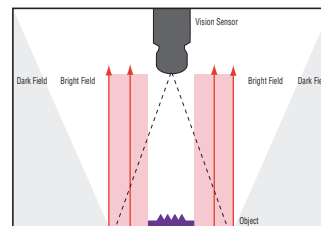
Bright-Field: Illuminate objects with direct light.

- Detect color change
- Smooth surfaces are bright



Backlight: Transmit light from behind the object.

- Highlights outlines and profiles
- Highest contrast



Optical Properties of a Target



Optical properties of a part can be used in conjunction with lighting to highlight features.

		Backlight	Directional	Ring	Low-Angle	Diffused	On-axis	Structured
The main goal of lighting in a vision application is to create contrast between the part and the background.								
Optical Properties	Example Parts							
Shape	Notches Stampings Embossing	Highlights outlines and profiles	Casts shadows to highlight height changes	—	Height changes are bright Flat surfaces are dark	Lowers contrast between shapes	Flat surfaces are bright Height changes are dark	Highlights changes in height on part
Surface Texture	Polished metal Sandpaper	—	Textured surfaces are bright Smooth surfaces are dark	—	Diffuse surfaces are brighter than reflective	Lowers contrast between reflective and textured surfaces	Reflective surface are brighter than diffuse	—
Color	Wires Printing Plastic UV Coatings	—	Based on target color	Based on target color	—	Based on target color	Based on target color	—
Translucency	Drilled hole Plastics	Solid parts block light, clear parts transmit light	—	—	—	—	—	—

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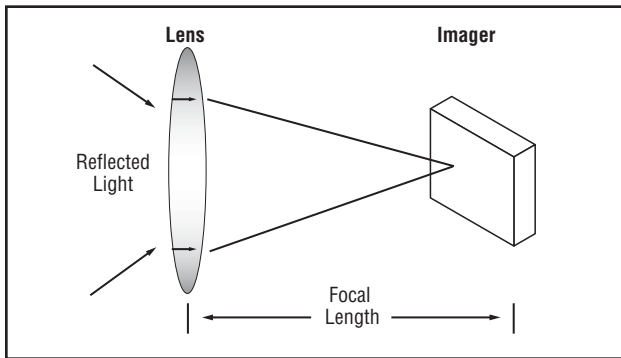
Vision Lenses



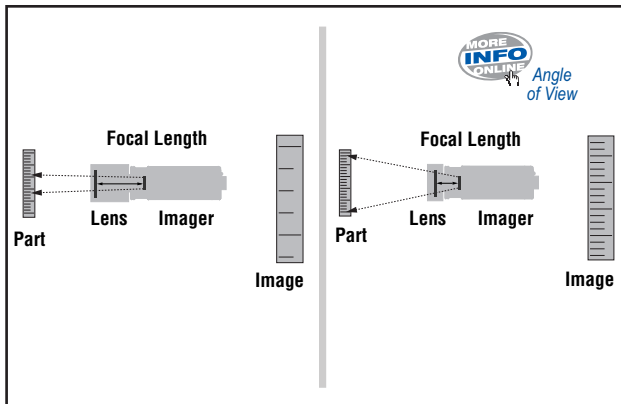
The sensor's lens focuses the reflected light onto the imager chip. The quality of the lens will influence the quality of the image. Lenses have one main function: To create a 2-D image of the scene, focusing the entire field-of-view (FOV) on the imager chip.

Lens Basics

Focal Length: The distance from the lens to the camera's imager. It is specified in millimeters. Focal length determines the relationship between working distance and the angle of view. Shorter focal length results in wider FOV.



Angle of View: Angle of view indicates how much of the visual scene can be captured by the lens. It is determined by the focal length of the lens and how far away the camera is from the target.



Working Distance: The distance from the camera to the target object under inspection.

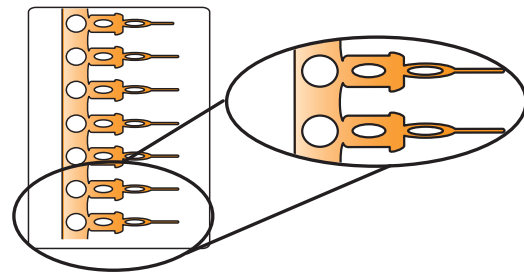


Image Quality

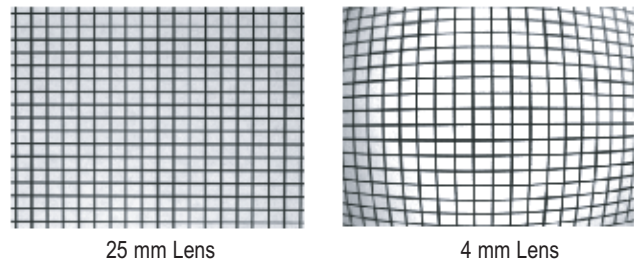
A camera that captures a high quality image assures the most accurate information for later analysis. To insure a high image quality, choose a lens that:

- Magnifies the feature of interest to fill the FOV
- Captures required FOV without adding distortion to the image
- Optimizes your FOV based on working distance
- Focuses entire scene of inspection

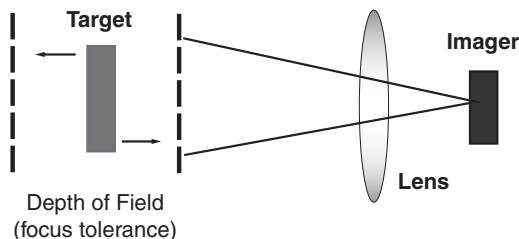
Resolution: The ability of a vision sensor to differentiate between two features that are close together. If the features blur together, a higher resolution lens is required.



Distortion: The lens can influence image quality by how it collects and focuses light on the imager chip. Different lenses have different degrees of optical distortion, or undesired change in the shape of an image.



Depth of Field: The in-focus range of a vision system that includes the areas which remain in focus behind and in front of the target.



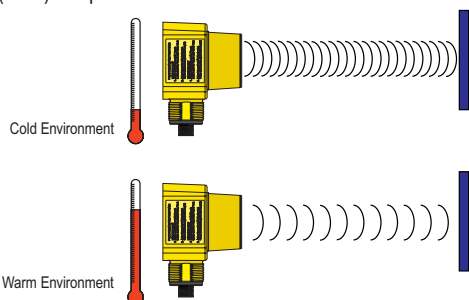
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Ultrasonic Sensors

Ultrasonic sensors emit a pulse of energy which travels at the speed of sound. A portion of this energy is reflected off of a target and travels back to the sensor. The sensor measures the total time required for the energy to reach the target and return to the sensor and calculates the distance from the sensor to the target.

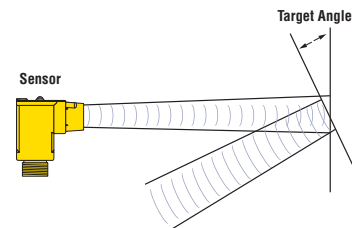
Temperature Effect

The speed of sound depends on chemical composition, pressure and temperature of the gas in which it is traveling. In most ultrasonic applications, the composition and pressure of the gas are relatively fixed, while the temperature is not. The speed of sound increases roughly 1% per 10° F (6° C) temperature increase.



Target Angle

A flat target that is perpendicular to the beam axis will reflect the most sound energy back to the sensor. As the target angle increases, the amount of energy received by the sensor decreases. For most ultrasonic sensors, the target angle should be 10° or less.

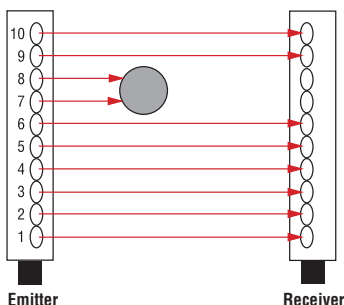


Air Currents

Air currents due to wind, fans, pneumatic equipment or other sources can deflect or disturb the path of the ultrasonic energy, so a sensor may fail to recognize the correct location of the target.

Measuring Light Screens

Banner light screens have a vertical array of photoelectric emitters and receivers: The emitters in one housing, the receivers in another. An object placed between the emitter and receiver will block the emitted light from reaching the corresponding receivers.



Synchronous Scanning

Identifies which of the beams is blocked, by enabling one emitter channel to pulse light while simultaneously directing its corresponding receiver to look for a signal. The system records which beam channels are blocked and which are clear, and then outputs a signal, either analog or discrete.

Sensor Response Time

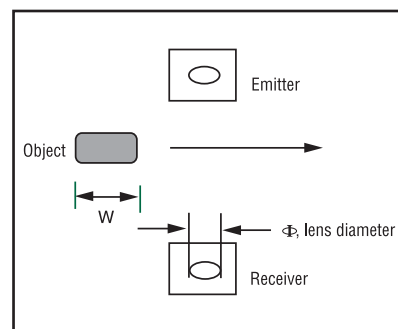
The time required for an array system to “see” an object varies depending on which channel is blocked, when the object blocks a particular channel and when that particular channel is scanned. The result is that the minimum response time is equal to 1 ms; the maximum response time is equal to twice the scan time. The scan time, in turn, varies according to array length and scanning mode, and is specified in the product literature. the lens diameter and the maximum response time of the system.

Minimum Object Detection

The minimum object detection size is a function of the lens diameter for an individual channel and the spacing between channels. The minimum object detection size is defined as the smallest diameter rod that can be detected reliably.

Maximum Part Speed

The maximum speed of a passing part is a function of the part size, the lens diameter and the maximum response time of the system.



Measuring Modes

Banner’s measuring light screens can be configured, with a simple Windows setup program, for several measuring modes for both analog and discrete outputs. For example, the output can be based on the:

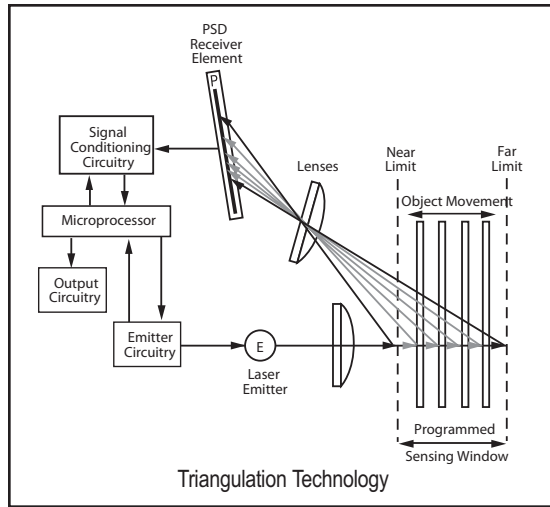
- First beam blocked
- Last beam blocked
- Total number of beams blocked
- First beam made
- Last beam made
- Total number of beams made
- Center beam of several blocked beams
- Number of transitions from blocked to made
- Highest number of contiguous beams blocked

Light Gauging Sensors

Light gauging sensors utilize either "Time of Flight" or triangulation technology to detect the presence and position of targets.

Time of Flight: Measurement of the amount of time that emitted light takes to travel to the target and return to the sensor. This technology is used in long-range sensing applications.

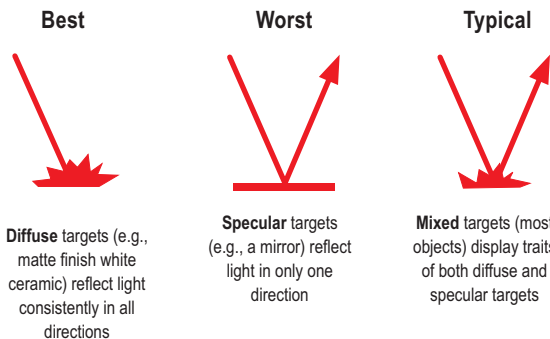
Triangulation: An emitter transmits visible light through a lens, towards a target. The beam bounces off the target, returning some light to the sensor's Position Sensitive Device (PSD) receiver element. The target's distance from the receiver determines the angle at which the light travels to the receiver element. This angle, in turn, determines where the received light will fall along the PSD receiver element. The position of the light on the PSD receiver element is processed through analog and/or digital electronics to calculate the appropriate output value.



Surface Reflectivity and Texture

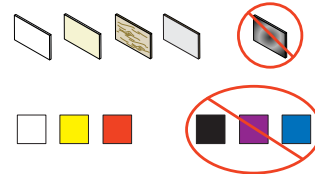
Triangulation sensors depend on the diffuse reflections of light from the target. A diffuse reflection is one in which the light tends to scatter equally in all directions from the target. If the target surface is mirror-like, then light will tend to reflect in only one direction (if this target is not perpendicular to the sensor, the light will be reflected away from the sensor).

Triangulation sensors also require a non-porous, opaque surface for accurate operation. Measurement errors will result from semi-transparent targets such as clear plastic, or from porous materials such as foam.

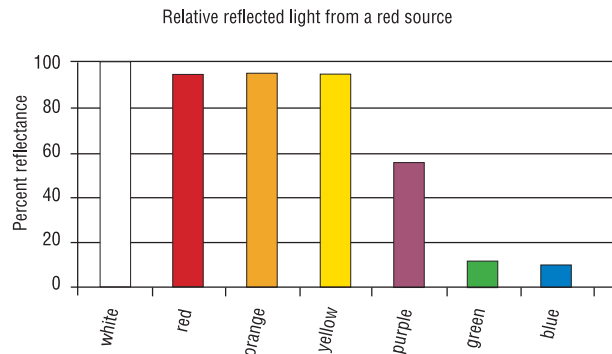


Color Effects

The color of the object being measured can affect the resolution and accuracy of the readings. White, red, yellow and orange targets will reflect more light than green, blue or black targets. The resolution for dark targets may be up to four times less that for white targets.

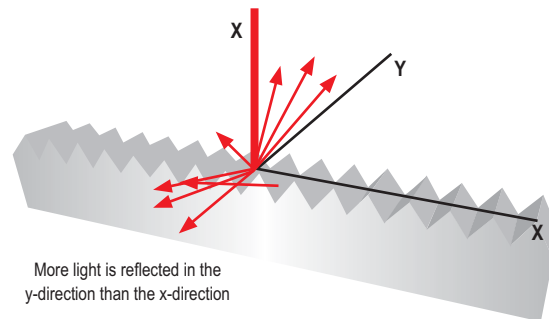


The graph below shows the relative amount of received light that is reflected from various target colors, using visible red light. The resolution is roughly affected according to the square of the received light. For example, reducing the amount of light by a factor of nine will degrade the resolution by a factor of three.



Metal Surfaces

Bare metal surfaces do not exhibit consistent reflectivity across their surfaces. As a result, the repeatability from one point on a metal surface to another, even at the same distance from the sensor, will degrade. This effect varies from metal to metal and is dependent upon surface finish.



Total Expected Measurement Error

Keep in mind that the overall expected accuracy of an analog sensor is the combination of several performance parameters, not simply the sensor's resolution. Linearity and temperature effect can also affect accuracy.

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Temperature Gauging Sensors



Q&A: T-GAGE

Temperature Gauging sensors activate an output when they detect objects that are either hotter or colder than the ambient condition. These passive, non-contact sensors use a thermopile as a receiver element to detect infrared light energy emitted by target objects. The information is measured and analyzed by the sensor, and depending on the thermal contrast, an output is given.

Range

The sensing range is determined by the sensor's field of view and the size of the target object.

Thermal Contrast

The difference between the ambient temperature and the temperature of the target object. High thermal contrast increases switching accuracy.

Field of View

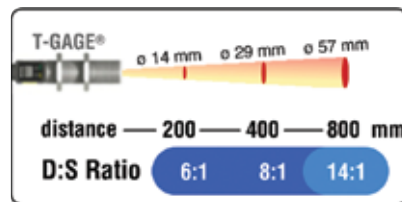
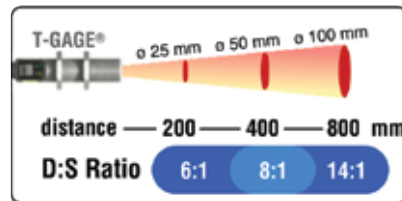
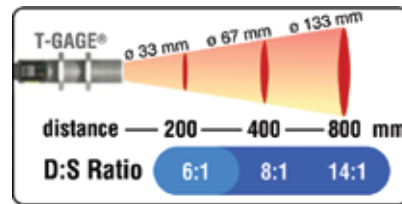
The field of view (FOV) is the area of response, based on the sensor's lens design. The temperature information collected by the sensor will be an average of everything in the sensor's field of view. To increase thermal contrast and reliability of the output, the target object must fill as much of the field of view as possible. If the target object does not fill the sensor's field of view, the sensor will average the temperature of everything in the field of view, thereby reducing the reliability of the output.

D:S Ratio

Spot size refers to the area where the temperature data is taken. Spot size can be calculated at any distance from the target by using the distance-to-spot ratio.

D:S ratio is inversely related to viewing angle. A sensor with a small viewing angle will have a large D:S ratio.

For a sensor with an 8:1 ratio, the sensor's spot size is a 1" diameter circle at a distance of 8". As you go out further from the sensor face, the spot size will be larger.



The sensor's distance-to-spot size ratio can be adjusted by lensing the thermopile. This might be necessary depending on the size of the target and the range at which it must be sensed.

Magnetic Sensors



Q&A: M-GAGE

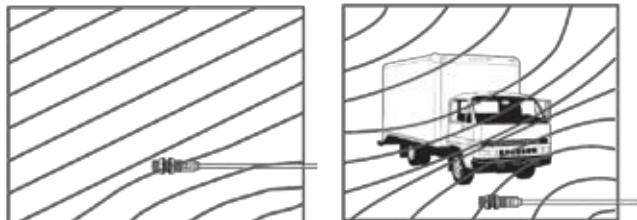
Magnetic devices are passive, non-contact magnetic receivers that detect 3-dimensional changes in the Earth's natural magnetic field caused by the presence of large ferrous objects.

Range

The sensor range depends on three variables:

1. The local magnetic environment (including nearby ferrous material)
2. The magnetic properties of the object to be sensed
3. Sensor settings

The strong disturbance of a large ferrous object decreases as distance from the sensor increases, and the magnitude and shape of the disturbance is dependent on the object's shape and content.



Sensing Area

Magnetic sensors are omni-directional; they can detect ambient magnetic field in all directions. They can be used in close proximity to each other without interaction since they are passive devices and individually learn their environment.



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Environmental Considerations

Environment	Typical Industries & Applications	Recommendations
Normal Temperature	All non-abusive applications from -20° to +55° C	<ul style="list-style-type: none"> All sensor types; choice depends on range, excess gain and electrical and performance requirements.
High Temperatures	<ul style="list-style-type: none"> Metal processing Painting applications Paper manufacturing Outdoor applications 	<ul style="list-style-type: none"> Glass fiber optics: Use when above +100° C; max. to 480° C. Plastic fiber optics: Use polycarbonate fibers up to +125° C. Remote sensors: Use up to +100° C.
Low Temperatures	<ul style="list-style-type: none"> Meat processing Food processing Chemical processing Outdoor applications 	<ul style="list-style-type: none"> Glass fiber optics: Use below -40° C; min. to -140° C. Remote sensors: -40° C to +100° C.
Moisture	<ul style="list-style-type: none"> Food processing Car washes Pharmaceuticals Bottling plants Outdoor applications 	<ul style="list-style-type: none"> Sensors with NEMA 6 ratings represent the best moisture seals and can resist occasional and prolonged (NEMA 6P) submersion. NEMA 4 and 6 ratings: Can withstand low-pressure washdown. NEMA tests do not take into account the elevated pressures and temperatures of solutions used to wash equipment in food processing applications. See NEMA and IP enclosure ratings chart online. Condensation can be eliminated by using unlensed fiber optics.
Corrosive Agents	<ul style="list-style-type: none"> Semiconductors Chemical Lumber Pulp/paper Amusement parks (UV light) 	<p>Solvents/Alkalis</p> <ul style="list-style-type: none"> Stainless steel sensor housings. Glass fiber optic assemblies in stainless steel sheathing. Fiber optic assemblies without epoxy (available by special order). <p>Bases</p> <ul style="list-style-type: none"> Fiber optic assemblies with PVC jackets. <p>Acids</p> <ul style="list-style-type: none"> Thermoplastic polyester housings; see chart online. Teflon® sheathing; protect the sensing tip from direct contact with concentrated acids. Polyethylene jacket of standard plastic fiber optic cables resists acids, but can degrade with prolonged contact.
Dirt, Dust, Fog	<ul style="list-style-type: none"> Lumber Ceramics ovens Paper Steel Mining 	<p>High Excess Gain</p> <ul style="list-style-type: none"> Excess gain data should be carefully evaluated. Opposed-mode sensors with excess gain above 1000x. <p>Lens Size</p> <ul style="list-style-type: none"> Smaller lens concentrates the beam for greater penetrating ability. Larger lenses will yield greater range, but will disperse available sensing energy. <p>Inductive Proximity Sensors</p> <ul style="list-style-type: none"> For metal targets and short sensing ranges.
Vibration & Shock	<ul style="list-style-type: none"> Metal (stamping) Printing (presses) Packaging 	<ul style="list-style-type: none"> Lightweight sensing components; smaller sensors. Anti-vibration mounts placed between the sensor and mounting bracket. Glass or plastic fiber optic assemblies can withstand more than 100 Gs of acceleration. Glass fibers cannot tolerate repeated flexing. Use plastic, hi-flex or coiled fibers. Remote sensors can withstand up to 15 Gs of acceleration. One-piece self-contained sensors with epoxy-encapsulated circuitry withstand up to 10 Gs of acceleration.
Hazardous Areas	<ul style="list-style-type: none"> Chemicals/Gas/Oil/Refinery Grain elevators Airbag manufacturers 	<ul style="list-style-type: none"> Special sensing equipment must be installed, using measures to avoid sources of ignition. See chart defining Hazardous Location Classifications online. NAMUR photoelectric sensors. Glass and plastic fiber optics. (Plastic fiber optics are preferred, as it is easier to seal around the fiber bundle at the barrier between the hazardous and safe environment).

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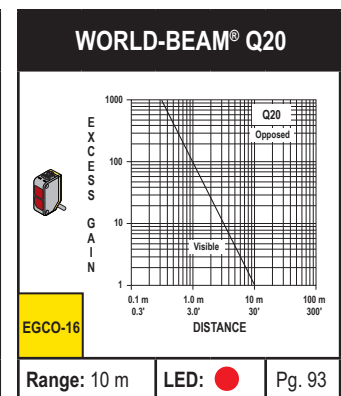
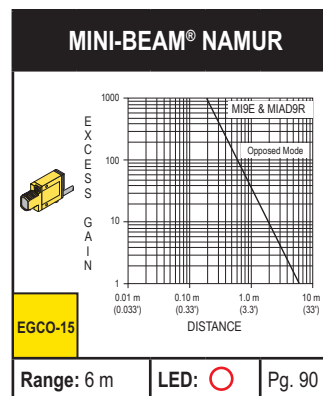
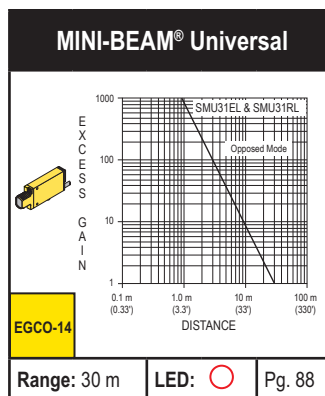
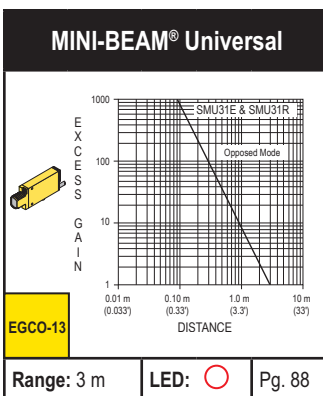
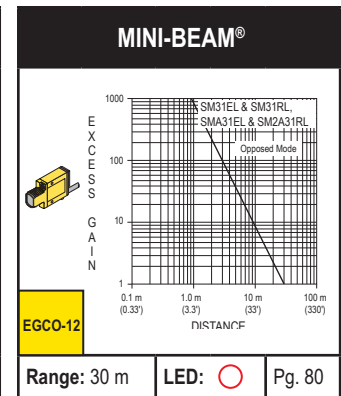
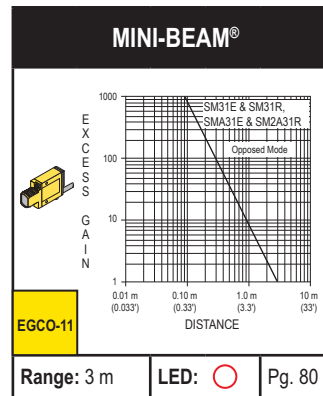
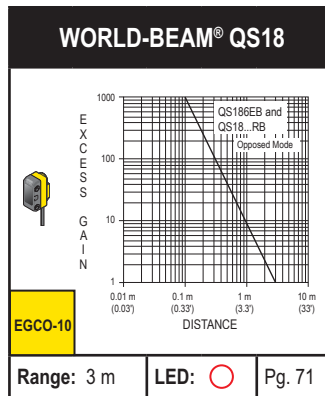
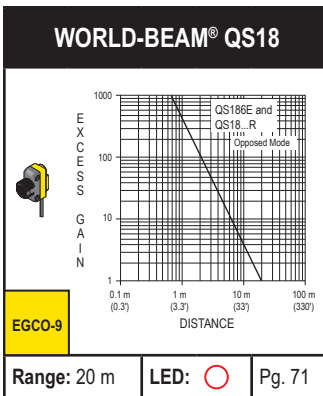
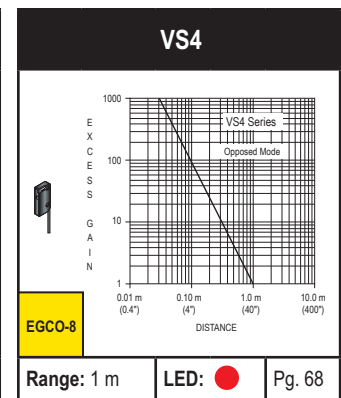
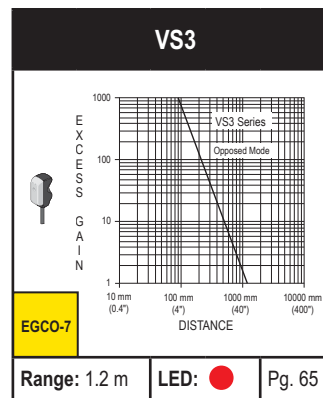
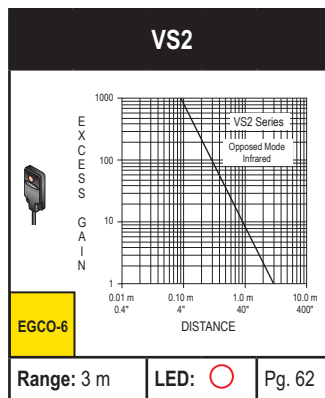
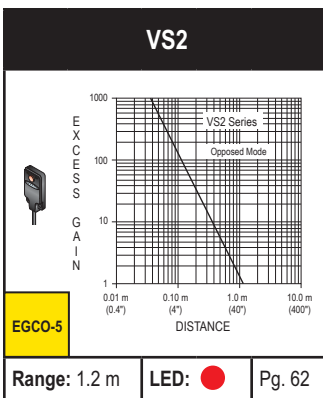
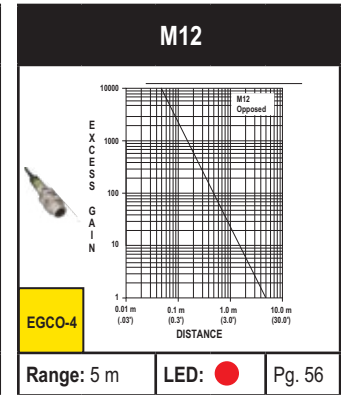
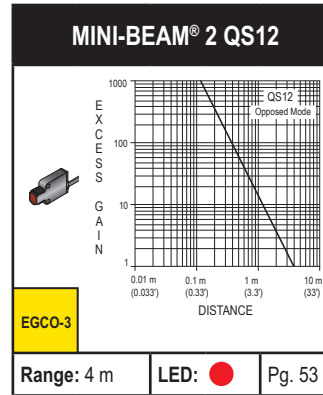
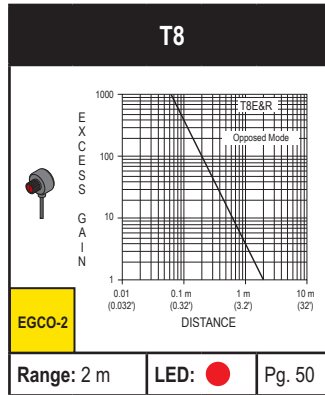
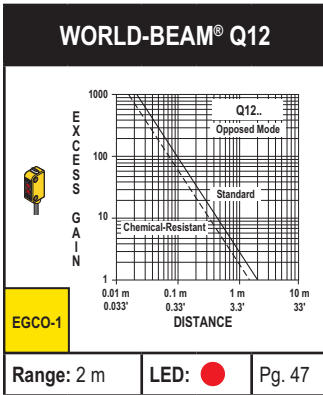
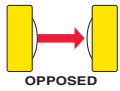
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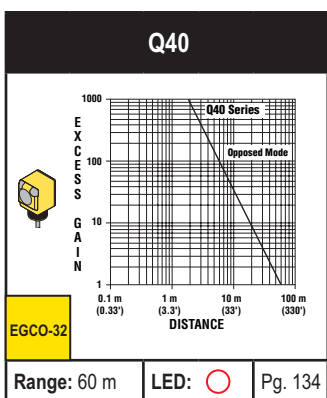
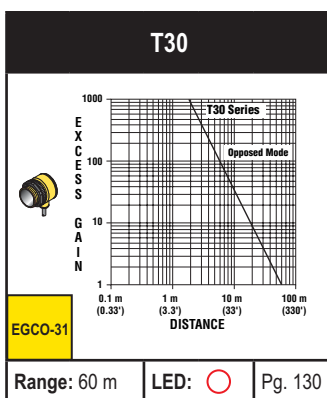
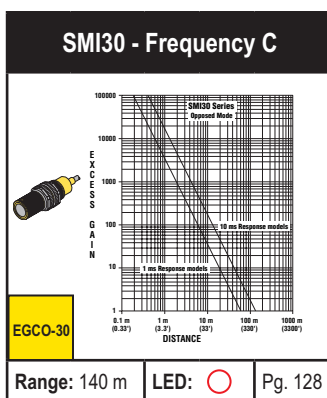
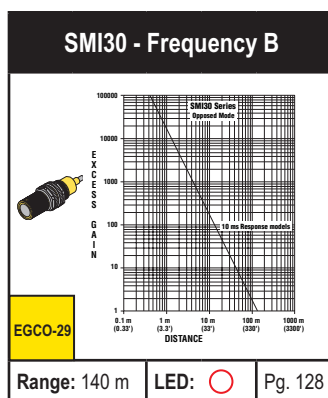
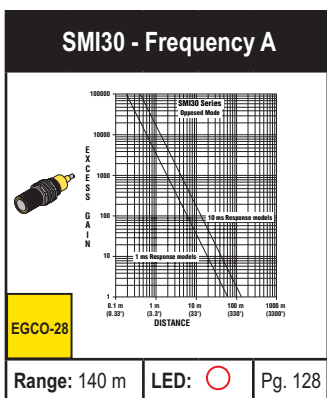
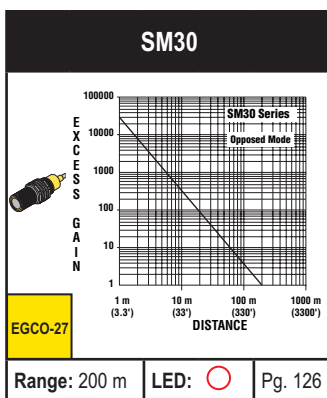
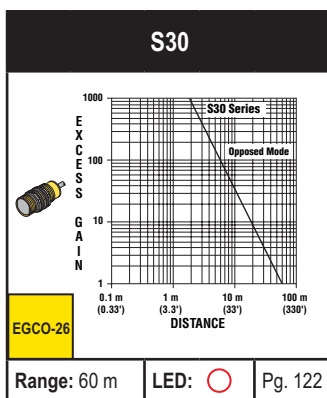
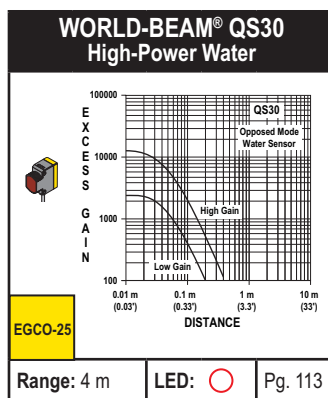
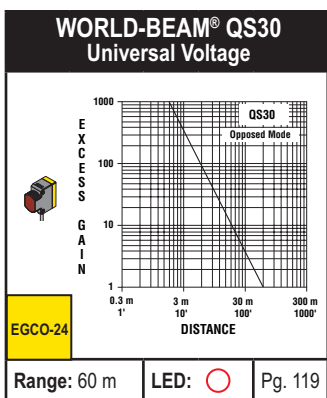
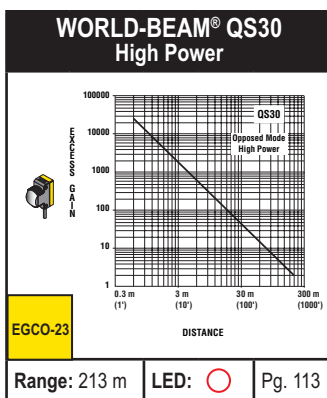
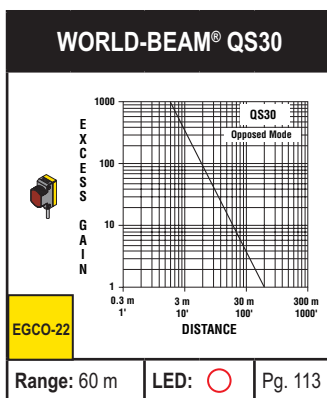
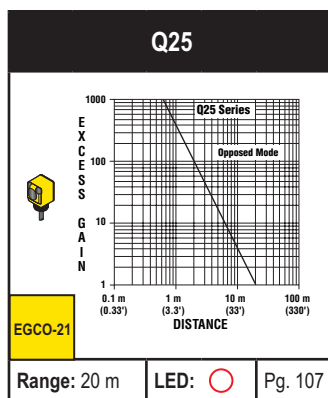
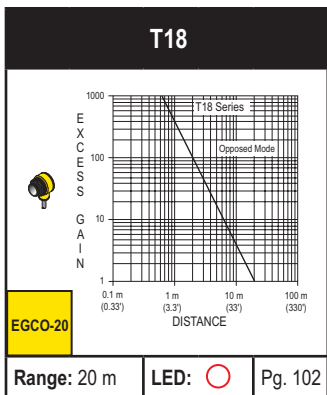
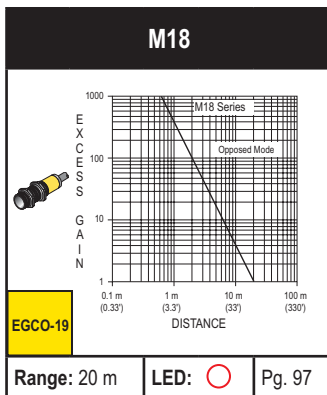
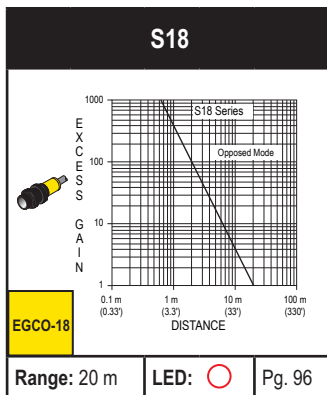
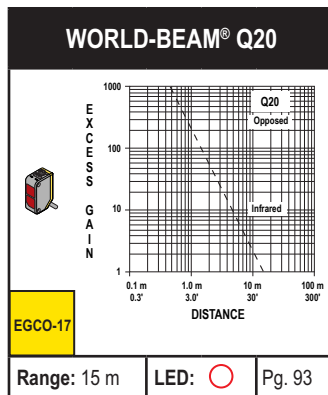
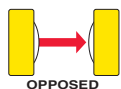
○ = Infrared LED
● = Visible Red LED



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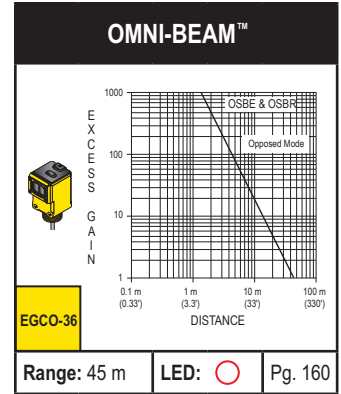
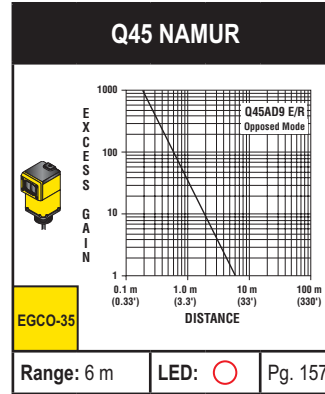
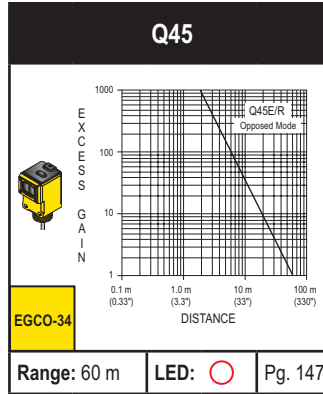
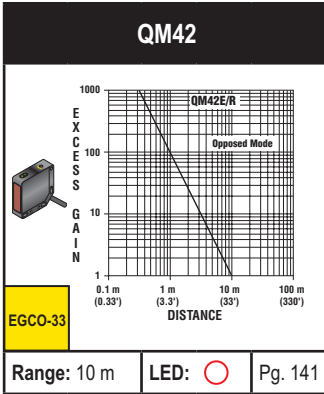
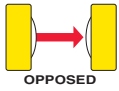
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Lighting Selection Chart

Training Note
Using Color Filters

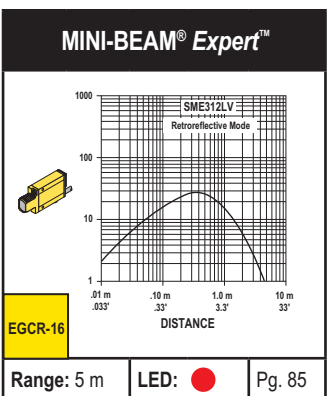
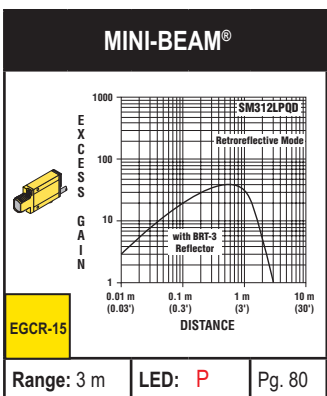
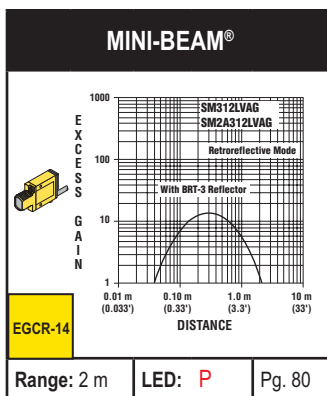
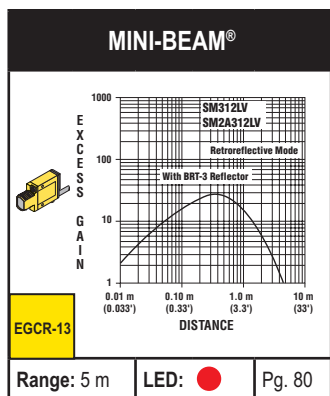
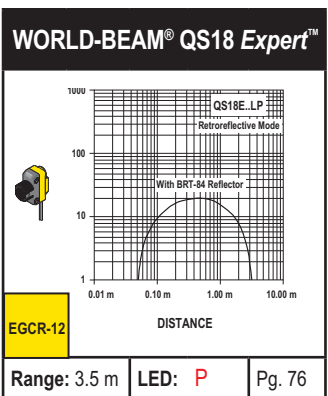
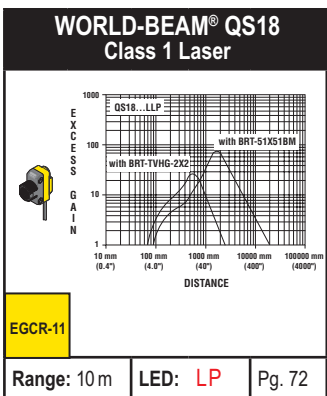
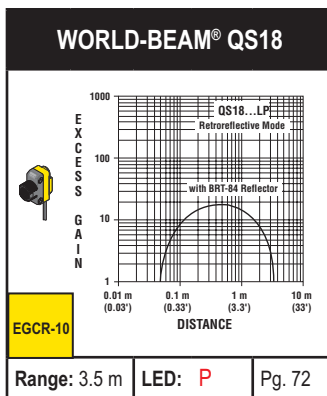
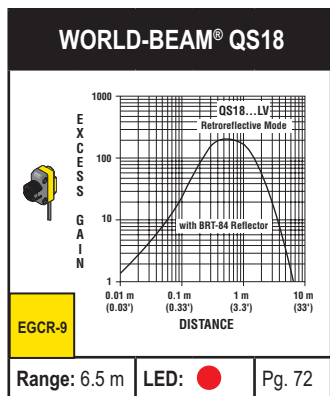
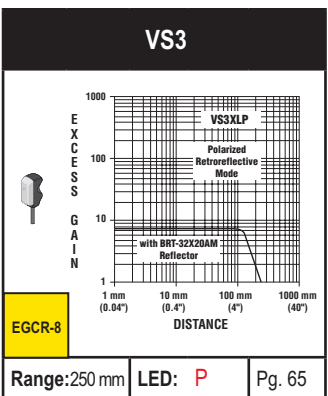
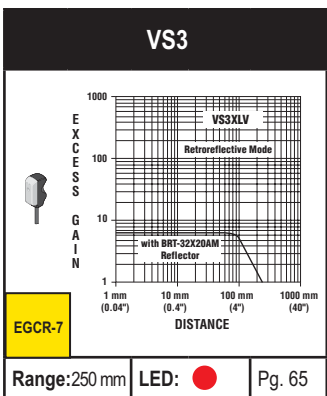
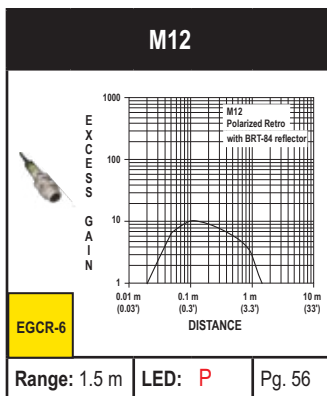
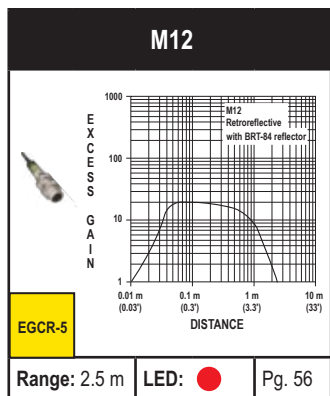
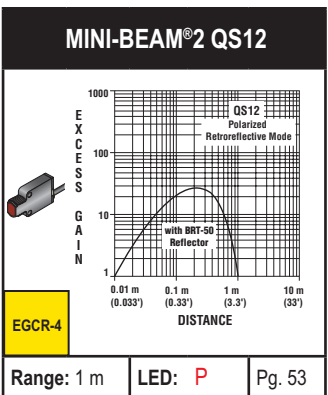
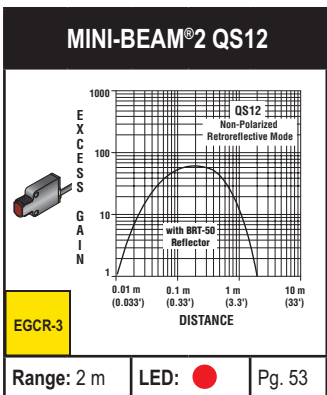
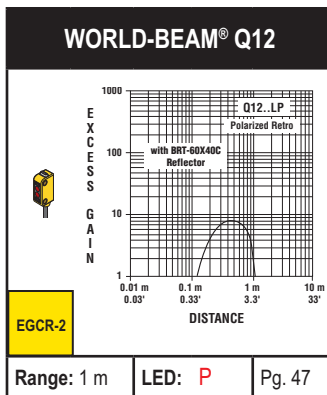
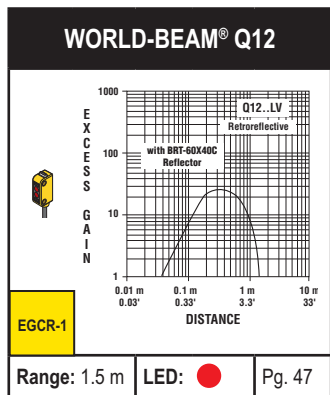
Training Note
Lighting Techniques

Supplemental Information
Vision Sensors - Choosing a Lens for a 1/3" Imager (Personnel/LED® Pro and Personnel/LED® PA BCN) Units in Inches

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Retroreflective Mode

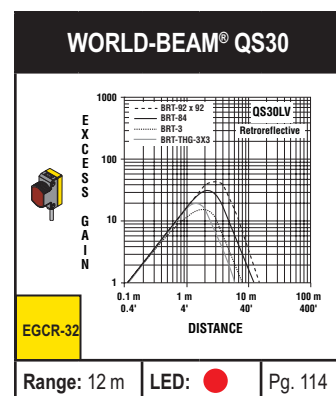
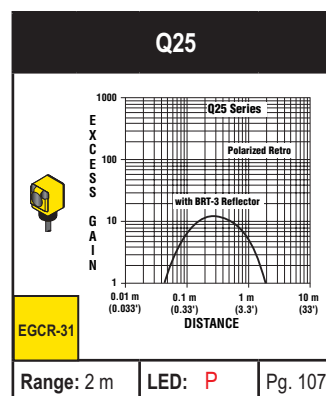
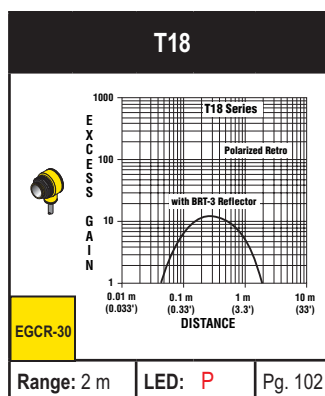
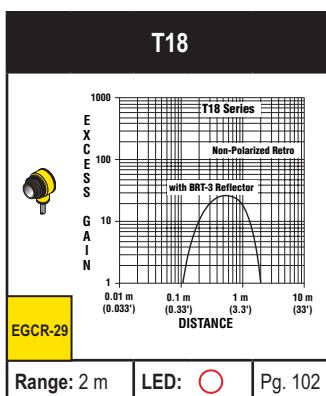
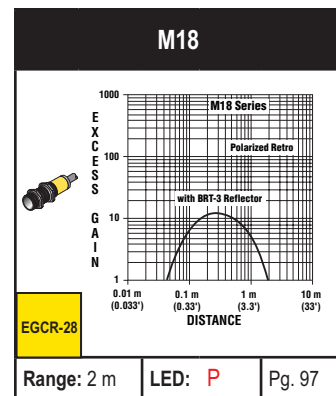
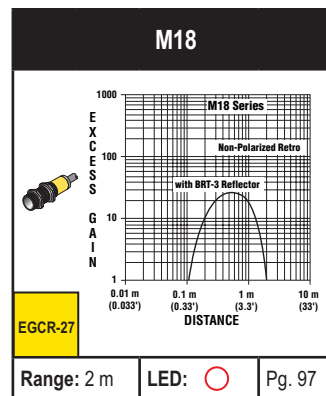
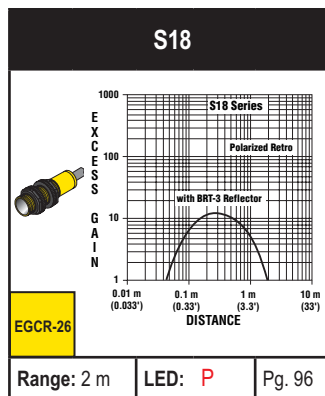
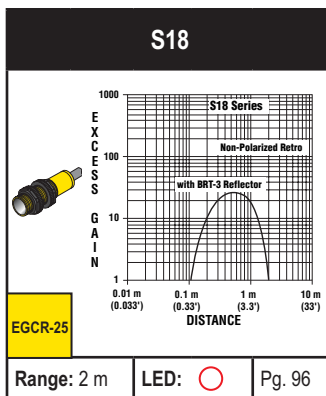
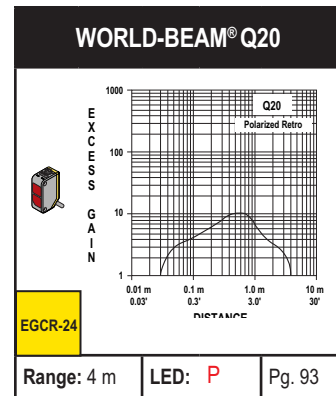
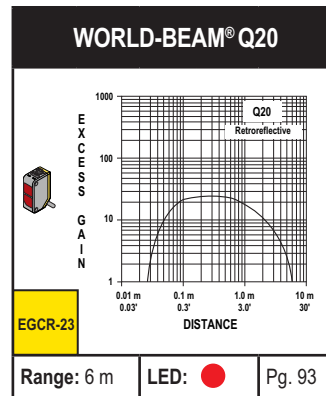
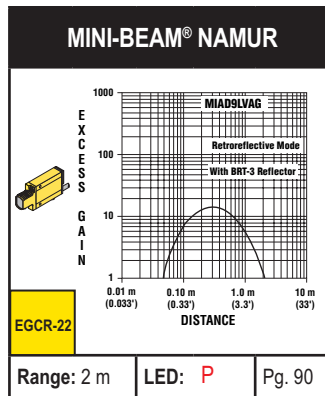
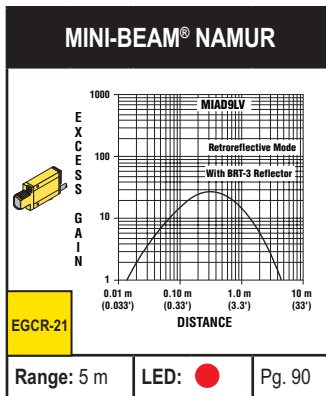
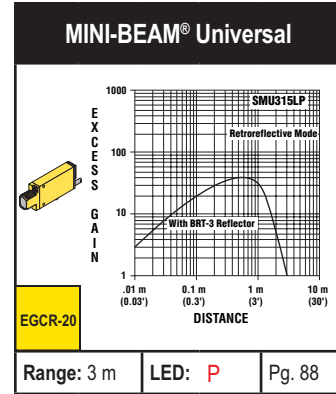
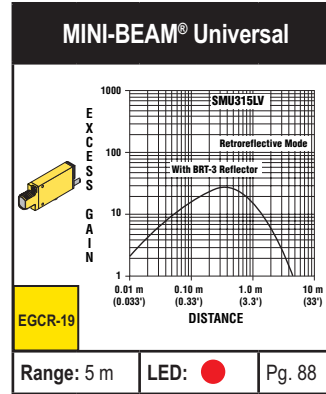
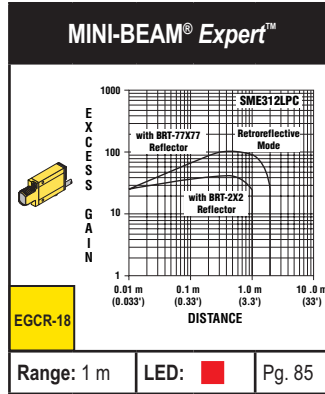
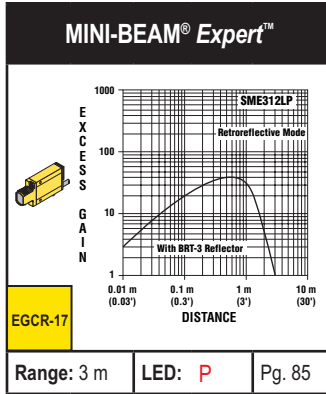
- = Visible Red LED
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- LP = Visible Red Laser LED Polarized



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Retroreflective Mode

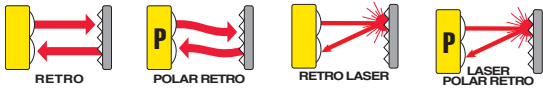
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Retroreflective Mode

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- LP = Visible Red Laser LED Polarized

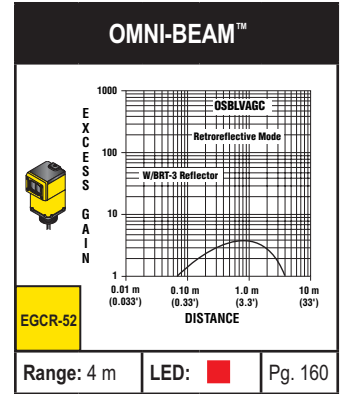
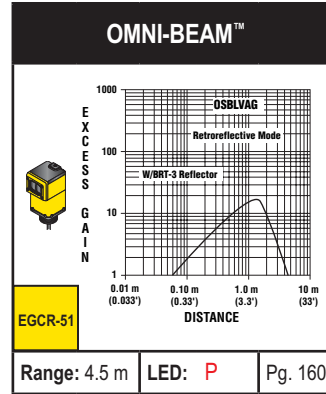
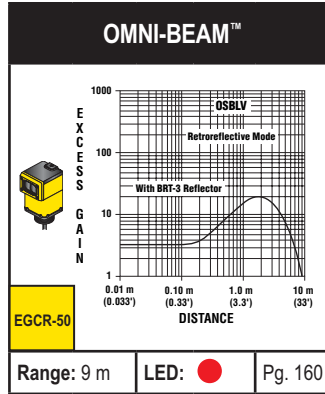
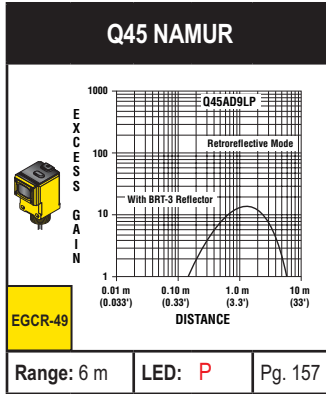
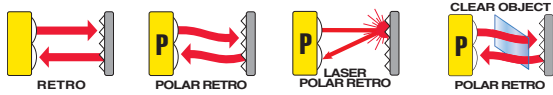


<p>WORLD-BEAM® QS30</p> <p>EGCR-33</p> <p>Range: 8 m LED: P Pg. 114</p>	<p>WORLD-BEAM® QS30 Class 1 Laser</p> <p>EGCR-34</p> <p>Range: 18 m LED: LP Pg. 116</p>	<p>WORLD-BEAM® QS30 Class 1 Laser</p> <p>EGCR-35</p> <p>Range: 2 m LED: LP Pg. 116</p>	<p>WORLD-BEAM® QS30 Universal</p> <p>EGCR-36</p> <p>Range: 8 m LED: P Pg. 119</p>
<p>S30</p> <p>EGCR-37</p> <p>Range: 6 m LED: P Pg. 122</p>	<p>T30</p> <p>EGCR-38</p> <p>Range: 6 m LED: P Pg. 130</p>	<p>Q40</p> <p>EGCR-39</p> <p>Range: 6 m LED: P Pg. 134</p>	<p>PicoDot®</p> <p>EGCR-40</p> <p>Range: 10.6 m LED: LP Pg. 138</p>
<p>PicoDot®</p> <p>EGCR-41</p> <p>Range: 39.6 m LED: LP Pg. 138</p>	<p>PicoDot®</p> <p>EGCR-42</p> <p>Range: 6 m LED: LP Pg. 138</p>	<p>QM42</p> <p>EGCR-43</p> <p>Range: 3 m LED: P Pg. 141</p>	<p>Q45</p> <p>EGCR-44</p> <p>Range: 9 m LED: ● Pg. 147</p>
<p>Q45</p> <p>EGCR-45</p> <p>Range: 6.0 m LED: P Pg. 147</p>	<p>Q45 Class 2 Laser</p> <p>EGCR-46</p> <p>Range: 70 m LED: ★ Pg. 147</p>	<p>Q45 Class 2 Laser</p> <p>EGCR-47</p> <p>Range: 40 m LED: LP Pg. 147</p>	<p>Q45 NAMUR</p> <p>EGCR-48</p> <p>Range: 9 m LED: ● Pg. 157</p>

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Retroreflective Mode

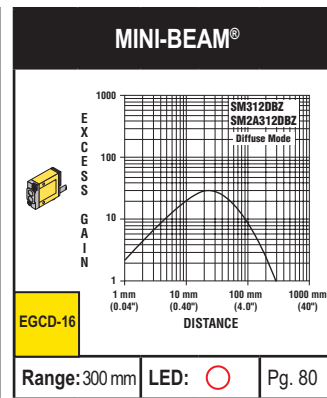
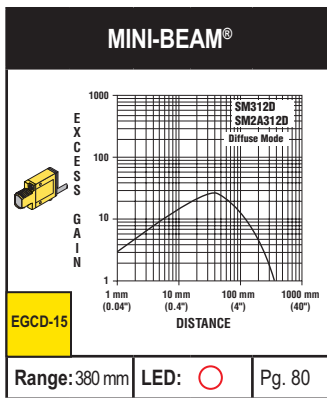
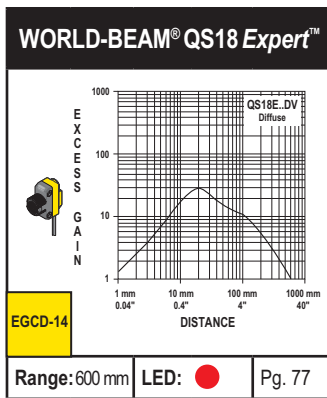
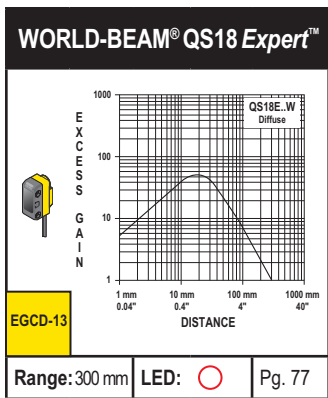
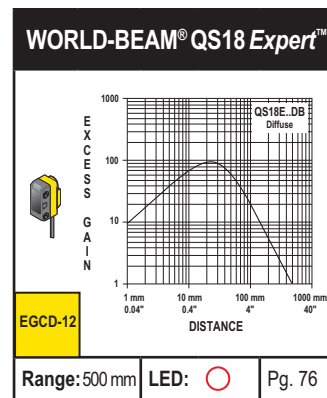
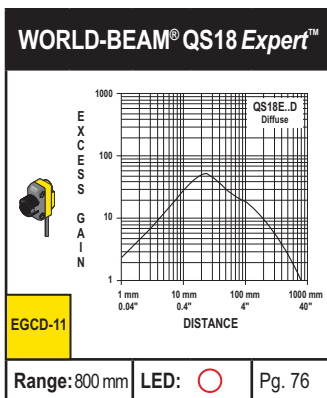
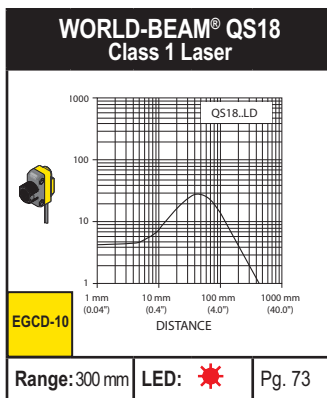
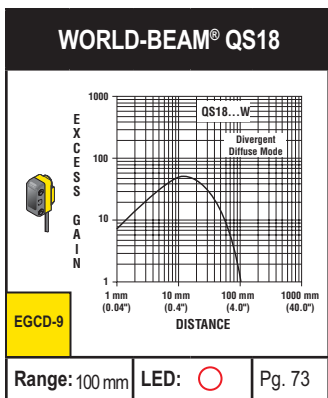
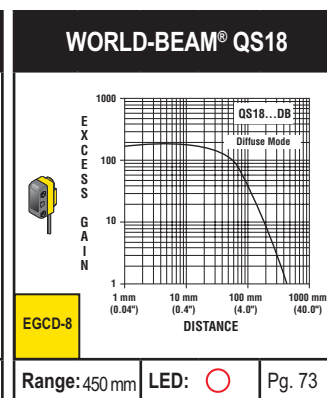
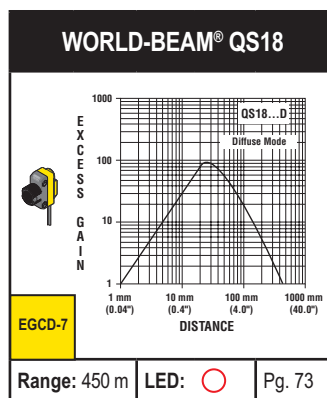
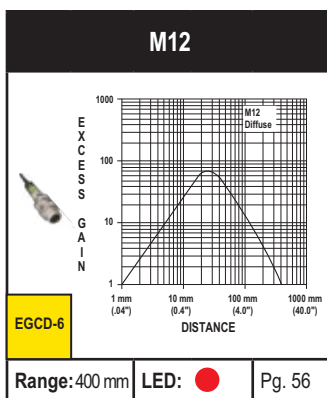
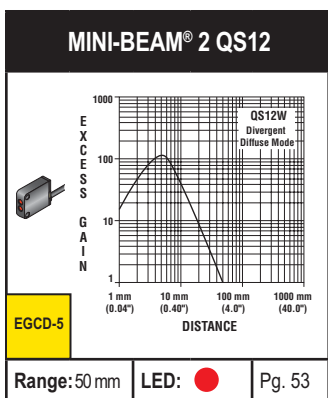
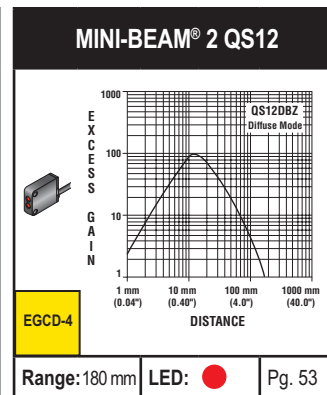
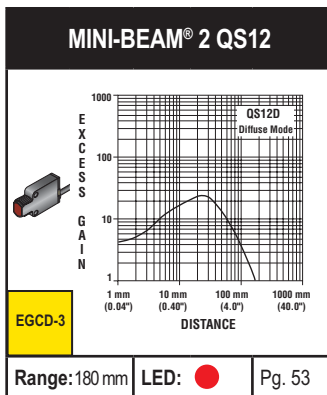
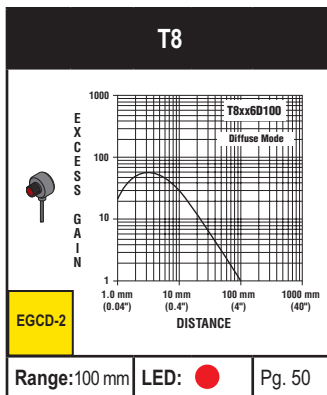
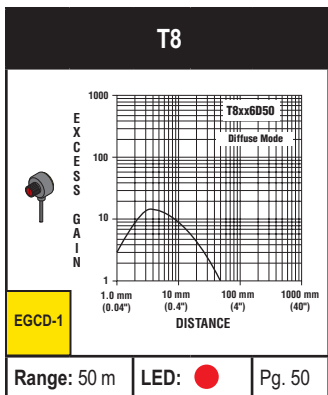
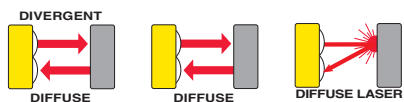
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Diffuse Mode (Performance based on 90% reflectance white test card)

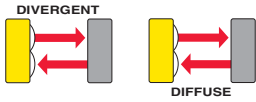
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Diffuse Mode (Performance based on 90% reflectance white test card)

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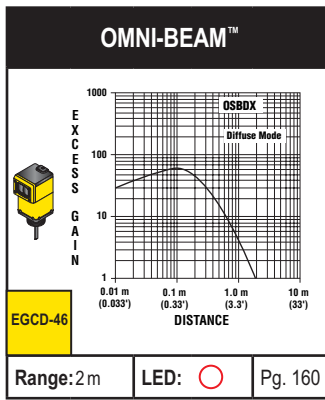
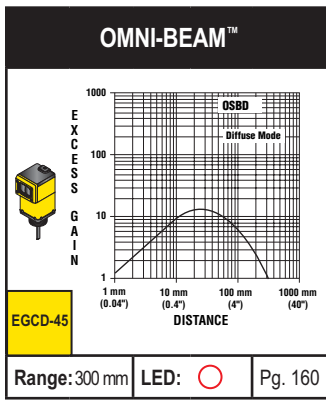
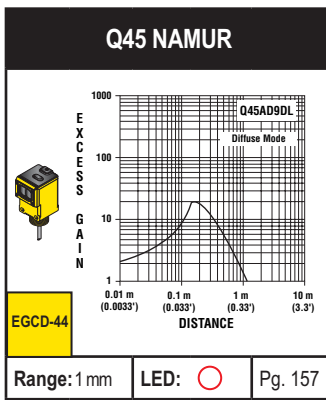
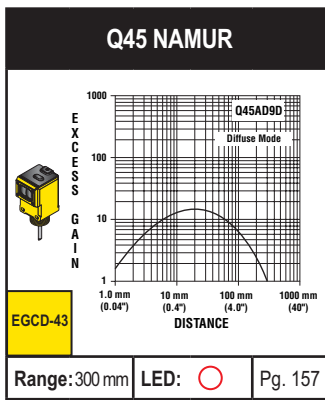
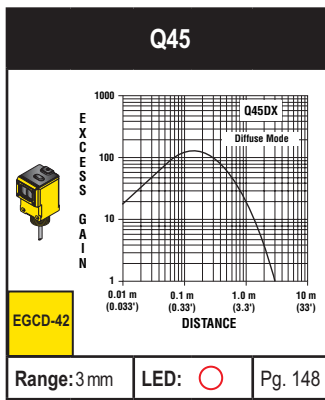
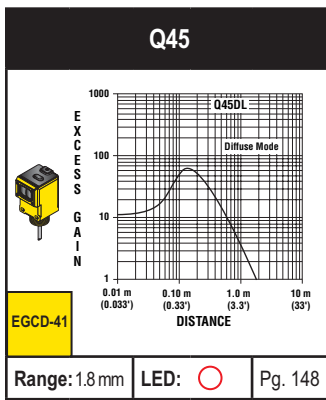
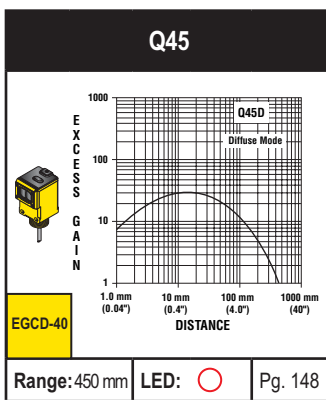
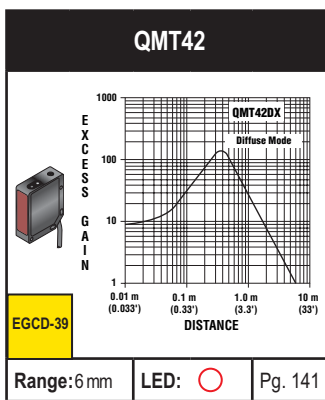
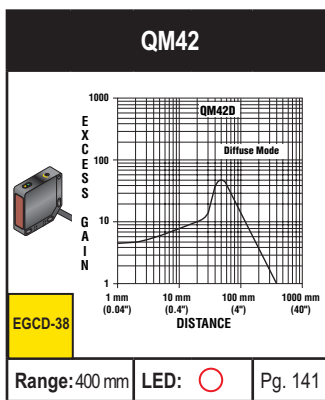
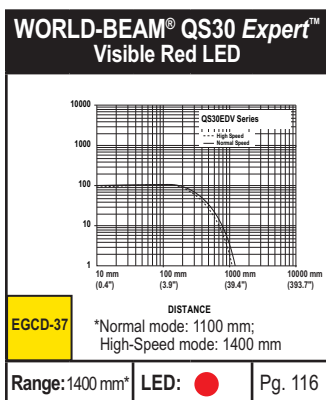
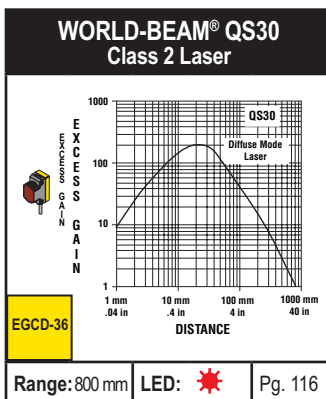
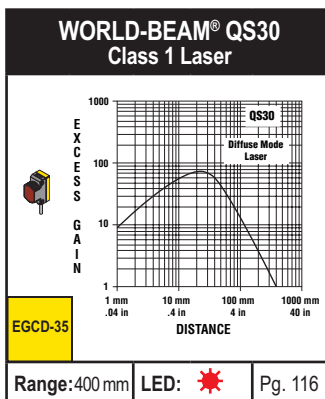
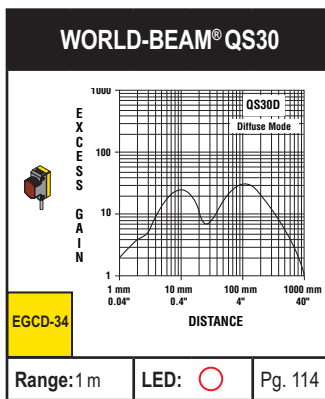
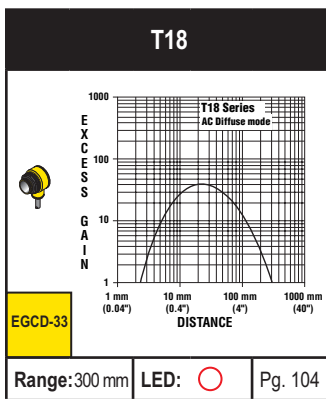


<p>MINI-BEAM®</p> <p>EGCD-17</p> <p>Range: 130 mm LED: ○ Pg. 80</p>	<p>MINI-BEAM® Expert™</p> <p>EGCD-18</p> <p>Range: 380 mm LED: ○ Pg. 85</p>	<p>MINI-BEAM® Expert™</p> <p>EGCD-19</p> <p>Range: 130 mm LED: ○ Pg. 85</p>	<p>MINI-BEAM® Expert™</p> <p>EGCD-20</p> <p>Range: 1100 mm LED: ● Pg. 85</p>
<p>MINI-BEAM® Universal</p> <p>EGCD-21</p> <p>Range: 380 mm LED: ○ Pg. 88</p>	<p>MINI-BEAM® Universal</p> <p>EGCD-22</p> <p>Range: 130 mm LED: ○ Pg. 88</p>	<p>MINI-BEAM® NAMUR</p> <p>EGCD-23</p> <p>Range: 380 mm LED: ○ Pg. 90</p>	<p>MINI-BEAM® NAMUR</p> <p>EGCD-24</p> <p>Range: 75 mm LED: ○ Pg. 90</p>
<p>WORLD-BEAM® Q20</p> <p>EGCD-25</p> <p>Range: 250 mm LED: ● Pg. 93</p>	<p>WORLD-BEAM® Q20</p> <p>EGCD-26</p> <p>Range: 800 mm LED: ● Pg. 93</p>	<p>WORLD-BEAM® Q20</p> <p>EGCD-27</p> <p>Range: 1500 mm LED: ○ Pg. 93</p>	<p>S18</p> <p>EGCD-28</p> <p>Range: 100 mm LED: ○ Pg. 96</p>
<p>S18</p> <p>EGCD-29</p> <p>Range: 300 mm LED: ○ Pg. 96</p>	<p>M18</p> <p>EGCD-30</p> <p>Range: 100 mm LED: ○ Pg. 97</p>	<p>M18</p> <p>EGCD-31</p> <p>Range: 300 mm LED: ○ Pg. 97</p>	<p>T18</p> <p>EGCD-32</p> <p>Range: 500 mm LED: ○ Pg. 102</p>

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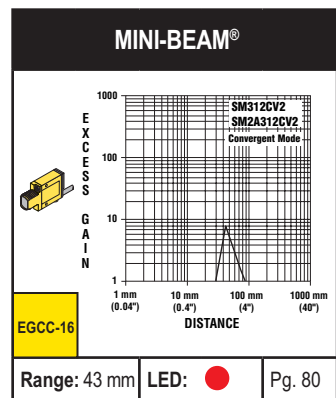
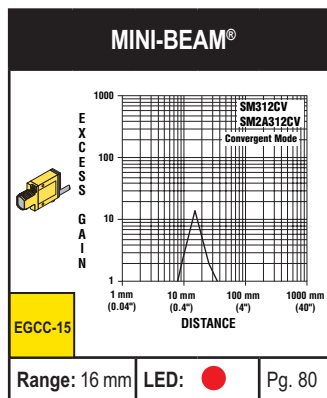
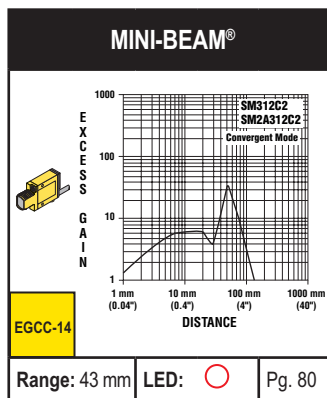
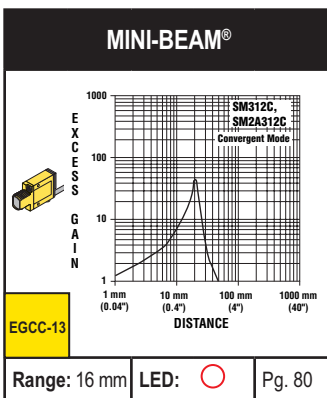
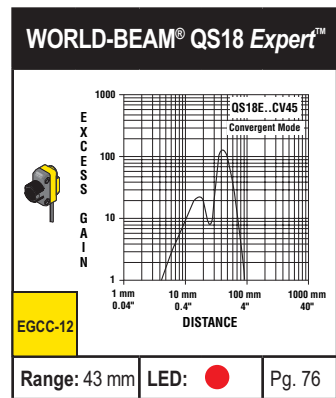
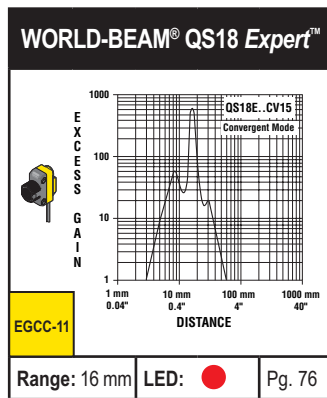
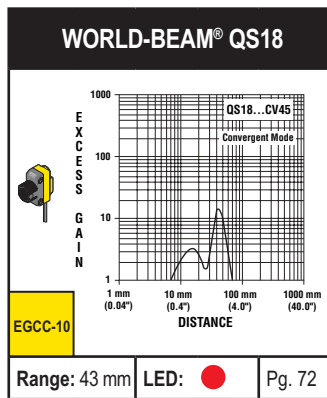
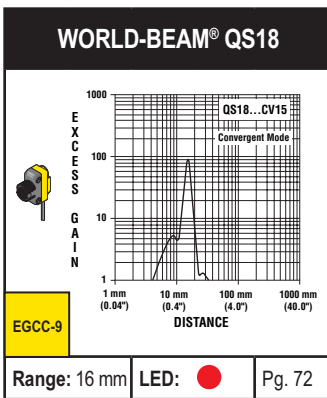
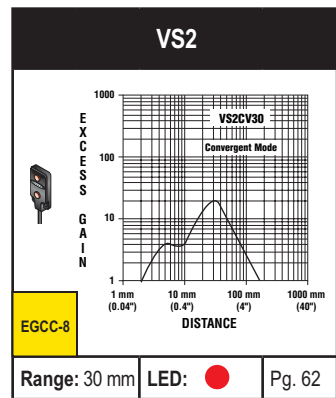
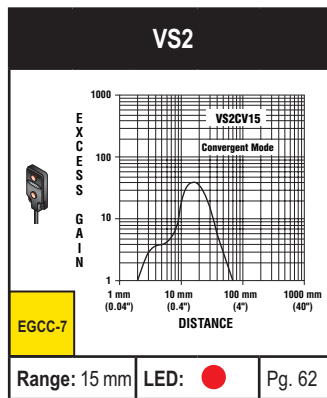
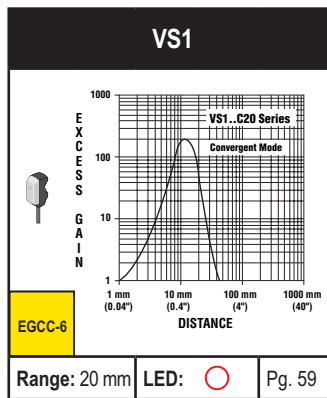
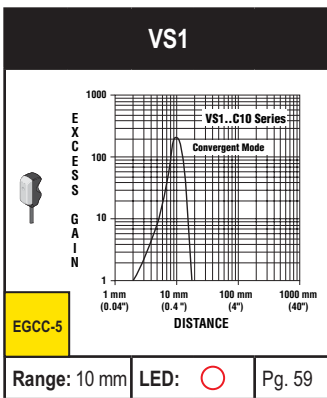
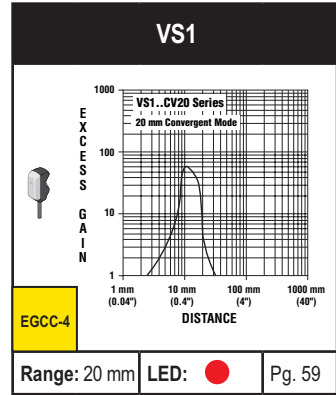
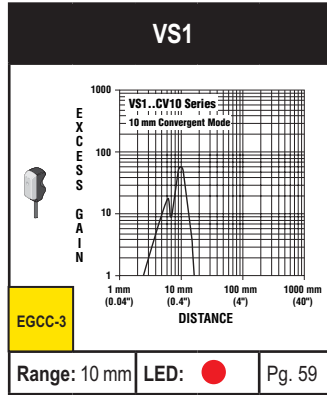
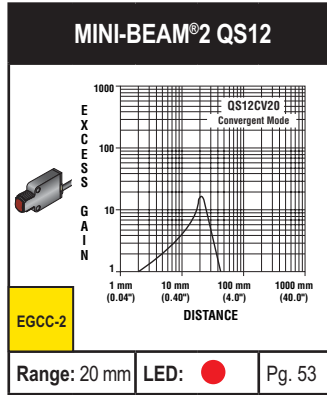
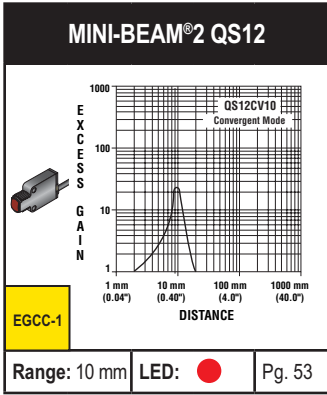
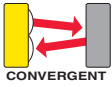
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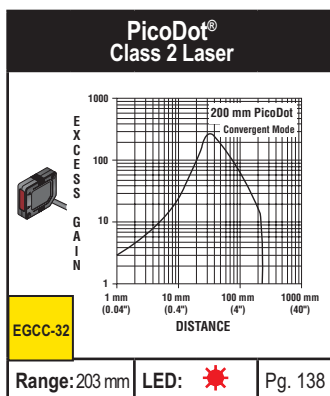
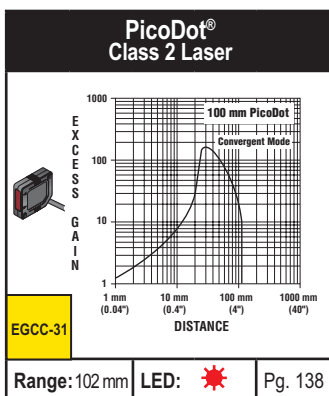
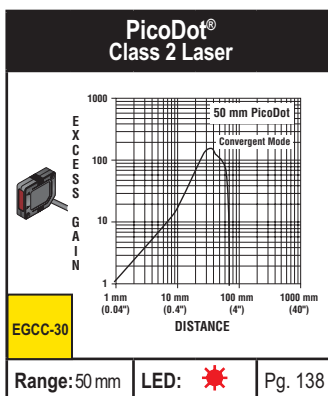
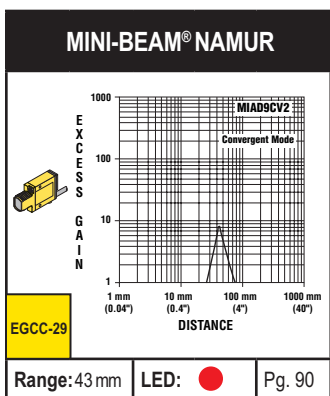
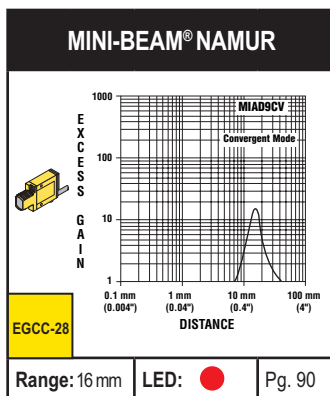
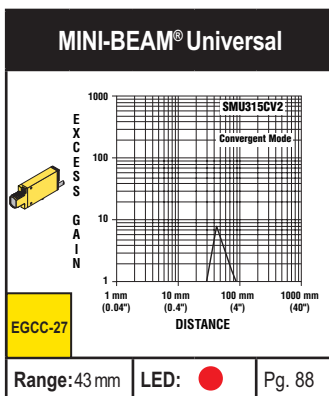
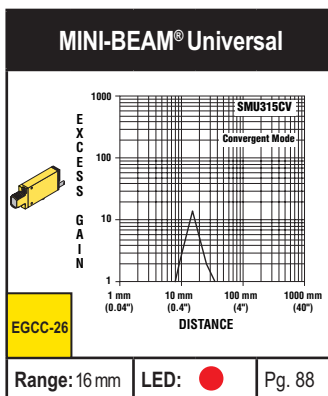
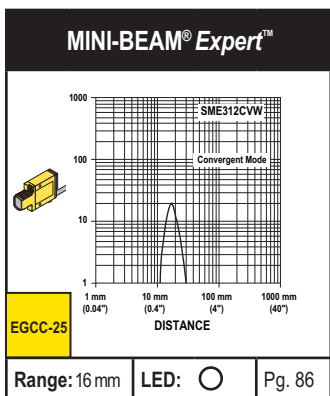
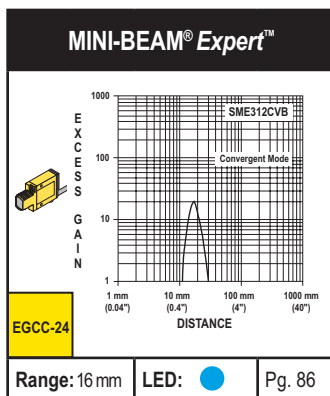
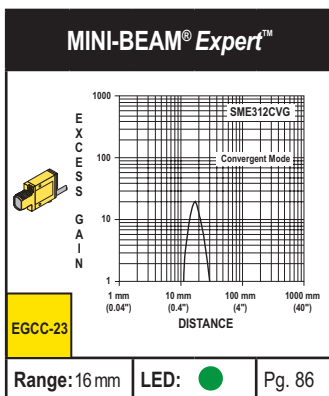
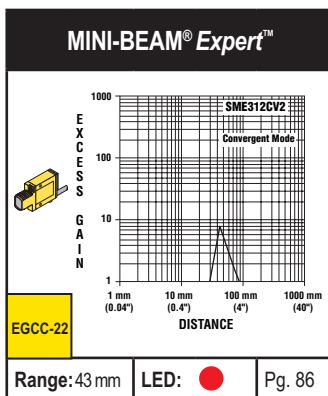
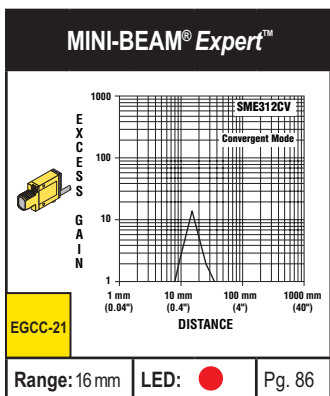
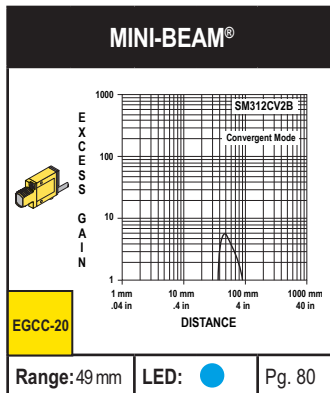
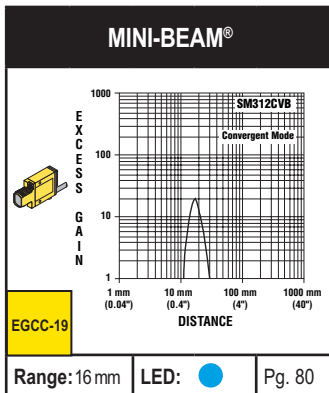
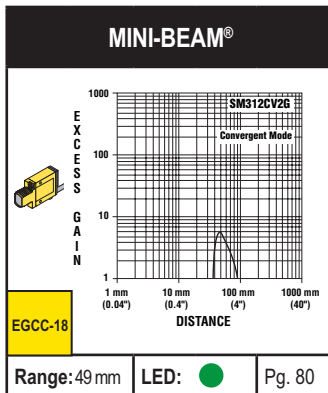
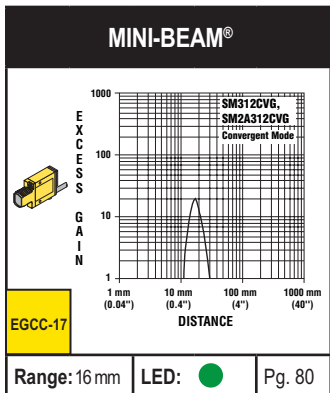
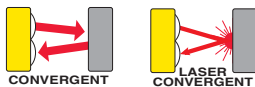
Convergent Mode (Performance based on 90% reflectance white test card) ○ = Infrared LED ● = Visible Red LED



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Convergent Mode (Performance based on 90% reflectance white test card)

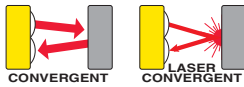
- = Visible Red LED
- = Visible Green LED
- = Visible Blue LED
- = Visible White LED
- ★ = Visible Red Laser LED



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Convergent Mode (Performance based on 90% reflectance white test card)

- = Visible Red LED
- = Visible Green LED
- = Visible Blue LED
- ★ = Visible Red Laser LED

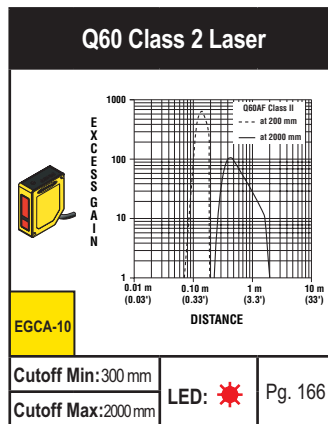
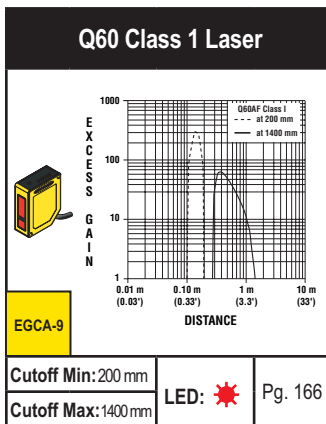
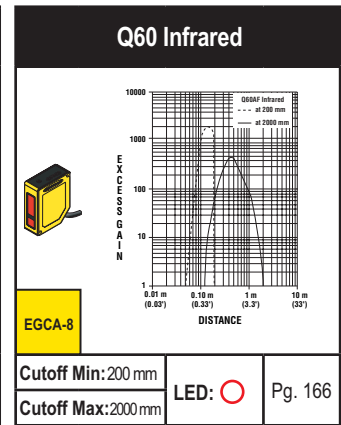
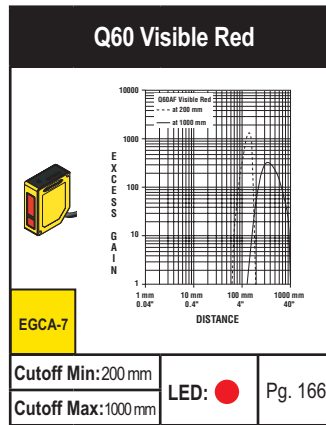
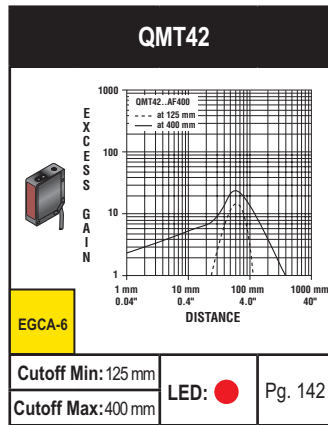
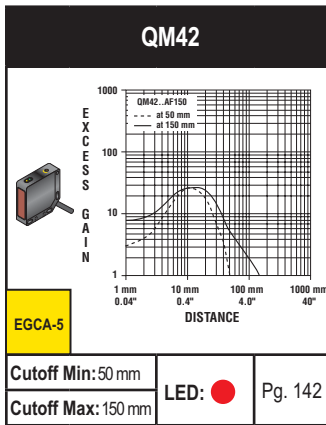
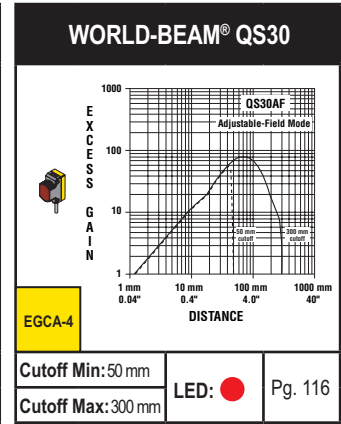
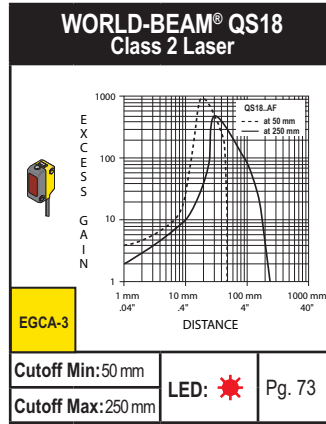
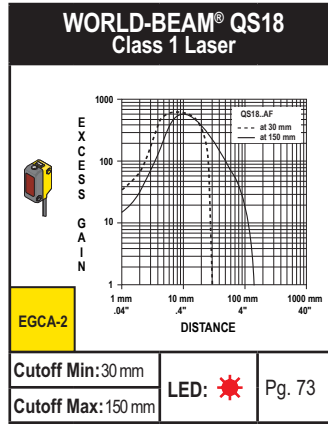
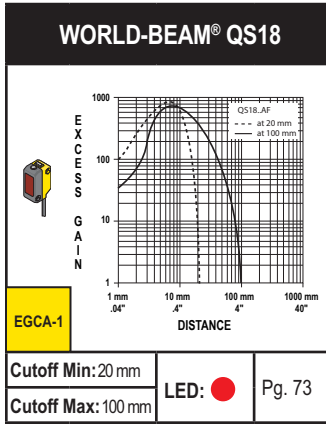


<p>PicoDot® Class 2 Laser</p> <p>EGCC-33</p> <p>Range: 305 mm LED: ★ Pg. 138</p>	<p>Q45</p> <p>EGCC-34</p> <p>Range: 38 mm LED: ● Pg. 148</p>	<p>Q45</p> <p>EGCC-35</p> <p>Range: 100 mm LED: ● Pg. 148</p>	<p>Q45 NAMUR</p> <p>EGCC-36</p> <p>Range: 38 mm LED: ● Pg. 157</p>
<p>Q45 NAMUR</p> <p>EGCC-37</p> <p>Range: 100 mm LED: ● Pg. 157</p>	<p>OMNI-BEAM™</p> <p>EGCC-38</p> <p>Range: 38 mm LED: ● Pg. 161</p>	<p>OMNI-BEAM™</p> <p>EGCC-39</p> <p>Range: 38 mm LED: ● Pg. 161</p>	<p>OMNI-BEAM™</p> <p>EGCC-40</p> <p>Range: 38 mm LED: ● Pg. 161</p>

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Adjustable-Field Mode (Performance based on 90% reflectance white test card)

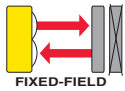
- = Infrared LED
- = Visible Red LED
- ★ = Visible Red Laser LED



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Fixed-Field Mode (Performance based on 90% reflectance white test card)

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- = Visible Red LED

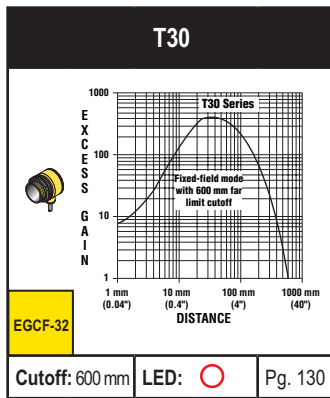
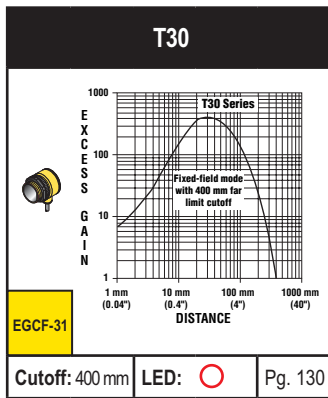
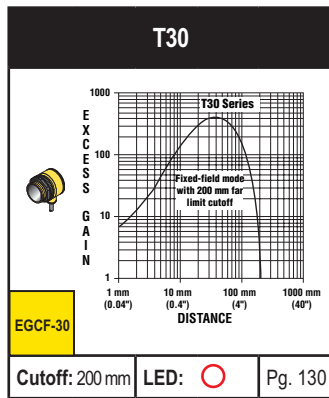
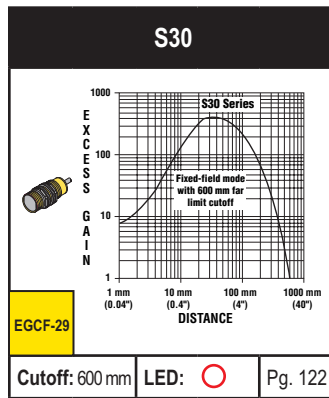
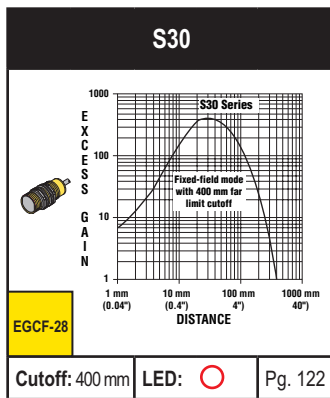
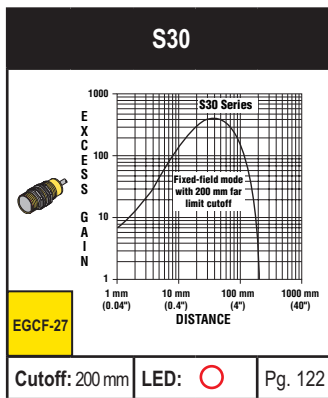
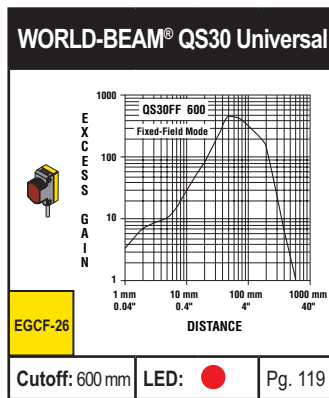
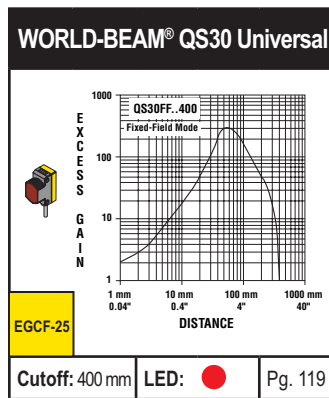
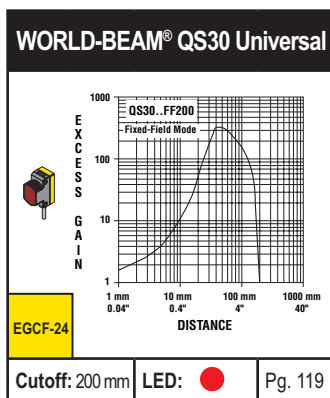
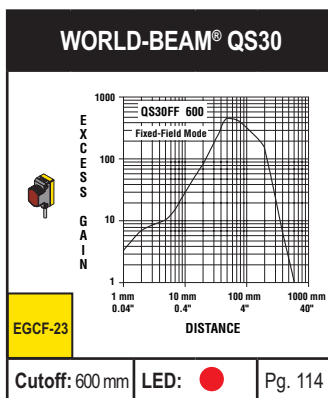
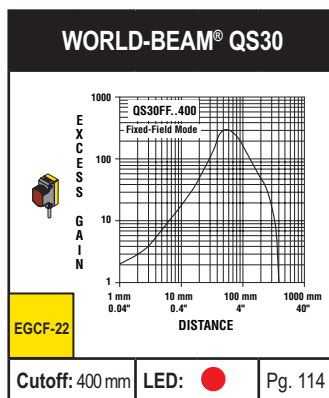
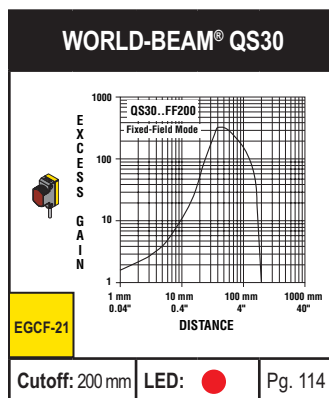
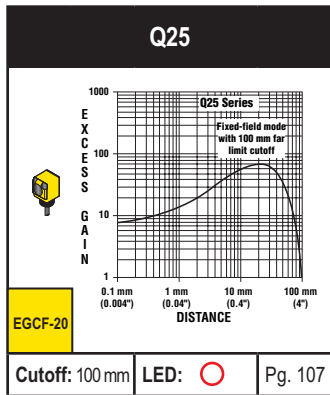
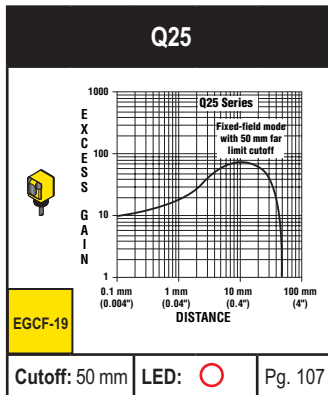
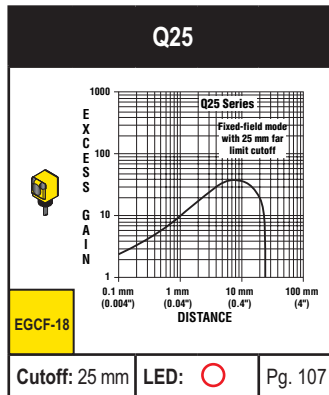
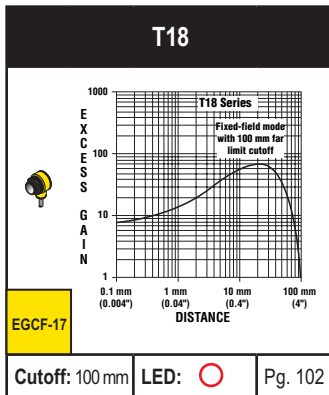
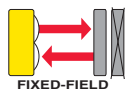


<p>WORLD-BEAM® Q12</p> <p>EGCF-1</p> <p>Cutoff: 15 mm LED: ● Pg. 47</p>	<p>WORLD-BEAM® Q12</p> <p>EGCF-2</p> <p>Cutoff: 30 mm LED: ● Pg. 48</p>	<p>WORLD-BEAM® Q12</p> <p>EGCF-3</p> <p>Cutoff: 50 mm LED: ● Pg. 48</p>	<p>M12</p> <p>EGCF-4</p> <p>Cutoff: 25 mm LED: ● Pg. 56</p>
<p>M12</p> <p>EGCF-5</p> <p>Cutoff: 50 mm LED: ● Pg. 56</p>	<p>M12</p> <p>EGCF-6</p> <p>Cutoff: 75 mm LED: ● Pg. 56</p>	<p>WORLD-BEAM® QS18</p> <p>EGCF-7</p> <p>Cutoff: 50 mm LED: ● Pg. 73</p>	<p>WORLD-BEAM® QS18</p> <p>EGCF-8</p> <p>Cutoff: 100 mm LED: ● Pg. 74</p>
<p>S18</p> <p>EGCF-9</p> <p>Cutoff: 25 mm LED: ○ Pg. 96</p>	<p>S18</p> <p>EGCF-10</p> <p>Cutoff: 50 mm LED: ○ Pg. 96</p>	<p>S18</p> <p>EGCF-11</p> <p>Cutoff: 100 mm LED: ○ Pg. 96</p>	<p>M18</p> <p>EGCF-12</p> <p>Cutoff: 25 mm LED: ○ Pg. 97</p>
<p>M18</p> <p>EGCF-13</p> <p>Cutoff: 50 m LED: ○ Pg. 97</p>	<p>M18</p> <p>EGCF-14</p> <p>Cutoff: 100 mm LED: ○ Pg. 97</p>	<p>T18</p> <p>EGCF-15</p> <p>Cutoff: 25 mm LED: ○ Pg. 102</p>	<p>T18</p> <p>EGCF-16</p> <p>Cutoff: 50 mm LED: ○ Pg. 102</p>

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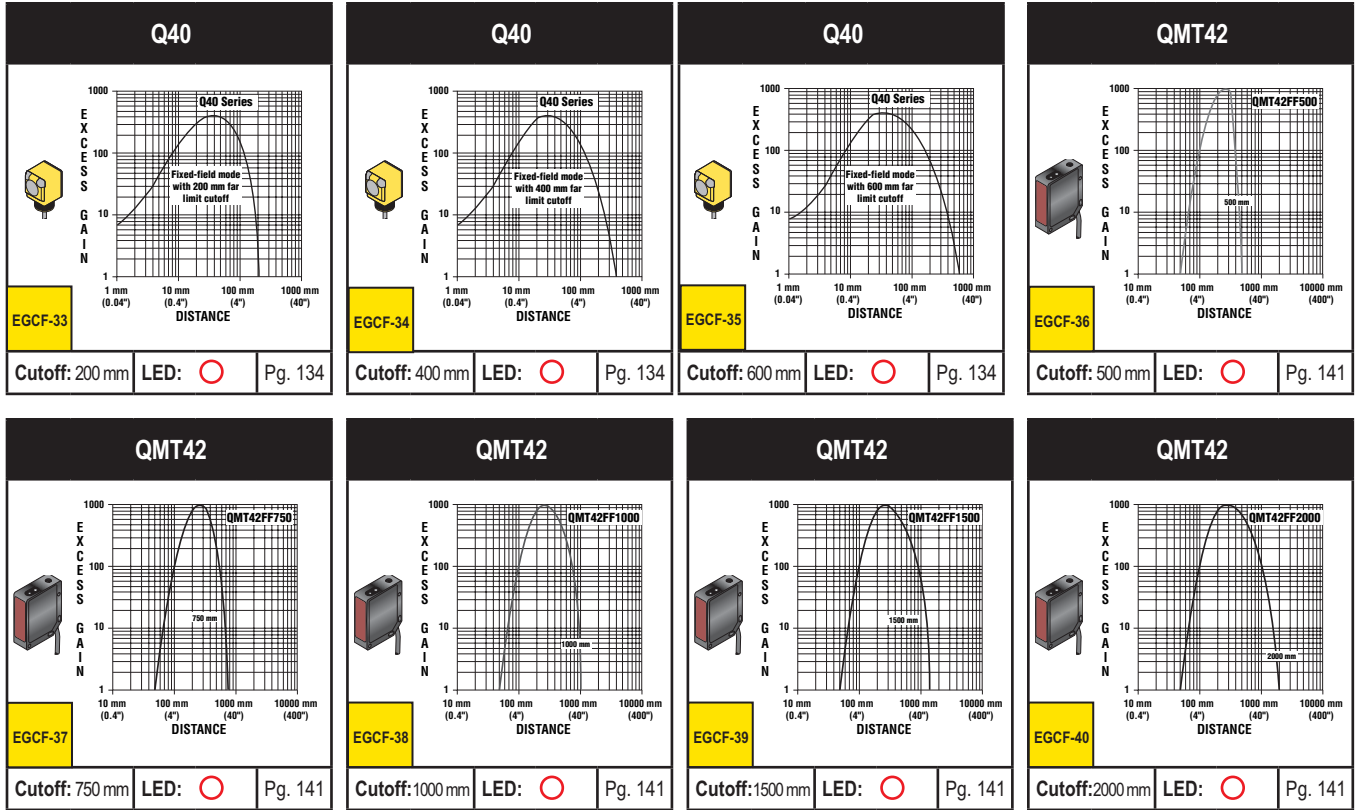
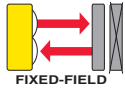
Fixed-Field Mode (Performance based on 90% reflectance white test card)

○ = Infrared LED
● = Visible Red LED



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Fixed-Field Mode (Performance based on 90% reflectance white test card) ○ = Infrared LED



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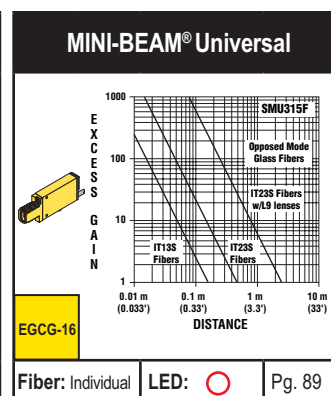
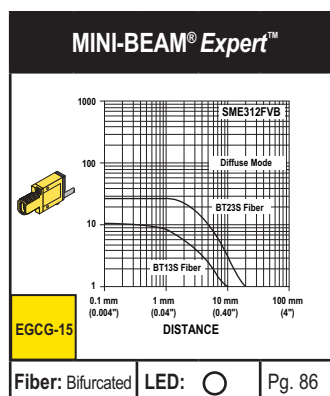
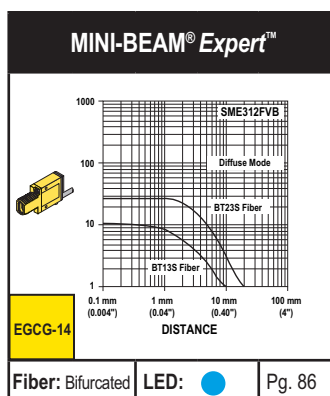
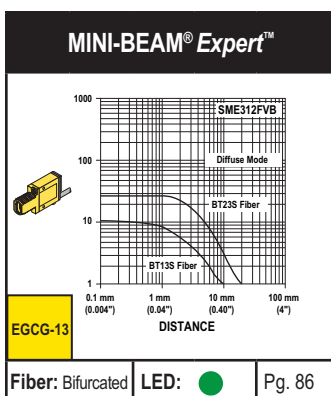
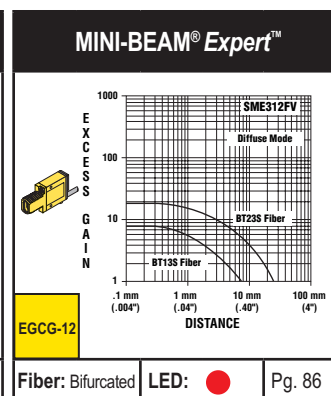
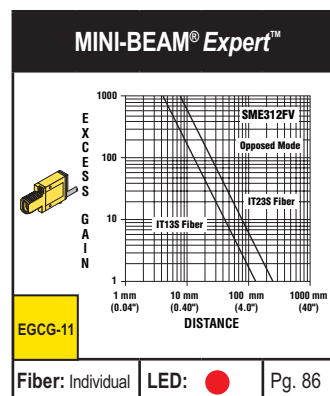
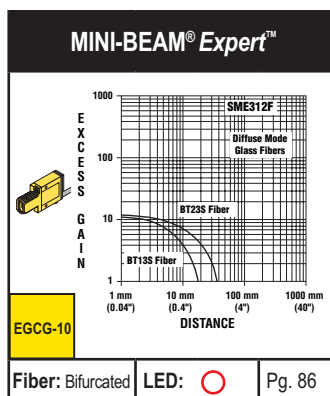
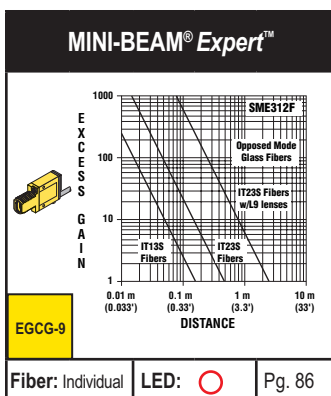
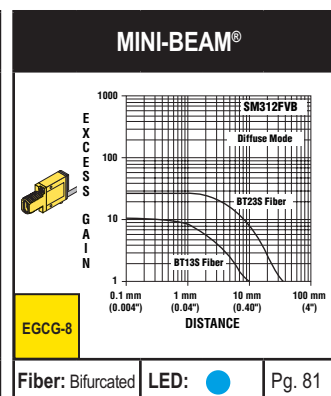
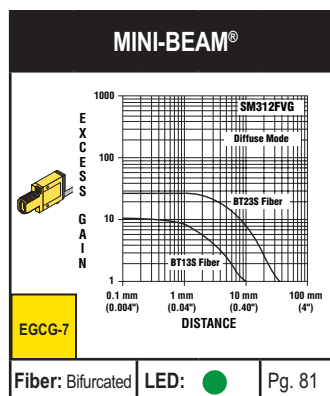
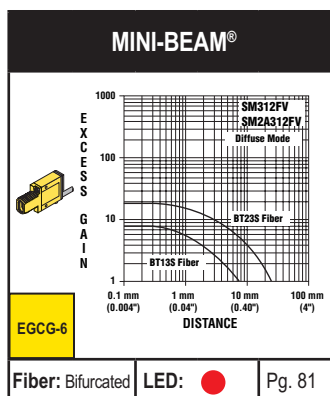
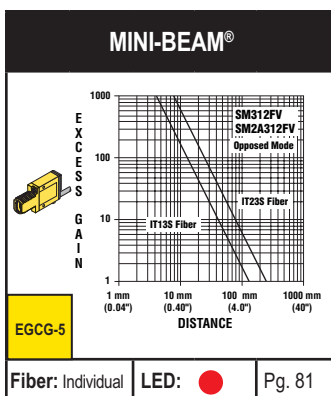
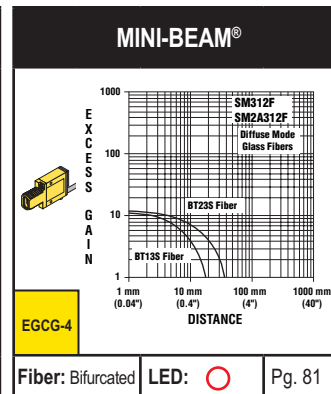
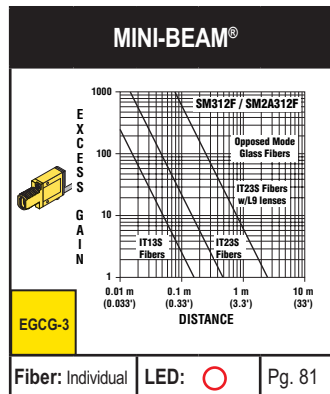
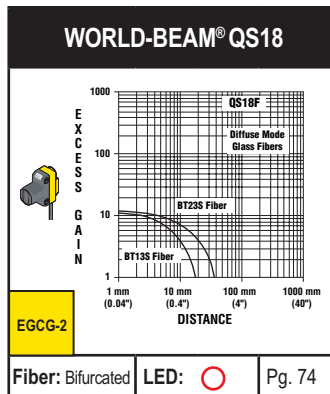
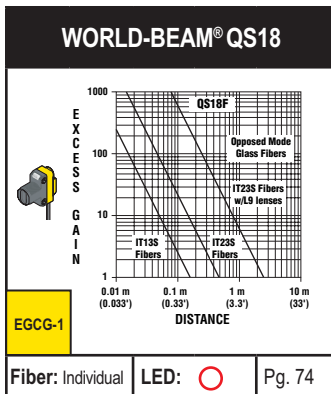
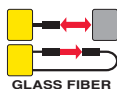
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Glass Fiber Optic Mode (Performance based on 90% reflectance white test card)

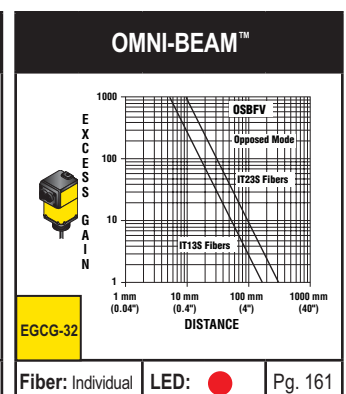
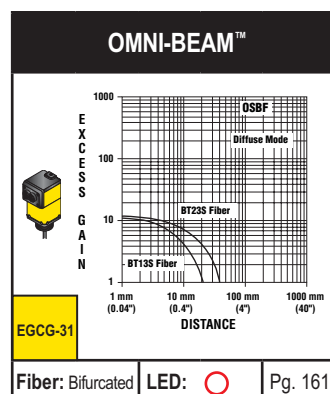
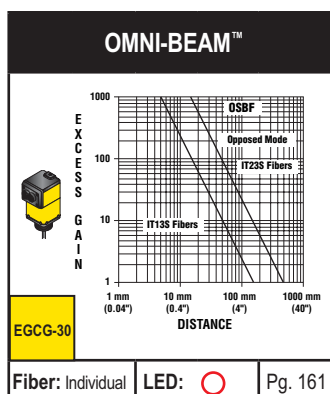
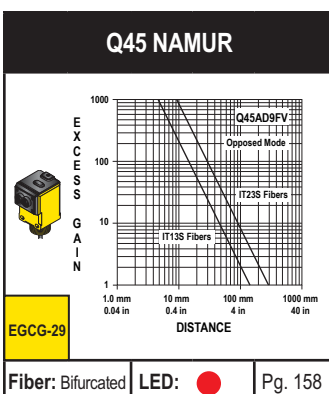
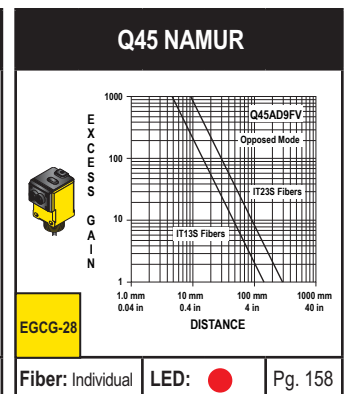
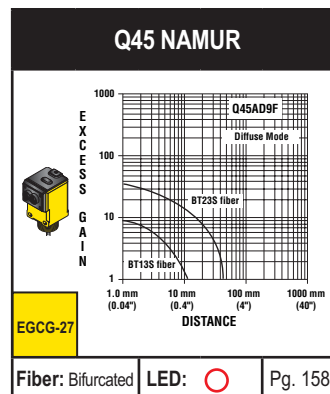
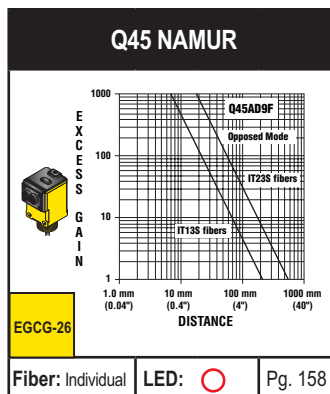
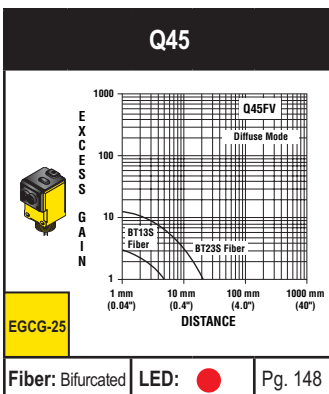
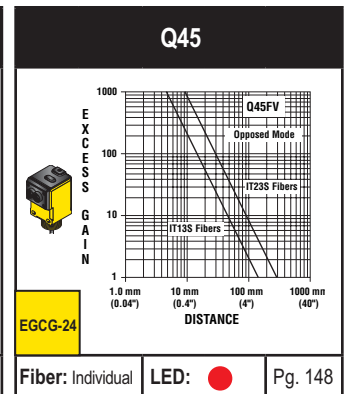
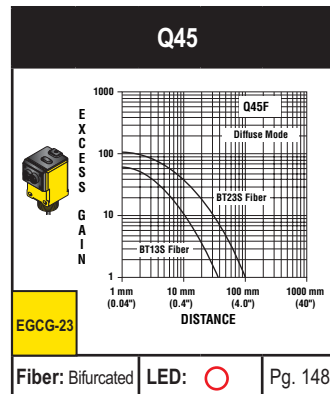
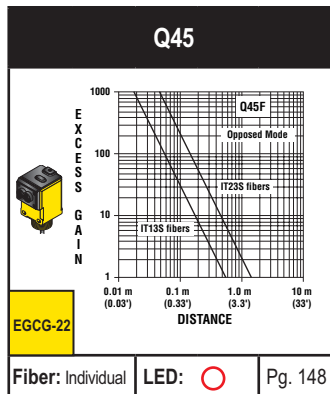
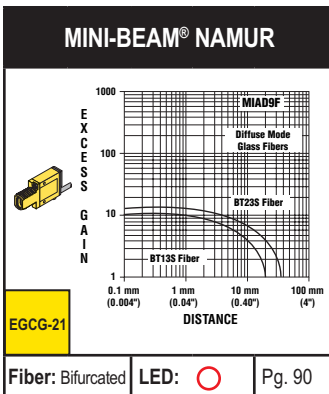
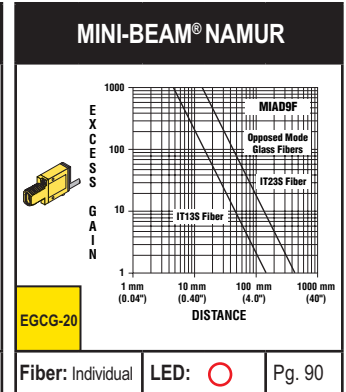
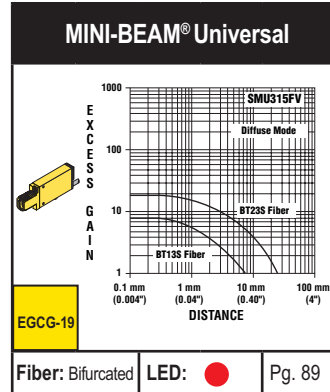
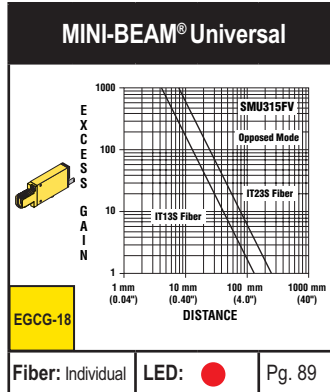
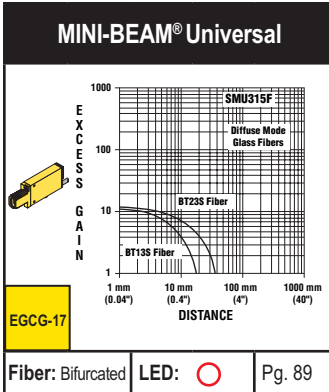
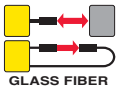
- = Infrared LED
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Glass Fiber Optic Mode (Performance based on 90% reflectance white test card)

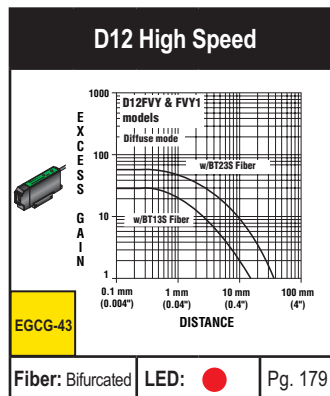
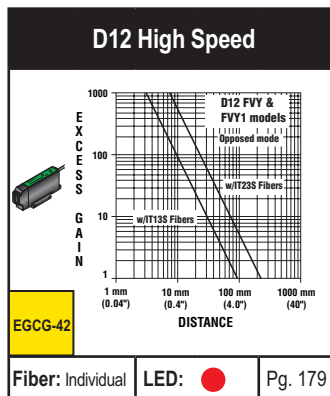
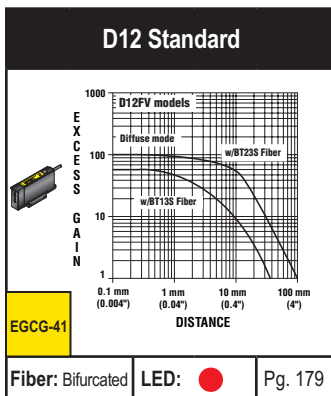
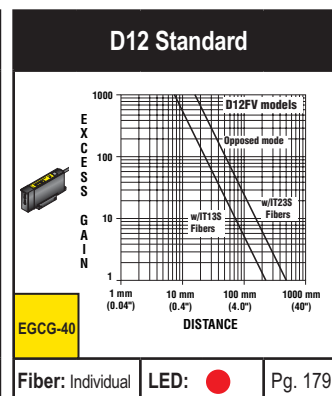
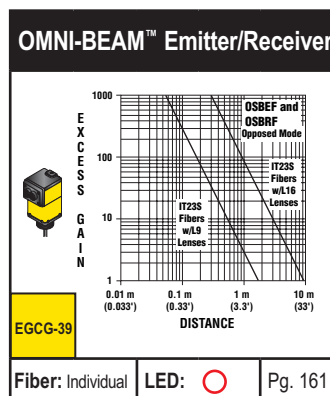
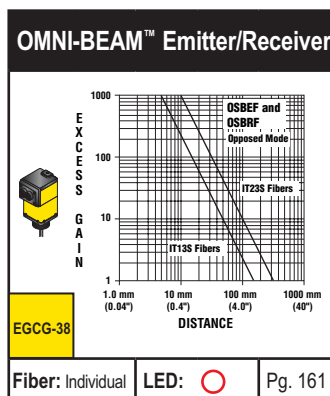
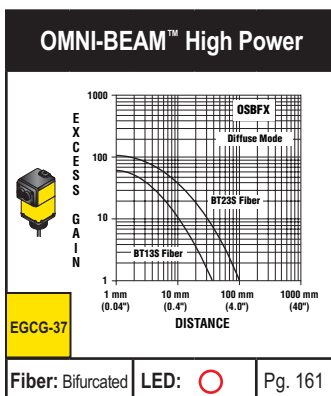
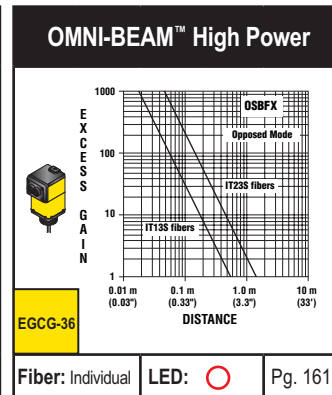
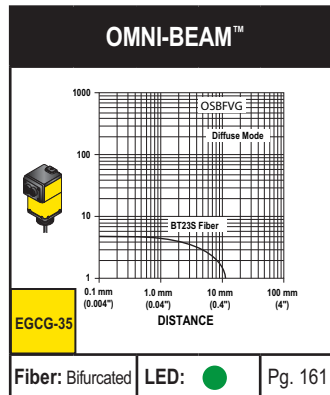
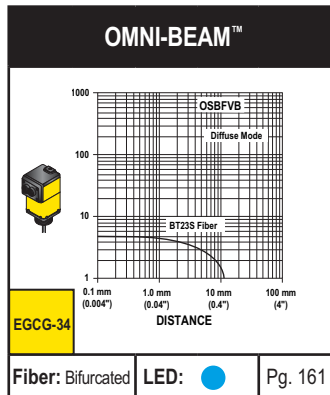
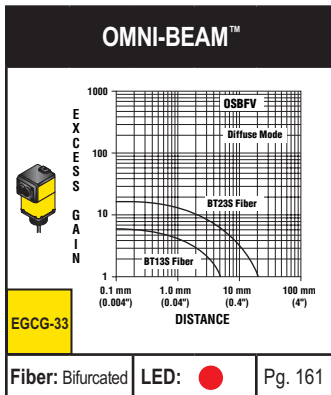
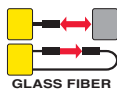
○ = Infrared LED
● = Visible Red LED



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Glass Fiber Optic Mode (Performance based on 90% reflectance white test card)

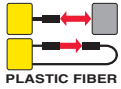
- = Infrared LED
- = Visible Red LED
- = Visible Green LED
- = Visible Blue LED



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Plastic Fiber Optic Mode (Performance based on 90% reflectance white test card)

- = Visible Red LED
- = Visible Green LED
- = Visible Blue LED
- = Visible White LED

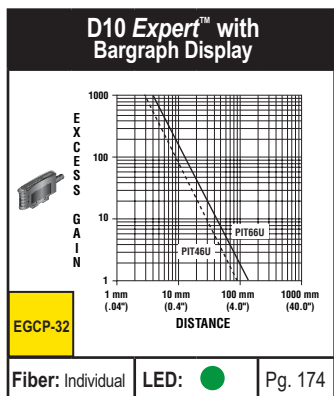
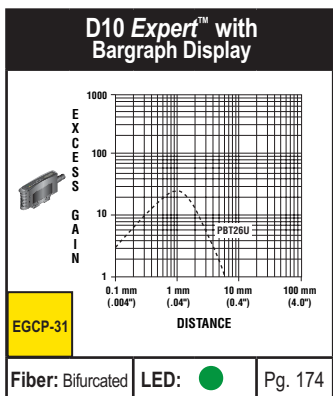
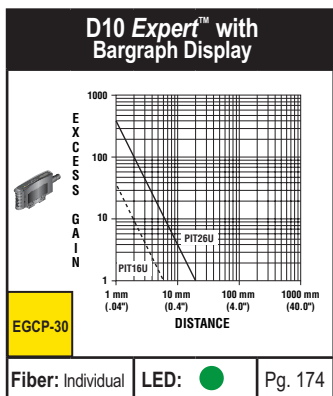
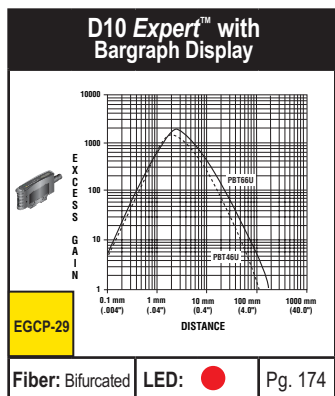
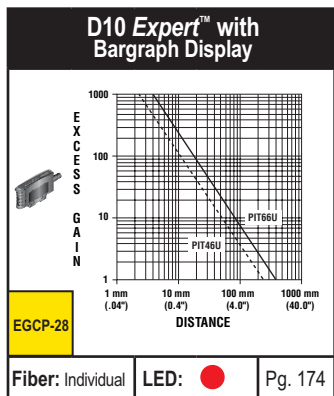
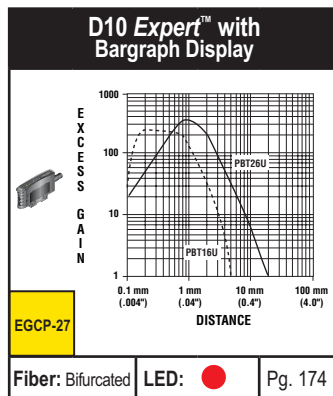
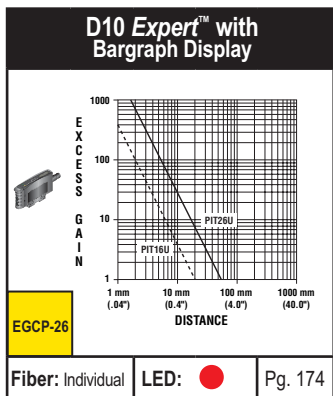
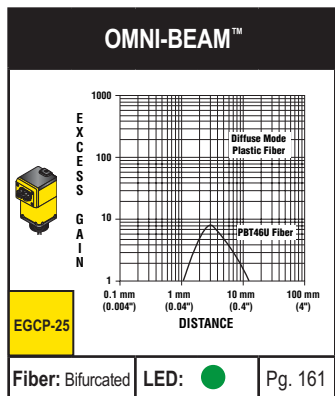
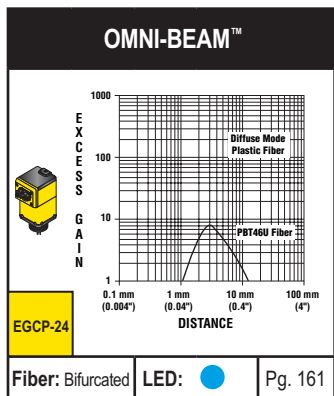
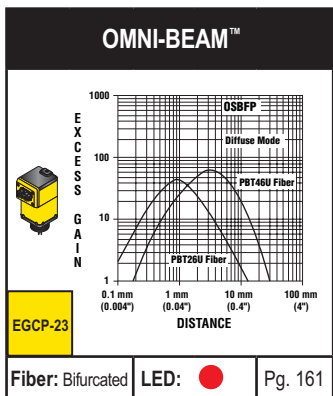
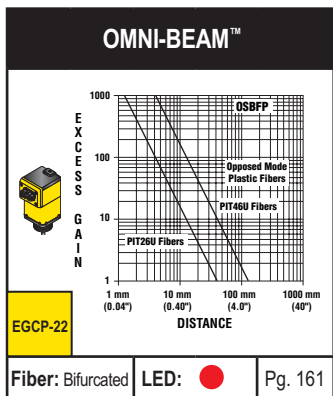
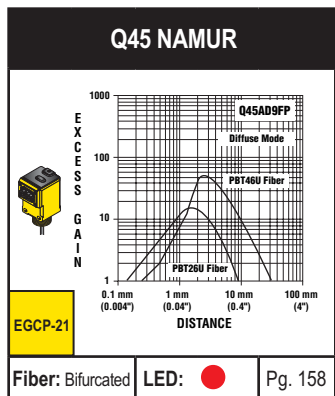
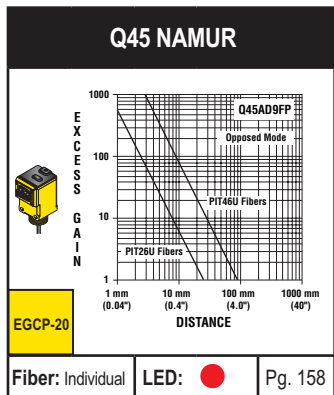
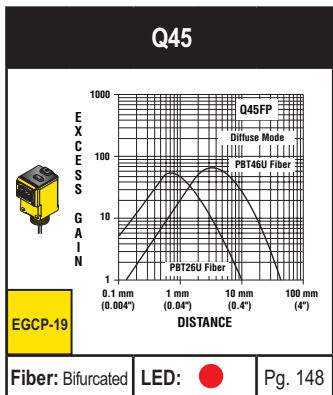
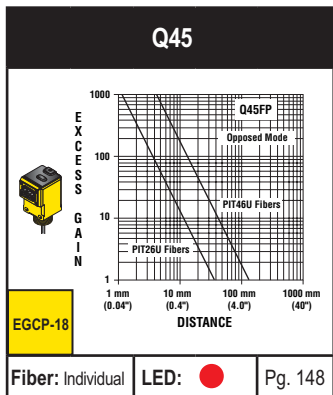
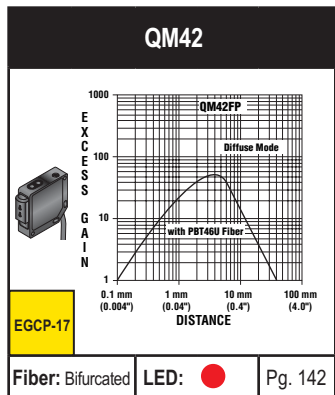
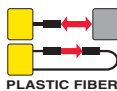


<p>WORLD-BEAM® QS18</p> <p>EGCP-1</p> <p>Fiber: Individual LED: ● Pg. 74</p>	<p>WORLD-BEAM® QS18</p> <p>EGCP-2</p> <p>Fiber: Bifurcated LED: ● Pg. 74</p>	<p>WORLD-BEAM® QS18 Expert™</p> <p>EGCP-3</p> <p>Fiber: Individual LED: ● Pg. 77</p>	<p>WORLD-BEAM® QS18 Expert™</p> <p>EGCP-4</p> <p>Fiber: Bifurcated LED: ● Pg. 77</p>
<p>MINI-BEAM®</p> <p>EGCP-5</p> <p>Fiber: Individual LED: ● Pg. 81</p>	<p>MINI-BEAM®</p> <p>EGCP-6</p> <p>Fiber: Bifurcated LED: ● Pg. 81</p>	<p>MINI-BEAM®</p> <p>EGCP-7</p> <p>Fiber: Bifurcated LED: ● Pg. 81</p>	<p>MINI-BEAM®</p> <p>EGCP-8</p> <p>Fiber: Bifurcated LED: ● Pg. 81</p>
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<p>MINI-BEAM® Expert™</p> <p>EGCP-13</p> <p>Fiber: Bifurcated LED: ○ Pg. 86</p>	<p>MINI-BEAM® Universal</p> <p>EGCP-14</p> <p>Fiber: Individual LED: ● Pg. 89</p>	<p>MINI-BEAM® Universal</p> <p>EGCP-15</p> <p>Fiber: Bifurcated LED: ● Pg. 89</p>	<p>QM42</p> <p>EGCP-16</p> <p>Fiber: Individual LED: ● Pg. 142</p>

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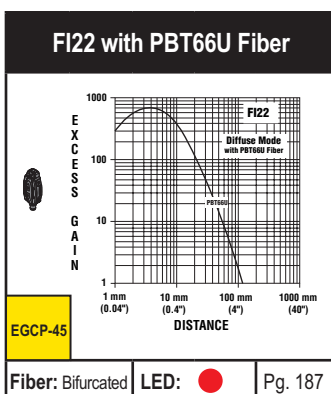
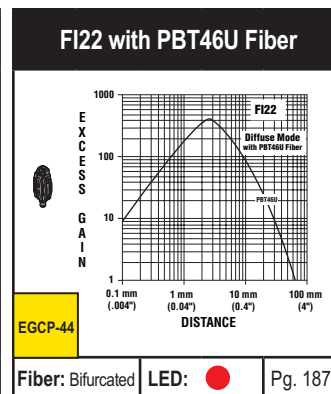
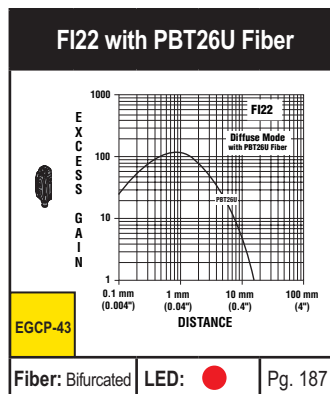
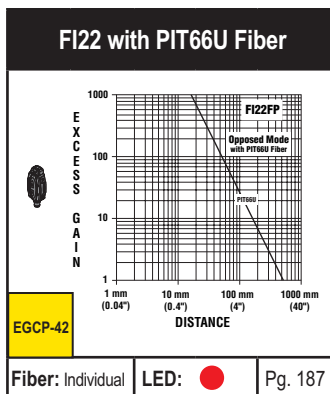
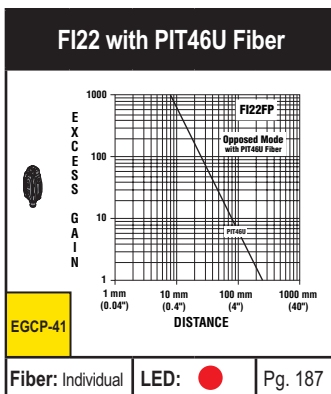
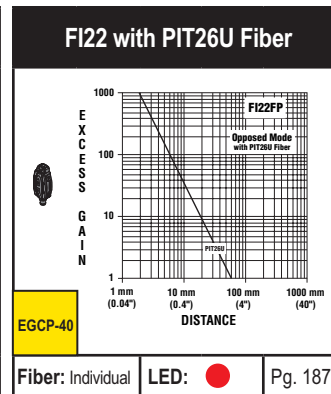
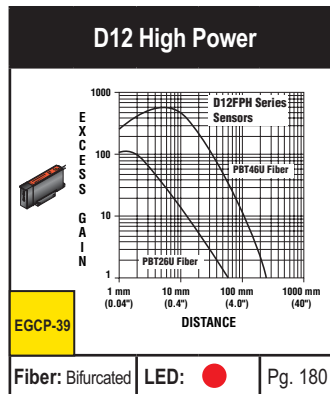
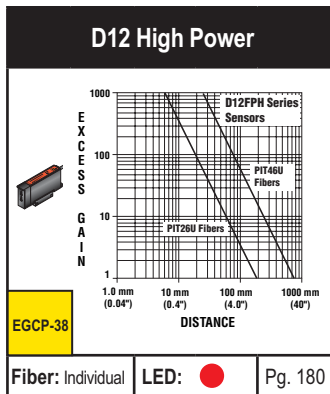
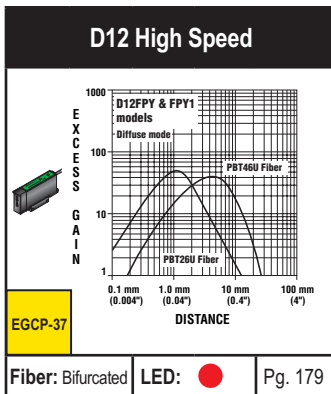
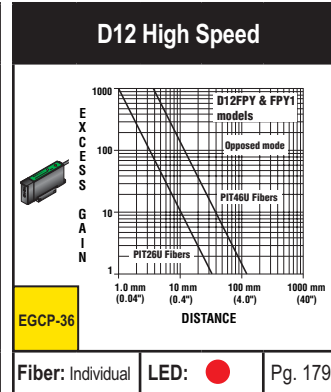
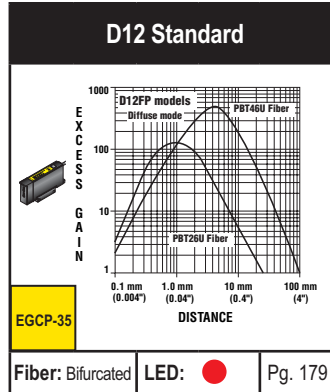
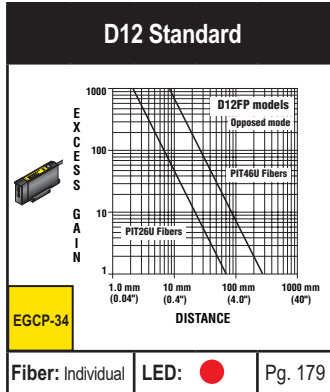
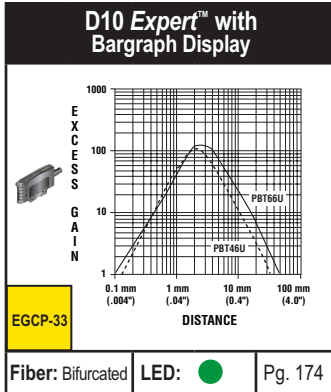
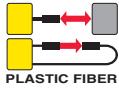
- = Visible Red LED
- = Visible Green LED
- = Visible Blue LED



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- = Visible Red LED
- = Visible Green LED



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Training Note

Timing Logic

ON Delay	Description	Uses
	Requires a sensing event to last for at least the ON delay time period before the output will energize. The timing begins at the leading edge of an input signal, but the output is energized only after the preset ON delay time has elapsed.	<ul style="list-style-type: none"> Allows sensing event
OFF Delay	Description	Uses
	"Holds" the output for a preset time after the input signal is removed. The OFF delay timing begins at the trailing edge of the input signal, keeping the output energized.	<ul style="list-style-type: none"> Allows sensing event Flare coat empty
ON and OFF Delay	Description	Uses
	Combines ON delay and OFF delay into a single function. The ON delay and OFF delay ("hold") times are independently adjustable within the (same) time range selected.	<ul style="list-style-type: none"> Jam and High-Low Edge-Gate
One-shot	Description	Uses
	Timed output pulse ("hold" time) begins at the leading edge of an input signal. The pulse is always of exactly the same duration, regardless of the length of the input signal. (The output cannot reenergize until the input signal is removed and reappplied.)	<ul style="list-style-type: none"> Including a time period edge of a
Delayed One-shot	Description	Uses
	Input signal initiates an adjustable delay period, at the end of which the output pulses for an adjustable pulse ("hold") time. Input may be momentary or maintained.	<ul style="list-style-type: none"> Sensing event
ON-delayed One-shot	Description	Uses
	Combines ON delay and one-shot timing into a single function. The input signal must be present for at least the time of the ON delay in order for a time-one shot pulse to occur.	<ul style="list-style-type: none"> Jam coat part that the ON delay

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Process Note

Sensitivity Adjustment

Sensors with Potentiometer Adjustment

Technique Manually adjust sensitivity with potentiometer.

Process 1. Adjust potentiometer completely counter-clockwise to minimum sensitivity. 2. Present the light sensing condition, and turn the potentiometer slowly clockwise, until the alignment indicator just comes on. Note this setting. 3. Present the dark sensing condition, and advance the potentiometer clockwise, until the alignment indicator just comes on. Note this setting. 4. Adjust the potentiometer to approximately midway between these two settings (see "Hint").

Concept Setting Sensitivity Using a Potentiometer Adjustment. Operating sensitivity setting (midway between light and dark thresholds). Switch point threshold for light condition. Switch point threshold for dark condition. Minimum sensitivity. Switching hysteresis. Maximum sensitivity.

Sensors with SET Mode Adjustment

Technique Sensor's microprocessor optimizes sensitivity automatically.

Process Present the dark sensing condition, and press the SET button (see "Hint"). The sensor automatically sets the operating sensitivity below the switch point threshold for the dark condition.

Concept Setting Sensitivity Using a SET Mode Adjustment. Operating sensitivity setting (automatically set by sensor). Switch point threshold for light condition. Switch point threshold for dark condition. Minimum sensitivity. Switching hysteresis. Maximum sensitivity.

Sensors with TEACH Mode Adjustment

Technique Sensor's microprocessor optimizes sensitivity automatically between two user-set reference points.

Process 1. Press and hold the TEACH button to enter the TEACH mode. 2. Present the light sensing condition, and single-click the TEACH button. 3. Present the dark sensing condition, and (again) single-click the TEACH button. 4. The sensor automatically sets the operating sensitivity, and returns to RUN mode.

Concept Setting Sensitivity Using a TEACH Mode Adjustment. Operating sensitivity setting (automatically set by sensor). TEACH light condition. TEACH dark condition. Minimum sensitivity. Switching hysteresis. Maximum sensitivity.

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Training Note

Types of Sensors: Self-contained, Remote and Fiber Sensors

Self-contained Sensors:

Limit

Pros

- Easy to wire: Self-contained sensors require only one source of voltage to power them and can interface directly with the load.
- Easy to align: Self-contained sensors contain the amplifier circuitry so they also have integral alignment indicators.

Cons

- Accessibility of controls: Depending on mounting constraints, alignment indicators may be difficult to view while mounting sensors.
- Temperature limitations: Avoid using self-contained sensors in temperatures exceeding 70 degrees C (158 degrees F).
- NOTE: Maximum operating temperature rating of some models is less than 70 degrees C.

Remote Sensors:

Pros

- Small sensor size: Remote sensors have minimal circuitry and can be much smaller.
- Accessibility of control: Amplifiers can be mounted away from sensing location, allowing easier access to sensitivity and timing adjustments.
- High temperature: Some remote sensors may be placed in high temperature environments but the amplifier needs to be kept relatively cool.

Cons

- Separate alignment indicator: The alignment indicator is housed with the amplifier module. If the amplifier is mounted away from view, aligning the emitter and receiver can be difficult.
- Wiring precautions: It is very important that you follow the instructions for wiring your sensor to avoid such problems as electrical "cross-talk".

Fiber Sensors:

Pros

- Immune to electrical noise: Fibers have no electrical circuitry and no moving parts.
- Tolerant to shock/vibration/temperature: Fibers are passive mechanical sensing components in rugged, protective assemblies.
- Considered intrinsically safe in some applications.

Cons

- Adds cost to sensing systems.
- Repetitive flexing can damage some fiber models.

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Supplemental Information

Relative Chemical Resistance of Sensor Housing Materials and Lenses

Housing Material	Resistance to:				
	Industrial Solvents	Dilute Acids	Concentrated Acids	Dilute Caustic Alkalis	Concentrated Caustic Alkalis
Thermoplastic Polyester	Fair	Excellent	Good	Poor	Poor
Lexan® Polycarbonate	Poor	Good	Fair	Poor	Poor
NORYL® Polyethylene oxide (PEO)	Fair	Good	Fair	Excellent	Good
Delrin® Acetal	Good	Fair	Poor	Fair	Poor
Extruded zinc-aluminum alloy	Good	Good	Fair	Good	Fair
Anodized Aluminum	Excellent	Fair	Poor	Good	Fair
Stainless Steel	Excellent	Fair	Poor	Excellent	Good
PC (Polycarbonate)	Fair	Good	Fair	Excellent	Excellent
Polyethylene	Fair	Excellent	Excellent	Good	Good
Cycloac® ABS	Poor	Good	Poor	Good	Good

Lens Material	Resistance to:				
	Industrial Solvents	Dilute Acids	Concentrated Acids	Dilute Caustic Alkalis	Concentrated Caustic Alkalis
Glass	Excellent	Good	Fair	Excellent	Good
Acrylic	Poor	Fair	Poor	Good	Fair
Polycarbonate	Fair	Fair	Poor	Fair	Poor
Lexan® Polycarbonate	Poor	Good	Fair	Poor	Poor

Key to Performance

Rating	Percent Retention to Strength	Degree of Attack
Excellent	85 to 100%	Slight (or no) attack
Good	75 to 84%	Moderate attack
Fair	50 to 74%	Noticeable swelling, softening, chipping or corrosion
Poor	<50%	Severe degradation

Notes: Chlorinated hydrocarbons include Freon, methylene and trichloroethylene. Note 1: Plastic lens covers are available for some sensors to Note 2: Glass covers are available for some sensors to protect lens. Lexan®, Cycloac® and NORYL® are registered trademarks of Delrin® is a registered trademark of Dupont Co.

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Training Note

Sensing Modes

Opposed Mode Best for general use and for use in contaminated environments.

Pros

- Most reliable mode for opaque objects
- Provides high excess gain
- Not affected by surface reflectivity
- Reliable for counting parts
- High excess gain allows for dirt/dust accumulation and misalignment tolerance

Cons

- Sees through clear materials
- Need to power two sides
- Need to shape effective beam

Retroreflective Mode Best for use in applications where space is limited on one side.

Pros

- Very convenient when space is limited
- Economical, compared to opposed mode

Cons

- Cannot easily shape effect or precise positioning
- Excess gain alternates in
- Sees through clear materials
- Proving can occur with stray light
- Stray light can occur at the reflector size and type

Diffuse Mode Best for very applications, or for when opposed or retroreflective sensors aren't practical.

Pros

- Very convenient when space is limited
- Can be used when opposed or retroreflective sensors aren't practical
- One piece sensing solution
- Economical

Cons

- Background objects may be seen
- Small parts don't offer enough gain
- Losses gain rapidly as dirt is added
- Unreliable for accurate count
- Less tolerant to surface reflectivity
- Stray objects must be kept light path in order to be seen

Divergent Good for sensing small objects and objects that aren't in a repeatable position.

Pros

- Reliable for clear material detection at close range
- Good for small objects
- Can sense surfaces that vibrate or flutter
- Economical
- More tolerant of surface reflectivity

Cons

- Low levels of excess gain
- Wide field-of-view causes side of the sensor
- Limited range

Convergent Best for small color marks or for small object detection.

Pros

- Accurate counting of radiused objects
- Accurate positioning
- Defined depth-of-field
- Provides relatively high excess gain

Cons

- Specific focal point will not allow larger sensor
- Moving background objects sensed, but can be addressed by positioning or field adjustment
- Surface reflectivity of object

Background Suppression (Fixed-Field, Adjustable-Field) Best for detecting targets of varying reflectivity and spotting backgrounds.

Pros

- Define range limit
- Provides high excess gain
- More tolerant of surface reflectivity

Cons

- Shiny surfaces beyond the max. lateral trigger sensor
- Moving background objects sensed, but can be addressed by positioning or field adjustment

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Training Note

Light Operate/Dark Operate

Sensing Mode

Light Path Beam of light from sensor's emitter to receiver.

Light Operate (LO) Sensor's output energizes when the sensor's receiver sees its own light.

Dark Operate (DO) Sensor's output energizes when the sensor's receiver does not see its own light.

Opposed Mode

Target Present Receiver sees light. Output on when light is received.

Target Absent Receiver sees light. Output on when light is received.

Retroreflective Mode

Target Present Receiver sees light. Output on when light is received.

Target Absent Receiver sees light. Output on when light is received.

Proximity Mode

Target Present Receiver sees light. Output on when light is received and object is present.

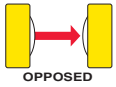
Target Absent Receiver sees light. Output on when light is received and object is not present.

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WORLD-BEAM® Q12
Effective Beam: 5.7 mm

BPO-1
Range: 2 m LED: ● Pg. 47

T8
Effective Beam: 4.3 mm

BPO-2
Range: 2 m LED: ● Pg. 50

MINI-BEAM® 2 QS12
Effective Beam: 5 mm

BPO-3
Range: 4 m LED: ● Pg. 53

M12
Effective Beam: 10 mm

BPO-4
Range: 5 m LED: ● Pg. 56

VS2
Effective Beam: 3 mm

BPO-5
Range: 1.2 m LED: ● Pg. 62

VS2
Effective Beam: 3 mm

BPO-6
Range: 3 m LED: ○ Pg. 62

VS3
Effective Beam: 3 mm

BPO-7
Range: 1.2 m LED: ● Pg. 65

VS4
Effective Beam: 3 mm

BPO-8
Range: 1 m LED: ● Pg. 68

WORLD-BEAM® QS18
Effective Beam: 13 mm

BPO-9
Range: 20 m LED: ○ Pg. 71

WORLD-BEAM® QS18
Effective Beam: 13 mm

BPO-10
Range: 3 m LED: ○ Pg. 71

MINI-BEAM®
Effective Beam: 3.5 mm

BPO-11
Range: 3 m LED: ○ Pg. 80

MINI-BEAM®
Effective Beam: 13 mm

BPO-12
Range: 30 m LED: ○ Pg. 80

MINI-BEAM® Universal
Effective Beam: 3.5 mm

BPO-13
Range: 3 m LED: ○ Pg. 88

MINI-BEAM® Universal
Effective Beam: 13 mm

BPO-14
Range: 30 m LED: ○ Pg. 88

MINI-BEAM® NAMUR
Effective Beam: 13 mm

BPO-15
Range: 6 m LED: ○ Pg. 90

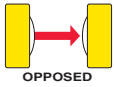
WORLD-BEAM® Q20
Effective Beam: 10 mm

BPO-16
Range: 10 m LED: ● Pg. 93

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Opposed Mode (Performance based on 90% reflectance white test card)

○ = Infrared LED



WORLD-BEAM® Q20
Effective Beam: 10 mm

BPO-17

Range: 15 m LED: ○ Pg. 93

S18
Effective Beam: 13 mm

BPO-18

Range: 20 m LED: ○ Pg. 96

M18
Effective Beam: 13 mm

BPO-19

Range: 20 m LED: ○ Pg. 97

T18
Effective Beam: 13 mm

BPO-20

Range: 20 m LED: ○ Pg. 102

Q25
Effective Beam: 23 mm

BPO-21

Range: 20 m LED: ○ Pg. 107

WORLD-BEAM® QS30
Effective Beam: 13 mm

BPO-22

Range: 60 m LED: ○ Pg. 113

WORLD-BEAM® QS30 High Power
Effective Beam: 18 mm

BPO-23

Range: 213 m LED: ○ Pg. 113

WORLD-BEAM® QS30 Universal
Effective Beam: 27 mm

BPO-24

Range: 60 m LED: ○ Pg. 119

WORLD-BEAM® QS30 High-Power Water
Effective Beam: 13 mm

BPO-25

Range: 4 m LED: ○ Pg. 113

S30
Effective Beam: 23 mm

BPO-26

Range: 60 m LED: ○ Pg. 122

SM30
Effective Beam: 19 mm

BPO-27

Range: 200 m LED: ○ Pg. 126

SMI30
Effective Beam: 19 mm

BPO-28

Range: 140 m LED: ○ Pg. 128

SMI30
Effective Beam: 22 mm

BPO-29

Range: 60 m LED: ○ Pg. 128

T30
Effective Beam: 23 mm

BPO-30

Range: 60 m LED: ○ Pg. 130

Q40
Effective Beam: 23 mm

BPO-31

Range: 60 mm LED: ○ Pg. 134

QM42
Effective Beam: 8 mm

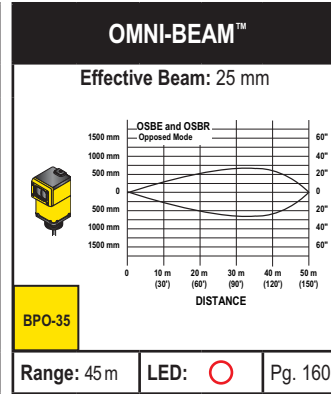
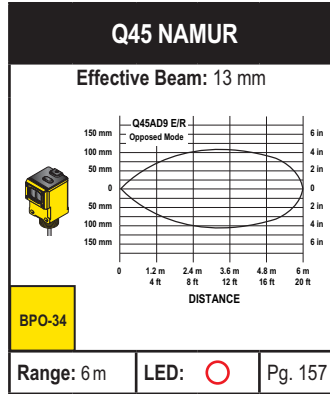
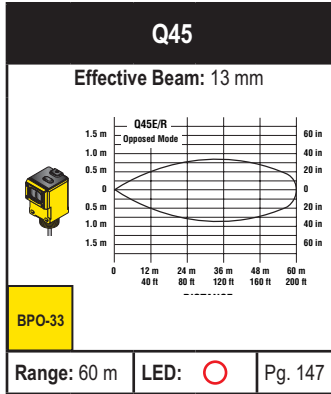
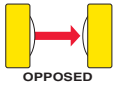
BPO-32

Range: 10 m LED: ○ Pg. 141

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Opposed Mode (Performance based on 90% reflectance white test card)

○ = Infrared LED



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- PERFORMANCE CURVES
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Retroreflective Mode

● = Visible Red LED
 P = Visible Red LED Polarized



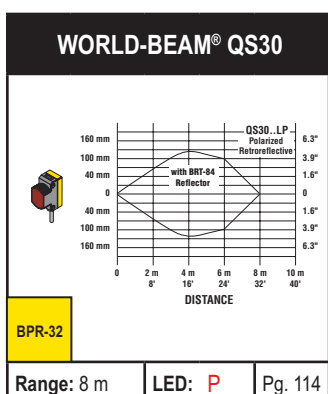
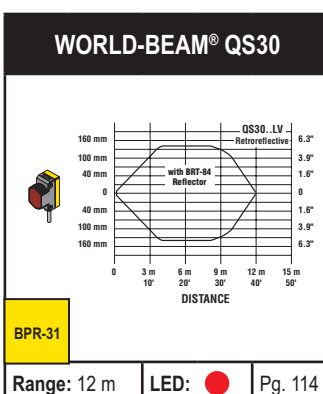
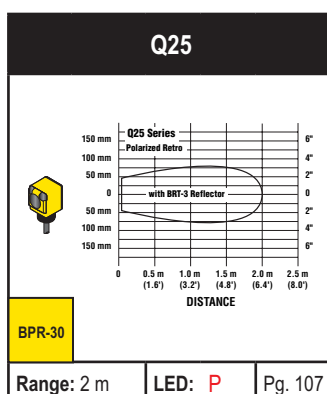
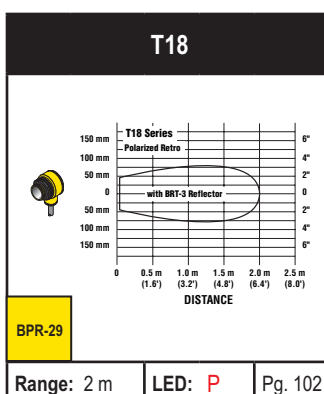
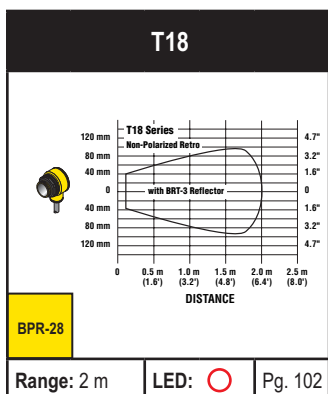
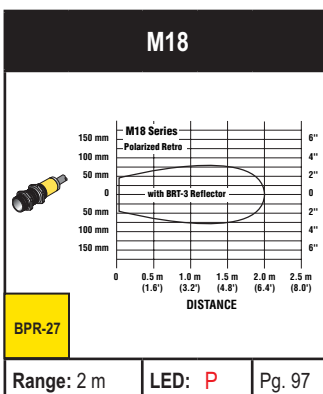
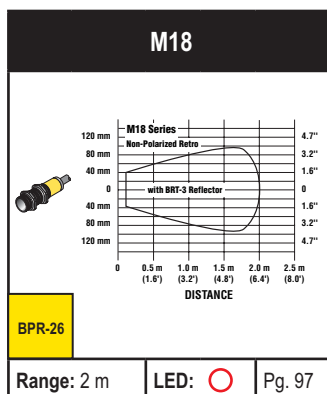
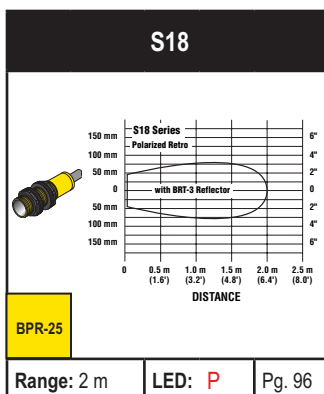
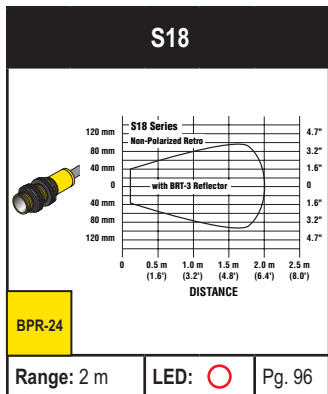
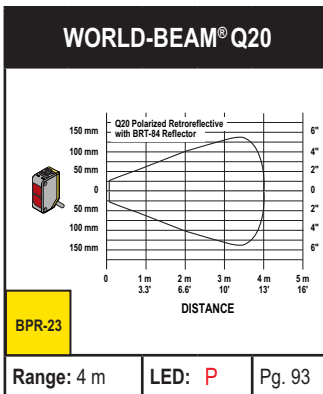
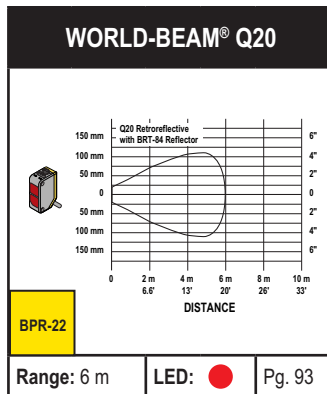
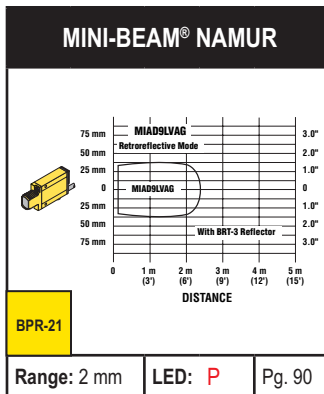
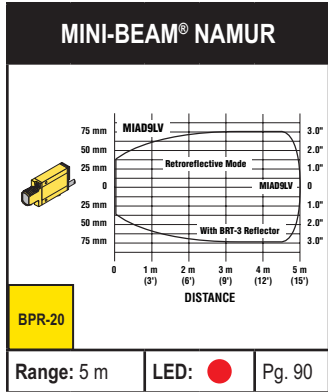
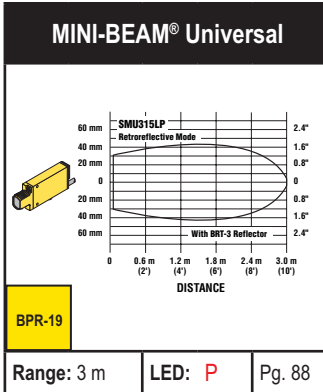
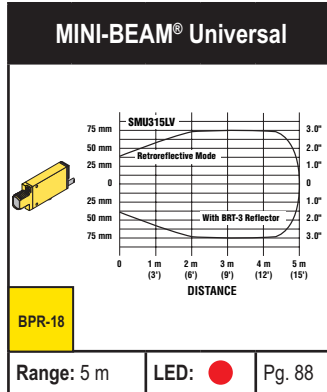
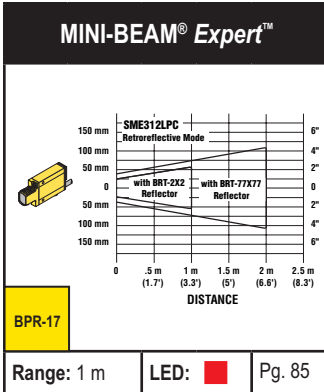
<p>WORLD-BEAM® Q12</p> <p>BPR-1</p> <p>Range: 1.5 m LED: ● Pg. 47</p>	<p>WORLD-BEAM® Q12</p> <p>BPR-2</p> <p>Range: 1 m LED: P Pg. 47</p>	<p>MINI-BEAM® QS12</p> <p>BPR-3</p> <p>Range: 2 m LED: ● Pg. 53</p>	<p>MINI-BEAM® QS12</p> <p>BPR-4</p> <p>Range: 1 m LED: P Pg. 53</p>
<p>M12</p> <p>BPR-5</p> <p>Range: 2.5 m LED: ● Pg. 56</p>	<p>M12</p> <p>BPR-6</p> <p>Range: 1.5 m LED: P Pg. 56</p>	<p>VS3</p> <p>BPR-7</p> <p>Range: 250 mm LED: ● Pg. 65</p>	<p>VS3</p> <p>BPR-8</p> <p>Range: 250 mm LED: P Pg. 65</p>
<p>WORLD-BEAM® QS18</p> <p>BPR-9</p> <p>Range: 6.5 m LED: ● Pg. 72</p>	<p>WORLD-BEAM® QS18</p> <p>BPR-10</p> <p>Range: 3.5 m LED: P Pg. 72</p>	<p>WORLD-BEAM® QS18 Expert™</p> <p>BPR-11</p> <p>Range: 3.5 m LED: P Pg. 76</p>	<p>MINI-BEAM®</p> <p>BPR-12</p> <p>Range: 5 m LED: ● Pg. 80</p>
<p>MINI-BEAM®</p> <p>BPR-13</p> <p>Range: 2 m LED: P Pg. 80</p>	<p>MINI-BEAM®</p> <p>BPR-14</p> <p>Range: 3 m LED: P Pg. 80</p>	<p>MINI-BEAM® Expert™</p> <p>BPR-15</p> <p>Range: 5 m LED: ● Pg. 85</p>	<p>MINI-BEAM® Expert™</p> <p>BPR-16</p> <p>Range: 3 m LED: ● Pg. 85</p>

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Retroreflective Mode



- = Infrared LED
- = Visible Red LED
- P = Visible Red LED Polarized
- = Visible Red Clear Object Detection Polarized



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Retroreflective Mode

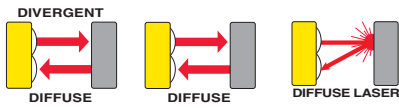


- = Visible Red LED
- P = Visible Red LED Polarized
- ★ = Visible Red Laser LED

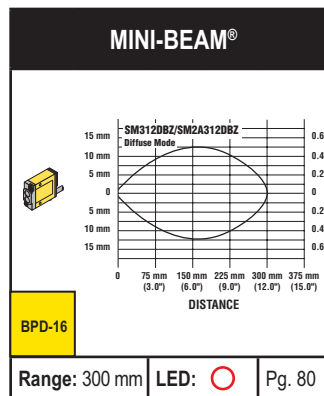
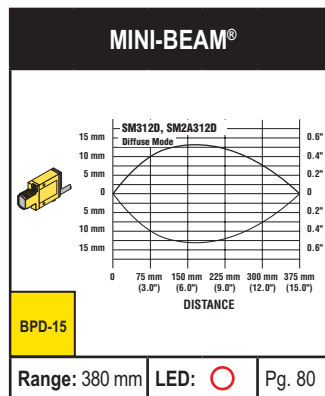
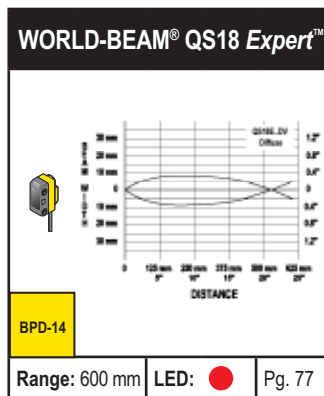
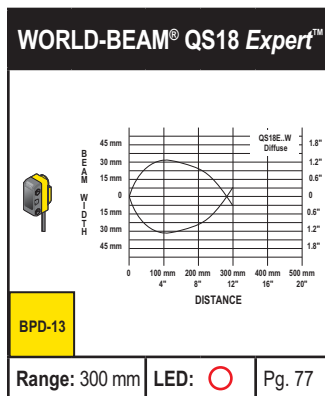
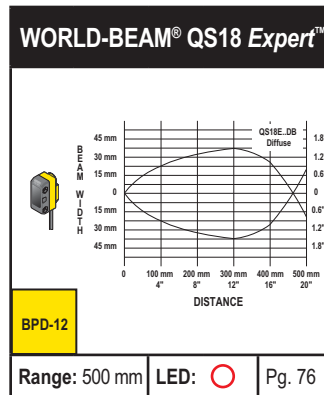
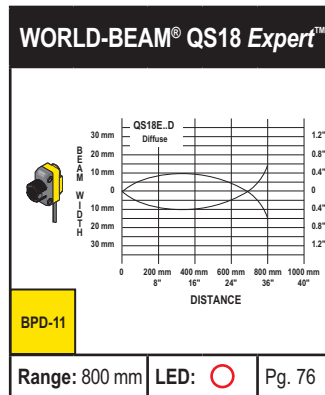
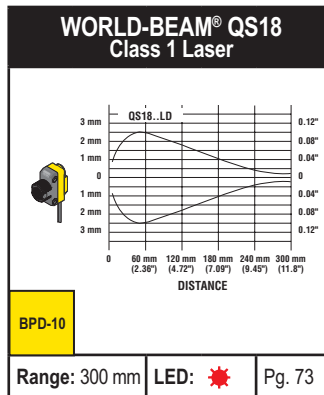
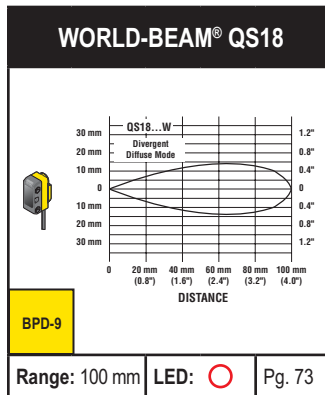
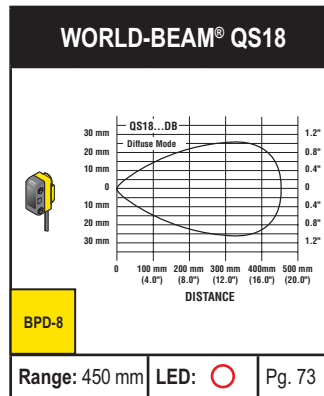
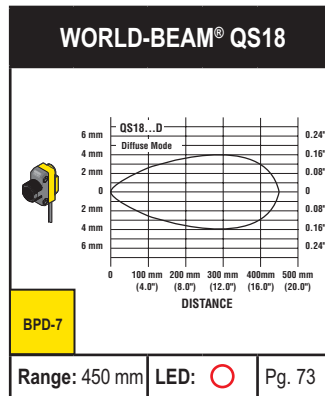
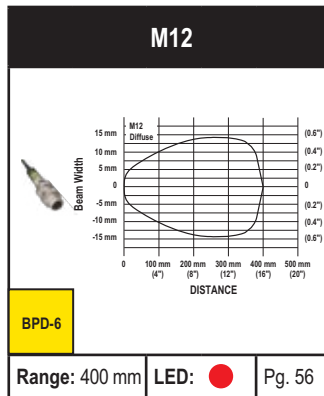
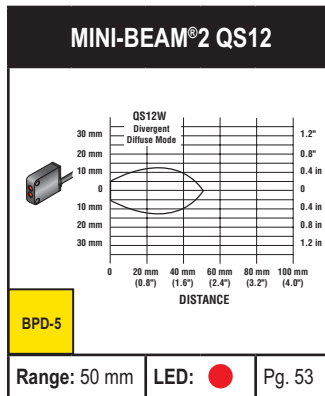
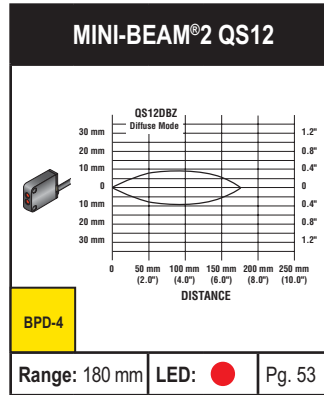
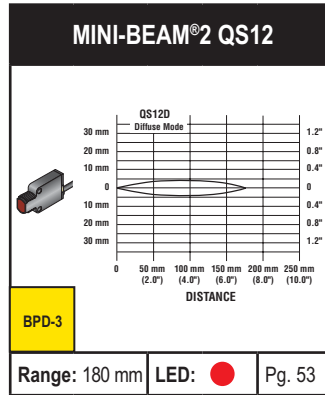
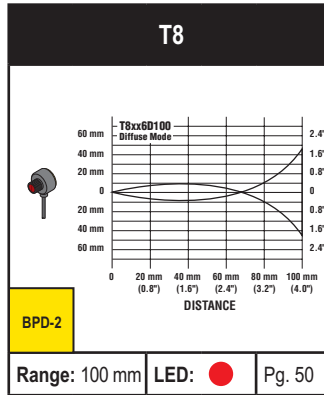
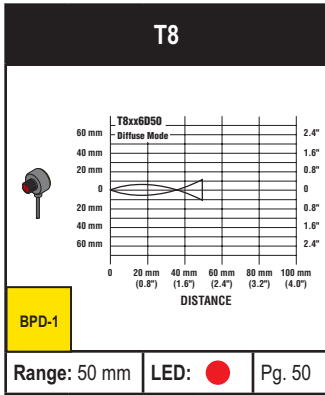
<p>WORLD-BEAM® QS30 Universal</p> <p>BPR-33</p> <p>Range: 8 m LED: P Pg. 119</p>	<p>S30</p> <p>BPR-34</p> <p>Range: 6 m LED: P Pg. 122</p>	<p>T30</p> <p>BPR-35</p> <p>Range: 6 m LED: P Pg. 130</p>	<p>Q40</p> <p>BPR-36</p> <p>Range: 6 m LED: P Pg. 134</p>
<p>QM42</p> <p>BPR-37</p> <p>Range: 3 m LED: P Pg. 141</p>	<p>Q45</p> <p>BPR-38</p> <p>Range: 9 m LED: ● Pg. 147</p>	<p>Q45</p> <p>BPR-39</p> <p>Range: 6 m LED: P Pg. 147</p>	<p>Q45 Class 2 Laser</p> <p>BPR-40</p> <p>Range: 70 m LED: ★ Pg. 147</p>
<p>Q45 NAMUR</p> <p>BPR-41</p> <p>Range: 9 m LED: ● Pg. 157</p>	<p>Q45 NAMUR</p> <p>BPR-42</p> <p>Range: 6 m LED: P Pg. 157</p>	<p>OMNI-BEAM™</p> <p>BPR-43</p> <p>Range: 9 m LED: ● Pg. 160</p>	<p>OMNI-BEAM™</p> <p>BPR-44</p> <p>Range: 4.5 m LED: P Pg. 160</p>

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Diffuse Mode (Performance based on 90% reflectance white test card)



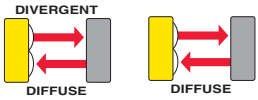
- = Infrared LED
- = Visible Red LED
- ★ = Visible Red Laser LED



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Diffuse Mode (Performance based on 90% reflectance white test card)

- = Infrared LED
- = Visible Red LED

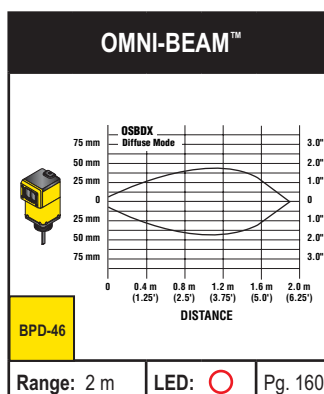
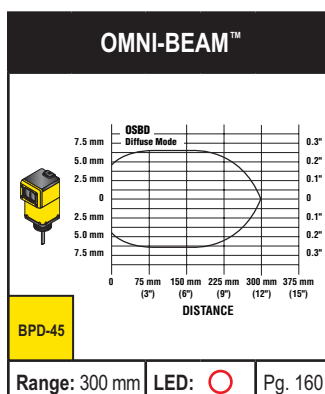
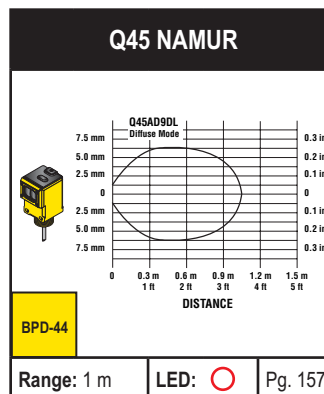
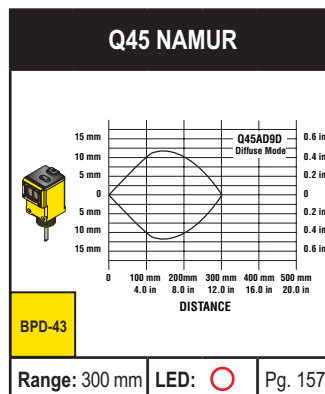
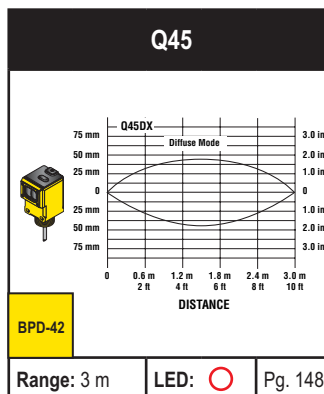
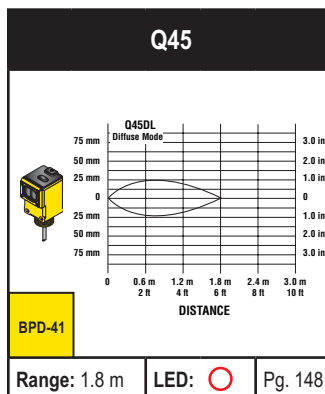
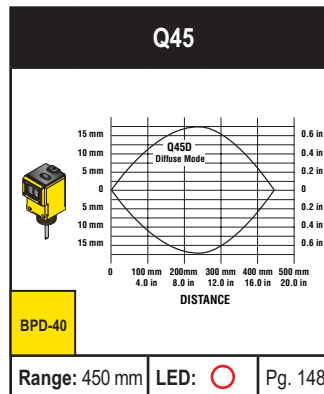
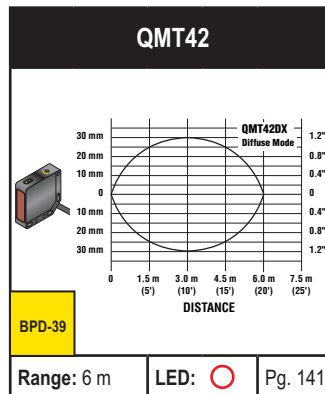
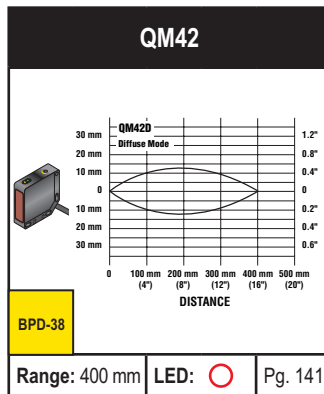
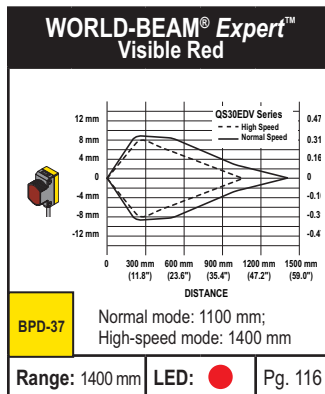
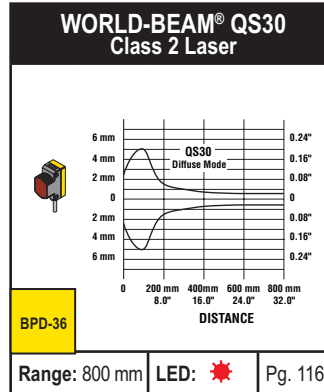
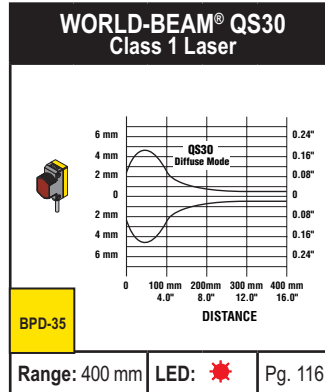
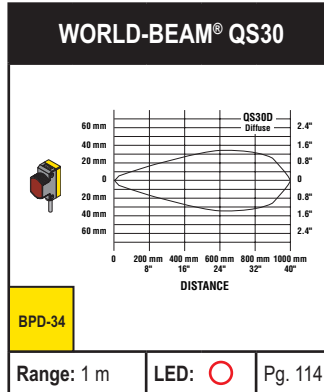
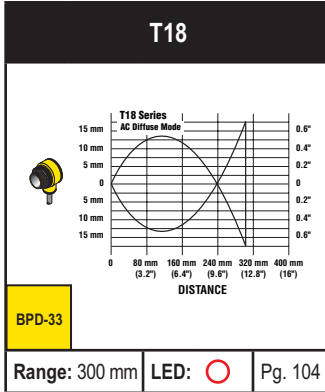
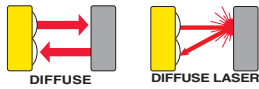


<p>MINI-BEAM®</p> <p>BPD-17</p> <p>Range: 130 mm LED: ○ Pg. 80</p>	<p>MINI-BEAM® Expert™</p> <p>BPD-18</p> <p>Range: 380 mm LED: ○ Pg. 85</p>	<p>MINI-BEAM® Expert™</p> <p>BPD-19</p> <p>Range: 130 mm LED: ○ Pg. 85</p>	<p>MINI-BEAM® Expert™</p> <p>BPD-20</p> <p>Range: 1100 mm LED: ● Pg. 85</p>
<p>MINI-BEAM® Universal</p> <p>BPD-21</p> <p>Range: 380 mm LED: ○ Pg. 88</p>	<p>MINI-BEAM® Universal</p> <p>BPD-22</p> <p>Range: 130 mm LED: ○ Pg. 88</p>	<p>MINI-BEAM® NAMUR</p> <p>BPD-23</p> <p>Range: 380 mm LED: ○ Pg. 90</p>	<p>MINI-BEAM® NAMUR</p> <p>BPD-24</p> <p>Range: 75 mm LED: ○ Pg. 90</p>
<p>WORLD-BEAM® Q20</p> <p>BPD-25</p> <p>Range: 250 mm LED: ● Pg. 93</p>	<p>WORLD-BEAM® Q20</p> <p>BPD-26</p> <p>Range: 800 mm LED: ● Pg. 93</p>	<p>WORLD-BEAM® Q20</p> <p>BPD-27</p> <p>Range: 1500 mm LED: ○ Pg. 93</p>	<p>S18</p> <p>BPD-28</p> <p>Range: 100 mm LED: ○ Pg. 96</p>
<p>S18</p> <p>BPD-29</p> <p>Range: 300 mm LED: ○ Pg. 96</p>	<p>M18</p> <p>BPD-30</p> <p>Range: 100 mm LED: ○ Pg. 97</p>	<p>M18</p> <p>BPD-31</p> <p>Range: 300 mm LED: ○ Pg. 97</p>	<p>T18</p> <p>BPD-32</p> <p>Range: 500 mm LED: ○ Pg. 102</p>

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Diffuse Mode (Performance based on 90% reflectance white test card)

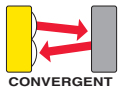
- = Infrared LED
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- ★ = Visible Red Laser LED



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Convergent Mode (Performance based on 90% reflectance white test card)

- = Infrared LED
- = Visible Red LED

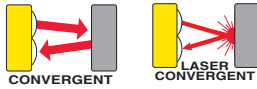


<p>MINI-BEAM®2 QS12</p> <p>BPC-1</p> <p>Range: 10 mm LED: ● Pg. 53</p>	<p>MINI-BEAM®2 QS12</p> <p>BPC-2</p> <p>Range: 20 mm LED: ● Pg. 53</p>	<p>VS1</p> <p>BPC-3</p> <p>Range: 10 mm LED: ● Pg. 59</p>	<p>VS1</p> <p>BPC-4</p> <p>Range: 20 mm LED: ● Pg. 59</p>
<p>VS1</p> <p>BPC-5</p> <p>Range: 10 mm LED: ○ Pg. 59</p>	<p>VS1</p> <p>BPC-6</p> <p>Range: 20 mm LED: ○ Pg. 59</p>	<p>VS2</p> <p>BPC-7</p> <p>Range: 15 mm LED: ● Pg. 62</p>	<p>VS2</p> <p>BPC-8</p> <p>Range: 30 mm LED: ● Pg. 62</p>
<p>WORLD-BEAM® QS18</p> <p>BPC-9</p> <p>Range: 16 mm LED: ● Pg. 72</p>	<p>WORLD-BEAM® QS18</p> <p>BPC-10</p> <p>Range: 43 mm LED: ● Pg. 72</p>	<p>WORLD-BEAM® QS18 Expert™</p> <p>BPC-11</p> <p>Range: 16 mm LED: ● Pg. 76</p>	<p>WORLD-BEAM® QS18 Expert™</p> <p>BPC-12</p> <p>Range: 43 mm LED: ● Pg. 76</p>
<p>MINI-BEAM®</p> <p>BPC-13</p> <p>Range: 16 mm LED: ○ Pg. 80</p>	<p>MINI-BEAM®</p> <p>BPC-14</p> <p>Range: 43 mm LED: ○ Pg. 80</p>	<p>MINI-BEAM®</p> <p>BPC-15</p> <p>Range: 16 mm LED: ● Pg. 80</p>	<p>MINI-BEAM®</p> <p>BPC-16</p> <p>Range: 43 mm LED: ● Pg. 80</p>

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Convergent Mode (Performance based on 90% reflectance white test card)

- = Visible Red LED
- = Visible Green LED
- = Visible Blue LED
- = Visible White LED
- ★ = Visible Red Laser LED

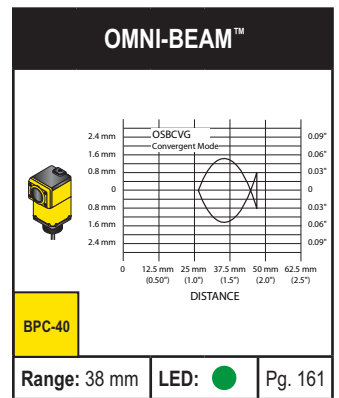
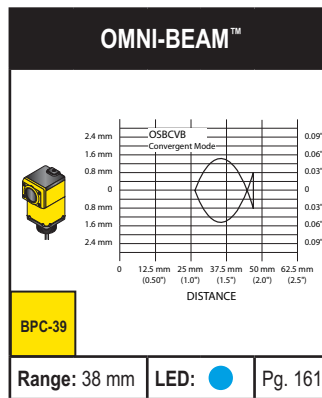
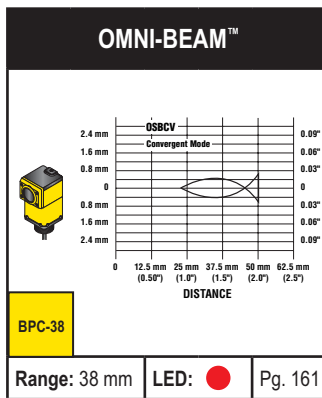
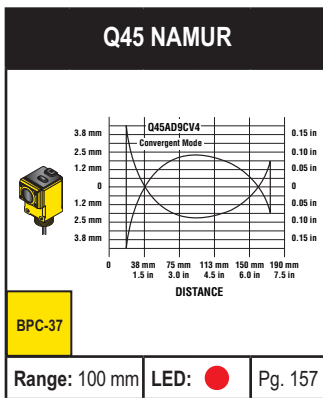
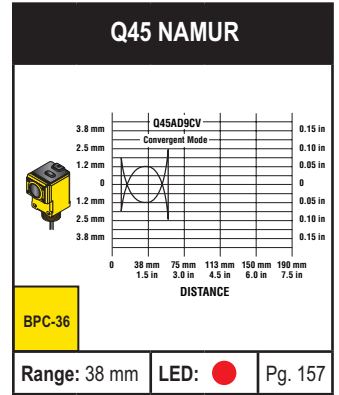
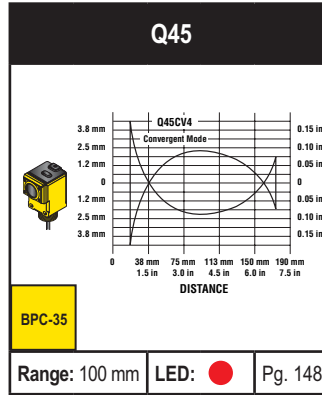
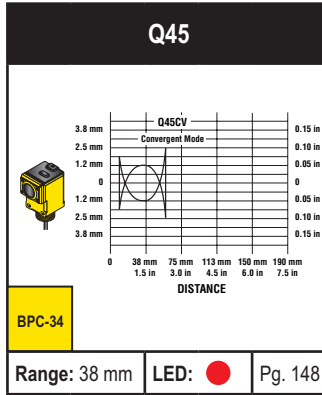
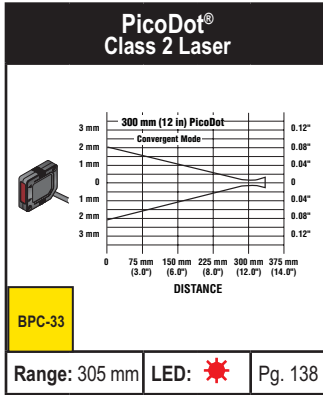
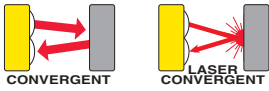


<p>MINI-BEAM®</p>	<p>MINI-BEAM®</p>	<p>MINI-BEAM®</p>	<p>MINI-BEAM®</p>
<p>MINI-BEAM® Expert™</p>	<p>MINI-BEAM® Expert™</p>	<p>MINI-BEAM® Expert™</p>	<p>MINI-BEAM® Expert™</p>
<p>MINI-BEAM® Expert™</p>	<p>MINI-BEAM® Universal</p>	<p>MINI-BEAM® Universal</p>	<p>MINI-BEAM® NAMUR</p>
<p>MINI-BEAM® NAMUR</p>	<p>PicoDot® Class 2 Laser</p>	<p>PicoDot® Class 2 Laser</p>	<p>PicoDot® Class 2 Laser</p>

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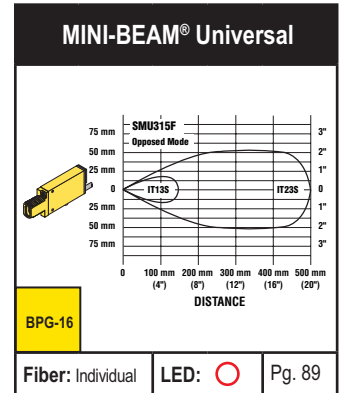
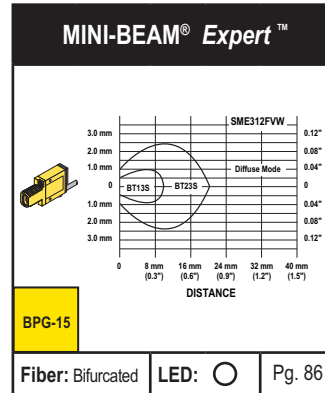
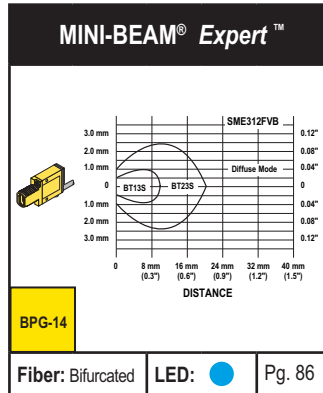
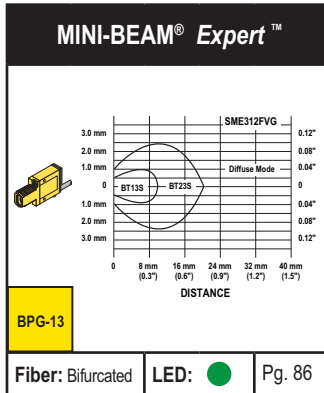
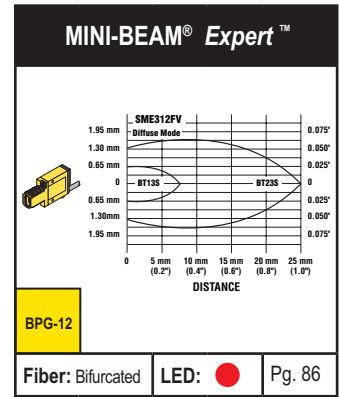
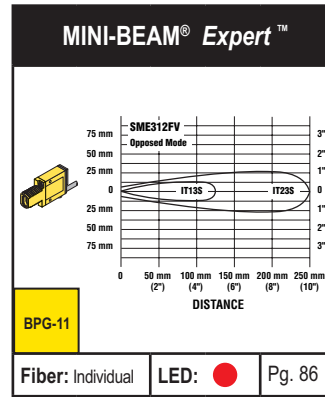
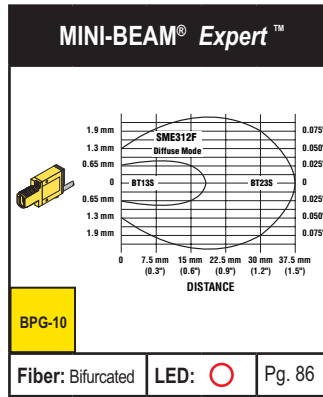
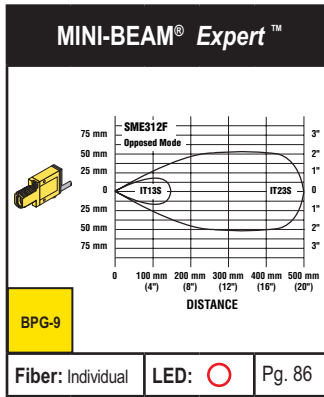
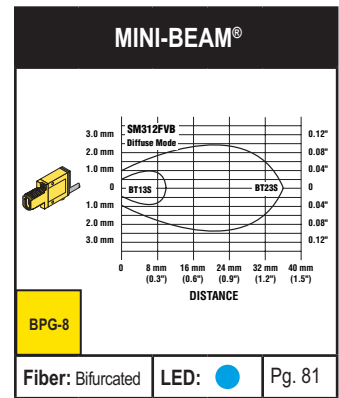
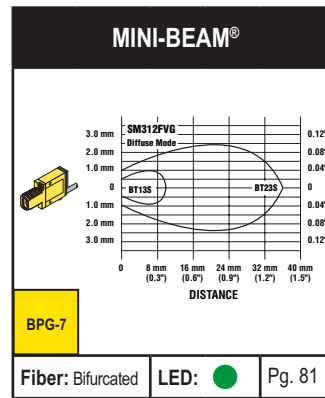
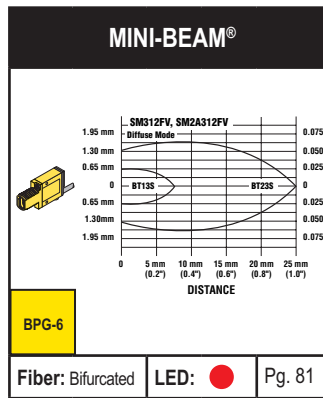
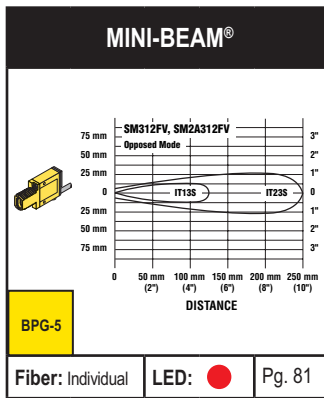
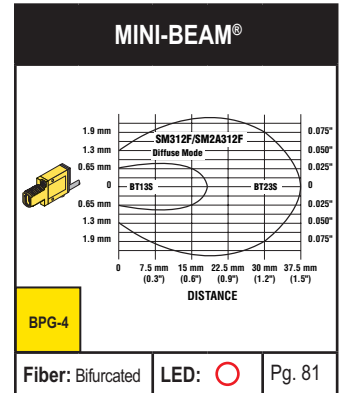
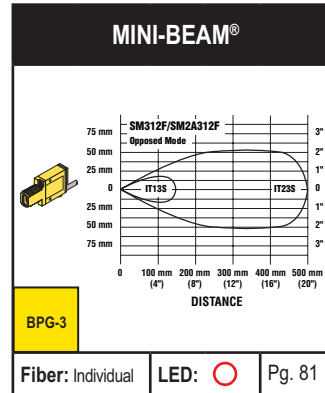
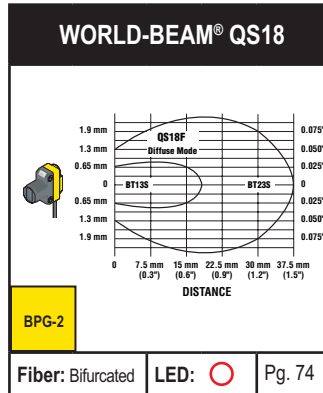
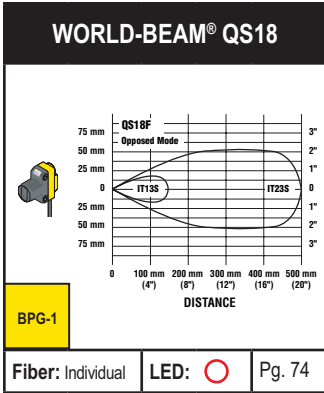
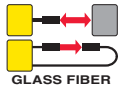
Convergent Mode (Performance based on 90% reflectance white test card)

- = Visible Red LED
- = Visible Green LED
- = Visible Blue LED
- ★ = Visible Red Laser LED



Glass Fiber Optic Mode (Performance based on 90% reflectance white test card)

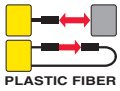
- = Visible Red LED
- = Visible Green LED
- = Visible Blue LED
- = Infrared LED
- = Visible White LED



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Glass Fiber Optic Mode (Performance based on 90% reflectance white test card)

● = Visible Red LED
○ = Infrared LED

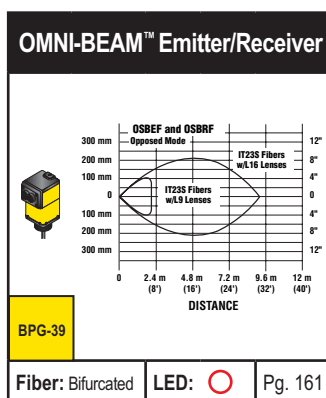
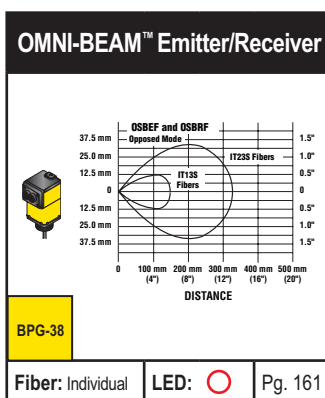
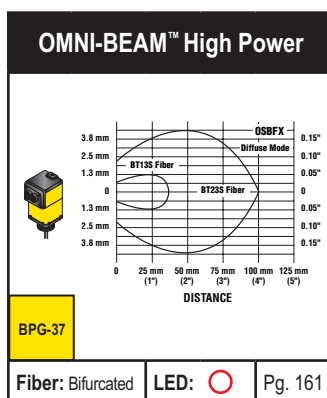
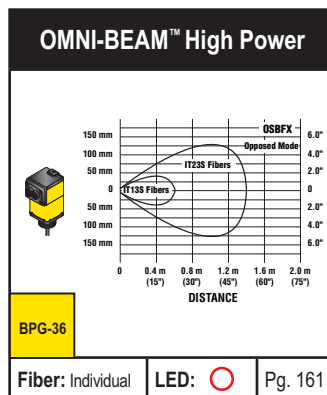
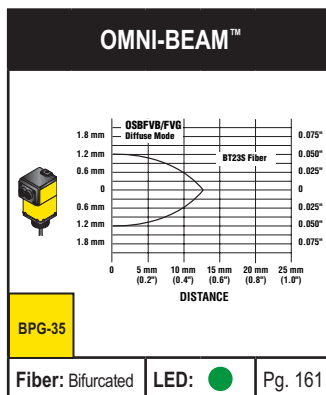
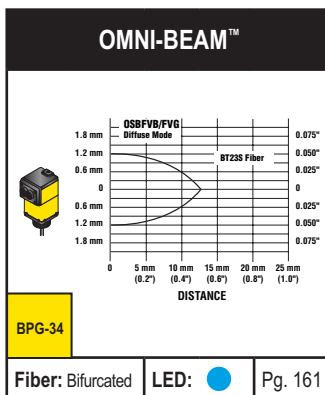
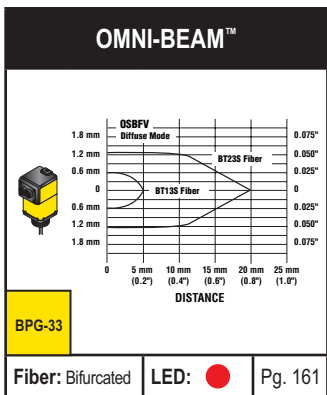
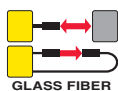


<p>MINI-BEAM® Universal</p> <p>BPG-17</p> <p>Fiber: Bifurcated LED: ○ Pg. 89</p>	<p>MINI-BEAM® Universal</p> <p>BPG-18</p> <p>Fiber: Individual LED: ● Pg. 89</p>	<p>MINI-BEAM® Universal</p> <p>BPG-19</p> <p>Fiber: Bifurcated LED: ● Pg. 89</p>	<p>MINI-BEAM® NAMUR</p> <p>BPG-20</p> <p>Fiber: Individual LED: ○ Pg. 90</p>
<p>MINI-BEAM® NAMUR</p> <p>BPG-21</p> <p>Fiber: Bifurcated LED: ○ Pg. 90</p>	<p>Q45</p> <p>BPG-22</p> <p>Fiber: Individual LED: ○ Pg. 148</p>	<p>Q45</p> <p>BPG-23</p> <p>Fiber: Bifurcated LED: ○ Pg. 148</p>	<p>Q45</p> <p>BPG-24</p> <p>Fiber: Individual LED: ● Pg. 148</p>
<p>Q45</p> <p>BPG-25</p> <p>Fiber: Bifurcated LED: ● Pg. 148</p>	<p>Q45 NAMUR</p> <p>BPG-26</p> <p>Fiber: Individual LED: ○ Pg. 158</p>	<p>Q45 NAMUR</p> <p>BPG-27</p> <p>Fiber: Bifurcated LED: ○ Pg. 158</p>	<p>Q45 NAMUR</p> <p>BPG-28</p> <p>Fiber: Individual LED: ● Pg. 158</p>
<p>Q45 NAMUR</p> <p>BPG-29</p> <p>Fiber: Bifurcated LED: ● Pg. 158</p>	<p>OMNI-BEAM™</p> <p>BPG-30</p> <p>Fiber: Individual LED: ○ Pg. 161</p>	<p>OMNI-BEAM™</p> <p>BPG-31</p> <p>Fiber: Bifurcated LED: ○ Pg. 161</p>	<p>OMNI-BEAM™</p> <p>BPG-32</p> <p>Fiber: Individual LED: ● Pg. 161</p>

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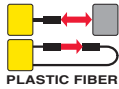
Glass Fiber Optic Mode (Performance based on 90% reflectance white test card)

- = Visible Red LED
- = Visible Green LED
- = Visible Blue LED
- = Infrared LED



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Plastic Fiber Optic Mode (Performance based on 90% reflectance white test card)



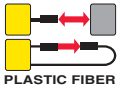
- = Visible Red LED
- = Visible Green LED
- = Visible Blue LED
- = Visible White LED

<p>WORLD-BEAM® QS18</p> <p>BPP-1</p> <p>Fiber: Individual LED: ● Pg. 74</p>	<p>WORLD-BEAM® QS18</p> <p>BPP-2</p> <p>Fiber: Bifurcated LED: ● Pg. 74</p>	<p>WORLD-BEAM® QS18 Expert™</p> <p>BPP-3</p> <p>Fiber: Individual LED: ● Pg. 77</p>	<p>WORLD-BEAM® QS18 Expert™</p> <p>BPP-4</p> <p>Fiber: Bifurcated LED: ● Pg. 77</p>
<p>MINI-BEAM®</p> <p>BPP-5</p> <p>Fiber: Individual LED: ● Pg. 81</p>	<p>MINI-BEAM®</p> <p>BPP-6</p> <p>Fiber: Bifurcated LED: ● Pg. 81</p>	<p>MINI-BEAM®</p> <p>BPP-7</p> <p>Fiber: Bifurcated LED: ● Pg. 81</p>	<p>MINI-BEAM®</p> <p>BPP-8</p> <p>Fiber: Bifurcated LED: ● Pg. 81</p>
<p>MINI-BEAM® Expert™</p> <p>BPP-9</p> <p>Fiber: Individual LED: ● Pg. 86</p>	<p>MINI-BEAM® Expert™</p> <p>BPP-10</p> <p>Fiber: Bifurcated LED: ● Pg. 86</p>	<p>MINI-BEAM® Expert™</p> <p>BPP-11</p> <p>Fiber: Bifurcated LED: ● Pg. 86</p>	<p>MINI-BEAM® Expert™</p> <p>BPP-12</p> <p>Fiber: Bifurcated LED: ● Pg. 86</p>
<p>MINI-BEAM® Expert™</p> <p>BPP-13</p> <p>Fiber: Bifurcated LED: ○ Pg. 86</p>	<p>MINI-BEAM® Universal</p> <p>BPP-14</p> <p>Fiber: Individual LED: ● Pg. 89</p>	<p>MINI-BEAM® Universal</p> <p>BPP-15</p> <p>Fiber: Bifurcated LED: ● Pg. 89</p>	<p>QM42</p> <p>BPP-16</p> <p>Fiber: Individual LED: ● Pg. 142</p>

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Plastic Fiber Optic Mode (Performance based on 90% reflectance white test card)

- = Infrared LED
- = Visible Red LED
- = Visible Green LED
- = Visible Blue LED

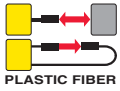


<p>QM42</p> <p>BPP-17</p> <p>Fiber: Bifurcated LED: ● Pg. 142</p>	<p>Q45</p> <p>BPP-18</p> <p>Fiber: Individual LED: ● Pg. 148</p>	<p>Q45</p> <p>BPP-19</p> <p>Fiber: Bifurcated LED: ● Pg. 148</p>	<p>Q45 NAMUR</p> <p>BPP-20</p> <p>Fiber: Individual LED: ● Pg. 158</p>
<p>Q45 NAMUR</p> <p>BPP-21</p> <p>Fiber: Bifurcated LED: ● Pg. 158</p>	<p>OMNI-BEAM™</p> <p>BPP-22</p> <p>Fiber: Individual LED: ● Pg. 161</p>	<p>OMNI-BEAM™</p> <p>BPP-23</p> <p>Fiber: Bifurcated LED: ● Pg. 161</p>	<p>OMNI-BEAM™</p> <p>BPP-24</p> <p>Fiber: Bifurcated LED: ● Pg. 161</p>
<p>OMNI-BEAM™</p> <p>BPP-25</p> <p>Fiber: Bifurcated LED: ● Pg. 161</p>	<p>D10 Expert™ with Bargraph Display</p> <p>BPP-26</p> <p>Fiber: Individual LED: ● Pg. 174</p>	<p>D10 Expert™ with Bargraph Display</p> <p>BPP-27</p> <p>Fiber: Bifurcated LED: ● Pg. 174</p>	<p>D10 Expert™ with Bargraph Display</p> <p>BPP-28</p> <p>Fiber: Individual LED: ● Pg. 174</p>
<p>D10 Expert™ with Bargraph Display</p> <p>BPP-29</p> <p>Fiber: Bifurcated LED: ● Pg. 174</p>	<p>D10 Expert™ with Bargraph Display</p> <p>BPP-30</p> <p>Fiber: Individual LED: ● Pg. 172</p>	<p>D10 Expert™ with Bargraph Display</p> <p>BPP-31</p> <p>Fiber: Bifurcated LED: ● Pg. 174</p>	<p>D10 Expert™ with Bargraph Display</p> <p>BPP-32</p> <p>Fiber: Bifurcated LED: ● Pg. 174</p>

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Plastic Fiber Optic Mode (Performance based on 90% reflectance white test card)

- = Visible Red LED
- = Visible Green LED



<p>D10 Expert™ with Bargraph Display</p> <p>BPP-33</p> <p>Fiber: Bifurcated LED: ● Pg. 174</p>	<p>FI22 with PIT26U Fiber</p> <p>BPP-34</p> <p>Fiber: Individual LED: ● Pg. 187</p>	<p>FI22 with PIT46U Fiber</p> <p>BPP-35</p> <p>Fiber: Individual LED: ● Pg. 187</p>	<p>FI22 with PIT66U Fiber</p> <p>BPP-36</p> <p>Fiber: Individual LED: ● Pg. 187</p>
<p>FI22 with PBT26U Fiber</p> <p>BPP-37</p> <p>Fiber: Bifurcated LED: ● Pg. 187</p>	<p>FI22 with PBT46U Fiber</p> <p>BPP-38</p> <p>Fiber: Bifurcated LED: ● Pg. 187</p>	<p>FI22 with PBT66U Fiber</p> <p>BPP-39</p> <p>Fiber: Individual LED: ● Pg. 187</p>	

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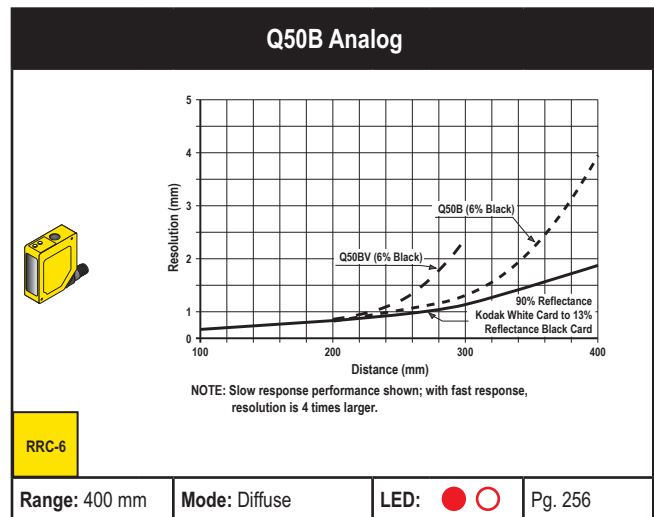
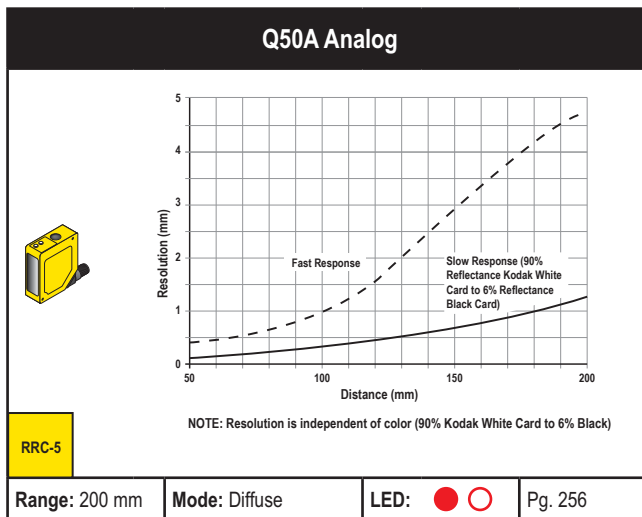
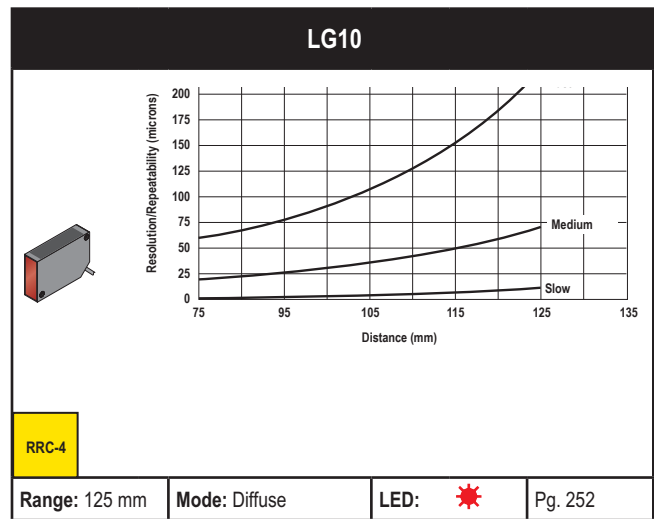
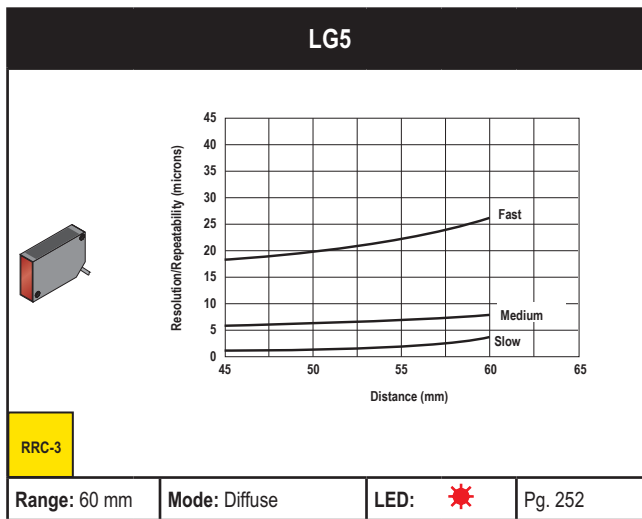
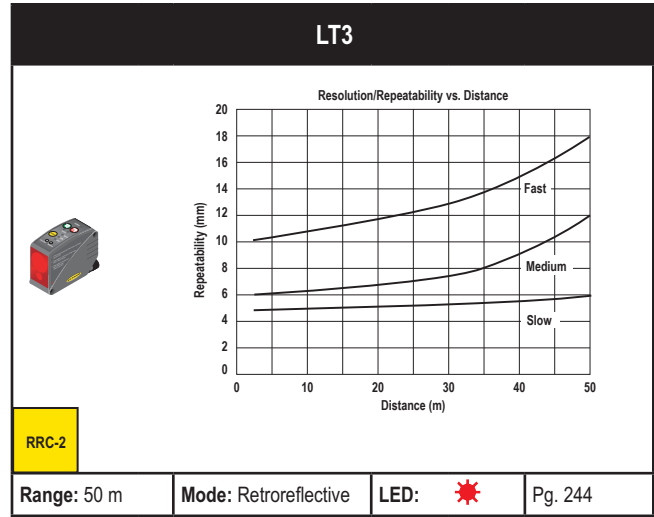
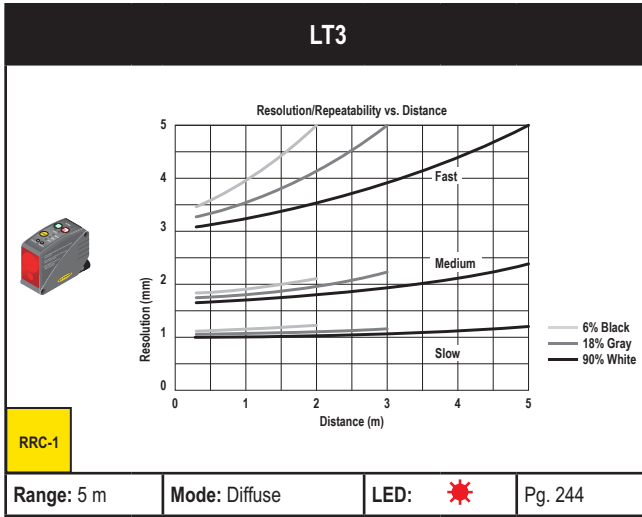
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Repeatability/Resolution Curves

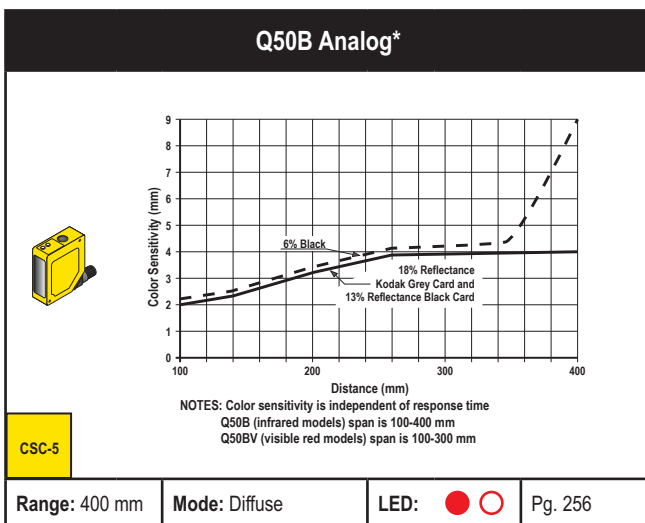
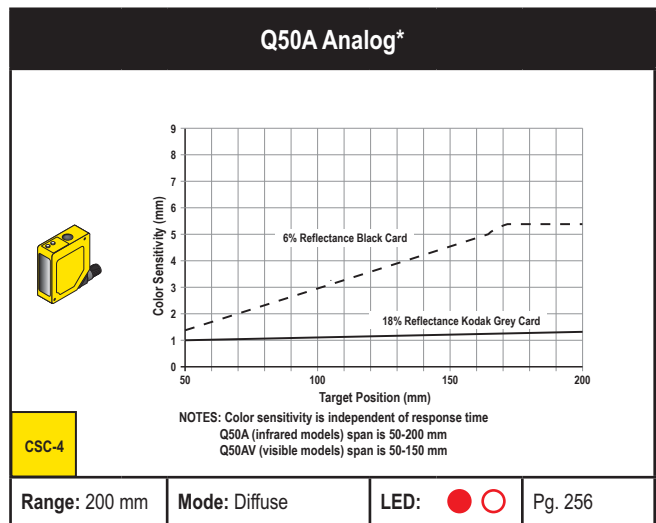
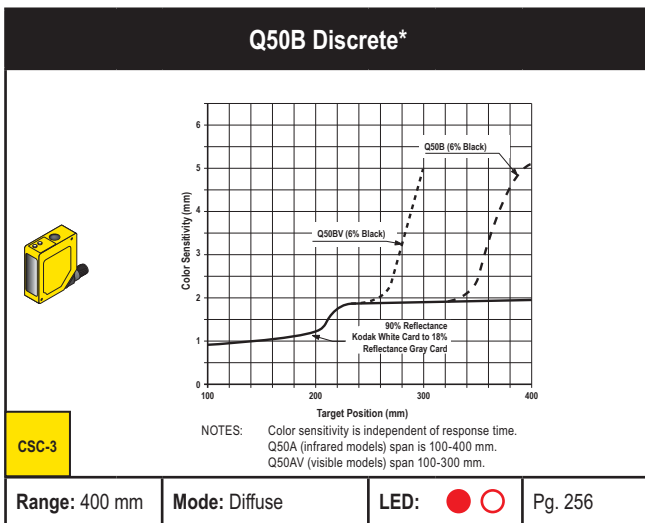
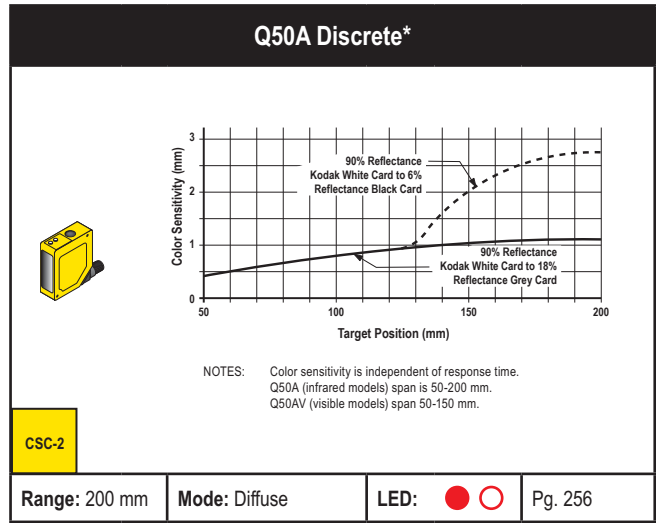
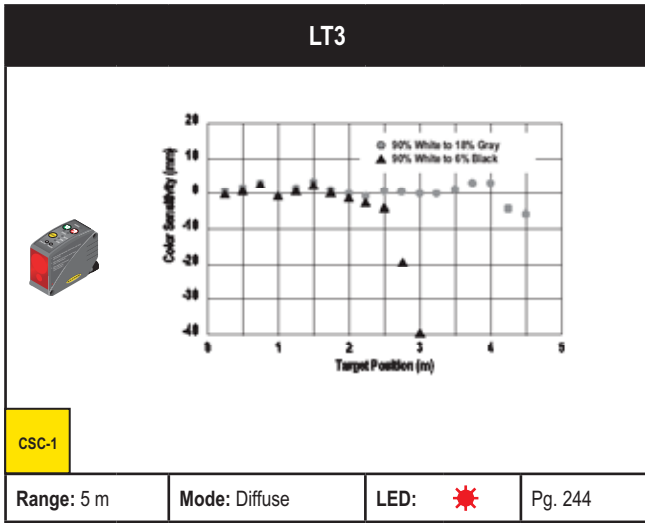
- = Visible Red LED
- = Infrared LED
- ★ = Visible Red Laser LED



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Color Sensitivity Curves

- = Visible Red LED
- = Infrared LED
- ★ = Visible Red Laser LED

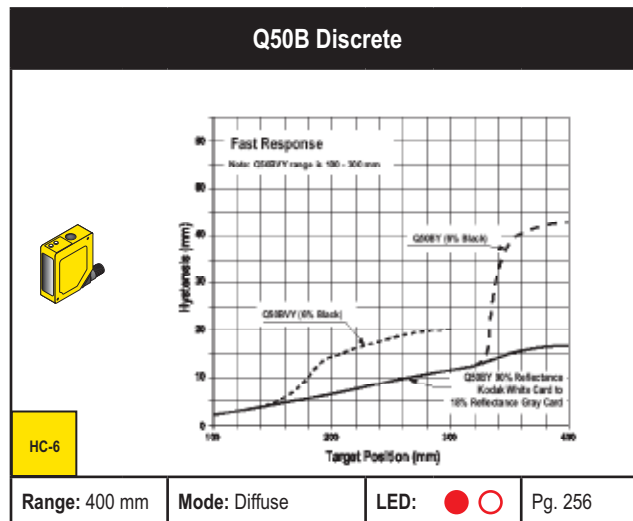
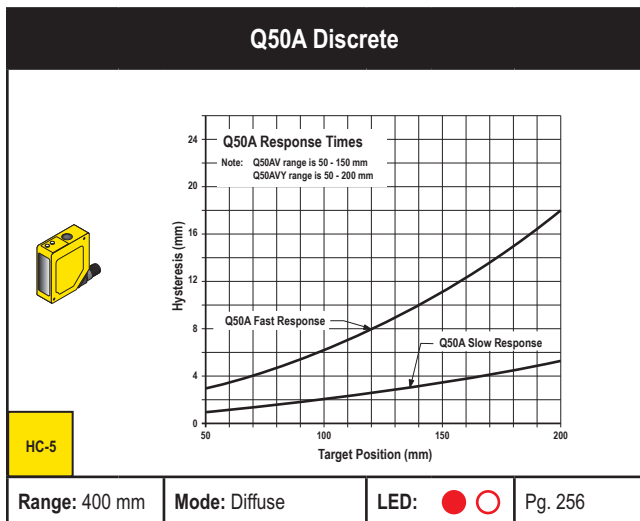
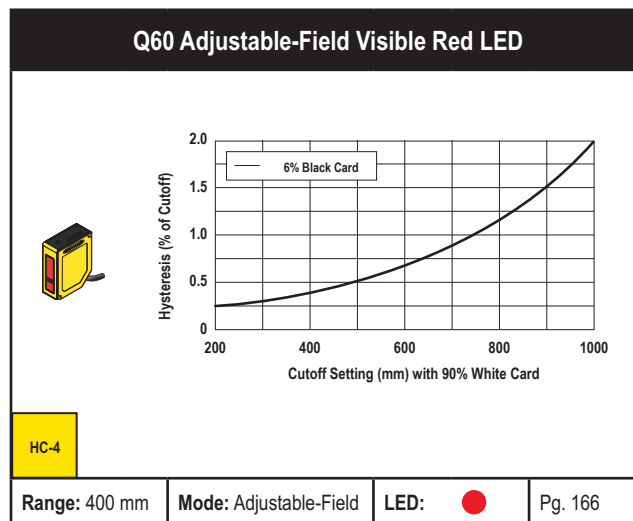
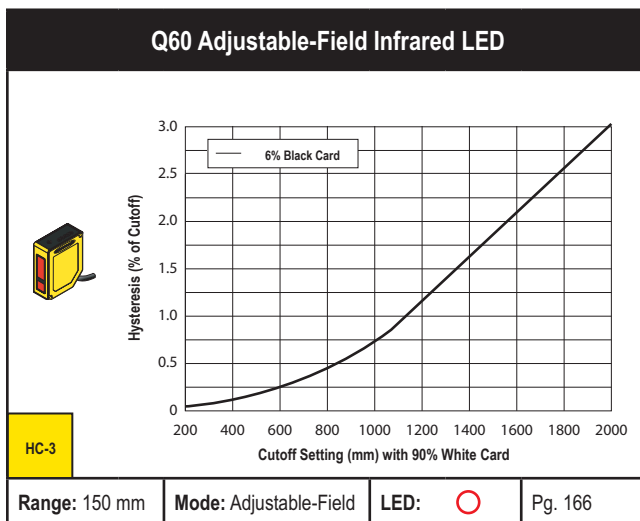
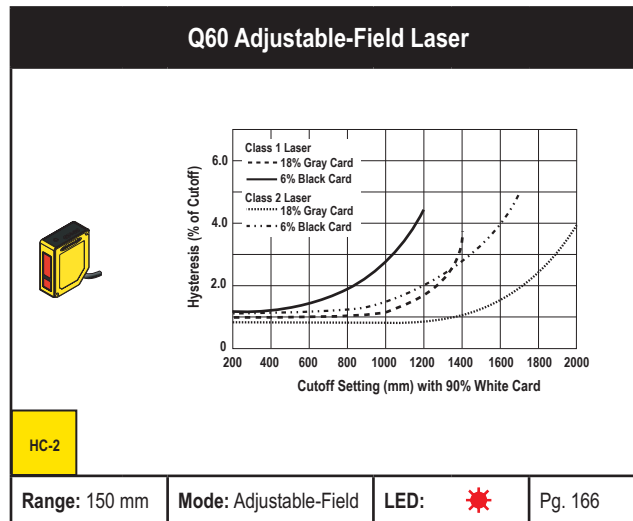
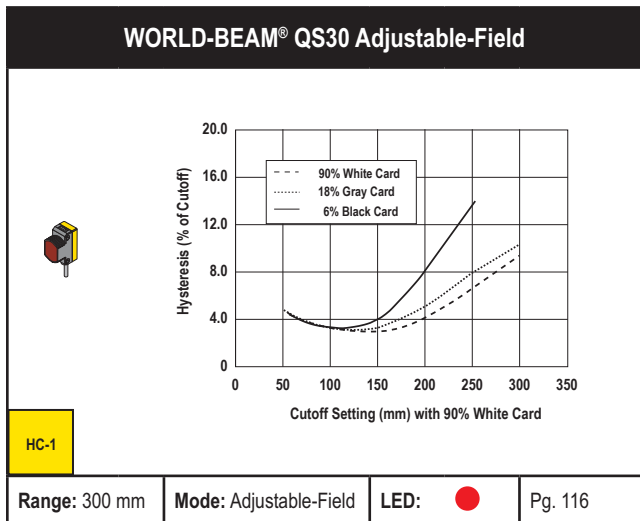


* Performance based on 6%, 13% or 18% reflectance white test card.

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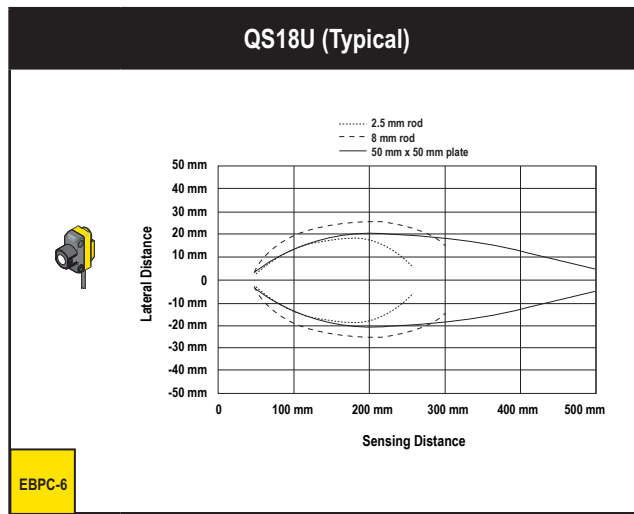
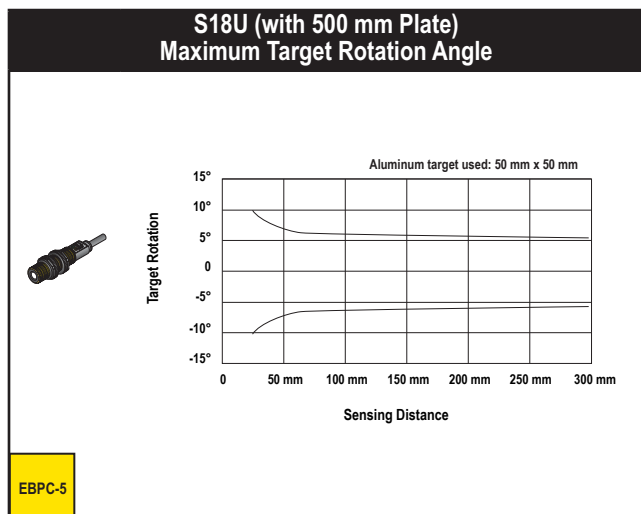
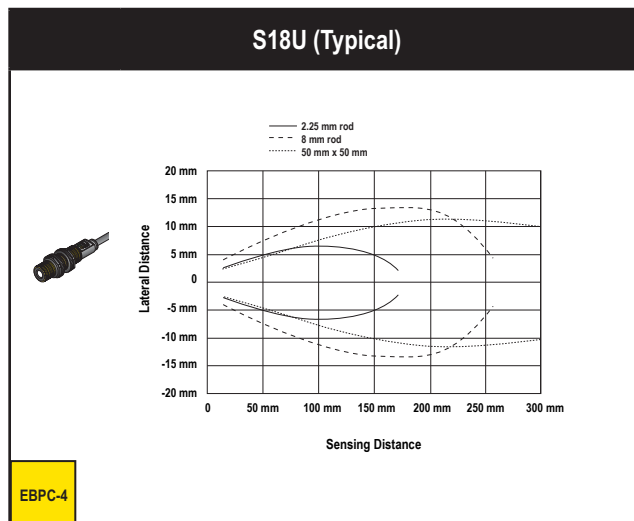
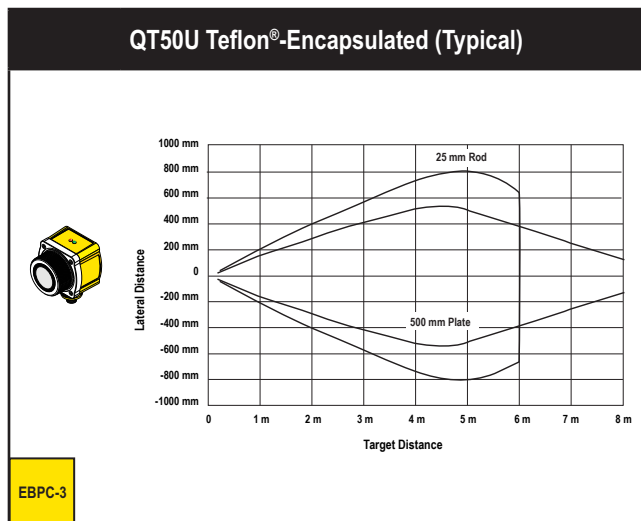
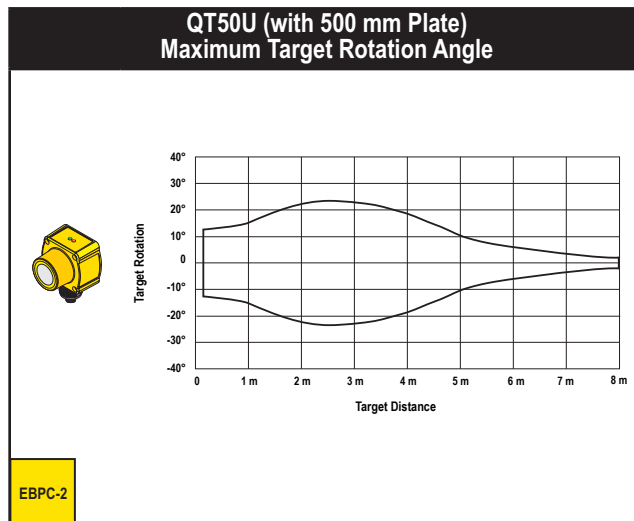
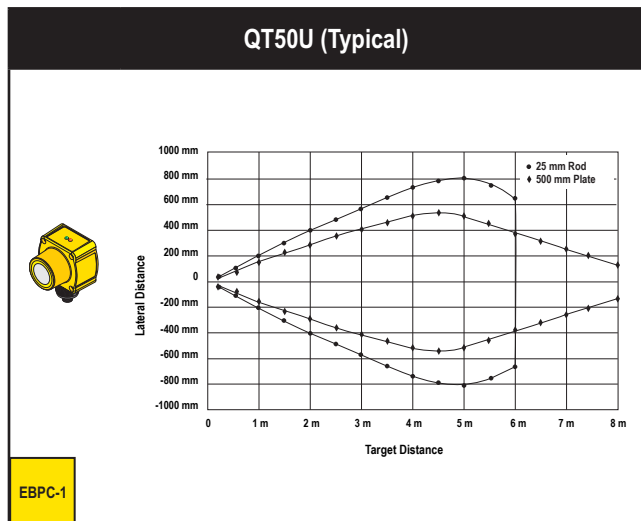
Hysteresis Curves

- = Visible Red LED
- = Infrared LED
- ★ = Visible Red Laser LED



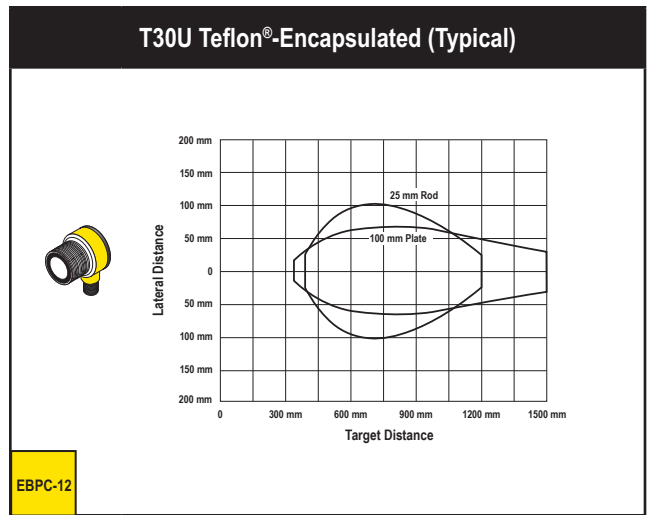
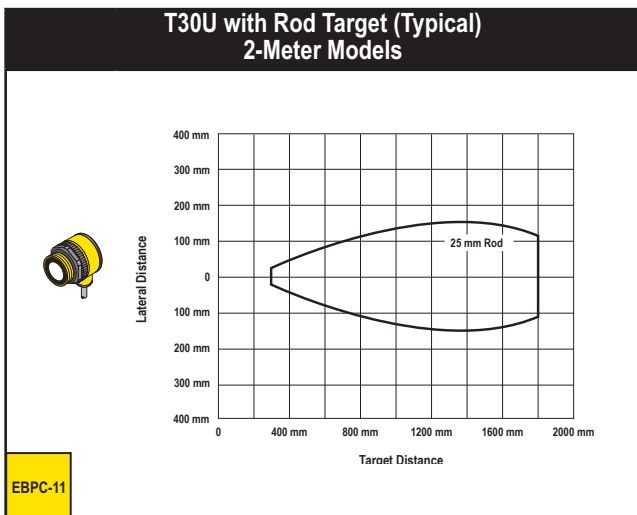
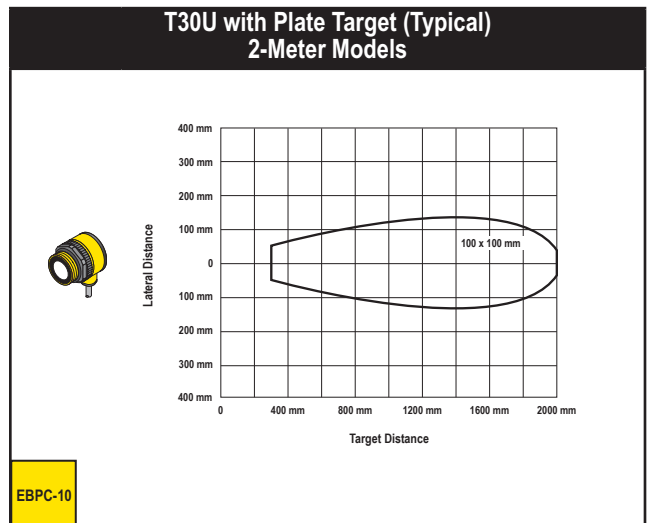
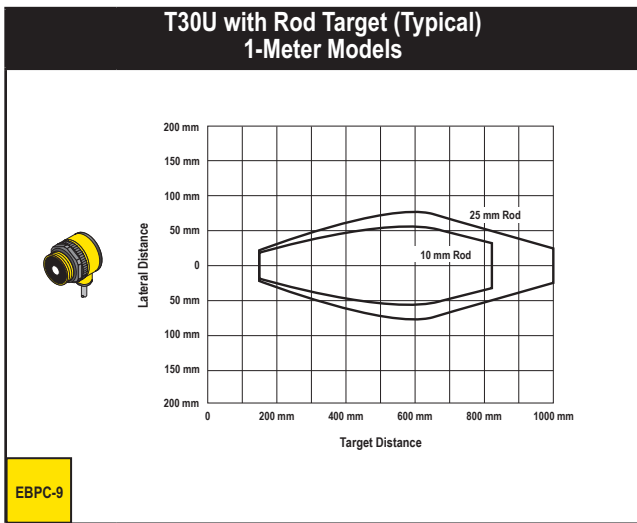
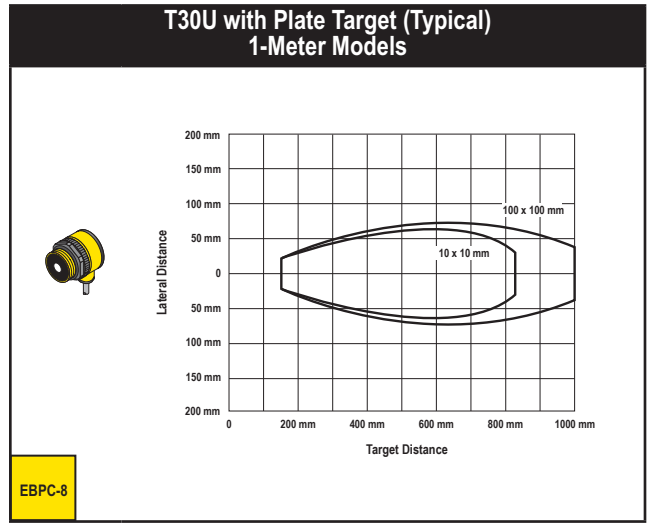
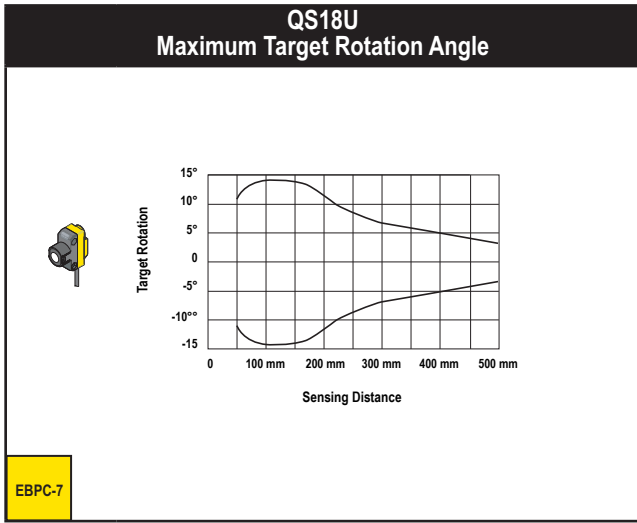
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Effective Beam Patterns



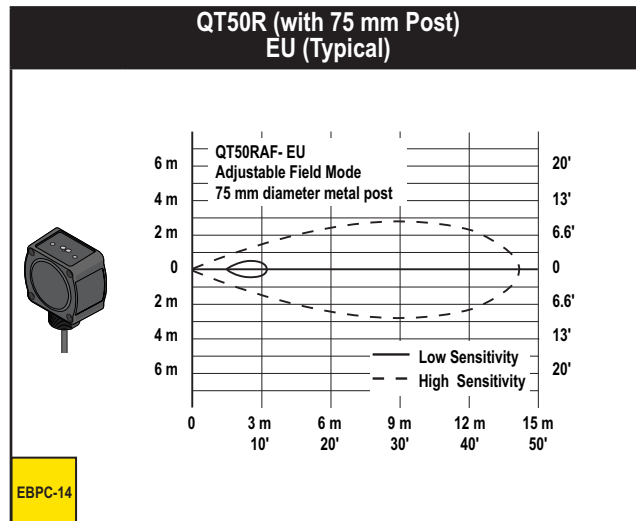
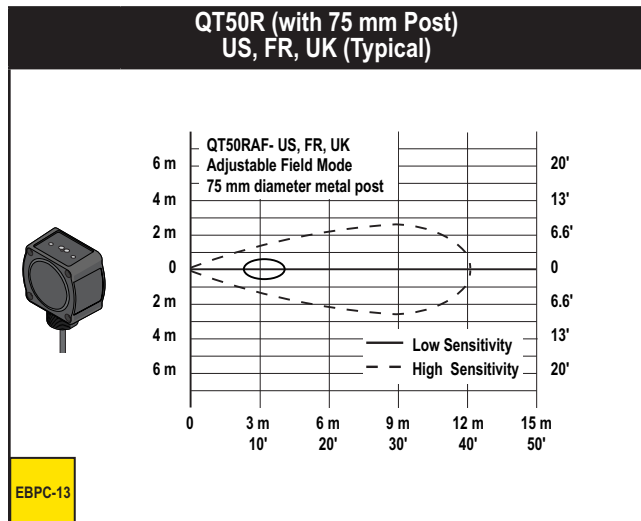
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Effective Beam Patterns

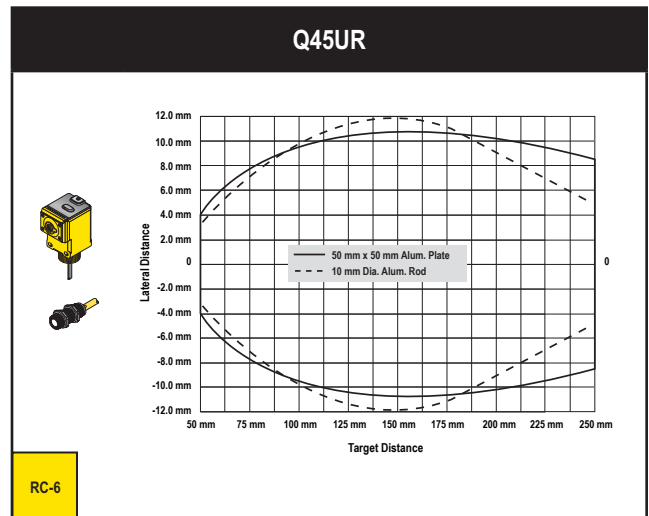
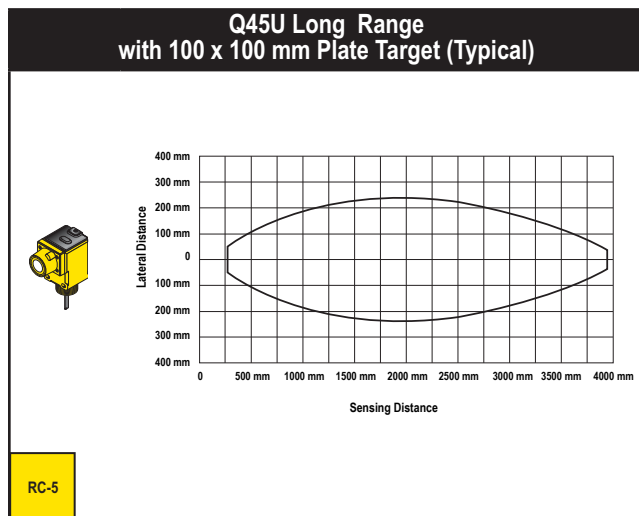
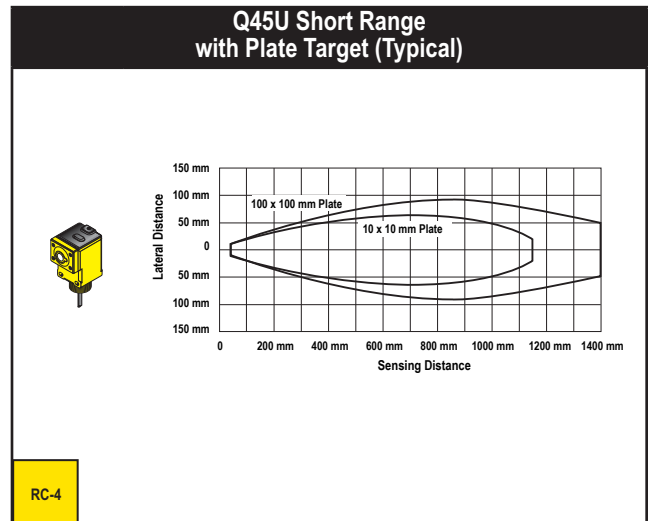
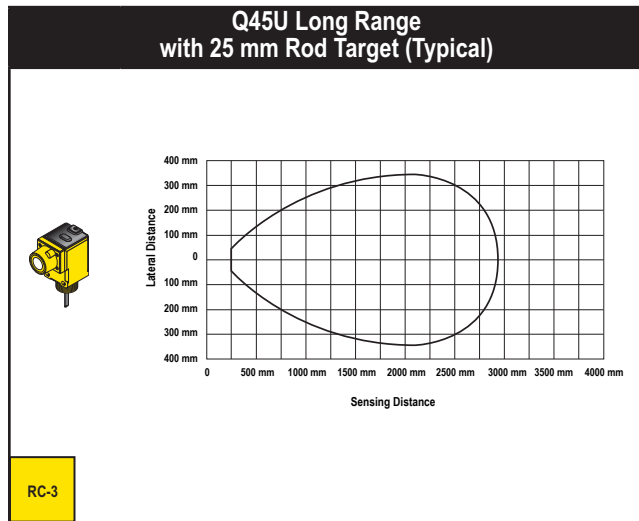
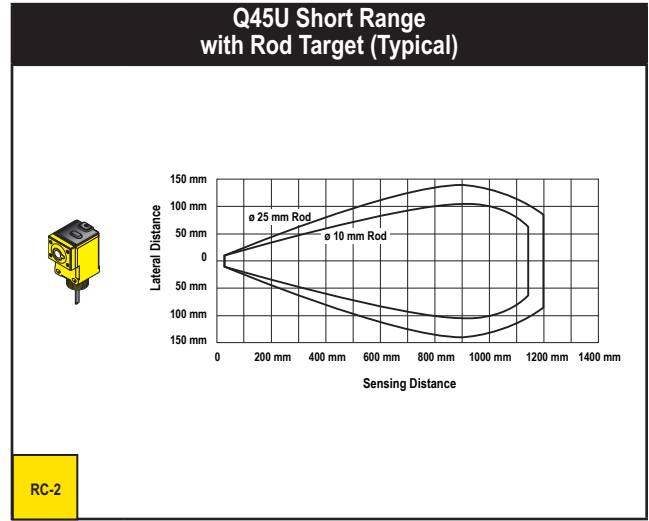
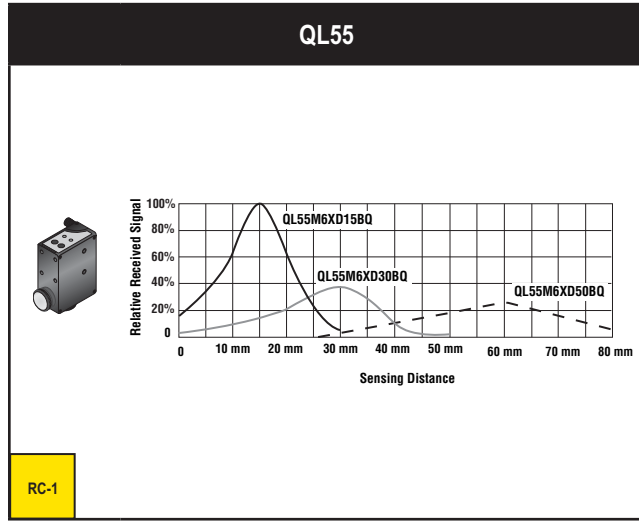


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Effective Beam Patterns

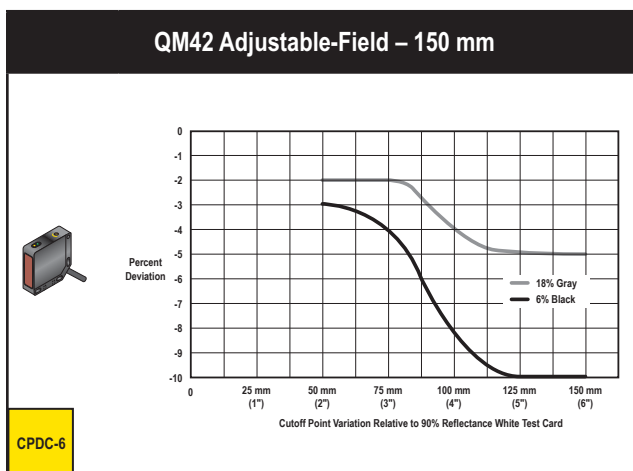
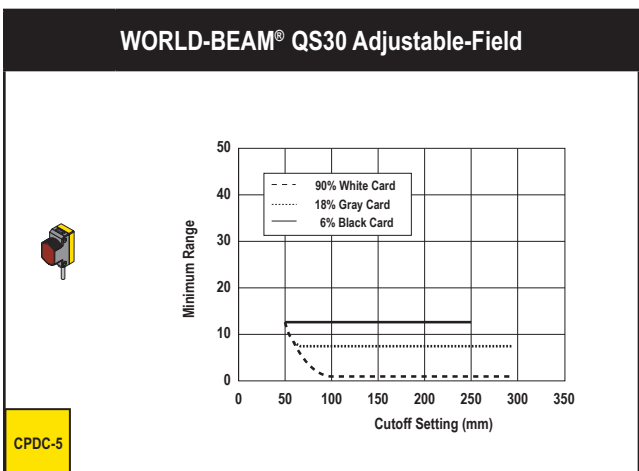
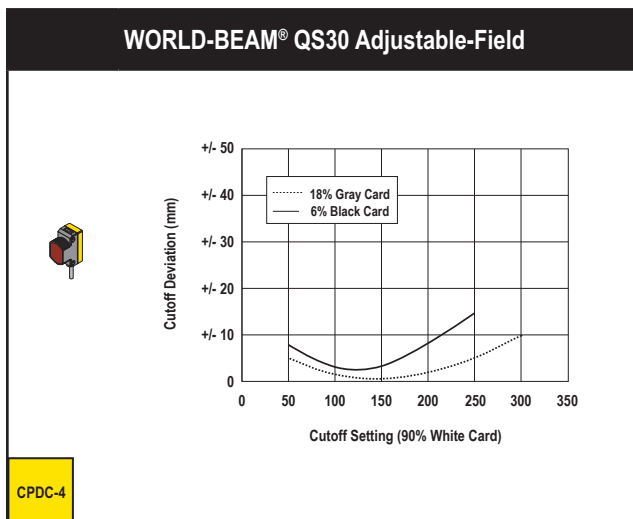
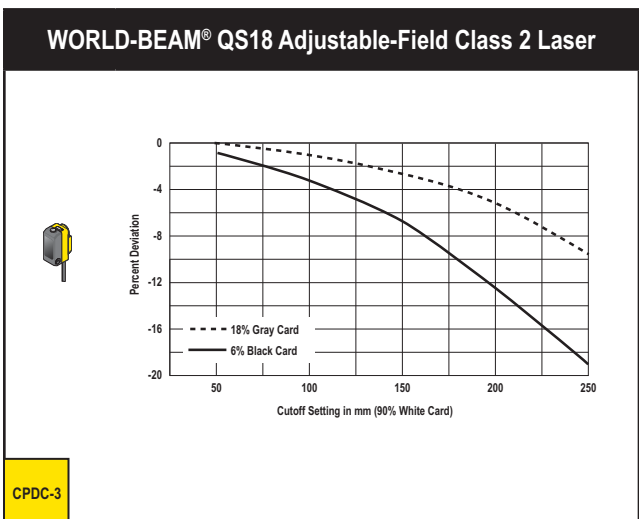
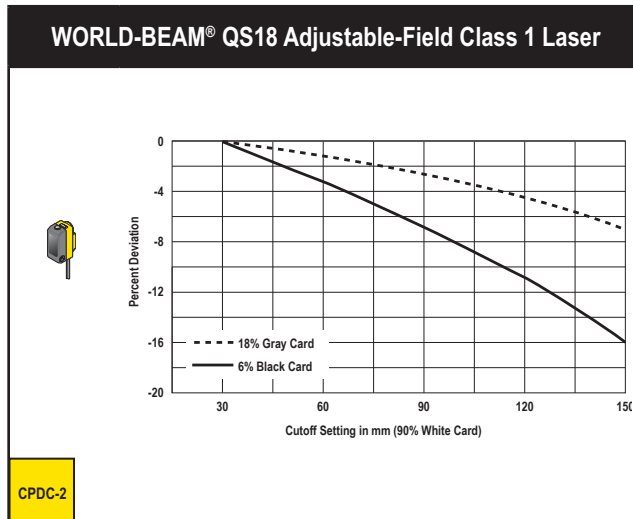
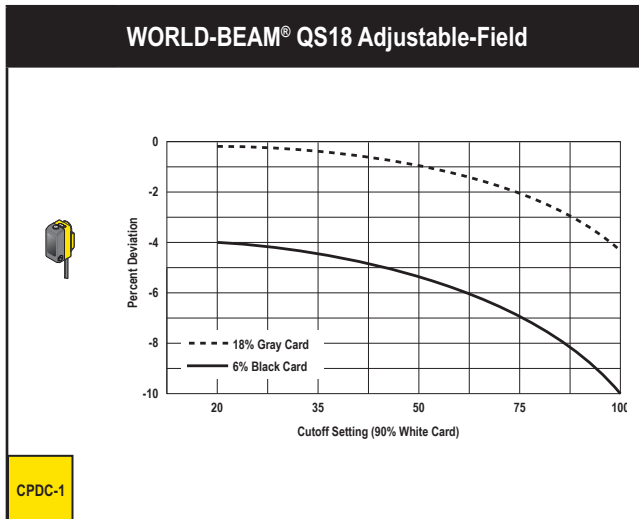


Response Curves



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Cutoff Point Deviation Curves

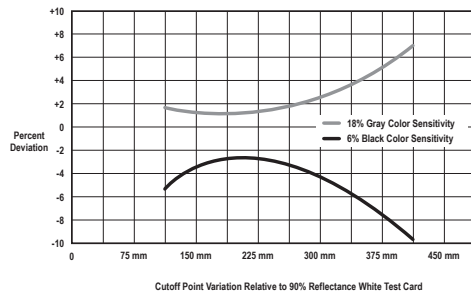
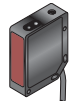


The percentage of deviation indicates a change in the cutoff point for either 18% gray or 6% black targets, relative to the cutoff point for a 90% reflective white test card. As an example, the cutoff point decreases 10% for a 6% reflectance black target when the cutoff point is 2000 mm using a 90% reflective white test card. In other words, the cutoff point for the black target is 1800 mm.

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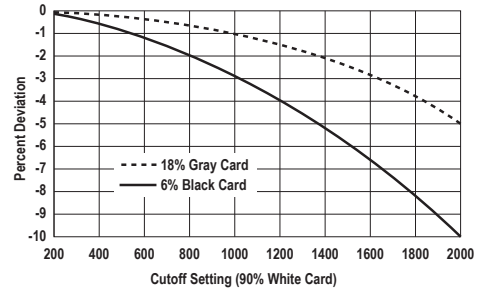
Cutoff Point Deviation Curves

QMT42 Adjustable-Field – 400 mm



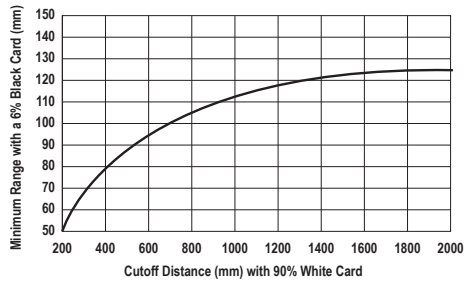
CPDC-7

Q60 Adjustable-Field Infrared LED



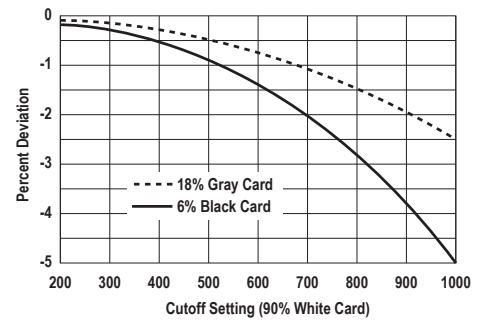
CPDC-8

Q60 Adjustable-Field Infrared LED



CPDC-9

Q60 Adjustable-Field Visible Red LED



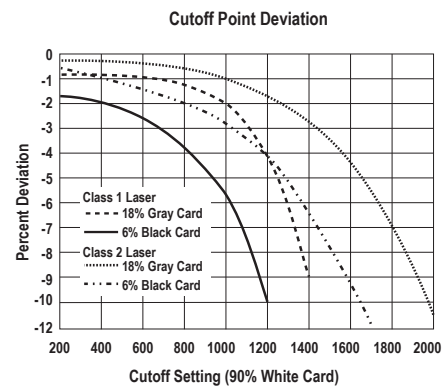
CPDC-10

Q60 Adjustable-Field Visible Red LED



CPDC-11

Q60 Laser Adjustable-Field



CPDC-12

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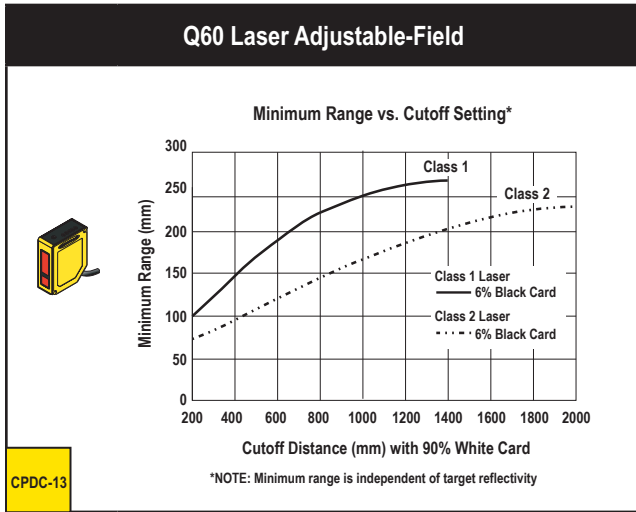
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Cutoff Point Deviation Curves



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DC Hookups

DC01	Current Sinking (NPN)	Key 1 = Brown 3 = Blue 4 = Black
Current Sourcing (PNP)		
3-Pin Pico		

DC02	Emitter	Key 1 = Brown 2 = White† 3 = Blue 4 = Black† † Not Used							
<table border="1" style="width: 100%; text-align: center;"> <tr> <td style="background-color: black; color: white;">3-Pin Pico</td> <td style="background-color: black; color: white;">4-Pin Pico</td> <td style="background-color: black; color: white;">4-Pin Euro</td> <td style="background-color: black; color: white;">4-Pin Mini</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> </tr> </table>			3-Pin Pico	4-Pin Pico	4-Pin Euro	4-Pin Mini			
3-Pin Pico	4-Pin Pico	4-Pin Euro	4-Pin Mini						

DC03	Complementary Current Sinking (NPN)	Key 1 = Brown 2 = White 3 = Blue 4 = Black
Complementary Current Sourcing (PNP)		
4-Pin Pico	4-Pin Euro	4-Pin Mini

DC04	Bipolar (NPN + PNP)	Key 1 = Brown 2 = White 3 = Blue 4 = Black
4-Pin Pico	4-Pin Euro	

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DC Hookups

DC05		Complementary Current Sinking (NPN) Standard Hookup	
		Key	
Current Sinking (NPN) Plus Current Sinking Alarm		1 = Brown 2 = White 3 = Blue 4 = Black	
4-Pin Pico		4-Pin Euro	

DC06		Complementary Current Sourcing (PNP) Standard Hookup	
		Key	
Current Sourcing (PNP) Plus Current Sourcing Alarm		1 = Brown 2 = White 3 = Blue 4 = Black	
4-Pin Pico		4-Pin Euro	

DC07		Current Sinking (NPN)	
		Key	
Current Sourcing (PNP)		1 = Brown 2 = White 3 = Blue 4 = Black	
4-Pin Pico		4-Pin Euro	

DC08		Bipolar (NPN + PNP)	
		Key	
*NOTE: For some QS30 models, gray wire is used for LO/DO Select. See data sheet.		1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray 6 = Pink †	
		† Not Used	
6-Pin Pico		5-Pin Euro	

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DC Hookups

DC09	Emitter Frequency A	Key 1 = Brown 2 = White 3 = Blue 4 = Black † 5 = Gray † Not Used
Emitter Frequency B		
5-Pin Euro		

DC10	Receiver Frequency A	Key 1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray
Receiver Frequency B		
5-Pin Euro		

DC11	Complementary Current Sinking (NPN)	Key 1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray
Complementary Current Sourcing (PNP)		
5-Pin Euro		

DC12	Bipolar (NPN + PNP)	Key 1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray*/Yellow†
5-Pin Euro	5-Pin Mini	

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DC Hookups

DC13 Current Sinking (NPN) Configuration		Key
Current Sourcing (PNP) Configuration		1 = Brown 2 = White 3 = Blue 4 = Black
4-Pin Euro	4-Pin Mini	

DC14 Current Sinking (NPN)		Key
Current Sourcing (PNP)		1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray 6 = Pink
6-Pin Pico		

DC15 Current Sinking (NPN) + Analog Current		Key
Current Sinking (NPN) + Analog Voltage		1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray 6 = Pink
6-Pin Pico		

DC16 Current Sourcing (PNP) + Analog Current		Key
Current Sourcing (PNP) + Analog Voltage		1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray 6 = Pink
6-Pin Pico		

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DC Hookups

DC17	Current Sinking (NPN) Cable Hookup	Key
Current Sourcing (PNP) Cable Hookup		Key
		<p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray</p>

DC18	SM30 DC Receivers (NPN) Light Operate	Key
SM30 DC Receivers (NPN) Dark Operate		Key
		<p>1 = Brown 2 = White 3 = Blue 4 = Black</p>
4-Pin Mini		

DC19	SM30 DC Receivers (PNP) Light Operate	Key
SM30 DC Receivers (PNP) Dark Operate		Key
		<p>1 = Brown 2 = White 3 = Blue 4 = Black</p>
4-Pin Mini		

DC20	Laser Emitter	Key
		<p>1 = Brown 2 = White 3 = Blue 4 = Black†</p> <p>† Not Used</p>
4-Pin Euro		

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AC Hookups

AC01	2-wire AC	Key
<p>NOTE: Wire a load in series before powering up sensor.</p>		<p>1 = Brown 3 = Blue</p>

AC02	2-wire AC with Quick-Disconnect Cable	Key
<p>NOTE: Wire a load in series before powering up sensor.</p>		<p>1 = Green† 2 = Red/Black 3 = Red/White</p> <p>† Not Used</p>

3-Pin Micro

AC03	Emitters	Key
<p>See Specifications</p>		<p>1 = Brown 3 = Blue</p>

AC04	Emitters with Quick-Disconnect Cable	Key
<p>See Specifications</p>		<p>1 = Green 2 = Red/Black 3 = Red/White</p>

3-Pin Mini	5-Pin Mini

3-Pin Micro	3-Pin Mini

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AC Hookups

AC05	3-wire AC	Key
		<p>1 = Brown 3 = Blue 4 = Black</p>
3-Pin Mini		

AC06	3-wire AC with Quick-Disconnect Cable	Key
		<p>1 = Red/Black 2 = Red/White 3 = Red 4 = Green†</p> <p>† Not Used</p>
4-Pin Micro		

AC07	Emitters with Quick-Disconnect Cable	Key
		<p>1 = Red/Black 2 = Red/White 3 = Red† 4 = Green†</p> <p>† Not Used</p>
4-Pin Micro		

AC08	SPDT Electromechanical Relay Output	Key
		<p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Yellow</p>
5-Pin Mini		

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AC Hookups

AC09	OPBA2 or OPBB2 3-wire SPST Solid-State Power Block	Key
		<p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Yellow</p>
5-Pin Mini		

AC10	SM30 2-wire AC Receivers with Attached Cables	Key
		<p>1 = Brown 2 = Blue 3 = Green</p>
<p>* Connect green wire to earth ground whenever a stainless steel model is powered by ac voltage.</p> <p>NOTE: Wire a load in series before powering up sensor.</p>		

AC11	SM30 2-wire AC Receivers	Key
		<p>1 = Green 2 = Red/Black 3 = Red/White</p>
<p>* Connect green wire to earth ground whenever a stainless steel model is powered by ac voltage.</p> <p>NOTE: Wire a load in series before powering up sensor.</p>		
3-Pin Mini		

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Universal AC/DC Hookups

UN01	SPDT Electromechanical Relay Output	Key
<p>** Supply Voltage (see Specifications)</p> <p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Yellow</p> <p>** NOTE: Connection of dc power is without regard to polarity.</p>		
5-Pin Mini		

UN02	Emitters		Key
<p>* Supply Voltage (see Specifications)</p> <p>1 = Brown 2 = Blue 3 = Black†</p> <p>† Not Used</p> <p>* NOTE: Connection of dc power is without regard to polarity.</p>			
3-Pin Mini		4-Pin Mini	

UN03	SPST Solid-State Relay Output	Key
<p>1 = Brown 2 = White 3 = Blue 4 = Black</p> <p>*NOTE: Connection of dc power is without regard to polarity.</p>		
4-Pin Mini		

UN04	SPST Electromechanical Relay Output	Key
<p>1 = Red/Black 2 = Red/White 3 = Red 4 = Green</p> <p>*NOTE: Connection of dc power is without regard to polarity.</p>		
4-Pin Micro		

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Universal AC/DC Hookups

UN05		Normally Open/Pump-In	
<p>1 — See Specifications** 2 — N.C./Pump Out 3 — C 4 — N.O./Pump In Shield* — Ground</p>		Key 1 = Brown 2 = White 3 = Blue 4 = Black 5 = Yellow	
<p>* It is recommended that the shield wire be connected to earth ground. ** DC hookup is without regard to polarity.</p>			
5-Pin Micro		5-Pin Mini	
<p>4A max. Load</p>		<p>8A max. Load</p>	

UN06		SM30 Emitters with Attached Cable	
<p>1 — 10-30V dc or 24-240V ac 3 — 4* — Ground</p>		Key 1 = Brown 3 = Blue 4 = Green	
<p>* Connect green wire to earth ground whenever a stainless steel model is powered by ac voltage.</p>			

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Special Hookups

SP01	NAMUR Hookup	Key
		<p>1 = Brown 2 = Blue</p>
4-Pin Euro Namur		

SP02	LX Emitter	Key
		<p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray</p>
LX Receiver		
5-Pin Euro		

SP03	SL10, SL30 and SLO30	Key
		<p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray</p>
<p>* For Dark Operate, connect gray wire to + (brown). For Light Operate, connect gray wire to - (blue) or leave circuit open.</p>		
5-Pin Euro		

SP04	SLC1 Outputs ON for gap between labels	Key
		<p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray</p>
<p>* Toggle to opposite polarity for > 100 ms to reset microprocessor.</p>		
SLC1 Outputs ON for labels		
		<p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray</p>
<p>* Toggle to opposite polarity for > 100 ms to reset microprocessor.</p>		
5-Pin Euro		

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Special Hookups

SP05	QC50/QCX50 Current Sinking (NPN)	Key
		<p>1 = White 2 = Brown 3 = Green 4 = Yellow 5 = Gray 6 = Pink 7 = Blue 8 = Red</p>
8-Pin Euro		

SP06	QC50/QCX50 Current Sourcing (PNP)	Key
		<p>1 = White 2 = Brown 3 = Green 4 = Yellow 5 = Gray 6 = Pink 7 = Blue 8 = Red</p>
8-Pin Euro		

SP07	QL50 Current Sinking (NPN)	Key
		<p>1 = Brown 2 = White 3 = Blue 4 = Black</p>
<p style="text-align: center;">QL50 Current Sourcing (PNP)</p>		
4-Pin Euro		

SP08	QL55 Current Sinking (NPN) with Analog Output	Key
		<p>1 = Brown 2 = White 3 = Blue 4 = Black</p>
<p style="text-align: center;">QL55 Current Sourcing (PNP) with Analog Output</p>		
4-Pin Euro		

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Measurement and Inspection Hookups

MI01	LT3 Analog and Current Sinking (NPN) Discrete Outputs	Key
		<p>1 = White 2 = Brown 3 = Green 4 = Yellow 5 = Gray 6 = Red 7 = Blue 8 = Shield</p>
<p>* It is recommended that the shield wire be connected to either earth ground or DC common.</p>		
8-Pin Euro		

MI02	LT3 Analog and Current Sourcing (PNP) Discrete Outputs	Key
		<p>1 = White 2 = Brown 3 = Green 4 = Yellow 5 = Gray 6 = Red 7 = Blue 8 = Shield</p>
<p>* It is recommended that the shield wire be connected to either earth ground or DC common.</p>		
8-Pin Euro		

MI03	LT3 with Two Discrete Outputs Current Sinking (NPN)	Key
		<p>1 = White 2 = Brown 3 = Green 4 = Yellow 5 = Gray 6 = Red 7 = Blue 8 = Shield</p>
<p>* It is recommended that the shield wire be connected to either earth ground or DC common.</p>		
8-Pin Euro		

MI04	LT3 with Two Discrete Outputs Current Sourcing (PNP)	Key
		<p>1 = White 2 = Brown 3 = Green 4 = Yellow 5 = Gray 6 = Red 7 = Blue 8 = Shield</p>
<p>* It is recommended that the shield wire be connected to either earth ground or DC common.</p>		
8-Pin Euro		

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MI05	LT7 Current Sourcing (PNP) and Analog Outputs	Key
		<p>1 = White 2 = Brown 3 = Green 4 = Yellow 5 = Gray 6 = Pink 7 = Red 8 = Black 9 = Purple 10 = Gray/Pink 11 = Red/Blue 12 = Blue</p>
12-Pin M16		

MI06	LG5/LG10 Analog and Current Sinking (NPN) Discrete Outputs	Key
		<p>1 = White 2 = Brown 3 = Green 4 = Yellow 5 = Gray 6 = Red 7 = Blue 8 = Shield</p>
8-Pin Euro		

* See data sheet for shield wire connection.

MI07	LG5/LG10 Analog and Current Sourcing (PNP) Discrete Outputs	Key
		<p>1 = White 2 = Brown 3 = Green 4 = Yellow 5 = Gray 6 = Red 7 = Blue 8 = Shield</p>
8-Pin Euro		

* See data sheet for shield wire connection.

MI08	Q50 with Discrete Outputs Complementary Current Sinking (NPN)	Key
<p>* It is recommended that the shield wire be connected to either earth ground or DC common.</p>		<p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray</p>
<p style="text-align: center;">Q50 with Discrete Outputs Complementary Current Sourcing (PNP)</p> <p>* It is recommended that the shield wire be connected to either earth ground or DC common.</p>		
5-Pin Euro		

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MI09	Q50 with Analog Outputs	Key
<p>1 — + 15-30V dc 3 — - 15-30V dc 2 — 4-20 mA or 0-10V 4 — Response 5-30V dc 4 ms 5 — Remote Teach 0-2V dc + 5-30V dc Shield* —</p>		<p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray</p>
<p>* It is recommended that the shield wire be connected to either earth ground or DC common.</p>		
5-Pin Euro		

MI10	QT50U with Discrete Outputs Current Sinking (NPN)		Key
<p>1 — + 10-30V dc 3 — - 10-30V dc 2 — Load 4 — Load 5* — Remote Teach 0-2V dc Shield** —</p>		<p>** It is recommended that the shield wire be connected to either earth ground or DC common.</p>	
QT50U with Discrete Outputs Current Sourcing (PNP)			
<p>1 — + 10-30V dc 3 — - 10-30V dc 2 — Load 4 — Load 5* — Remote Teach 0-2V dc Shield** —</p>		<p>** It is recommended that the shield wire be connected to either earth ground or DC common.</p>	
5-Pin Euro		5-Pin Mini	

MI11	QT50U with Analog Output	Key
<p>1 — + 10-30V dc 3 — - 10-30V dc 2 — 4-20 mA or 0-10V 4 — Remote Teach 0-2V dc Shield* —</p>		<p>5-Pin Euro 1 = White 2 = Brown 3 = Green 4 = Yellow 5 = Gray†</p> <p>5-Pin Mini 1 = Brown 2 = White 3 = Blue 4 = Black 5 = Yellow*</p>
<p>* It is recommended that the shield wire be connected to either earth ground or DC common.</p>		
5-Pin Euro		5-Pin Mini

MI12	Bipolar (NPN + PNP) with Shield		Key
<p>1 — + 10-30V dc 3 — - 10-30V dc 2 — Load 4 — Load 5 — Remote Teach 0-2V dc Shield* —</p>		<p>* It is recommended that the shield wire be connected to either earth ground or DC common.</p>	
5-Pin Euro			

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MI13	S18U with Analog Output	Key
<p>* It is recommended that the shield wire be connected to either earth ground or DC common.</p>		<p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray</p>
5-Pin Euro		

MI14	QS18U Current Sinking (NPN)	Key
<p>* It is recommended that the shield wire be connected to either earth ground or DC common.</p>		<p>1 = Brown 2 = White 3 = Blue 4 = Black</p>
QS18U Current Sourcing (PNP)		
<p>* It is recommended that the shield wire be connected to either earth ground or DC common.</p>		<p>1 = Brown 2 = White 3 = Blue 4 = Black</p>
4-Pin Pico		4-Pin Euro

MI15	T30U with Discrete Outputs Current Sinking (NPN)	Key
<p>* It is recommended that the shield wire be connected to either earth ground or DC common.</p>		<p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray</p>
T30U with Discrete Outputs Current Sourcing (PNP)		
<p>* It is recommended that the shield wire be connected to either earth ground or DC common.</p>		<p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray</p>
5-Pin Euro		

MI16	T30U with Analog & Discrete Outputs Current Sinking (NPN)	Key
<p>* It is recommended that the shield wire be connected to either earth ground or DC common.</p>		<p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray</p>
T30U with Analog & Discrete Outputs Current Sourcing (PNP)		
<p>* It is recommended that the shield wire be connected to either earth ground or DC common.</p>		<p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray</p>
5-Pin Euro		

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MI17	Q45U & Q45UR with Discrete Outputs	<p>Note: for Q45U models, gray/yellow wire is used for enable.</p> <p>** It is recommended that the shield wire be connected to either earth ground or DC common.</p>	Key
Q45U & Q45UR with Analog Outputs		<p>Note: for Q45U models, gray/yellow wire is used for enable.</p> <p>* It is recommended that the shield wire be connected to either earth ground or DC common.</p>	Key
		5-Pin Euro	1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray†
		5-Pin Mini	1 = Brown 2 = White 3 = Blue 4 = Black 5 = Yellow*

MI18	T18U Current Sinking (NPN) NORMAL Resolution		Key
T18U Current Sinking (NPN) HIGH Resolution			Key
		4-Pin Euro	1 = Brown 2 = White 3 = Blue 4 = Black

MI19	T18U Current Sourcing (PNP) NORMAL Resolution		Key
T18U Current Sourcing (PNP) HIGH Resolution			Key
		4-Pin Euro	1 = Brown 2 = White 3 = Blue 4 = Black

MI20	T18UE Emitter		Key
		4-Pin Euro	1 = Brown 2 = White 3 = Blue 4 = Black†
			† Not Used

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MI21	M18T with Analog Output	Key
		<p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray</p>
<p>* It is recommended that the shield wire be connected to either earth ground or DC common.</p>		
5-Pin Euro		

MI22	R-GAGE™	Key
		<p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray*</p> <p>* Not used</p>
<p>NOTE: It is recommended that the shield wire (QD cordsets only) be connected to earth ground or dc common. Shielded cordsets are recommended for all models.</p>		
5-Pin Euro		

MI23	EZ-ARRAY™ Sinking (NPN) with Analog Output	Key
		<p>1 = White 2 = Brown 3 = Green 4 = Yellow 5 = Gray 6 = Pink 7 = Blue 8 = Red</p>
<p>10-30V dc Power</p>		
8-Pin Euro		

MI24	EZ-ARRAY™ Sourcing (PNP) with Analog Output	Key
		<p>1 = White 2 = Brown 3 = Green 4 = Yellow 5 = Gray 6 = Pink 7 = Blue 8 = Red</p>
<p>10-30V dc Power</p>		
8-Pin Euro		

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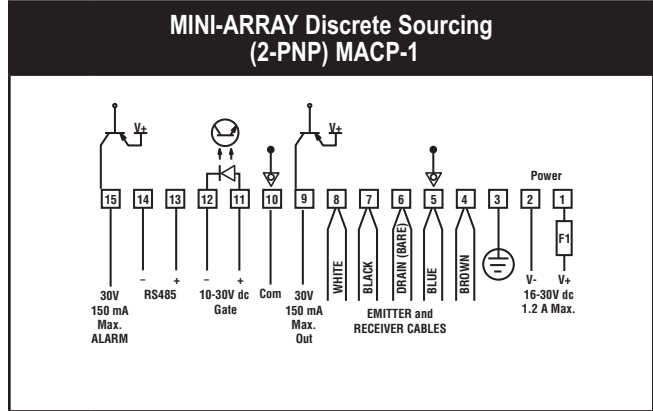
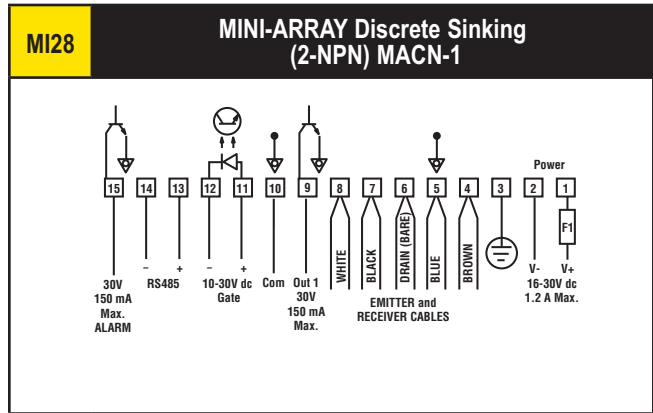
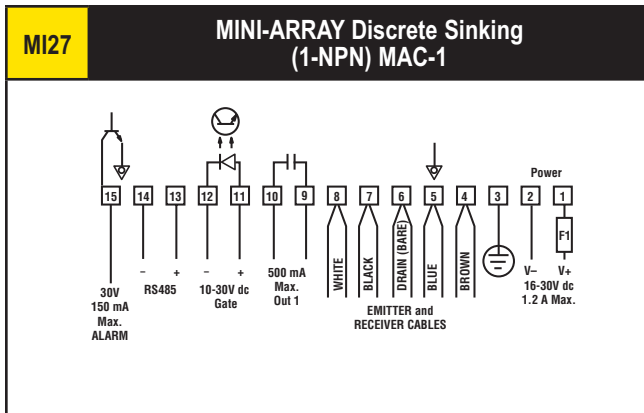
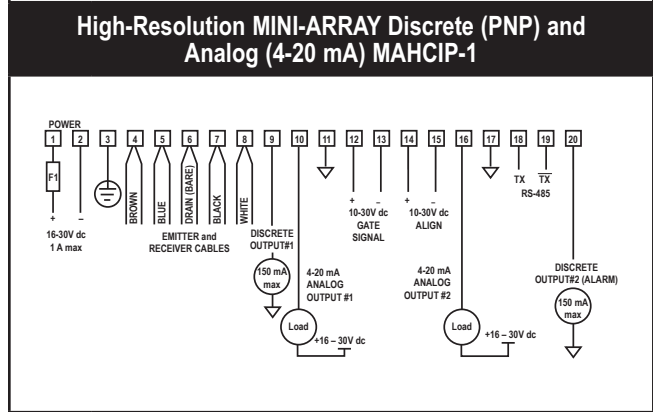
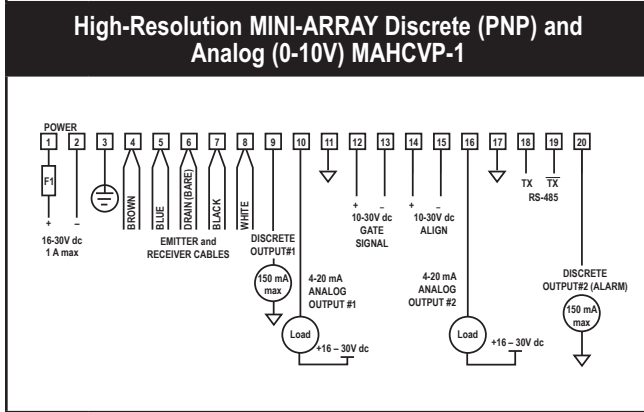
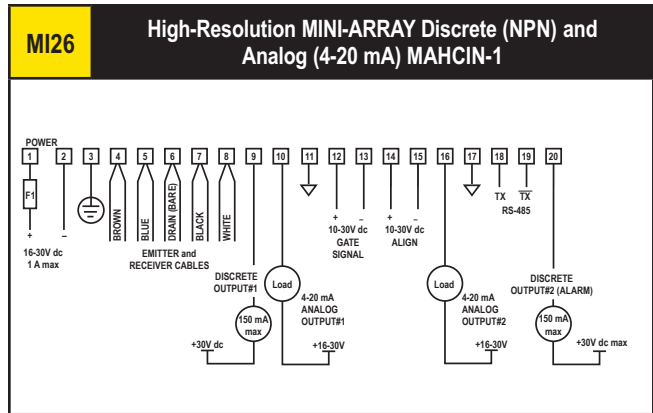
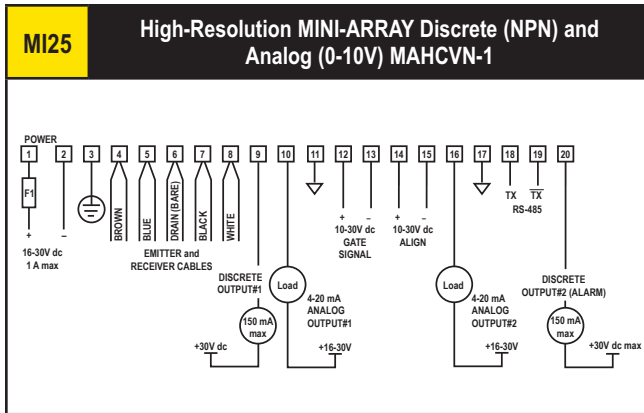
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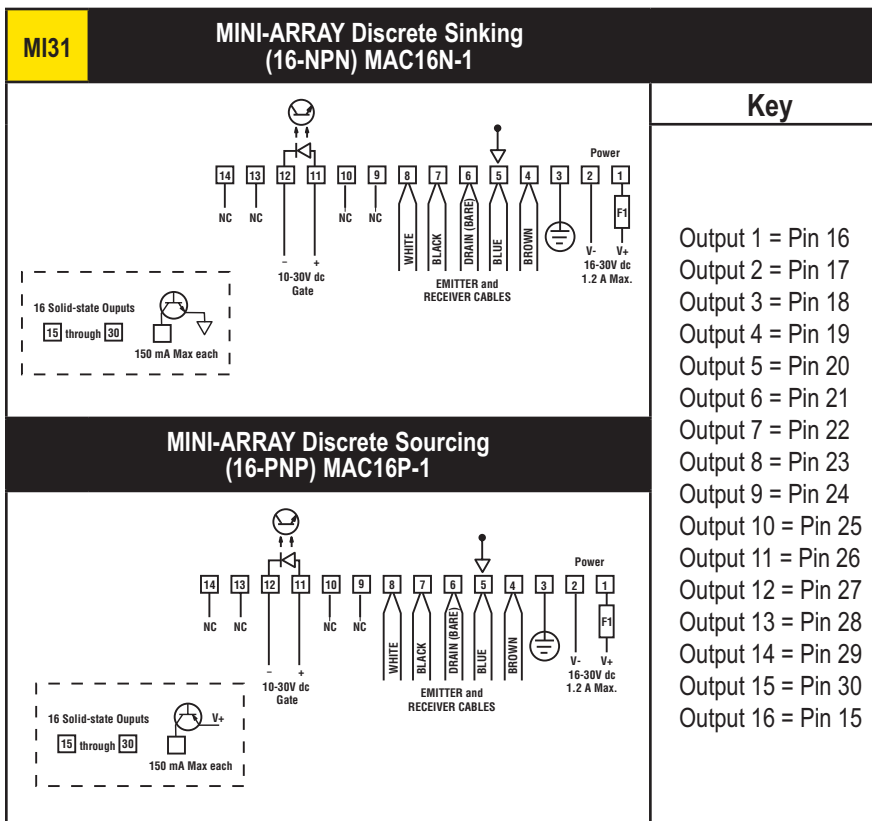
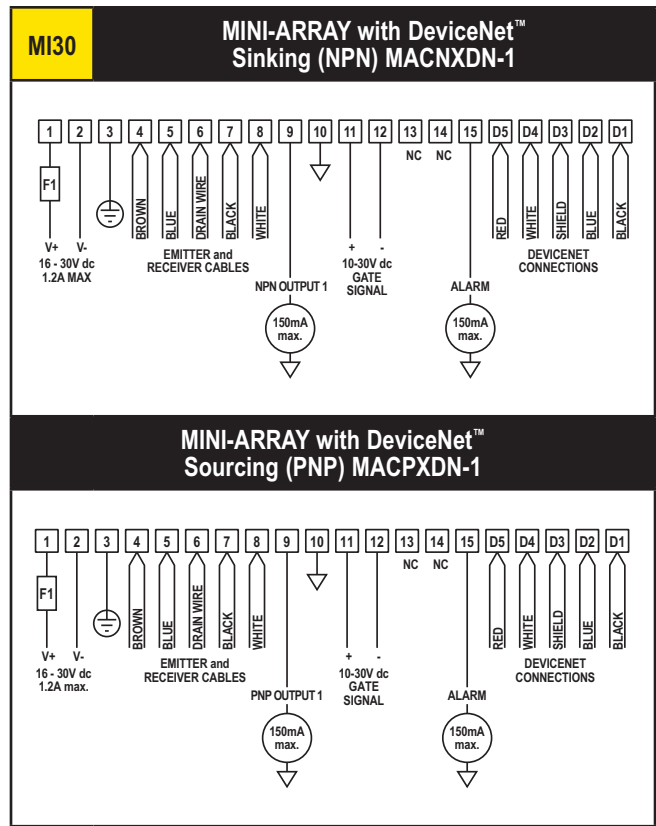
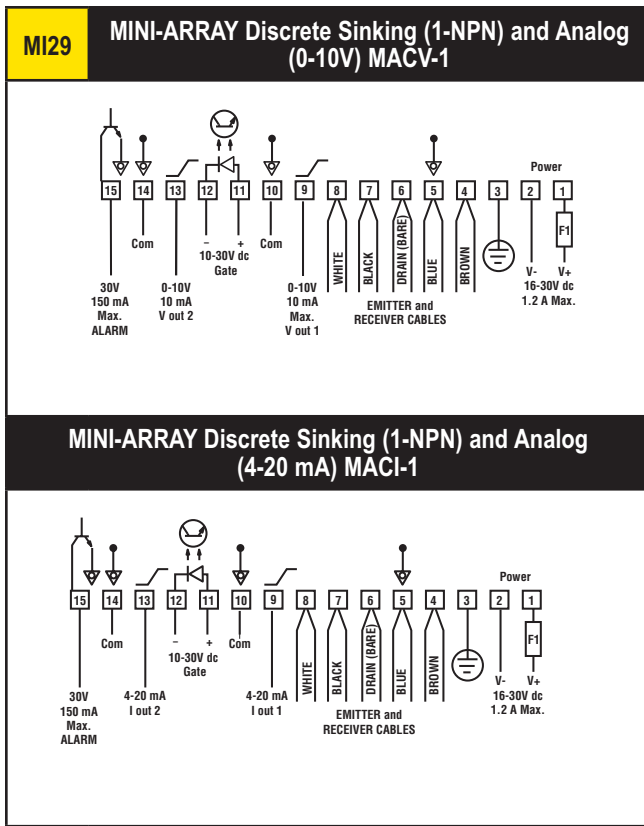
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PresencePlus® Vision Hookups

VS01	Pro NPN Outputs with NPN Inputs†	Key	VS02	Pro PNP Outputs with NPN Inputs†
		<p>1 = Brown 2 = Blue 3 = Green 4 = Red 5 = Yellow** 6 = Yellow 7 = Yellow** 8 = Yellow** 9 = White* 10 = White* 11 = White* 12 = White* 13 = White* 14 = White* 15 = Green 16 = Green 17 = Green 18 = Green 19 = Green 20 = Green</p>		
<p>† Inputs can be either NPN or PNP. * Can be independently configured as an output or input. ** Not used</p>			<p>† Inputs can be either NPN or PNP. * Can be independently configured as an output or input. ** Not used</p>	

VS03	P4 NPN Outputs with NPN Inputs†	Key	VS04	P4 PNP Outputs with NPN Inputs†
		<p>1 = Yellow 2 = Gray 3 = Orange 4 = Pink 5 = Black* 6 = Red* 7 = White* 8 = Light Blue* 9 = Purple 10 = Green 11 = Blue 12 = Brown Shield = Bare Metal</p> <p>12-Pin QD</p>		
<p>† Inputs can be either NPN or PNP. * Can be independently configured as an output or input.</p>			<p>† Inputs can be either NPN or PNP. * Can be independently configured as an output or input.</p>	

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EZ-LIGHT™ Hookups

IN01	K50 and K80 Current Sinking (NPN) Hookup for Solid Job Light	Key
		<p>1 = Brown 2 = White 3 = Blue 4 = Black</p>
K50 and K80 Current Sourcing (PNP) Hookup for Solid Job Light		
4-Pin Euro		

IN02	PVD with Switch-Selectable Output Current Sinking (NPN)	Key
<p>* See configuration information in data sheet for job light enable input requirements. † For specialized applications requiring custom configuration options. See data sheet and contact your Banner representative for more information.</p>		<p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray</p>
PVD with Switch-Selectable Output Current Sourcing (PNP)		
<p>* See configuration information in data sheet for job light enable input requirements. † For specialized applications requiring custom configuration options. See data sheet and contact your Banner representative for more information.</p>		
5-Pin Euro		

IN03	PVA Current Sinking (NPN)	Key
<p>* See data sheet for Programming information or job light enable requirements.</p>		<p>1 = Brown 2 = White 3 = Blue 4 = Black</p>
PVA Current Sourcing (PNP)		
<p>* See data sheet for Programming information or job light enable requirements.</p>		
4-Pin Euro		

IN04	PVA Emitter	Key
<p>* See data sheet for Programming information or job light enable requirements.</p>		<p>1 = Brown 2 = White 3 = Blue 4 = Black†</p> <p>† Not Used</p>
PVA Emitter		
4-Pin Euro		

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EZ-LIGHT Hookups

IN05	VTB Current Sinking (NPN) 1-Color for Solid Job Light	Key
		<p>1 = Brown 2 = White 3 = Blue 4 = Black</p>
VTB Current Sinking (NPN) 1-Color for Flashing Job Light		
4-Pin Euro		

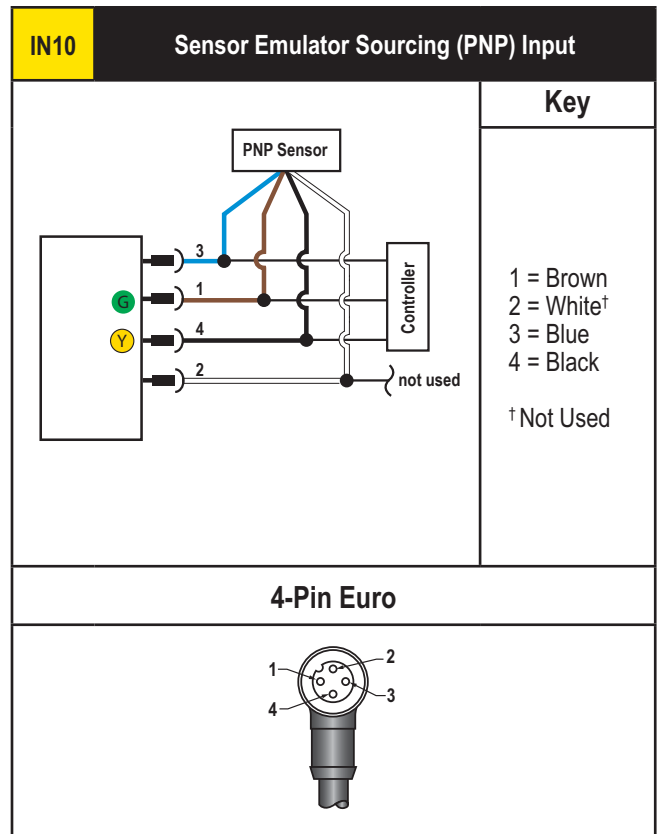
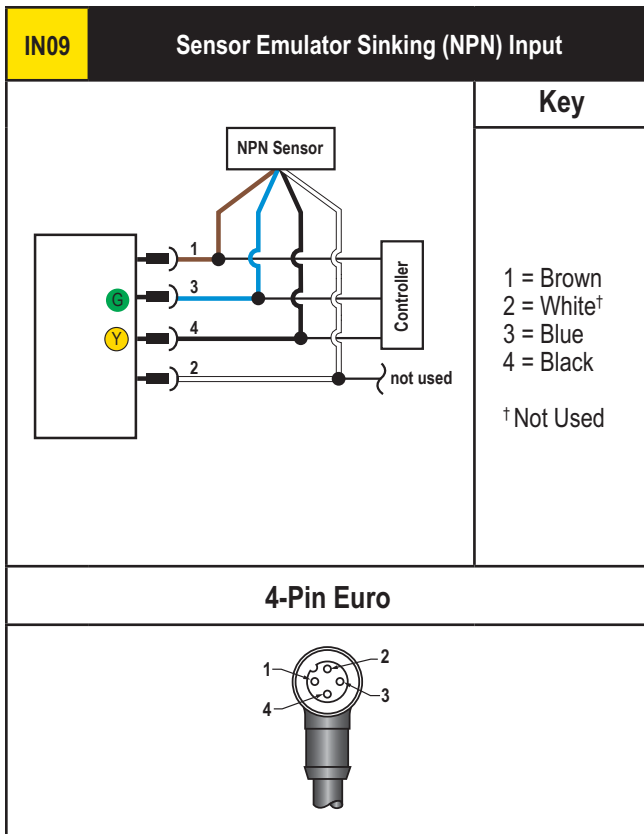
IN06	VTB Current Sourcing (PNP) 1-Color for Solid Job Light	Key
		<p>1 = Brown 2 = White 3 = Blue 4 = Black</p>
VTB Current Sourcing (PNP) 1-Color for Flashing Job Light		
4-Pin Euro		

IN07	VTB Current Sinking (NPN) 2-Color Job Light	Key
		<p>1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray</p>
VTB Current Sourcing (PNP) 2-Color Job Light		
5-Pin Euro QD		

IN08	EZ-LIGHT General-Purpose AC Input	Key
		<p>1 = Brown 2 = White 3 = Yellow 4 = Black 5 = Blue</p>
EZ-LIGHT General-Purpose AC Input		
5-Pin Micro		

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EZ-LIGHT™ Hookups



IN11 EZ-LIGHT Indicators—General-Purpose and Multi-Function						
Multi-Function	General	Light/Flash	PNP Hookup	NPN Hookup	Function*	Wiring Diagram
•	•				Red steady	<div style="text-align: left; padding: 5px;"> <p>EZ-LIGHT PNP Hookup</p> </div> <div style="text-align: left; padding: 5px;"> <p>EZ-LIGHT NPN Hookup</p> </div> <p><small>*K50L and K80L voltage 18-30V dc</small></p> <p>Wiring key: 1 = Brown; 2 = White; 3 = Blue; 4 = Black</p>
•					Red flashes	
•	•				Yellow steady	
•					Yellow flashes	
•	•				Green steady	
•					Green flashes	
•					Red, Green, Yellow flash cycle	

* LED Function is for 3-color, multi-function models. See data sheets for 4- and 5-color LED function information. General-purpose models do not have flash function.

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EZ-LIGHT™ Hookups

IN12 EZ-LIGHT K80L Segmented Sinking (NPN) Input†	
	Key 1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray
† Hookup is for 4 segment models. Depending on the number of segments, Pins 5, 2 and 1 may not be used.	
5-Pin Euro	

IN13 EZ-LIGHT K80L Segmented Sourcing (PNP) Input†	
	Key 1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray
† Hookup is for 4 segment models. Depending on the number of segments, Pins 5, 2 and 1 may not be used.	
5-Pin Euro	

IN14 EZ-LIGHT Audible Sinking (NPN) Input	
	Key 1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray
5-Pin Euro	

IN15 EZ-LIGHT Audible Sourcing (PNP) Input	
	Key 1 = Brown 2 = White 3 = Blue 4 = Black 5 = Gray
5-Pin Euro	

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2-wire sensor

A sensor designed to wire in series with its load, exactly like a limit switch. A 2-wire sensor remains powered when the load is "off" by a residual "leakage current" that flows through the load.

2.4 GHz

One of the ISM bands in the radio spectrum that is recognized worldwide. Experiences more path loss than 900 MHz band.

902-928 MHz Band

One of the ISM bands in the radio spectrum recognized in North America, Australia, and Israel; characterized by lower throughput but better range and wall penetration.

A**A/D converter**

(Analog to Digital Converter) An electronic device that converts data from analog form to digital, or binary code for a computer.

AC

(Alternating Current) A sinusoidal current rated at a given frequency.

Acceleration

The rate of change of velocity, with respect to time.

Accuracy (1)

1. The degree to which a measured value is similar to an actual value.
2. The extent to which vision sensors can correctly measure and obtain a true value of a feature.

Accuracy (2)

The difference between indicated value and actual value, at room temperature. In most cases, the accuracy of a measurement and inspection sensor is comprised of two main sources of error: the resolution and the linearity.

Acquisition

The manner in which outside information is brought into an analysis system; an image acquisition generally involves A/D conversion.

Adjustable-field mode

Adjustable-field sensors use two receivers and a comparator circuit to cancel sensing response whenever the intensity of the reflected light reaching the long-range receiver exceeds the intensity of the reflected light reaching the close-range receiver. As a result, any object lying beyond the sensor's "cutoff point" can be reliably ignored.

Alignment

Positioning of a sensor so that the maximum amount of the emitted energy reaches the receiver sensing element.

AM

Abbreviation for Amplitude Modulation. Type of modulations in which the data signal is "attached" to a carrier wave by varying the amplitude of the carrier wave.

Ampere

(Amp) A unit of measurement of electric current.

Amplifier

A device that accepts a small signal and outputs a larger signal generally matching the characteristics of the input signal. Amplifiers are available to boost electrical and optical signals.

Analog

Pertaining to a class of devices or circuits in which the output varies as a continuous function of the input.

Analog output

A sensor output that varies over a range of voltage (or current) and is proportional to some sensing parameter (as opposed to a digital output).

Analysis tools

Tool set included in vision software which uses information analyzed by the Vision Tools to create distance, size and count measurements and result tolerances for the vision tools.

AND logic

A logic function in which all of two or more defined input conditions must exist simultaneously before a load is energized (A and B and C = output).

Angle of acceptance

The included angle of the area of sensor response.

Angle of incidence

The angle at which light strikes a surface.

Angle of view

- 1) The angle formed between two lines drawn from the most widely separated points in the object plane to the center of the lens.
- 2) The angle between the axis of observation and perpendicular to the specimen surface.

Antenna

An electronic component used to transmit and receive radio waves, in a narrow frequency range.

Anti-glare

A lens attachment consisting of a pair of polarizing filters oriented so that planes of polarization are at 90 degrees to one another.

Aperture

1. The size of a lens opening.
2. A mechanical part attached to a lens used to restrict the size of a lens opening.

Architecture

Overall design or structure of a system or network, including all hardware and software.

Area light

An area light provides even illumination in a concentrated area.

ASCII

Acronym of American Standard Code for Information Interchange. Pronounced askee. An 8 bit coded character set used to represent alphanumeric, punctuation marks and certain special control characters.

ASIC

Acronym for Application Specific Integrated Circuit. A chip designed for a specific application rather than a general-purpose chip such as a microprocessor.

Aspect Ratio

The width to height of an object. The ratio states the relationship of one side to the other. A computer monitor is 4:3, meaning 4 units wide by 3 units high.

Asynchronous

Describes serial communication that does not use a receive and transmit synchronizing clock signal to transmit data.

Attenuation

Lessening or loss of signal intensity during transmission.

B**Background**

The parts of a scene in and around the Feature of Interest (FOI) that are not "of interest" to the software.

Background suppression

A photoelectric proximity sensing mode with response that is similar to a diffuse sensor, but with a defined range limit. Two background suppression modes are fixed-field and adjustable-field.

Backlight

Lighting option that provides even, low-intensity light. It is placed behind the target and aimed directly back towards the camera. The resulting silhouette can be inspected for proper size and shape.

Backlighting

A condition where the light reaching the image sensor is not reflecting from the surface of the object, but is provided behind the objects or area of interest.

Band

A section of the RF spectrum.

Bandwidth

Width of radio frequency band. For analog signals, this is measured in Hertz. With digital signals, bandwidth describes the amount of data that can be transferred through a signal connection in a given time, measured in bits or bytes per second.

Bar code

A coding system designed to be read and decoded by optical scanners. One dimensional or linear bar codes are made up of black bars and white spaces, representing a string of numbers or letters. Two-dimensional bar codes are read on two axes and typically contain more data in a smaller space.

Baud Rate

Data rate in bits per second.

Beam angle

The cone of sonic energy emitted by an ultrasonic sensor that diverges with distance.

Beam pattern

A two-dimensional graph of a sensor's response. Beam patterns are helpful in predicting the performance of the sensor.

Bend radius

The radius below which an optical fiber should not be bent. Usually bend radius is a function of tensile strength.

Bifurcated fiber

A fiber optic assembly that is branched to combine emitted light with received light in the same assembly.

BiModal output

An exclusive Banner output circuit design that offers either sinking (NPN) or sourcing (PNP) output, depending upon the polarity with which the two DC supply leads are connected.

Binding

Locking a Node to a specific Gateway by teaching the Node the Gateway's unique serial number. After a Node is bound, the Node only accepts data from the Gateway to which it is bound.

Bipolar output

The dual output configuration of a DC sensing device, where one output switch is a sinking device (NPN) and the other output switch is a sourcing device (PNP). The solid-state equivalent of a DPST relay (for most loads).

Blind spot

The area close to a sensor lens, where light energy is returned to the emitter rather than the receiver, rendering the sensor effectively blind. This effect is most pronounced with some retroreflective sensors.

BLOB

A connected region in an image in which all pixels have the same gray-level value.

Bright-field

Lighting of objects or surfaces at an angle close to perpendicular so that the light is reflected back into the optics directly.

Broadband

A high-speed data transmission rate, where two or more signals may share the cable.

Burn-through

Describes the ability of high-powered modulated opposed mode sensors to "see" through paper, thin cardboard, opaque plastics, and materials of similar optical density.

Bus

A common pathway or circuit between multiple devices. One of the primary network configurations or topologies.

Bus Network

A network architecture in which multiple devices are connected by a shared communication line.

C**C-mount**

Threaded lens mount developed from 16 mm movie work; used extensively for closed-circuit television.

D

Cable assembly

An optical fiber cable that has connectors installed on one or both ends.

Carrier Wave

A high-frequency waveform that can be modulated in amplitude, phase or frequency to carry a signal from a transmitter to a radio receiver.

CCD

Abbreviation for Charge Coupled Device. An analog device that captures light for conversion to electricity.

Character

A single letter, digit or punctuation mark requiring one byte storage.

Channel

A path for communications. A range of radio frequencies used by a transceiver during communication.

Circuit

1. An electronic path between two or more components capable of providing a number of channels.
2. Interconnection of conductors to carry an electrical current.

Cladding

The material surrounding the core of an optical fiber. The cladding has a lower refractive index (faster speed) to keep the light in the core.

Clean air

An operating environment in which no dirt build-up occurs on lenses or reflectors.

CMOS

Acronym for Complementary Metal Oxide Semiconductor. A CMOS-based chip that records the intensities of light as variable charges similar to a CCD chip.

CNC

Abbreviation for Complementary Normally Closed

Coating

A protective layer applied over the fiber cladding to protect it from the environment.

Collimated source

A light source that emits light in parallel beams.

Collimation

The process by which a lens converts a divergent beam into a parallel beam of light.

Color marks

Also known as registration marks or index marks, color marks are used extensively in packaging applications for registering the cutoff of wrapping or bagging materials so that product names and other information always appear in the same location.

Color sensitivity

The change in output when the color of a target changes.

Communication tool

A tool included in vision software which exports inspection results to an external device.

Complementary Normally Closed

(CNC) An auxiliary (non-safety) output that is always in an opposite state to its associated normally open safety output, even in the event of a single failure.

Complementary output

The dual output configuration of a sensing device, where one output is normally open and the other is normally closed.

Contact

One of the current-carrying parts of a relay, switch, or connector that open and close to complete associated electrical circuits.

Contact configuration

Refers to the construction of a relay or a switch, in many configurations, for example, SPDT (Form C), with one normally open, one normally closed, and one common between the two.

Contamination

Dirt, dust, smoke, or fog in the sensing path; plus dirt, dust, fog, oil, grease, or soot build-up on the face of a sensor can all contribute to attenuation of the light energy available for sensing.

Continuous trigger

Functionality that allows a sensor to take pictures continuously without being triggered by an external device.

Contrast

The ratio of the amount of light falling on the receiver in the "light" condition as compared to the "dark" condition. Optimizing contrast in any sensing situation will increase the reliability of the sensing system.

Control relay

Type of relay used to perform logic functions in a machine control circuit.

Convergent mode

A special variation of diffuse mode photoelectric proximity sensing which uses additional optics to create a small, intense, and well-defined image at a fixed distance from the front surface of the sensor lens.

Core

The central region of an optical fiber through which light is transmitted. It has a higher refractive index (slower speed) than the surrounding cladding.

Corner-cube prisms

A prism having three mutually perpendicular surfaces and a hypotenuse face. Used in retroreflectors.

Coupler

A device that combines two or more fiber optic signals into one, or divides one fiber optic signal into two or more.

Coupling

1. Transfer of energy from one circuit to another.
2. Transfer of light energy using a fiber optic cable. This term does not imply that a coupler is used.

Critical angle

The maximum angle from the central axis of a fiber optic cable at which light can be confined within the core.

Crosstalk

Optical crosstalk occurs when a photoelectric receiver responds to light from an adjacent emitter.

Current

The flow of electrons through a circuit. Measured in "amperes."

Current sinking output

The output of a DC device that switches ground (DC common) to a load. The load is connected between the output of the device and the positive side of the power supply. The switching components is usually an open collector NPN transistor, with its emitter tied to the negative side of the supply voltage.

Current sourcing output

The output of a DC device that switches positive DC to a load. The load is connected between the output of the device and the ground (DC common) side of the power supply. The switching component is usually an open collector PNP transistor, with its emitter tied to the positive side of the supply voltage.

Cutoff distance

See cutoff point.

Cutoff point

Definable point at which the sensor will actuate or will cease to operate. All objects beyond the cutoff point are ignored by the sensor. Cutoff point can be influenced by the range of the sensor and by its other physical specifications.

Cyclic Reporting

The Gateway polls the Node at user-defined intervals.

Dark condition

One of two sensing conditions in a sensing application which is characterized by a lower level of received sensing energy, or in some case, no energy. See also Light Condition.

Dark operate

(D/O) The initiation of a photoelectric sensor's output (or of timing logic) when the receiver goes sufficiently dark. See also light operate.

Dark-field

Lighting of object or surfaces at very shallow or low angles so that the light does not enter the optics directly.

DC (Direct Current)

A current that flows only in one direction through a circuit.

Deadband

The region where the sensor cannot make measurements.

Demod (Demodulation) Falling

A discrete input point must detect a specific number of inputs low before the input is considered to have changed state.

Demod (Demodulation) Rising

A discrete input point must detect a specific number of inputs high before the input is considered to have changed state.

Depth-of-field (1)

The range of distance within which a sensor has a response. Used to define the response pattern of proximity-mode sensors, especially ultrasonic and photoelectric convergent, fixed-field and adjustable-field sensors.

Depth-of-field (2)

The in-focus range of an imaging system. Measured from the distance behind an object to the distance in front of the object with all objects appearing in focus.

Depth-of-focus

The range of lens to image plane distance having the image formed by the lens appearing in focus.

Device Address

Unique identifier for each wireless device on a network.

DeviceNet

The bus-type wiring scheme, specifically for automation sensors, that allows sensors and controllers to exchange data over a single cable.

Diffraction

The bending of light rays as they pass around corners or through holes smaller than their own wavelengths.

Diffuse light

Soft lighting that is scattered from a variety of angles in order to eliminate shadows and view highly specular surfaces.

Diffuse mode

A photoelectric proximity sensing mode in which light from the emitter strikes a surface of an object at some arbitrary angle and is diffused from the surface at all angles.

Diffuse Source

A light source that illuminates a target from many directions, eliminating shadows or glare.

Digital output

A sensor that exists in only one of two states: "on" or "off." The outputs of most sensors and sensing systems is digital.

Digitization

Sampling and conversion of image or signal into a digital code by scanning or using an analog to digital converter.

DIN standard

(Deutsches Institut fur Normung) A collection of German industry standards.

Diode

A two-layer semiconductor that allows current to flow in only one direction.

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Dispersion

The spreading or broadening of light rays as they travel through a fiber optic strand. The fiber property that causes this effect is also called dispersion.

Distortion

An undesired change in the shape of an image or waveform from the original object or signal.

Divergent mode

A variation of the diffuse photoelectric sensing mode in which the emitted beam and the receiver's field of view are both very wide.

DPDT

(Double-Pole Double-Throw) A relay with two sets of single-pole double-throw (Form C) contacts that are operated simultaneously by a single action.

DPST

(Double-Pole Single-Throw) A switch configuration that has four terminals. One pair is used to connect or disconnect to the other pair.

Driver

A type of software that enables communication between a computer and a peripheral device. Also known as device driver.

Dropping resistor

A precision resistor used to convert a 4 to 20 mA signal to a voltage signal.

DSSS

Abbreviation for Direct Sequence Spread Spectrum. A method for generating spread spectrum transmissions where the transmitted signal is sent at a much higher frequency than the original signal, spreading the energy over a much wider band. The receiver is able to de-spread the transmission and filter the original message. DSSS is useful for sending large amounts of data in low to medium interference environments.

E**Edge**

A change in pixel values exceeding some threshold between two adjacent regions of relatively uniform values. Edges correspond to changes in brightness corresponding to a discontinuity in surface orientation, reflectance, or illumination.

Effective beam

The "working" part of a photoelectric beam. Not to be confused with the actual radiation pattern of the emitter, or with the field of view of the receiver.

Electromechanical

Any device using electrical energy to produce mechanical movements.

Electromechanical relay

Conventional switching relays consisting of "hard" contacts (metal-to-metal), switched to opened or closed position by applying voltage to an electromagnetic coil.

EMI

Abbreviation for electromagnetic interference. Electrical "noise" which may interfere with proper operation of sensors, programmable logic controllers, counters, data recorders, and other sensitive electronic equipment.

Emissivity

A measurement of the thermal signature and characteristics of different materials and surfaces.

Emitter

1. The sensor containing the source of sensing energy in opposed-mode sensing.
2. The emitting device within any sensor (e.g. LED, laser diode, ultrasonic transducer, etc.).

Ethernet

Access method for computer network (Local Area Networks) communications, defined by the IEEE as the 802.3 standard.

Excess gain

The measurement of the amount of light falling on the receiver of a sensing system over and above the minimum amount of light required to just operate the sensor's amplifier.

Extension tube

Spacers between the lens and the camera that allow the lens to focus at closer working distances.

F**F/stop**

The ratio of the focal length of a system to the diameter of the entrance pupil.

False triggering

Refers to a change in a sensor's output, when there should be no change.

Fast response

Any response time that is faster than 1 millisecond.

Feature

Used in vision applications to describe any characteristic descriptive of an image or a region in an image.

Ferrule

A ceramic, plastic or stainless steel part of a fiber optic termination that holds the end of the fiber and aligns it to the sensor for fiber mounting.

FHSS

Abbreviation for Frequency Hopping Spread Spectrum. A method for generating spread spectrum transmissions where the signal is switched between different frequency channels in a pseudorandom sequence known by both the transmitter and the receiver pair. FHSS is useful for sending small, redundant packets of data in a high interference environment.

Fiber

A thin filament of glass or plastic consisting of a core (inner region) and a cladding (outer region) and a protective coating.

Fiber optics

Transparent fibers of glass or plastic used for conducting and guiding light energy. Used in photoelectrics as "light pipes" to conduct sensing light into and out of a sensing area.

Field of view (1)

The area of response of an optical sensor.

Field of view (2)

The area of object space imaged at the focal plane of a camera.

Filters

A device placed over a light source or a sensor to select or reject specific frequencies of light.

Fixed-field mode

Fixed-field sensors use two receivers and a comparator circuit to cancel sensing response whenever the intensity of the reflected light reaching the long-range receiver exceeds the intensity of the reflected light reaching the close-range receiver.

FlexPower™

The ability of a device to take multiple types of power including battery, line, or solar.

Flutter

Bouncing or vibrating movement of a sensing target.

FM

Abbreviation for Frequency modulation. A type of modulation in which the data signal is "attached" to the carrier wave by varying the frequency of the carrier wave.

Focal length

The distance from a lens' principal point to the corresponding focal point. Also referred to as the equivalent focal length and the effective focal length.

Focal point

The point at which the lens focuses the image. The imager is located at the focal point.

FOI

Abbreviation for Feature of Interest. The crucial visual information within the imaged scene that the customer is trying to detect for an inspection.

FOV

Abbreviation for Field of View. The area of object space imaged at the focal plane of a camera.

Frequency

The number of recurrences of a periodic phenomenon in a unit of time. Electrical frequency is measured in Hertz (Hz).

Frequency response

The maximum frequencies an analog sensor can track. All analog sensors have an inherent response time that limits their ability to measure periodic motions at high frequencies.

Front lighting

An arrangement in which the object is illuminated and viewed from the same side.

G**Gain**

An increase in signal power, voltage, or current by an amplifier.

Gain potentiometer

An electronic device used to set the gain or the switching threshold of a sensor. Also known as a sensitivity adjustment.

Gate

A combinational logic circuit having one or more input channels.

Gateway

A wireless network master communication device used to control and initiate commands to other devices in the system. Serves as a "portal" from one network to another and communicates between the wireless network and the central control process.

Geometry of Propagation

Describes the way a light beam leaves its source, examples include Collimated, Point Source or Diffuse.

GHz

Gigahertz. 1 GHz=1000 MHz.

Glass fibers

Glass fiber assemblies are constructed of a bundle of individual glass fibers, contained and protected by a sheath (typically a flexible armored cable).

Gray scale

Variations of values from white, through shades of gray, to black in a digitized image with black assigned the value of zero and white the value of one.

Ground

A conducting path between an electric circuit or equipment and the earth, or some conducting body serving in place of the earth.

GUI

Acronym for Graphical User Interface, a graphics-based interface through which a user may communicate with a computer.

H**Half Wave**

Antenna type whose overall span is one half the length of the wave that can be transmitted.

Hermetic seal

An air-tight seal.

Hop

1. The act of changing from one frequency to another.

2. The device to device transmission link, such as from the Master device to the Slave device.

Housing

Describes several aspects of a sensor: body style, housing material, and sealing capacity.

Hysteresis

Intentional time lag added to a circuit to prevent false actuation or intermittent operation (chatter).

Hz

(Hertz) The international unit of frequency, equal to one cycle per second. Named after the German physicist, Heinrich Rudolph Hertz.

I

I/O

(Input-Output) Provides communication channels to system and to manufacturing process.

Image

Projection of an object or a scene onto an imager chip.

Image acquisition

The capture and generation of an image of an object or scene on the imager chip. Involves the use of illumination, optics, filters and the vision sensor.

Image quality

The degree to which an image shows contrast.

Image chip

The physical device that replaces film in a digital camera system. Two common types are CCD and CMOS. Also known as imager or image sensor.

Incident light

The light falling directly on an object.

Index of Refraction

The ratio of the velocity of light in a vacuum to the velocity of light in a specific material. Using 1.0 as the base reference, the higher the number, the slower light travels.

Individual fiber

A fiber optic assembly having one control end and one sensing end. Usually used in pairs in the opposed sensing mode.

Inductive proximity sensor

Sensors with an oscillator and coil which radiate an electromagnetic field that induces eddy currents on the surface of metallic objects approaching the sensor face.

Input

1. The signal (voltage or current) applied to a circuit to cause the output of that circuit to change state.
2. The terminals, jacks or receptacle provided for reception of the input signal.

Input voltage

The power source required by an electric or electronic device (e.g. a self-contained sensor) in order for the device to operate properly.

Inspection

1. The process of examining a part to match the part to a known "good" reference.
2. A specific file or program run in the vision software to look at a specific part. Also known as a recipe.

Intensity

Degree of strength of electricity, light, heat or sound per unit area or volume.

Intrinsic safety

A design technique applied to electrical equipment, such as sensors, switches, and wiring for hazardous locations. The technique involves limiting energy to a level below that required to ignite a specific hazardous atmosphere. Intrinsic safety design often eliminates the requirement for explosion-proof enclosures. (Also see "NAMUR".)

Intrinsic safety barrier

A protective component designed to limit the voltage and current in an explosive area. The barrier functions outside of the explosive location to divert abnormal energy to ground.

Inverse Square Law

The intensity of radiated energy (such as light energy emitted from a photoelectric sensor, or sound energy emitted from an ultrasonic sensor) falls off by an amount equal to the square of the increase in distance from the source.

Inverting output

Analog photoelectric sensors provide a variable voltage or current output signal that is inversely related to and decreases with the strength of the light signal. Also known as negative slope.

IP address

(Internet Protocol address) Address of a computer attached to an IP network (TCP/IP network). Written as four sets of numbers separated by periods.

IP rating

A rating system established by the IEC standards 144 and 529 which defines the suitability of sensor and sensor system enclosures for various environments. Similar to NEMA ratings for enclosures.

ISM Band

Abbreviation for Industrial, Scientific, and Medical band. Part of the radio spectrum that does not require a license for use.

J

Jacket

The outer sheath on a wire or cable which provides protection from the environment and also additional insulation.

K

kHz

Abbreviation for kilohertz, 1000 hertz.

L

LAN

(Local Area Network) A computer network dedicated to sharing data among several single-user computers.

Laser

(Light Amplification by the Stimulated Emission of Radiation) A device that creates a narrow, intense and coherent light. Many lasers deliver light in an almost-perfectly parallel collimated beam that is very pure, approaching a single wavelength.

Latched

Setting in which an output will stay on until the inspection result from subsequent inspection changes.

Latency

Maximum acceptable delay between transmission and reception.

Leading edge

The leading edge of the sensing event is the first occurrence in a material flow.

Leakage current

An undesirable small value stray current which flows over or through an insulator.

LED

Abbreviation for Light Emitting Diode. A semiconductor that emits light when current flows through it.

Lens

The optical component of a sensor that collimates or focuses light rays onto a receiver optoelement (photoelectric sensing) or an imager chip (vision sensing).

Light condition

One of two sensing conditions in a sensing application which is characterized by a higher level of received sensing energy. This term is generally used in photoelectric sensing. See Dark Condition.

Light operate

(L/O) The program mode for a photoelectric sensor in which the output energizes (or the timing logic begins) when the receiver becomes sufficiently light.

Light screen

See Active Opto-electronic Protective Device.

Light source

Any device serving as a source of illumination.

Lighting geometry

The physical relationship between the light source, the target object and the vision sensor.

Lighting technique

The way a light source is physically positioned relative to the object it is illuminating.

Line of sight

An unobstructed radio path between a radio's transmitter and receiver status.

Line voltage

The normal in-plant power line supply voltage which is usually 120 or 220/240 or 440V ac.

Linearity

The maximum deviation above or below the ideal output of the sensor.

Load

A general term for a device (or a circuit) that draws power when switched by another device or circuit.

Location tools

Tool set included in vision software used to locate the region of interest regardless of translational or rotational variations of the inspected part.

Log-log scale

A graph with logarithmic x and y scales. A logarithmic scale reveals percentage changes. A change from 100 to 200, for example, is presented in the same way as a change from 1,000 to 2,000.

Logic

Methods used to condition a sensor output signal by way of timing or counting, or to coordinate control of a process by comparing multiple sensor outputs.

Logic module

A sensing system accessory that interprets one or more input signals and modifies and/or combines those input signals for control of a process.

Low-Angle Light

Low-angle lighting enhances the contrast of surface features.

M

Machine vision

Computerized image measurement, analysis, and interpretation used to improve production processes and quality.

Master/Slave

Model for communication protocol between devices or processes, in which one device initiates commands (master) and other devices respond (slave). The Gateway is the Master device to the Nodes which are the Slave devices.

Micron

One micron = 0.000001 meter or 0.001 millimeter.

Microsecond

One millionth of a second. 1 microsecond = 0.000001 second or 0.001 millisecond.

Millisecond

One thousandth of a second. 1 millisecond = 0.001 second or 1000 microseconds.

Milliwatt (mW)

A unit of power equal to one thousandth (10⁻³) of a watt.

Modbus

An openly-published, communication protocol that is a means of connecting almost any industrial electronic

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device. Runs at layer 7 of the OSI model. Defines message structure for a client/server environment. Often used with TCP/IP over Ethernet and runs on RS-232 or RS-485.

Modulation

In photoelectrics, modulation of an emitter means to turn it on and off at a high frequency (typically several kilohertz). A modulated sensor's receiver and amplifier are tuned to the frequency of modulation. Only the modulated light is amplified, and all other light which reaches the receiver is ignored.

Multiplexing

A scheme in which an electronic control circuit interrogates each sensor of an array in sequence. True photoelectric multiplexing enables each modulated emitter only during the time that it samples the output of the associated receiver. In this way, the chance of false response of any receiver to the wrong light source is eliminated.

N

NAMUR

Devices and sensors designed for use with certified switching amplifiers with intrinsically-safe circuits. NAMUR sensors are most commonly used in explosive environments.

Nanometer

Unit of length used to specify the wavelength of light energy. 1 nm = 0.000000001 meter.

NC

Abbreviation for Normally Closed.

Negative slope

Analog photoelectric sensors provide a variable voltage or current output signal that is inversely related to and decreases with the strength of the light signal. Also known as inverting output.

NEMA

The National Electrical Manufacturers Association (NEMA) has established guidelines for specifying the degree of sealing offered by any particular electrical enclosure design.

Network ID (NID)

A system-level parameter allowing multiple radio devices to operate as a complete wireless network. Enables multiple wireless networks to be co-located within range of each other.

NO

Abbreviation for Normally Open.

Node

A wireless network slave device used to provide sensing capability in a remote area or on the factory floor. This device aggregates and communicates data back to a gateway device for transmission back to a central control unit.

Noise

(Electrical) Describes undesirable energy that may cause false response of sensing system logic or may be falsely recognized as a received signal by a sensor amplifier. Includes EMI and RFI.

Non-inverting output

Analog photoelectric sensors provide a variable voltage or current output signal that is directly related to and increases with the strength of the light signal. Also known as positive slope.

Normally Closed

Designation which states that the contacts of a switch or relay are closed or connected when at rest (i.e. no energy applied). When activated, the contacts open or separate. Symbolized by NC.

Normally Open

Designation which states that the contacts of a switch or relay are normally open or not connected at rest (i.e. no energy applied). When activated, the contacts close or become connected. Symbolized by NO.

NPN output

A transistor available as an output switch in DC sensors and logic modules. Usually configured with its collector open and its emitter connected to ground (DC common). In this configuration, a load is connected between the output (collector) and the positive of the DC supply. This output configuration is also called a "sinking" output.

Null

Used in analog sensing and control to describe the minimum voltage (or current) in an analog output range. Analog sensors have an adjustment for setting the null value.

O

OCR

Abbreviation for Optical Character Recognition. Recognition of each character in a string by a vision system.

OEM

Abbreviation for Original Equipment Manufacturer.

OFF-delay

Timing logic in which the output energizes immediately when an input signal is received, and remains energized as long as the input signal is present.

Ohm

Unit of measurement for resistance and impedance.

Ohm's law

$E=I \times R$. Current (I) is directly proportional to voltage (E) and inversely proportional to total resistance (R) of a circuit.

Omni

Omni-directional antenna. Antenna that radiates power equally in all directions and is equally receptive to signals from all directions.

On-axis light

On-axis lighting provides even, diffused illumination for flat, reflective surfaces.

ON-delay

Timing logic in which timing begins at the leading edge of an input signal, but the output is energized only after the preset ON-delay has elapsed.

Opaque

A term used to describe a material that blocks the passage of light energy.

Operating voltage

Refers to the range of voltage in which the sensor or device can operate.

Opposed mode

A photoelectric sensing mode in which the emitter and receiver are positioned opposite each other so that the light from the emitter shines directly at the receiver. An object is detected when it breaks the light beam that is established between the two.

Optical crosstalk

An unwanted situation which occurs when a photoelectric receiver responds to light from an adjacent emitter.

Oscillate

To swing back and forth between a minimum and maximum value. One complete oscillation is regarded as one cycle.

OSI Method

Open Systems Interconnection. A methodology used for communication and computer network protocol design, where the functions of the protocol are divided into seven layers.

Output

1. The section of a sensor or control circuit that energizes and/or de-energizes the attached load (or input).
2. The useful energy delivered by a circuit or device.

Output delay

The time from when the inspection is triggered until the sensor output turns on.

Output duration

The time from when an output turns on until it turns off. Also known as Pulsed Output.

P

Parallel

Connection of two or more parts of a circuit to the same pair of terminals, so that current divides between the parts.

Path Loss

Describes attenuation as a function of wavelength of the operating frequency and the distance between the transmitter and receiver.

Peer/Peer

Model for communication protocol in which any device in the network can send and receive data, and initiate communication.

Photocell

A resistive photosensitive device in which the resistance varies in inverse proportion to the amount of incident light.

Photodiode

A semiconductor diode in which the reverse current varies with illumination. Characterized by linearity of its output over several magnitudes of light intensity, very fast response time, and wide range of color response.

Photoelectric sensor

An electrical device that responds to a change in the intensity of light falling upon it.

Photosite

The smallest discrete physical unit on an imager chip. A pixel is a digital representation of a photosite.

Phototransistor

A phototransistor is a photojunction device in which current flow is directly proportional to the amount of incident light.

Pixel

Acronym for picture element. The smallest unit on a display screen.

PLC

Abbreviation for Programmable Logic Controller. A control device that employs the hardware architecture of a computer and relay ladder diagram language.

PNP output

A transistor available as an output switch in DC sensors. Usually configured with its collector open and its emitter connected to the positive of the sensor supply voltage. In this configuration, a load is connected between the output (collector) and ground (DC common). This output configuration is also called a "sourcing" output.

Point Source

A light source, such as a spot light, that illuminates a target from one direction.

Point-to-Point

Indicates a direct connection between two devices in a network.

Polarization

The alignment of the perpendicular electrical and magnetic fields that make up a light wave.

Polarized light

Light which has all component waves in the same direction of displacement. Natural light is made up of waves having a variety of displacements.

Polarizing filter

A filter that polarizes light passing through it.

Polycarbonate

Thermoplastics characterized by high-impact strength, light weight, and flexibility. Used as a shatter-resistant substitute for glass.

Positive slope

Analog photoelectric sensors provide a variable voltage or current output signal that is directly related to and increases with the strength of the light signal. Also known as non-inverting output.

Potentiometer

A variable resistor, primarily used as a voltage divider. Potentiometers are used to set sensor sensitivity (as a threshold adjustment).

Preprocessing

Enhancement, transformation, or filtering of images before processing.

Programmable I/O

A type of input/output that is not factory set and therefore can have its purpose changed. This I/O can be reprogrammed for general output, pass, fail, ready, error and general input.

Protocol Layering

Division of protocol design into smaller of parts, each of which accomplish smaller tasks. Layering keeps each design simple.

Proximity

(Sensing) Direct sensing of an object by its presence in front of a sensor.

Proxing

In retroreflective sensing, "proxing" is used to describe undesirable reflection of the sensing beam directly back from an object that is supposed to break the beam.

Pulsed output

The time from when an output turns on until it turns off. Also known as Output Duration.

Q

QD

Abbreviation for quick disconnect. A cable attachment scheme used on some Banner sensors in which a male connector in the base of the sensor mates with the female connector of an industrial-grade cable.

Quater Wave

Antenna type whose overall span is one quarter the length of the wave that can be transmitted.

R

Radiation pattern

The total area of sensing energy emission.

Radio

1. Transmission or reception of electromagnetic radiation in the radio frequency band, used to send information through a medium without the use of wires.
2. Equipment used to transmit and receive radio signals.

Range

The specified maximum operating distance of a sensor or sensing system.

Ratio

Relation in degree or number between two similar things.

Receiver

1. The transducer element that responds to the sensing energy.
2. The name for the half of an opposed pair of photoelectric or ultrasonic sensors that receives the sensing energy from the emitter.

Reflection

The return of light waves from surfaces on which they are incident.

Reflectivity

A measure of the efficiency of any material surface as a reflector of light, as compared to a Kodak white test card, which is arbitrarily rated at 90% reflectivity.

Refraction

The bending of light rays as they pass through a transmission medium of one refractive index into a medium with a different refractive index.

Region of Interest

The area inside defined boundaries that the user wants to analyze.

Reject

A mechanism used on a manufacturing line to remove defective or sample product from the main stream or conveyor.

Relay

A switching device, operated by variations in the conditions of one circuit, which serves to make or break one or more connections in the same or another circuit.

Remote sensor

Remote sensor describes the part of a photoelectric component system that contains only the optical elements. The circuitry for system power, amplification, logic, and output switching are all located at a central location, typically a control cabinet.

Repeatability

A measure of the repeat accuracy of a sensor and/or timer and/or control mechanism. Usually expressed as a distance or time.

Repeater

A communication device that extends the transmission range of a data signal by amplifying or regenerating the signal. Used in long-distance transmission.

Resolution (1)

The degree of sharpness of a displayed or printed character or image. On screen, resolution is expressed as a matrix of dots.

Resolution (2)

1. The smallest detectable change in position or size of an object.
2. The closest distance between two objects (points) in an image identifiable as two separate objects rather than one object.

Response time

The time required for the output of a sensor or sensing system to respond to a change of the input signal (e.g. a sensing event). Also known as response speed.

Retroreflective mode

A retroreflective photoelectric sensor contains both the emitter and receiver. A light beam is established between the sensor and a special retroreflective target. As in opposed sensing, an object is detected when it interrupts this beam.

Retroreflector

A reflector made out of highly reflective material is used in retroreflective sensing to return the emitted light directly back to the sensor.

RF

Radio Frequency. Electromagnetic signals in the radio band.

RFI

Abbreviation for Radio Frequency Interference. Interference caused by electromagnetic radiation at radio frequencies to sensors or other sensitive electronic circuitry. RFI may generate false signals or random triggering of equipment or processes.

Ring Light

A ring light provides diffused illumination over a small area.

ROI

Abbreviation for Region of Interest. The area inside defined boundaries that the user wants to analyze.

RS-232

Industrial standard for serial transmission between computers and peripheral devices.

RSSI

Received Signal Strength Indication. The measurement of the strength of received signal strength in a wireless environment. See Site Survey.

S

SCADA

Supervisory Control And Data Acquisition. Process control system that collects data from sensors or machines in remote areas and sends them to a central computer for control and management.

Scene

The entire area under inspection by the camera. See also: Field of View

Self-contained

Describes a sensor that contains the sensing element, amplifier, power supply, and output switch in a single package.

Sensing mode

The method or way in which a sensor detects an object.

Sensitivity control

An adjustment made to a sensor's amplifier that determines the sensor's ability to discriminate between different levels of received sensing energy (e.g. between two light levels reaching a photoelectric receiver).

Sensor

A device that senses a change in a physical quantity, such as light intensity, and converts that change into a useful control signal.

Serial port

A socket that receives a standard connector and protocol connecting external devices to a computer's serial interface.

Series

The connection of components end to end in a circuit, that provide a single path for the current.

SET

An actuation or adjustment feature of some Banner sensors, which simplifies the process of setting the sensor's operating sensitivity. With a single user input, the sensor automatically sets the operating sensitivity below the threshold.

Set point

Condition initiated by the user to control a sensor's output(s) during sensing events. This condition may use one or two parameters (depending on the sensing technology being used) within which is an acceptable range for sensing events to occur.

Shape

An object's physical and optical characteristic, often refers to its spatial contours.

Sheathing

An outer covering that protects optical fibers. Can be made of stainless steel flexible conduit, PVC, or some other type of flexible tubing.

Signal-to-Noise Ratio

The ratio of the maximum value of an output signal to the standard deviation amplitude of the noise on the signal.

Sinking output

The output of a DC device that switches ground (DC common) to a load. The load is connected between the output of the device and the positive side of the power supply.

Skew angle

An alignment technique used in diffuse, retroreflective, and convergent-mode photoelectric sensing to increase the optical contrast ratio.

Slightly dirty

Describes an environment in which there is a slight build-up of dust, dirt, oil, moisture, etc. on lenses and reflectors. Lenses are cleaned on a regular basis.

Solenoid

A magnetic switch that closes a circuit, often used as a relay.

Solid-state

Any element that can control current without moving parts, heated filaments, or vacuum gaps.

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Solid-state switch

A solid-state device where switching is accomplished by a solid-state element such as a transistor or SCR.

Sourcing output

The output of a DC device that switches positive DC to a load. The load is connected between the output of the device and the ground (DC common) side of the power supply.

SPDT

Abbreviation for Single Pole Double Throw. Refers to a three terminal switch or a relay (electromechanical or solid-state) having one normally open (Form A) contact and one normally closed (Form B) contact that have an electrically common point (complementary switching). Also known as Form C.

Specular

Describing a mirror-like finish that returns light energy at an equal and opposite angle from the angle of incident light.

Spread Spectrum

A technique in which the transmitter sends (or spreads) a signal over a wide range of frequencies. The receiver then concentrates the frequencies to recover the information.

SPST

Abbreviation for Single Pole Single Throw. Refers to a switch or a relay contact (electromechanical or solid-state) with a single contact that is either normally open or normally closed.

Star Network

A network topology where all nodes are connected to a central node. This central node is responsible for gathering and distributing data among the other nodes.

Surface reflectivity

A measure of the efficiency of any material surface as a reflector of light, as compared to a Kodak white test card which is arbitrarily rated at 90% reflectivity.

Switch transistor type

The transistor, a solid-state device designed to switch DC current, can be either NPN or PNP. Some sensors offer Bipolar output, both NPN and PNP or BiModal output, either NPN or PNP.

Switchpoint

The signal level at which the sensor's output turns on or off. Often used interchangeably with threshold.

T**Target**

1. Any object being sensed
2. A retroreflective material that returns light back to a sensor

TCP/IP

Abbreviation for Transmission Control Protocol/Internet Protocol. A protocol for communication between computers, used as a standard for transmitting data over networks and as the basis for standard Internet protocols.

TDMA

Time Division Multiple Access. A wireless network communication architecture that provides a given slot of time for each device on the network. Provides guaranteed opportunity for each device to transmit to the gateway.

TEACH

A feature on some Banner sensors which allows the sensor to "learn" the light and dark sensing conditions, based on user inputs. The sensor can then automatically adjust the sensitivity to place the operating threshold midway between threshold for the light and the dark condition.

Test tool

The tool, within the software GUI, used to set tolerance to the vision and analysis tools results, and to activate the discrete outputs.

Texture

An object physical and optical characteristic, often refers to the degree of smoothness of an object's surface. Texture affects light reflection.

Thermopile

A "thermometer" for measuring heat radiation consisting of several thermocouple junctions.

Threshold

In photoelectric sensing, threshold is the point at which adequate received signal level overcomes sensor circuit hysteresis and causes the sensor output to change state. It is also the point at which the light and dark condition are differentiated.

Through-beam sensing

See "opposed sensing mode."

Topology

The pattern of interconnection between devices in a communication network. Some examples include: Bus, Ring, or Star configurations.

Trailing edge

The trailing edge in a sensing event is the last occurrence in a material flow.

Transducer

A device that converts energy of one form into another form. The sensing element of a non-contact presence sensor that converts a change in incident sensing energy (e.g. light, sound, etc) into a proportional electrical quantity such as voltage or current.

Transistor

An active semiconductor device having three or more electrodes. The three main electrodes used are the emitter, base and collector.

Translation

Movement in the X and/or Y direction from a known point.

Translucent

Term used to describe materials that have the property of reflecting a part and transmitting a part of incident radiation.

Transparent

Permitting passage of electromagnetic radiation of specified frequencies, such as visible light or radio waves.

Trigger

A mechanism, usually a photoelectric sensor, that initiates the vision sensor to take action when a prespecified event occurs.

TTL

Abbreviation for Transistor Transistor Logic. A digital circuit composed of bipolar transistors wired in a certain manner. Indicates a digital rather than an analog circuit.

U**UL**

Abbreviation for "Underwriters Laboratory, Inc.," a testing agency for products sold in the United States. A device that has "UL approval" has been type-tested and approved by Underwriter's Laboratory as meeting certain electrical and/or safety codes.

Ultrasonic

Sound energy at frequencies just above the range of human hearing, starting at about 20 kHz. Banner ultrasonic sensors function at between 75 to 400 kHz, depending on model.

UV

Abbreviation for ultraviolet. Invisible short wavelength light energy that lies immediately beyond the violet end of the color spectrum between approximately 100 and 380 nm.

V**Vibration**

An oscillating change in displacement, with respect to a fixed reference.

Vignetting

A gradual darkening around the periphery of an image. Optical vignetting often occurs when the lens is too small for the imager.

Visible light

The wavelength range of 400-750 nm to which the human eye is sensitive.

Vision

Electronic imaging applied in manufacturing settings for the purpose of control, whether it is process control, machine tool control, robot control or quality control. Vision sensing is used to improve production processes and quality.

Vision tools

A tool set included in vision software used to analyze an image and extract information for judgment criteria.

Voltage

The force, or pressure, of electricity that exists between two points and is capable of producing a flow of current when a closed circuit is connected between the two points.

W**Wave**

A physical activity that rises and falls, or advances and retreats periodically as it travels through a medium.

Wave amplitude

The maximum change from zero of the characteristic of the wave.

Wave angle

The angle at which a wave is propagated from one point to another.

Wavelength

In a periodic wave, the distance between points of corresponding phase of two consecutive wave cycles.

Wireless

Refers to radio wave transmission used to transfer data or signals between locations that have no physical connections.

Wireless Sensor Network

Network of low-power electronic devices combining sensing and processing ability. The devices communicate wirelessly to a gateway device, connecting remote areas to the central control process.

Working distance

The distance from the camera to the object under inspection.

X**X-ray**

Electromagnetic radiation with high frequency, short wavelengths between .01-10 nm, able to penetrate solid objects.

Y**Yagi**

Antenna type that is directionally sensitive to signals received from the front and less sensitive to those received from the sides or rear.

Z**Zoom**

To electronically or optically enlarge or reduce the size of an image.

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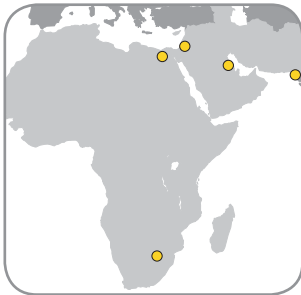
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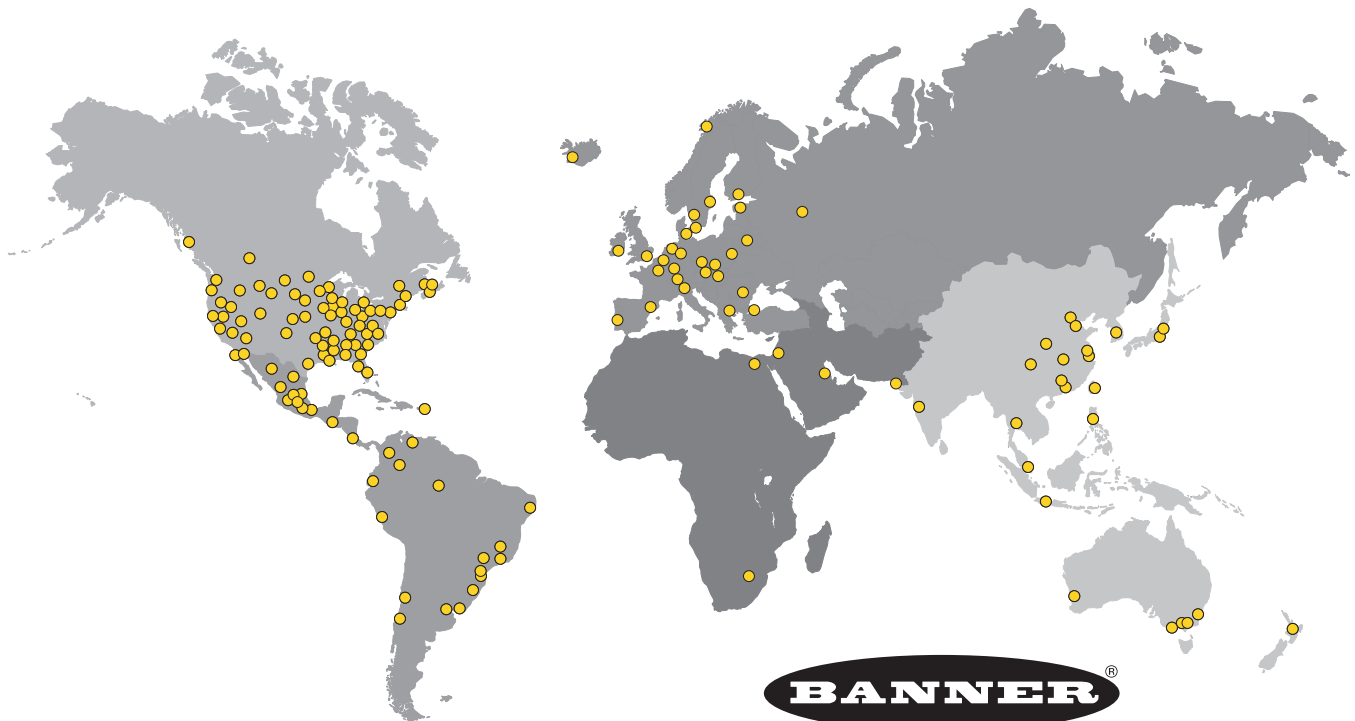
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						BHATR.753SMRA	21098	204	BMT16.6S-HT	64397	202
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						BM.753P	17250	204	BMTAP.753P	21104	204
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BR2.52.5PM2.5	24695	204	BRT-80X50CM	73841	433	BTA13S	20195	204	CL3RB	26455	w.o.
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BR23SMCSC	21289	204	BRT-THG-18X36	26618	435	BTA23SM900	21435	206	CM5A	26673	w.o.
BR23SMRA	20490	204	BRT-THG-1-900	26864	w.o.	BTA24P	64454	204	CM5B	26674	w.o.
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BRB-O	16149	w.o.	BRT-THG-4X4-5	26616	435	BTETA.753S	21794	204	CR3RB	26423	w.o.
BRB-S	16151	w.o.	BRT-THG-8.5X11-2	26617	435	BTETA1.53P	23229	204	CR5A	26677	w.o.
BRB-T	16153	w.o.	BRT-THT-100	27451	435	BTETA1.53S	21496	207	CR5B	26678	w.o.
BRB-U	16155	w.o.	BRT-TVHG.4X1.5	74231	w.o.	BTETA1.53SM600	71986	207	CR5RA	26424	w.o.
BRB-XL	17595	w.o.	BRT-TVHG-2X2	57260	435	BTETA13S	21762	204	CR5RB	26425	w.o.
BRSE2.53S	22823	204	BRT-TVHG-8X10P	69119	435	BTETA13SM600	24871	204	CSB-M1240M1240	64206	414
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BRT-1.5	16163	425	BT.756S	23407	204	BTHA2.53SM600	70649	204	CSB-M12425M1241	75276	414
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BRT-30X20M	73687	430	BT210SM600	21723	204	BWA-910-A	77480	343	D10AFPYQ	73122	174
BRT-30X20MT	73688	430	BT210SM8	24670	204	BWA-9Y6-A	77479	343	D10BFF	72613	174
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MQDC2S-830	70977	417	MSS24	44313	439	OSEFX	27306	w.o.	OUC-L	27252	445
MQDC-306	45137	419	MSS36	44316	440	OSELV	27302	w.o.	OUC-LAG	27253	445
MQDC-306RA	47105	419	MSS48	44319	440	OSELVAG	27303	w.o.			
MQDC-315	26849	419				OSER	27309	w.o.			
MQDC-315RA	26847	419	N			OTBA5	27986	235	P12-C1	51832	193
MQDC-330	34848	419	NO5-Q08-AN7	27390	w.o.	OTBA5L	32167	235	P22-C1	56058	193
MQDC-330RA	31148	419	NO5-Q08-AN7V1131	27394	w.o.	OTBA5LQD	32255	235	P2C-07	63211	w.o.
MQDC-406	45136	412	NO5-Q08-AP7	27392	w.o.	OTBA5QD	28149	235	P32-C2	61217	193
MQDC-406RA	47104	412	NO5-Q08-AP7V1131	27396	w.o.	OTBA5QD W/G	35099	235	P4A1.3I	74774	3.7
MQDC-415	26850	412	NO5-Q08-RN7	27389	w.o.	OTBA5QD W/Y	35079	235	P4A1.3IK06	75174	w.o.
MQDC-415RA	26848	412	NO5-Q08-RN7V1131	27393	w.o.	OTBA5QD W/Y	35079	235	P4A1.3IK23	75175	w.o.
MQDC-430	27142	412	NO5-Q08-RP7	27391	w.o.	OTBB5	27987	235	P4A1.3IK32	75176	w.o.
MQDC-430RA	27080	412	NO5-Q08-RP7V1131	27395	w.o.	OTBB5 W/G	35102	235	P4A1.3R	74773	317
MQDC-450	33649	412	NP6X	27468	w.o.	OTBB5 W/R	35062	235	P4A1.3RK06	75170	w.o.
MQDC-450RA	49213	412				OTBB5 W/Y	35082	235	P4A1.3RK23	75171	w.o.
MQDC-806	57593	416	O			OTBB5L	32254	235	P4A1.3RK32	75172	w.o.
MQDC-815	57594	416	OASBCV	27605	w.o.	OTBB5L W/G	35104	235	P4AI	74772	317
MQDC-830	57595	416	OASBD	27602	w.o.	OTBB5L W/R	35064	235	P4AIK06	75168	w.o.
MQDEC2-406	73661	412	OASBDX	27603	w.o.	OTBB5L W/Y	35084	235	P4AIK23	75169	w.o.
MQDEC2-406RA	73664	412	OASBF	27600	w.o.	OTBB5LQD	32256	235	P4AR	74771	317
MQDEC2-415	73662	412	OASBFP	27604	w.o.	OTBB5LQD W/G	35105	235	P4ARK06	75165	w.o.
MQDEC2-415RA	73665	412	OASBFV	27624	w.o.	OTBB5LQD W/R	35065	235	P4ARK23	75112	w.o.
MQDEC2-430	73663	412	OASBFX	27601	w.o.	OTBB5LQD W/Y	35085	235	P4ARK32	75166	w.o.
MQDEC2-430RA	73666	412	OC-12	16373	w.o.	OTBB5QD	28150	235	P4BC1.3I	75335	317
MQDEC2-506	60810	415	OC-120	18822	w.o.	OTBVN6	28591	235	P4BC1.3IK06	76019	w.o.
MQDEC2-506RA	60813	415	ODB1	27100	w.o.	OTBVN6 W/G	35110	235	P4BC1.3IK23	76471	w.o.
MQDEC2-515	60811	415	OLM5	27098	162	OTBVN6 W/R	35070	235	P4BC1.3I-OC	79917	317
MQDEC2-515RA	60814	415	OLM8	27099	162	OTBVN6 W/Y	35090	235	P4BC1.3R	75334	317
MQDEC2-530	60812	415	OLM8M1	27257	162	OTBVN6L	33706	235	P4BC1.3RK23	76471	w.o.
MQDEC2-530RA	60815	415	OPBA2	27093	162	OTBVN6L W/G	35112	235	P4BC1.3R-OC	79916	317
MQDEC-403RR	47452	w.o.	OPBA2QD	27094	162	OTBVN6L W/Y	35072	235	P4BCI	75626	317
MQDEC-403RS	47456	413	OPBA2QDA3	31782	w.o.	OTBVN6L W/Y	35092	235	P4BCIK06	75068	w.o.
MQDEC-403SS	47627	w.o.	OPBA2QDH	32687	w.o.	OTBVN6LQD	35057	235	P4BCIK23	75063	w.o.
MQDEC-403SS	47631	413	OPBA3	27415	w.o.	OTBVN6LQD W/G	35113	235	P4BCIK32	75064	w.o.
MQDEC-406RR	47453	w.o.	OPBA3QD	27331	w.o.	OTBVN6LQD W/R	35073	235	P4BCI-OC	79915	317
MQDEC-406RS	47457	413	OPBA5	27255	w.o.	OTBVN6LQD W/Y	35093	235	P4BCR	75625	317
MQDEC-406RS	47457	413	OPBA5QD	27198	w.o.	OTBVN6LQDH	67222	235	P4BCRY06	75066	w.o.
MQDEC-406SS	47628	w.o.	OPBAE	27163	162	OTBVN6QD	28585	235	P4BCRK23	76474	w.o.
MQDEC-406SS	47632	413	OPBAEQD	27164	162	OTBVN6QD W/G	35111	235	P4BCRK32	75067	w.o.
MQDEC-412RR	47454	w.o.	OPBB2	27096	162	OTBVN6QD W/R	35071	235	P4BCR-OC	79914	317
MQDEC-412RR	47458	413	OPBB2QD	27097	162	OTBVN6QD W/Y	35091	235	P4C06	73491	418
MQDEC-412RS	47629	w.o.	OPBB3	27417	w.o.	OTBVN6QDH	62415	235	P4C06SIM	75633	418
MQDEC-412SS	47633	413	OPBB3QD	27414	w.o.	OTBVP6	28589	235	P4C23	73492	418
MQDEC-420RR	47455	w.o.	OPBB5	27449	w.o.	OTBVP6 W/G	35114	235	P4C23SIM	75634	418
MQDEC-420RS	47459	413	OPBB5QD	27450	w.o.	OTBVP6 W/R	35074	235	P4C32	73493	418
MQDEC-420RS	47630	w.o.	OPBBE	27167	162	OTBVP6 W/Y	35094	235	P4C32SIM	75635	418
MQDEC-420SS	47634	413	OPBBEQD	27168	162	OTBVP6L	34110	235	P4C50	64120	418
MQDEC-430RS	78626	413	OPBP2QD	35979	w.o.	OTBVP6L W/G	35116	235	P4C75	75318	418
MQDEC-430RS	78626	413	OPBT2	27073	162	OTBVP6L W/R	35076	235	P4C0BI	76877	w.o.
MQDEC-430SS	72154	413	OPBT2QD	27095	162	OTBVP6L W/Y	35096	235	P4COBR	76876	w.o.
MQDEC-450SS	76602	413	OPBT2QDH	27189	162	OTBVP6L W/Y	34997	235	P4C0C	76028	317
MQDMC-506	76642	422	OPBT3	27416	w.o.	OTBVP6LQD	35117	235	P4C0I-BC	76877	317
MQDMC-506RA	76643	422	OPBT3QD	27330	w.o.	OTBVP6LQD W/G	35117	235	P4C0I-BCBD	79952	317
MQDMC-515	76644	422	OPBT3QDH	31567	w.o.	OTBVP6LQD W/R	35077	235	P4C0I-BCBDOC	79955	317
MQDMC-515RA	76645	422	OPBTE	27165	162	OTBVP6LQD W/Y	35097	235	P4C0I-CCOC	79953	317
MQDMC-530	76646	422	OPBTEQD	27166	162	OTBVP6LQDH	67223	235	P4C0I-BD	79950	317
MQDMC-530RA	76647	422	OPBTEQDH	27190	162	OTBVP6QD	28590	235	P4C0I-BDOC	79954	317
MQVR3S-506	72671	419	OPEJ5	27310	w.o.	OTBVP6QD W/R	35115	235	P4C0I-OC	79951	317
MQVR3S-506RA	72672	419	OPEJ5QD	27311	w.o.	OTBVP6QD W/Y	35095	235	P4COR	76027	317
MQVR3S-515	72673	419	OPEJE	27322	w.o.	OTBVP6QDH	46169	235	P4COR-BC	76876	317
MQVR3S-515RA	72674	419	OPEJEQD	27323	w.o.	OTBVR81	33080	235	P4COR-BCBD	79945	317
MQVR3S-530	72713	419	OS-11	17709	w.o.	OTBVR81 W/G	35106	235	P4COR-BCBDOC	79948	317
MQVR3S-530RA	72714	419	OS-8	16383	w.o.	OTBVR81 W/R	35066	235	P4COR-CCOC	79946	317
MRB	16347	w.o.	OSBCV	27088	161	OTBVR81 W/Y	35086	235	P4COR-BD	79943	317
MRB-12	16941	w.o.	OSBCV4	27226	w.o.	OTBVR81L	34040	235	P4COR-BDOC	79947	317
MRB-L	16349	w.o.	OSBCV4B	38208	w.o.	OTBVR81L W/G	35108	235	P4CORK06	78532	w.o.
MRB-O	16351	w.o.	OSBCVB	38209	161	OTBVR81L W/R	35068	235	P4CORK23	77392	w.o.
MRB-T	16353	w.o.	OSBCVG	53397	161	OTBVR81L W/Y	35088	235	P4COR-OC	79944	317
MRB-U	16354	w.o.	OSBD	27086	160	OTBVR81LQD	34041	235	P4D1	74582	447
MRB-XL	16355	w.o.	OSBDX	27087	160	OTBVR81LQD W/G	35109	235	P4E1.3I	74154	317
MRS-1	16365	w.o.	OSBE	27089	160	OTBVR81LQD W/R	35069	235	P4E1.3IK06	74249	w.o.
MRS-1CEM	16370	w.o.	OSBEF	27328	161	OTBVR81LQD W/Y	35089	235	P4E1.3IK23	74250	w.o.
MRS-1MM	16366	w.o.	OSBF	27083	161	OTBVR81QD	34078	235	P4E1.3IK32	74251	w.o.
MSA-LAT-1	57708	w.o.	OSBFAC	27402	161	OTBVR81QD W/G	35107	235	P4E1.3R	74153	317
MSA-S24-1	43174	441	OSBFP	27085	161	OTBVR81QD W/R	35067	235	P4E1.3RK06	74246	w.o.
MSA-S42-1	43175	441	OSBFPB	50554	161	OTBVR81QD W/Y	35087	235	P4E1.3RK23	74247	w.o.
MSA-S86-1	43176	441	OSBFFG	50553	161	OTC-1-BK	30221	240	P4E1.3RK32	74248	w.o.
MSA-S84-1	52397	441	OSBFV	27183	161	OTC-1-BK-10	40046	w.o.	P4EI	73600	317
MSA-TE-12	70436	436	OSBFVAC	27622	w.o.						
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P4EIK23	73681	w.o.	PBD-1	16755	w.o.	PD45VP6C100	46288	138	PIPS46U	35039	198
P4EIK32	73682	w.o.	PBDN	18962	w.o.	PD45VP6C100Q	46289	138	PIPS46UHF	51789	199
P4ER	73599	317	PBE46UTMLLP	48056	195	PD45VP6C200	48323	138	PIPS46UHT1M.45	61191	188
P4ERK06	73677	w.o.	PBE46UTMLLPHT1	51830	195	PD45VP6C200Q	48324	138	PIPS66U	48016	198
P4ERK23	73678	w.o.	PBE46UTMNL	48055	195	PD45VP6C300	71508	138	PIPSB46U	38625	198
P4ERK32	73679	w.o.	PBE46UTMNLMT9	56116	188	PD45VP6C300Q	71509	138	PIPSB46UHF	56093	199
P4G1.3I	73610	317	PBEF26U	28131	191	PD45VP6C50	64962	138	PIPSM26U	38237	198
P4G1.3IK06	73824	w.o.	PBF16U	45073	190	PD45VP6C50Q	64963	138	PIR1X166U	39152	200
P4G1.3IK23	73825	w.o.	PBF21U-100	58131	188	PD45VP6LLP	58620	138	PIR1X166UM.4	65940	188
P4G1.3IK32	73826	w.o.	PBF26U	28131	190	PD45VP6LLPQ	58622	138	PIRS1X1615UMP.75	65890	188
P4G1.3R	73609	317	PBF43TMB5	70798	194	PD49VN6C100	66990	138	PIRS1X1615UMP2.2	65933	188
P4G1.3RK06	73821	w.o.	PBF46U	26035	190	PD49VN6C100Q	66991	138	PIRS1X163TMB5M.4	70869	188
P4G1.3RK23	73822	w.o.	PBF46UHF	51786	193	PD49VN6C200	66994	138	PIRS1X166U	39155	200
P4G1.3RK32	73823	w.o.	PBF46UM3MJ1.3	56109	190	PD49VN6C200Q	66995	138	PIRS1X166UM.4	65919	200
P4GI	73393	317	PBF66U	39981	190	PD49VN6C300	71511	138	PIRS1X166UMPM.75	56068	200
P4GIK06	73399	w.o.	PBFM16U	39115	190	PD49VN6C300Q	71512	138	PIRS1X166UMPMAL	48066	200
P4GIK23	73400	w.o.	PBFM16UM.63	56105	188	PD49VN6C50	66986	138	PIT16U	39983	197
P4GIK32	73401	w.o.	PBFM16UMBM.63	56108	188	PD49VN6C50Q	66987	138	PIT1X46U	39138	198
P4GR	73392	317	PBFM16UMBM.75	56107	188	PD49VN6LLP	66988	138	PIT26U	26079	197
P4GRK06	73396	w.o.	PBFM1X43T	38328	188	PD49VN6LLPQ	66989	138	PIT26UHF	61210	199
P4GRK23	73397	w.o.	PBFM1X43T5	65902	192	PD49VP6C100	66992	138	PIT4100U	70778	188
P4GRK32	73398	w.o.	PBFM1X46T	74364	188	PD49VP6C100Q	66993	138	PIT433U	70777	188
P4O1.3BI	75399	w.o.	PBFM1X46T5	65903	188	PD49VP6C200	66996	138	PIT43TMB5	70766	201
P4O1.3BR	75398	w.o.	PBFM46U	39110	190	PD49VP6C200Q	66997	138	PIT46U	26034	197
P4O1.3I	75319	317	PBFM46UHF	51850	193	PD49VP6C300	71514	138	PIT46UC	26085	198
P4O1.3I-BC	75399	317	PBFMP16UMP	61220	191	PD49VP6C300Q	71515	138	PIT46UHF	51783	199
P4O1.3I-BCBD	79936	317	PBFMP16UMP.2	61220	191	PD49VP6C50	66988	138	PIT46UHT1	42804	200
P4O1.3I-BCBDOC	79941	317	PBO	16391	w.o.	PD49VP6C50Q	66989	138	PIT46UM5	65901	188
P4O1.3I-BCOC	79937	317	PBOB	17639	w.o.	PD49VP6LLP	67000	138	PIT49TB5HF	70839	188
P4O1.3I-BD	79934	317	PBOBL	17794	w.o.	PD49VP6LLPQ	67001	138	PIT66U	39899	197
P4O1.3I-BDOC	79939	317	PBP	16392	w.o.	PD415U-LLD	65936	188	PIT66UMSS	56115	188
P4O1.3I-OC	79935	317	PBP16U	39992	191	PD46U-LLD	61240	195	PITA43TMB5	70889	201
P4O1.3R	75316	317	PBP26U	26082	191	PD415UM12	56104	188	PITP43TMB5	70856	201
P4O1.3R-BC	75398	317	PBP26UM3.75	65938	188	PD415UM12.5M3	65921	188	PIU1X16100U	61242	188
P4O1.3R-BCBD	79929	317	PBP46U	26084	191	PD415UM12	42880	200	PIU230U	26750	203
P4O1.3R-BCBDOC	79932	317	PBP46UC	26088	192	PD415UM12	61182	188	PIU230UHF	65925	188
P4O1.3R-BCOC	79930	317	PBP46UHF	51788	193	PD415UM12	51829	200	PIU260U	26231	203
P4O1.3R-BD	79927	317	PBP46UM.78	65893	188	PDIT26T5	65907	201	PIU4.568U-100	65917	188
P4O1.3R-BDOC	79931	317	PBP46UM2.5	37415	188	PDIT26TP5	65908	188	PIU4.610U-100	65913	188
P4O1.3R-OC	79928	317	PBP48	26305	w.o.	PDIT4100U	56075	201	PIU4100U	26937	188
P4OBI	75397	w.o.	PBPF215U	61181	188	PFC-2	56380	w.o.	PIU4100UMJ1.3	70760	188
P4OBR	75396	w.o.	PBPF26U	39127	191	PFC-2-100	72143	w.o.	PIU4100UXP	71565	188
P4OI	75300	317	PBPF26UMB	39116	191	PFC-2-20	72144	w.o.	PIU4100UXT	71570	188
P4OI-BC	79918	317	PBPMSB36U	38711	191	PFC-2-25	02813	203	PIU41600UXT	71574	188
P4OI-BCBD	79921	317	PBPS215U	65941	188	PFK20	26227	201	PIU4200UXP	71566	188
P4OI-BCBDOC	79924	317	PBPS26U	35042	191	PFK40	26226	203	PIU4200UXT	71571	188
P4OI-BCOC	79922	317	PBPS43TMB5	70862	194	PFS44S6T	48029	203	PIU430U	26751	203
P4OI-BD	79919	317	PBPS46U	35040	191	PFS53S6T	48028	203	PIU430UXP	70720	188
P4OI-BDOC	79923	317	PBPS46UHF	51824	193	PFS69S6T	48027	203	PIU430UXT	68618	188
P4OI-OC	79920	317	PBPS46UMT	48005	191	PG-29	71105	w.o.	PIU4330UXP	71567	188
P4OR	75299	317	PBPS66U	48015	191	PIA16U	26637	196	PIU4330UXT	71572	188
P4OR-BC	79906	317	PBR1X326U	39987	193	PIA26U	25905	196	PIU4500U	26941	188
P4OR-BCBD	79910	317	PBR1X326U	39986	193	PIA415UMNFM1.12	61184	188	PIU4500UXP	71568	188
P4OR-BCBDOC	79913	317	PBR26U	61216	195	PIA46UMJ1.3	56113	188	PIU4500UXT	71573	188
P4OR-BCOC	79911	317	PBT	16393	w.o.	PIAT16U	48022	196	PIU460U	26230	203
P4OR-BD	79907	317	PBT-1	16394	w.o.	PIAT26U	28235	196	PIU460UXP	70721	188
P4OR-BDOC	79912	317	PBT16U	42822	190	PIAT43TMB5	70864	201	PIU460UXT	68619	188
P4OR-OC	79908	317	PBT215UHF	61209	188	PIAT46U	27336	196	PIU6100U	65918	188
P4RE67-G	73657	438	PBT26U	26080	190	PIAT46UC	61200	188	PIU630U	39997	203
P4RE67-P	73658	438	PBT26UHF	61208	193	PIAT46UHF	56090	199	PIU660U	39998	203
PBA	16384	w.o.	PBT26UM6M.1	65942	195	PIAT46UM.4X.4MT	45077	196	PIU680U	65896	188
PBA-1	16385	w.o.	PBT415U	26564	188	PIAT66U	42885	196	PKG3M-10	76963	410
PBAM	18823	w.o.	PBT41TMB5	70773	188	PIE46UT	48040	199	PKG3M-2	63977	410
PBAN	18631	w.o.	PBT43TB5HF	56292	188	PIE615UTMNLMT6	65899	188	PKG3M-4	76571	410
PBAQ	16603	w.o.	PBT43TMB5	70768	194	PIE66UTMNL	48052	199	PKG3M-7	76572	410
PBAT	16386	w.o.	PBT450UHT1	65926	188	PIES430UTMT6HT1	56117	188	PKG3M-9	63978	410
PBAT43TMB5	70866	194	PBT46TB5HF	69729	188	PIES46UT	51758	199	PKG3Z-2	27490	w.o.
PBB	16387	w.o.	PBT46U	25967	190	PIF16U	42821	196	PKG4-2	32438	410
PBB-1	16389	w.o.	PBT46UC	26086	192	PIF26U	27367	196	PKG4M-2	02878	411
PBBN	18912	w.o.	PBT46UHF	51784	193	PIF26UM.12X.6	70749	188	PKG4M-9	02879	411
PBBT	16388	w.o.	PBT46UHT1	42799	194	PIF26UMLS	39130	196	PKG4S-2	73659	411
PBCF21.7T	38637	188	PBT46UM1/4-20	69565	188	PIF43TMB5	70796	201	PKG6Z-.5	71429	w.o.
PBCF21X46U	40414	192	PBT66U	39982	190	PIF460UMNMCN	65935	188	PKG6Z-2	62985	411
PBCF415U	65943	188	PBTA43TMB5	70891	194	PIF46U	26036	197	PKG6Z-9	62986	411
PBCF41U	65887	188	PBTP43TMB5	70858	194	PIF46UHF	51785	199	PKG3M-10	78753	410
PBCF46U	42888	192	PBTU	27456	w.o.	PIF615UMVFA	61190	188	PKG3M-4	78751	410
PBCL21.5T	65931	188	PBU430U	26229	203	PIF630U	70832	188	PKG3M-7	78752	410
PBCL21T	65932	188	PBU460U	26749	203	PIF66U	39988	197	PKW3-2	27491	w.o.
PBCL22T	65944	188	PC44BN6FP	32274	w.o.	PIF66UM.52M.19D	41542	201	PKW3M-2	63979	410
PBCT21X46U	45071	192	PC44BP6FP	32275	w.o.	PIF66UM.52M.19D	38636	198	PKW3M-9	63980	410
PBCT22TSM4M2.5	65916	188	PD-28	16401	w.o.	PIF66U	39113	197	PKW4M-2	02880	411
PBCT23MB5	70850	188	PD45VN6C100	46286	138	PIF66UHF	56091	199	PKW4M-9	02881	411
PBCT23TMB5	70850	194	PD45VN6C100Q	46287	138	PIL46U	34080	197	PKW4Z-2	34462	410
PBCT23TMB5M4	71385	194	PD45VN6C200	47926	138	PIP16U	35044	197	PKW4ZS-2	73660	411
PBCT26TSM4M2.5	61186	188	PD45VN6C200Q	48322	138	PIP26U	26081	197	PKW6Z-2	62998	411
PBCT26U	45091	192	PD45VN6C300	71505	138	PIP46U	26083	197	PKW6Z-9	62999	411
PBCT26UM3	45090	192	PD45VN6C300Q	71506	138	PIP46UC	26087	198	PL4-2	16404	w.o.
PBCT26UM4M2.5	56125	192	PD45VN6C50	64959	138	PIP46UHF	51787	199	PLI-A10	68639	192
PBCT415UM8M.75	65946	188	PD45VN6C50Q	64960	138	PIP660UMPPM.5	65945	188	PLIS-1	71208	198
PBCT46U	35214	192	PD45VN6LLP	57202	138	PIPS26U	35041	198	PP1.3BK06	77564	w.o.

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PP1.3K06	77562	w.o.	PPROCAMSI-G	77028	315	PVA225N6E	51926	354	Q12RB6FF50Q	72120	48
PP1.3K23	77563	w.o.	PPROCAMSI-P	77033	315	PVA225N6EQ	51930	354	Q12RB6FF50Q5	74144	48
PP1.3K23R	79039	w.o.	PPROCAMSR-G	77026	315	PVA225N6Q	52908	354	Q12RB6LP	72131	47
PP1.3KS	77828	w.o.	PPROCAMSR-P	77027	315	PVA225N6R	51910	354	Q12RB6LPQ	72132	47
PPBK	76653	w.o.	PPROCAMSS	77977	315	PVA225N6RQ	51922	354	Q12RB6LPQ5	74146	47
PPBKSRG13	77888	w.o.	PPROCAMSSB-G	79254	315	PVA225P6	52905	354	Q12RB6LV	72125	47
PPC06	62409	418	PPROCAMSSB-P	79255	315	PVA225P6E	50785	354	Q12RB6LVQ	72126	47
PPC06HF	71435	418	PPROCAMSSC-G	79232	315	PVA225P6EQ	51914	354	Q12RB6LVQ5	74148	47
PPC06RA	70827	418	PPROCAMSSC-P	79233	315	PVA225P6Q	52907	354	Q12RB6R	72137	47
PPC06RAHF	71676	418	PPROCAMSSG-G	79256	315	PVA225P6R	50789	354	Q12RB6RCR	76487	47
PPC08AC	75207	w.o.	PPROCAMSSG-P	79257	315	PVA225P6RQ	51918	354	Q12RB6RQ	72138	47
PPC13S	75981	418	PPROCAMSSI-G	79238	315	PVA300N6	52910	354	Q12RB6RQ5	74140	47
PPC23	62410	418	PPROCAMSSI-P	79239	315	PVA300N6E	51927	354	Q13C2.0	59424	281
PPC23HF	71436	418	PPROCAMSSR-G	79236	315	PVA300N6EQ	51931	354	Q146E	45151	w.o.
PPC23RA	70828	418	PPROCAMSSR-P	79237	315	PVA300N6Q	52912	354	Q146EQ	45731	w.o.
PPC23RAHF	71677	418	PPROCAMSSW-G	79258	315	PVA300N6R	51911	354	Q14AN6R	45152	w.o.
PPC23S	76494	418	PPROCAMSSW-P	79259	315	PVA300N6RQ	51923	354	Q14AN6RQ	45732	w.o.
PPC32	71103	w.o.	PPROCAMSW-G	77066	315	PVA300P6	52909	354	Q14AP6R	45387	w.o.
PPC32HF	71437	w.o.	PPROCAMSW-P	77067	315	PVA300P6E	50786	354	Q14AP6RQ	45733	w.o.
PPC32RA	71104	w.o.	PPROCTL	75315	315	PVA300P6EQ	51915	354	Q14RN6R	45388	w.o.
PPC32S	76964	w.o.	PPROCTL1.3	77015	315	PVA300P6Q	52911	354	Q14RN6RQ	45734	w.o.
PPCBK	77072	w.o.	PPROCTL1.3-BC	77258	315	PVA300P6R	50790	354	Q14RP6R	45389	w.o.
PPCK	77071	w.o.	PPROCTL1.3-BCBD	call	315	PVA300P6RQ	51919	354	Q14RP6RQ	45735	w.o.
PPCK06	77867	w.o.	PPROCTL1.3-BCBDOC	call	315	PVA375N6	52914	354	Q20E	77781	93
PPCK23	79614	w.o.	PPROCTL1.3-BCOC	call	315	PVA375N6E	51928	354	Q20EL	78159	93
PPE4-G	02803	438	PPROCTL1.3-BD	call	315	PVA375N6EQ	51932	354	Q20ELQ	78226	93
PPE4-P	02695	438	PPROCTL1.3-BDOC	call	315	PVA375N6Q	52916	354	Q20ELQ5	78206	93
PPE4-RG	71737	w.o.	PPROCTL1.3-OC	call	315	PVA375N6R	51912	354	Q20ELQ7	78160	93
PPE4-RP	71738	w.o.	PPROCTL-BC	76115	315	PVA375N6RQ	51924	354	Q20EQ	78225	93
PPE-G	72012	438	PPROCTL-BCBD	call	315	PVA375P6	52913	354	Q20EQ5	78205	93
PPE-P	71772	438	PPROCTL-BCBDOC	call	315	PVA375P6E	50787	354	Q20EQ7	77782	93
PPE-RG	72090	438	PPROCTL-BCOC	call	315	PVA375P6EQ	51916	354	Q20ND	77759	93
PPE-RP	72091	438	PPROCTL-BD	call	315	PVA375P6Q	52915	354	Q20NDL	77755	93
PPK	72233	w.o.	PPROCTL-BDOC	call	315	PVA375P6R	50791	354	Q20NDLQ	78208	93
PPK06	69657	w.o.	PPROCTL-C	76114	315	PVA375P6RQ	51920	354	Q20NDLQ5	78188	93
PPK23	69651	w.o.	PPROCTL-BC	76874	315	PVD100	70988	352	Q20NDLQ7	77756	93
PPK32	71681	w.o.	PPROCTL-BCBD	call	315	PVD100Q	70989	352	Q20NDQ	78212	93
PPKS	77073	w.o.	PPROCTL-BCBDOC	call	315	PVD225	70990	352	Q20NDQ5	78192	93
PPKSCG23	77717	w.o.	PPROCTL-BCOC	call	315	PVD225Q	70991	352	Q20NDQ7	77760	93
PPKSCG32	77830	w.o.	PPROCTL-BC	call	315				Q20NDLQ	78153	93
PPKSR-P-23	77752	w.o.	PPROCTL-BDOC	call	315				Q20NDXLQ	78210	93
PPLIM	76428	449	PPROCTL-OC	call	315	Q106E	44756	w.o.	Q20NDXLQ5	78190	93
PPM7PS	73053	w.o.	PPROCTL-OC	call	315	Q106EQ	44856	w.o.	Q20NDXLQ7	78154	93
PPM8	78391	334	PPSIM-NC	75630	449	Q10AN6D	44857	w.o.	Q20NLP	77763	93
PPM9	68366	334	PPSIM-NT	75629	449	Q10AN6DQ	44858	w.o.	Q20NLPQ	78214	93
PPROCAM	74937	315	PPSIM-PC	75632	449	Q10AN6R	44748	w.o.	Q20NLPQ5	78194	93
PPROCAM1.3	76585	315	PPSIM-PT	75631	449	Q10AN6RQ	44749	w.o.	Q20NLPQ5	77764	93
PPROCAM1.3S	77093	315	PPSCL50-G	76800	w.o.	Q10AP6D	44861	w.o.	Q20NLPQ7	77764	93
PPROCAM1.3SB-G	77050	315	PPSCL50-P	76801	w.o.	Q10AP6DQ	44862	w.o.	Q20NLV	77767	93
PPROCAM1.3SB-P	77051	315	PPSSLC50-G	78324	w.o.	Q10AP6R	44752	w.o.	Q20NLVQ	78216	93
PPROCAM1.3SC-G	77039	315	PPSSLC50-P	78325	w.o.	Q10AP6RQ	44753	w.o.	Q20NLVQ5	78196	93
PPROCAM1.3SC-P	77044	315	PS115-1N	74823	449	Q10RN6D	44859	w.o.	Q20NLVQ7	77768	93
PPROCAM1.3SG-G	77052	315	PS115-1P	74824	449	Q10RN6DQ	44860	w.o.	Q20NR	77779	93
PPROCAM1.3SG-P	77053	315	PS120-15	18775	w.o.	Q10RN6R	44750	w.o.	Q20NRL	78274	93
PPROCAM1.3SI-G	77048	315	PS15-1	16410	w.o.	Q10RN6RQ	44751	w.o.	Q20NRLQ	78283	93
PPROCAM1.3SI-P	77049	315	PS24-1N	74821	449	Q10RP6D	44863	w.o.	Q20NRLQ5	78281	93
PPROCAM1.3SR-G	77045	315	PS24-1P	74822	449	Q10RP6DQ	44864	w.o.	Q20NRLQ7	78275	93
PPROCAM1.3SR-P	77047	315	PS24W	77422	343	Q10RP6R	44754	w.o.	Q20NRQ	78224	93
PPROCAM1.3SS	78327	315	PS2V-12	65720	448	Q10RP6RQ	44755	w.o.	Q20NRQ5	78204	93
PPROCAM1.3SSB-G	79248	315	PS2V-12E	65721	448	Q126E	72140	47	Q20NRQ7	77780	93
PPROCAM1.3SSB-P	79249	315	PSA-12	65715	448	Q126EQR	76488	47	Q20PD	77757	93
PPROCAM1.3SSC-G	79242	315	PSA-12E	65716	448	Q126EQ	72141	47	Q20PDL	77753	93
PPROCAM1.3SSC-P	79243	315	PSA-24	66216	448	Q126EQ5	74138	47	Q20PDLQ	78207	93
PPROCAM1.3SSG-G	79250	315	PSA-24E	66217	448	Q12AB6FF15	72104	47	Q20PDLQ5	78187	93
PPROCAM1.3SSG-P	79251	315	PSBA-120	27836	w.o.	Q12AB6FF15CR	76477	47	Q20PDLQ7	77754	93
PPROCAM1.3SSI-G	79246	315	PSC-24	65717	448	Q12AB6FF15Q5	72105	47	Q20PDQ	78211	93
PPROCAM1.3SSI-P	79247	315	PSC-24E	65718	448	Q12AB6FF15Q55	74141	47	Q20PDQ5	78191	93
PPROCAM1.3SSR-G	79244	315	PSDINA-24-4	76809	448	Q12AB6FF30	72110	48	Q20PDQ7	77758	93
PPROCAM1.3SSR-P	79245	315	PT200	16411	w.o.	Q12AB6FF30CR	76482	48	Q20PDXL	78151	93
PPROCAM1.3SSW-G	79252	315	PT200B	16412	w.o.	Q12AB6FF30Q	72111	48	Q20PDXLQ	78209	93
PPROCAM1.3SSW-P	79253	315	PT200E	37152	w.o.	Q12AB6FF50	72116	48	Q20PDXLQ5	78189	93
PPROCAM1.3SW-G	77054	315	PT250	16413	w.o.	Q12AB6FF50CR	76484	48	Q20PDXLQ7	78152	93
PPROCAM1.3SW-P	77055	315	PT250B	16414	w.o.	Q12AB6FF50Q	72117	48	Q20PLP	77761	93
PPROCAMC	76113	315	PT250E	37153	w.o.	Q12AB6L	72128	47	Q20PLPQ	78213	93
PPROCAMCS	77068	315	PT300	26540	w.o.	Q12AB6LPQ	72129	47	Q20PLPQ5	78193	93
PPROCAMCSC-G	77024	315	PT300E	37154	w.o.	Q12AB6LPQ5	74145	47	Q20PLPQ7	77762	93
PPROCAMCSC-P	77025	315	PT400	16415	w.o.	Q12AB6LV	72122	47	Q20PLV	77765	93
PPROCAMCSS	78326	315	PT410	16418	w.o.	Q12AB6LVQ	72123	47	Q20PLVQ	78215	93
PPROCAMCSSC-G	79234	315	PVA100N6	52902	354	Q12AB6R	72134	47	Q20PLVQ5	78195	93
PPROCAMCSSC-P	79235	315	PVA100N6E	51925	354	Q12AB6RCR	76486	47	Q20PLVQ7	77766	93
PPROCAMCSSW-G	79240	315	PVA100N6EQ	51929	354	Q12AB6RQ	72135	47	Q20PR	77777	93
PPROCAMCSSW-P	79241	315	PVA100N6Q	52904	354	Q12AB6RQ5	74139	47	Q20PRL	78272	93
PPROCAMCSW-G	77034	315	PVA100N6R	51909	354	Q12RB6FF15	72107	47	Q20PRLQ	78282	93
PPROCAMCSW-P	77035	315	PVA100N6RQ	51921	354	Q12RB6FF15CR	76481	47	Q20PRLQ5	78280	93
PPROCAMS	75126	315	PVA100P6	52901	354	Q12RB6FF15Q5	72108	47	Q20PRLQ7	78273	93
PPROCAMSB-G	77062	315	PVA100P6E	50784	354	Q12RB6FF15Q55	74142	47	Q20PRQ	78223	93
PPROCAMSB-P	77063	315	PVA100P6EQ	51913	354	Q12RB6FF30CR	72113	48	Q20PRQ5	78203	93
PPROCAMSC-G	77020	315	PVA100P6Q	52903	354	Q12RB6FF30CR	76483	48	Q20PRQ7	77778	93
PPROCAMSC-P	77021	315	PVA100P6R	50788	354	Q12RB6FF30Q	72114	48	Q236E	46435	w.o.
PPROCAMSG-G	77064	315	PVA100P6RQ	51917	354	Q12RB6FF30Q5	74143	48	Q236EQ	46446	w.o.
PPROCAMSG-P	77065	315	PVA225N6	52906	354	Q12RB6FF50	72119	48	Q23SN6CV50	48403	w.o.
						Q12RB6FF50CR	76485	48	Q23SN6CV50Q	48401	w.o.

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Q23SN6D	46436	w.o.	Q40AW3FF600	32371	135	Q45B66FP	36561	148	Q45ULIU64BCRQ	47557	277
Q23SN6DL	46431	w.o.	Q40AW3FF600Q1	34341	135	Q45B66FPO	36730	148	Q45ULIU64BCRQ6	47558	277
Q23SN6DLQ	46442	w.o.	Q40AW3LP	32362	134	Q45B66FPQ5	38668	148	Q45UR3BA63C	52134	281
Q23SN6DQ	46447	w.o.	Q40AW3LPQ1	33396	134	Q45B66FQ	36729	148	Q45UR3BA63CK	53742	281
Q23SN6FP	46438	w.o.	Q40AW3R	32374	134	Q45B66FQ5	38667	148	Q45UR3BA63CKQ	59425	281
Q23SN6FPQ	46449	w.o.	Q40AW3RE	37104	w.o.	Q45B66FV	43545	148	Q45UR3BA63CKS	59428	281
Q23SN6FPY	46462	w.o.	Q40AW3REQ1	37106	w.o.	Q45B66FVQ	42971	148	Q45UR3BA63CQ	53010	281
Q23SN6FPYQ	46464	w.o.	Q40AW3RQ1	33402	134	Q45B66FVQ5	43546	148	Q45UR3BA63CQ6	53011	281
Q23SN6LP	46429	w.o.	Q40RW3FF200	33382	135	Q45B66LL	37248	147	Q45UR3BA63CQ6-63060	63060	282
Q23SN6LPQ	46440	w.o.	Q40RW3FF200Q1	33388	135	Q45B66LLP	39551	147	Q45UR3BA63CQ6K	53741	281
Q23SN6R	46433	w.o.	Q40RW3FF400	33383	135	Q45B66LLPQ	39550	147	Q45UR3BA63CQ6KQ	59427	281
Q23SN6RE	46468	w.o.	Q40RW3FF400Q1	33389	135	Q45B66LLPQ6	41033	147	Q45UR3BA63CQ6KS	59430	281
Q23SN6REQ	46470	w.o.	Q40RW3FF600	34563	135	Q45B66LLQ	39552	147	Q45UR3BA63CQK	53740	281
Q23SN6RQ	46444	w.o.	Q40RW3FF600Q1	34565	135	Q45B66LLQ6	41032	147	Q45UR3BA63CQKQ	59426	281
Q23SP6CV50	48404	w.o.	Q40RW3LP	33384	134	Q45B66LP	36556	147	Q45UR3BA63CQKS	59429	281
Q23SP6CV50Q	48402	w.o.	Q40RW3LPQ1	33397	134	Q45B66LPQ	36726	147	Q45UR3LIU64C	53012	281
Q23SP6D	46437	w.o.	Q40RW3R	33385	134	Q45B66LPQ5	38666	147	Q45UR3LIU64CK	53745	281
Q23SP6DL	46432	w.o.	Q40RW3RE	37105	w.o.	Q45B66LV	36557	147	Q45UR3LIU64CKQ	59431	281
Q23SP6DLQ	46443	w.o.	Q40RW3REQ1	37107	w.o.	Q45B66LVQ	36727	147	Q45UR3LIU64CKS	59434	281
Q23SP6DQ	46448	w.o.	Q40RW3RQ1	33403	134	Q45B66LVQ5	38665	147	Q45UR3LIU64CQ	53013	281
Q23SP6FP	46439	w.o.	Q40SN6FF200	32363	134	Q45B66R	36562	147	Q45UR3LIU64CQ6	53014	281
Q23SP6FPQ	46450	w.o.	Q40SN6FF200Q	33390	134	Q45B66RQ	36731	147	Q45UR3LIU64CQ6-63677	63677	282
Q23SP6FPY	46463	w.o.	Q40SN6FF400	32366	134	Q45B66RQ5	38660	147	Q45UR3LIU64CQ6K	53744	281
Q23SP6FPYQ	46465	w.o.	Q40SN6FF400Q	33391	134	Q45B66RQ5	38660	147	Q45UR3LIU64CQ6KQ	59433	281
Q23SP6LP	46430	w.o.	Q40SN6FF600	32369	134	Q45B66RQ5	38660	147	Q45UR3LIU64CQ6KS	59436	281
Q23SP6LPQ	46441	w.o.	Q40SN6FF600Q	34342	134	Q45B66RQ5	38660	147	Q45UR3LIU64CQK	53743	281
Q23SP6R	46434	w.o.	Q40SN6LP	32360	134	Q45B66RQ5	38660	147	Q45UR3LIU64CQKQ	59432	281
Q23SP6RE	46469	w.o.	Q40SN6LPQ	33394	134	Q45B66RQ5	38660	147	Q45UR3LIU64CQKS	59435	281
Q23SP6REQ	46471	w.o.	Q40SN6R	32372	134	Q45B66RQ5	38660	147	Q45VR2CV	35446	149
Q23SP6RQ	46445	w.o.	Q40SN6RE	37100	w.o.	Q45B66RQ5	38660	147	Q45VR2CV4	35447	149
Q253E	31966	107	Q40SN6REQ	37102	w.o.	Q45B66RQ5	38660	147	Q45VR2CV4Q	37008	149
Q253EQ1	31971	107	Q40SN6RQ	33399	134	Q45B66RQ5	38660	147	Q45VR2CVQ	37007	149
Q256E	31926	107	Q40SP6FF200	32364	134	Q45B66RQ5	38660	147	Q45VR2D	35438	149
Q256EQ	31935	107	Q40SP6FF200Q	33392	134	Q45B66RQ5	38660	147	Q45VR2DL	35439	149
Q25AW3FF100	31918	108	Q40SP6FF300Q	44919	w.o.	Q45B66RQ5	38660	147	Q45VR2DLQ	36025	149
Q25AW3FF100Q1	31922	108	Q40SP6FF400	32367	134	Q45B66RQ5	38660	147	Q45VR2DQ	37000	149
Q25AW3FF25	58402	107	Q40SP6FF400Q	33393	134	Q45B66RQ5	38660	147	Q45VR2DX	44550	149
Q25AW3FF25Q1	58410	107	Q40SP6FF600	32370	134	Q45B66RQ5	38660	147	Q45VR2DXQ	47139	149
Q25AW3FF50	31916	108	Q40SP6FF600Q	34343	134	Q45B66RQ5	38660	147	Q45VR2F	35444	150
Q25AW3FF50Q1	31920	108	Q40SP6LP	32361	134	Q45B66RQ5	38660	147	Q45VR2FP	35445	150
Q25AW3LP	31964	107	Q40SP6LPQ	33395	134	Q45B66RQ5	38660	147	Q45VR2FPQ	37006	150
Q25AW3LPQ1	31969	107	Q40SP6R	32373	134	Q45B66RQ5	38660	147	Q45VR2FQ	37005	150
Q25AW3R	31967	107	Q40SP6RE	37101	w.o.	Q45B66RQ5	38660	147	Q45VR2FV	43543	150
Q25AW3RE	37096	w.o.	Q40SP6REQ	37103	w.o.	Q45B66RQ5	38660	147	Q45VR2FVQ	43544	150
Q25AW3REQ1	37098	w.o.	Q40SP6RQ	33400	134	Q45B66RQ5	38660	147	Q45VR2LP	35440	149
Q25AW3RQ1	31972	107	Q452E	35442	148	Q45B66RQ5	38660	147	Q45VR2LPQ	37001	149
Q25RW3FF100	31919	108	Q452EQ	37003	148	Q45B66RQ5	38660	147	Q45VR2LV	35441	149
Q25RW3FF100Q1	31923	108	Q452EQ1	40222	148	Q45B66RQ5	38660	147	Q45VR2LVQ	37002	149
Q25RW3FF25	58403	107	Q453E	53994	150	Q45B66RQ5	38660	147	Q45VR2R	35443	148
Q25RW3FF25Q1	58411	107	Q453EQ	54328	150	Q45B66RQ5	38660	147	Q45VR2RQ	37004	148
Q25RW3FF50	31917	108	Q456E	36563	147	Q45B66RQ5	38660	147	Q45VR3CV	53972	151
Q25RW3FF50Q1	31921	108	Q456EQ	36732	147	Q45B66RQ5	38660	147	Q45VR3CV4	53973	151
Q25RW3LP	31965	107	Q456EQ5	38659	147	Q45B66RQ5	38660	147	Q45VR3CV4Q	54307	151
Q25RW3LPQ1	31970	107	Q459E	37625	157	Q45B66RQ5	38660	147	Q45VR3CVQ	54306	151
Q25RW3R	31968	107	Q459EQ	37635	157	Q45B66RQ5	38660	147	Q45VR3D	53974	151
Q25RW3RE	37097	w.o.	Q45AD9CV	37623	157	Q45B66RQ5	38660	147	Q45VR3DL	53975	151
Q25RW3REQ1	37099	w.o.	Q45AD9CV4	37624	157	Q45B66RQ5	38660	147	Q45VR3DLQ	54309	151
Q25RW3RQ1	31973	107	Q45AD9CV4Q	37634	157	Q45B66RQ5	38660	147	Q45VR3DQ	54308	151
Q25S2P6FF25Q	58414	107	Q45AD9CVQ	37633	157	Q45B66RQ5	38660	147	Q45VR3DX	53976	151
Q25SN6FF100	31931	107	Q45AD9D	37617	157	Q45B66RQ5	38660	147	Q45VR3DXQ	54310	151
Q25SN6FF100Q	31940	107	Q45AD9DL	37618	157	Q45B66RQ5	38660	147	Q45VR3F	53977	151
Q25SN6FF25	58400	107	Q45AD9DLQ	37628	157	Q45B66RQ5	38660	147	Q45VR3FP	53978	151
Q25SN6FF25Q	58408	107	Q45AD9DQ	37627	157	Q45B66RQ5	38660	147	Q45VR3FPQ	54312	151
Q25SN6FF50	31929	107	Q45AD9F	37621	158	Q45B66RQ5	38660	147	Q45VR3FQ	54311	151
Q25SN6FF50Q	31938	107	Q45AD9FP	37622	158	Q45B66RQ5	38660	147	Q45VR3FV	53979	151
Q25SN6LP	31924	107	Q45AD9FPQ	37632	158	Q45B66RQ5	38660	147	Q45VR3FVQ	54313	151
Q25SN6LPQ	31933	107	Q45AD9P	37619	157	Q45B66RQ5	38660	147	Q45VR3LP	53980	150
Q25SN6R	31927	107	Q45AD9LPQ	37629	157	Q45B66RQ5	38660	147	Q45VR3LPQ	54314	150
Q25SN6RE	37092	w.o.	Q45AD9LV	37620	157	Q45B66RQ5	38660	147	Q45VR3LV	53981	150
Q25SN6REQ	37094	w.o.	Q45AD9LVQ	37630	157	Q45B66RQ5	38660	147	Q45VR3LVQ	54315	150
Q25SN6RQ	31936	107	Q45AD9R	37626	157	Q45B66RQ5	38660	147	Q45VR3R	53982	150
Q25SP6FF100	31932	107	Q45AD9RQ	37636	157	Q45B66RQ5	38660	147	Q45VR3RQ	54316	150
Q25SP6FF100Q	31941	107	Q45AD9RQ	37636	157	Q45B66RQ5	38660	147	Q45X8EQ	37879	w.o.
Q25SP6FF25	58401	107	Q45AD9RQ	37636	157	Q45B66RQ5	38660	147	Q45X8EQVQ	37886	w.o.
Q25SP6FF25Q	58409	107	Q45BB6CV	36836	148	Q45B66RQ5	38660	147	Q45X8EQVQ	37885	w.o.
Q25SP6FF50	31930	107	Q45BB6CV4	36837	148	Q45B66RQ5	38660	147	Q45X8EQVQ	37884	w.o.
Q25SP6FF50Q	31939	107	Q45BB6CV4Q	37010	148	Q45B66RQ5	38660	147	Q45X8EQVQ	37883	w.o.
Q25SP6LP	31925	107	Q45BB6CV4Q5	38662	148	Q45B66RQ5	38660	147	Q45X8EQVQ	37882	w.o.
Q25SP6LPQ	31934	107	Q45BB6CVQ	37009	148	Q45B66RQ5	38660	147	Q45X8EQVQ	37881	w.o.
Q25SP6R	31928	107	Q45BB6CVQ5	38661	148	Q45B66RQ5	38660	147	Q45X8EQVQ	37880	w.o.
Q25SP6RE	37093	w.o.	Q45BB6D	36558	148	Q45B66RQ5	38660	147	Q45X8EQVQ	37879	w.o.
Q25SP6REQ	37095	w.o.	Q45BB6DL	36559	148	Q45B66RQ5	38660	147	Q45X8EQVQ	37878	w.o.
Q25SP6RQ	31937	107	Q45BB6DLQ	36564	148	Q45B66RQ5	38660	147	Q45X8EQVQ	37877	w.o.
Q403E	32376	134	Q45BB6DLQ5	38664	148	Q45B66RQ5	38660	147	Q45X8EQVQ	37876	w.o.
Q403EQ1	33401	134	Q45BB6DQ	36728	148	Q45B66RQ5	38660	147	Q45X8EQVQ	37875	w.o.
Q406E	32375	134	Q45BB6DQ5	38663	148	Q45B66RQ5	38660	147	Q45X8EQVQ	37874	w.o.
Q406EQ	33398	134	Q45BB6DX	42476	148	Q45B66RQ5	38660	147	Q45X8EQVQ	37873	w.o.
Q40AW3FF200	32365	135	Q45BB6DXQ	47137	148	Q45B66RQ5	38660	147	Q45X8EQVQ	37872	w.o.
Q40AW3FF200Q1	33386	135	Q45BB6DXQ5	47138	148	Q45B66RQ5	38660	147	Q45X8EQVQ	37871	w.o.
Q40AW3FF400	32368	135	Q45BB6F	36560	148	Q45B66RQ5	38660	147	Q45X8EQVQ	37870	w.o.
Q40AW3FF400Q1	33387	135				Q45B66RQ5	38660	147	Q45X8EQVQ	37869	w.o.

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Q50AUQ	67607	258	Q85BW13R-T9	35571	w.o.	QM42VP6FP	45783	142	QS186LE2	75951	w.o.
Q50AVI	63862	258	Q85BW13R-T9-B	35573	w.o.	QM42VP6FPQ	45784	142	QS186LE211	75762	w.o.
Q50AVIQ	63863	258	Q85VR3D	31655	w.o.	QM42VP6LP	44901	141	QS186LE212	71366	331
Q50AVN	63874	257	Q85VR3D-B	31657	w.o.	QM42VP6LPQ	44903	141	QS186LE212Q	75967	331
Q50AVNQ	63875	257	Q85VR3DL	31539	w.o.	QM42VP6R	44332	141	QS186LE212Q5	74318	331
Q50AVNY	63877	257	Q85VR3DL-B	31540	w.o.	QM42VP6RQ	44335	141	QS186LE214Q5	75972	w.o.
Q50AVNYQ	63878	257	Q85VR3DL-T9	31537	w.o.	QMT42VN6AFV400	46855	142	QS186LE2Q	75953	w.o.
Q50AVP	63886	247	Q85VR3DL-T9-B	31538	w.o.	QMT42VN6AFV400Q	46857	142	QS186LE2Q5	75954	w.o.
Q50AVPQ	63887	257	Q85VR3D-T9	31654	w.o.	QMT42VN6DX	56894	141	QS186LEQ8	70253	72
Q50AVPY	63889	257	Q85VR3D-T9-B	31656	w.o.	QMT42VN6DXQ	56895	141	QS18EN6CV15	68850	76
Q50AVPYQ	63890	257	Q85VR3LP	31213	w.o.	QMT42VN6FF1000	49231	141	QS18EN6CV15Q	68852	76
Q50AVU	63868	248	Q85VR3LP-B	31214	w.o.	QMT42VN6FF1000Q	49232	141	QS18EN6CV15Q5	68854	76
Q50AVUQ	63869	258	Q85VR3LP-T9	30872	w.o.	QMT42VN6FF1500	57543	141	QS18EN6CV15Q7	72004	76
Q50BI	63865	258	Q85VR3LP-T9-B	31212	w.o.	QMT42VN6FF1500Q	57544	141	QS18EN6CV15Q8	71992	76
Q50BIQ	63866	258	Q85VR3R	31651	w.o.	QMT42VN6FF2000	49235	141	QS18EN6CV45	68743	76
Q50BN	63880	258	Q85VR3R-B	31653	w.o.	QMT42VN6FF2000Q	49236	141	QS18EN6CV45Q	68749	76
Q50BNQ	63881	258	Q85VR3R-T9	31650	w.o.	QMT42VN6FF500	49227	141	QS18EN6CV45Q5	68755	76
Q50BNY	63883	258	Q85VR3R-T9-B	31652	w.o.	QMT42VN6FF500Q	49228	141	QS18EN6CV45Q7	72000	76
Q50BNYQ	63884	258	QAL50INQ	72675	w.o.	QMT42VN6FF750	57541	141	QS18EN6CV45Q8	71988	76
Q50BP	63892	258	QAL50IPQ	72676	w.o.	QMT42VN6FF750Q	57542	141	QS18EN6D	69205	76
Q50BPQ	63893	258	QBF2.53S	62256	w.o.	QMT42VP6AFV400	46856	142	QS18EN6DB	68745	76
Q50BPY	63895	258	QBM.53P	17978	w.o.	QMT42VP6AFV400Q	46858	142	QS18EN6DBQ	68751	76
Q50BPYQ	63896	258	QBT210S	23437	w.o.	QMT42VP6DX	56896	141	QS18EN6DBQ5	68757	76
Q50BU	63871	258	QBT23S	20687	w.o.	QMT42VP6DXQ	56897	141	QS18EN6DBQ7	72002	76
Q50BUQ	63872	258	QBT25S	24805	w.o.	QMT42VP6FF1000	49233	141	QS18EN6DBQ8	71990	76
Q50BVI	65273	258	QC50A3N6XDWQ	70902	229	QMT42VP6FF1000Q	49234	141	QS18EN6DQ	69206	76
Q50BVIQ	65274	258	QC50A3P6XDWQ	70826	229	QMT42VP6FF1500	57545	141	QS18EN6DQ5	69207	76
Q50BVN	65279	258	QCX50A3N6XDWQ	72061	229	QMT42VP6FF1500Q	57546	141	QS18EN6DQ7	72006	76
Q50BVNQ	65280	258	QCX50A3P6XDWQ	72060	229	QMT42VP6FF2000	49237	141	QS18EN6DQ8	71994	76
Q50BVNY	65282	258	QDC-515C	37442	421	QMT42VP6FF2000Q	49238	141	QS18EN6DV	75218	77
Q50BVNYQ	65283	258	QDC-525C	37443	421	QMT42VP6FF500	49229	141	QS18EN6DVQ	75220	77
Q50BVP	65285	258	QDC-550C	37498	421	QMT42VP6FF500Q	49230	141	QS18EN6DVQ5	75221	77
Q50BVPQ	65286	258	QH236E	48807	w.o.	QMT42VP6FF750	57540	141	QS18EN6DVQ8	75223	77
Q50BVPY	65288	258	QH236EQ	48818	w.o.	QMT42VP6FF750Q	57371	141	QS18EN6FP	75722	77
Q50BVPYQ	65289	258	QH23SN6CV50	48872	w.o.	QS126E	58623	53	QS18EN6FPQ	75724	77
Q50BVU	65276	258	QH23SN6CV50Q	48873	w.o.	QS126EQ	58624	53	QS18EN6FPQ5	75725	77
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Q60BB6LAF1400QP	71783	166	QH23SN6FPYQ	48836	w.o.	QS12VN6DQ	58657	53	QS18EN6W	69213	77
Q60BB6LAF2000	71634	166	QH23SN6LP	48801	w.o.	QS12VN6LP	58632	53	QS18EN6WQ	69214	77
Q60BB6LAF2000Q	71743	166	QH23SN6LPQ	48812	w.o.	QS12VN6LPQ	58633	53	QS18EN6WQ5	69215	77
Q60BB6LAF2000QP	71784	w.o.	QH23SN6R	48805	w.o.	QS12VN6LV	58638	53	QS18EN6WQ7	72008	77
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Q60VR3AFV1000	70094	166	QH23SN6RQ	48816	w.o.	QS12VN6RQ	58627	53	QS18EP6CV15Q	68853	76
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Q60VR3LAF1400Q1	71744	166	QH23SP6D	48809	w.o.	QS12VP6CV10	58647	53	QS18EP6CV15Q8	71993	76
Q60VR3LAF2000	71636	166	QH23SP6DL	48804	w.o.	QS12VP6CV10Q	58648	53	QS18EP6CV45	68744	76
Q60VR3LAF2000Q1	71745	166	QH23SP6DLQ	48815	w.o.	QS12VP6CV20	58653	53	QS18EP6CV45Q	68750	76
Q7MB	71837	242	QH23SP6DQ	48820	w.o.	QS12VP6CV20Q	58654	53	QS18EP6CV45Q5	68756	76
Q7MBQ	72491	242	QH23SP6FP	48811	w.o.	QS12VP6D	58659	53	QS18EP6CV45Q7	72001	76
Q853E	31648	w.o.	QH23SP6FPQ	48822	w.o.	QS12VP6DBZ	58671	53	QS18EP6CV45Q8	71989	76
Q853E-B	31649	w.o.	QH23SP6FPY	48835	w.o.	QS12VP6DBZQ	58672	53	QS18EP6D	69209	76
Q8562E	34262	w.o.	QH23SP6FPYQ	48837	w.o.	QS12VP6DQ	58660	53	QS18EP6DB	68746	76
Q8562E-B	34263	w.o.	QH23SP6LP	48802	w.o.	QS12VP6LP	58635	53	QS18EP6DBQ	68752	76
Q85BB62D	34269	w.o.	QH23SP6LPQ	48813	w.o.	QS12VP6LPQ	58636	53	QS18EP6DBQ5	68758	76
Q85BB62D-B	34271	w.o.	QH23SP6R	48806	w.o.	QS12VP6LV	58641	53	QS18EP6DBQ7	72003	76
Q85BB62DL	34259	w.o.	QH23SP6RE	48841	w.o.	QS12VP6LVQ	58642	53	QS18EP6DBQ8	71991	76
Q85BB62DL-B	34261	w.o.	QH23SP6REQ	48843	w.o.	QS12VP6R	58629	53	QS18EP6DQ	69210	76
Q85BB62DL-T9	34258	w.o.	QH23SP6RQ	48817	w.o.	QS12VP6RQ	58630	53	QS18EP6DQ5	69211	76
Q85BB62DL-T9-B	34260	w.o.	QL50AN6XD20BQ	70937	231	QS12VP6W	58665	53	QS18EP6DQ7	72007	76
Q85BB62D-T9	34268	w.o.	QL50AP6XD20BQ	70936	231	QS12VP6WQ	58666	53	QS18EP6DQ8	71995	76
Q85BB62D-T9-B	34270	w.o.	QL55M6XD15BQ	70938	232	QS186E	61618	71	QS18EP6DV	75224	77
Q85BB62LP	34255	w.o.	QL55M6XD30BQ	70939	232	QS186EB	61675	71	QS18EP6DVQ	75226	77
Q85BB62LP-B	34257	w.o.	QL55M6XD50BQ	70940	232	QS186EBQ	61676	71	QS18EP6DVQ5	72493	77
Q85BB62LP-T9	34254	w.o.	QM426E	44331	141	QS186EBQ5	64589	71	QS18EP6DVQ7	75227	77
Q85BB62LP-T9-B	34256	w.o.	QM426EQ	44334	141	QS186EBQ7	66426	71	QS18EP6DVQ8	75228	77
Q85BB62R	34265	w.o.	QM42VN6AF150	45687	142	QS186EBQ8	66448	71	QS18EP6FP	75728	77
Q85BB62R-B	34267	w.o.	QM42VN6AF150Q	45689	142	QS186EQ	61619	71	QS18EP6FPQ	75730	77
Q85BB62R-T9	34264	w.o.	QM42VN6AFV150	48694	142	QS186EQ5	64582	71	QS18EP6FPQ5	75731	77
Q85BB62R-T9-B	34266	w.o.	QM42VN6AFV150Q	48696	142	QS186EQ7	66425	71	QS18EP6FPQ7	75732	77
Q85BW13D	35576	w.o.	QM42VN6D	44338	141	QS186EQ8	66447	71	QS18EP6FPQ8	75733	77
Q85BW13D-B	35578	w.o.	QM42VN6DQ	44340	141	QS186E	70252	72	QS18EP6LP	68742	76
Q85BW13DL	35568	w.o.	QM42VN6FP	45785	142	QS186LE10	70254	72	QS18EP6LPQ	68748	76
Q85BW13DL-B	35570	w.o.	QM42VN6FPQ	45786	142	QS186LE10Q5	71330	72	QS18EP6LPQ5	68754	76
Q85BW13DL-T9	35567	w.o.	QM42VN6LP	44902	141	QS186LE10Q8	70255	72	QS18EP6LPQ7	71999	76
Q85BW13DL-T9-B	35569	w.o.	QM42VN6LPQ	44904	141	QS186LE11	02756	72	QS18EP6LPQ8	71987	76
Q85BW13D-T9	35575	w.o.	QM42VN6R	44337	141	QS186LE11Q5	71331	72	QS18EP6W	69217	77
Q85BW13D-T9-B	35577	w.o.	QM42VN6RQ	44339	141	QS186LE11Q8	02757	72	QS18EP6WQ	69218	77
Q85BW13LP	35564	w.o.	QM42VP6AF150	45688	142	QS186LE12	02758	72	QS18EP6WQ5	69219	77
Q85BW13LP-B	35566	w.o.	QM42VP6AF150Q	45690	142	QS186LE12Q5	71332	72	QS18EP6WQ7	72009	77
Q85BW13LP-T9	35563	w.o.	QM42VP6AFV150	48695	142	QS186LE12Q8	02759	72	QS18EP6WQ8	71997	77
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QS18VN6CV45Q8	66457	72	QS18VP6DQ5	63189	73	QS30FF400Q	73089	114			
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QS18VN6DQ	61652	73	QS18VP6FF100Q7	71883	74	QS30LDLQ	02786	116			
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QS18VN6FF100	71639	74	QS18VP6FF50Q7	71875	73	QS30LLPCQ	71378	116			
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RSBESR	26966	w.o.	S18RW3RQ	29832	w.o.	S30SN6REQ	37086	w.o.	SE612FNC	27349	w.o.
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RSBFF100	32198	w.o.	S18S2P6FF25Q	58427	w.o.	S30SP6FF200	32330	122	SE612FP	26535	w.o.
RSBFF50	32197	w.o.	S18SN6D	29407	96	S30SP6FF200Q	33370	122	SE612FPNC	28931	w.o.
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SLM220P6QN	75459	218	SM2A312FV	26863	83	SM30SRLQD	37149	w.o.	SM312LVMHS	26200	80
SLM30B6	74969	217	SM2A312FVG	29188	83	SM30SRLQD	27290	126	SM312LVMHSQD	28279	80
SLM30B6N	75462	217	SM2A312FVGQD	35485	83	SM30SRLQDB	27377	126	SM312LVMHSQDP	30134	80
SLM30B6QPMMA	75028	217	SM2A312FVQD	35549	83	SM30SRLQDC	27563	126	SM312LVQD	26838	80
SLM30B6QPMAN	75475	217	SM2A312FVQDP	29566	83	SM312C	28302	80	SM312W	26264	80
SLM30N6Q	74976	217	SM2A312LP	49773	83	SM312C2	27337	80	SM312WMHS	27079	80
SLM30N6QN	75452	217	SM2A312LPQD	49775	83	SM312C2MHS	29319	80	SM312WMHSQD	35719	80
SLM30P6Q	74974	217	SM2A312LPQDP	49776	83	SM312C2MHSQD	35973	80	SM312WMHSQDP	35720	80
SLM30P6QN	75451	217	SM2A312LV	25964	83	SM312C2MHSQDP	35974	80	SM312WQD	26892	80
SLM50B6	74977	217	SM2A312LVAG	26055	83	SM312C2QD	27444	80	SM312WQDP	29540	80
SLM50B6N	75463	217	SM2A312LVAGQD	26865	83	SM312C2QDP	35971	80	SM31E	25623	80
SLM50B6QPMMA	75030	217	SM2A312LVAGQDP	29557	83	SM312CMHS	35722	80	SM31EL	25724	80
SLM50B6QPMAN	75476	217	SM2A312LVQD	26845	83	SM312CMHSQDP	35723	80	SM31ELMHSQD	30236	80
SLM50N6Q	74980	217	SM2A312LVQDP	29556	83	SM312CQD	29184	80	SM31ELMHSQDP	35669	80
SLM50N6QN	75454	217	SM2A312W	26265	83	SM312CQDP	35721	80	SM31ELQD	26952	80
SLM50P6Q	74978	217	SM2A312WQD	26893	83	SM312CV	25621	80	SM31ELQDP	29535	80
SLM50P6QN	75453	217	SM2A312WQDP	29559	83	SM312CV2	26159	80	SM31EMHS	26411	80
SLM80B6	74981	217	SM2A31R	26060	82	SM312CV2B	50386	80	SM31EMHSQD	29268	80
SLM80B6N	75464	217	SM2A31REQD	37125	w.o.	SM312CV2BQD	51253	80	SM31EMHSQDP	35667	80
SLM80B6QPMMA	75032	217	SM2A31REQDP	37131	w.o.	SM312CV2G	50384	80	SM31EPD	26537	80
SLM80B6QPMAN	75477	217	SM2A31RL	26061	82	SM312CV2GQD	50986	80	SM31EPDMHSQD	35710	80
SLM80N6Q	74984	217	SM2A31RLE	37120	w.o.	SM312CV2MHSQDP	35895	80	SM31EPDMHSQDP	35711	80
SLM80N6QN	75456	217	SM2A31RLEQD	37126	w.o.	SM312CV2QD	26903	80	SM31EPDQD	26891	80
SLM80P6Q	74982	217	SM2A31RLEQDP	37132	w.o.	SM312CV2QDP	29542	80	SM31EPDQDP	29547	80
SLM80P6QN	75455	217	SM2A31RLQD	26991	82	SM312CVB	47271	80	SM31EQD	26835	80
SLO30VB6	59768	220	SM2A31RLQDP	29555	82	SM312CVBQD	47277	80	SM31EQDP	28550	80
SLO30VB6Q	59769	220	SM2A31RPD	26566	82	SM312CVG	50966	80	SM31R	25622	80
SLO30VB6Y	59771	220	SM2A31RPDE	37121	w.o.	SM312CVGQD	50985	80	SM31RDL	26889	80
SLO30VB6YQ	59772	220	SM2A31RPDEQD	37127	w.o.	SM312CVMH	26357	80	SM31RLE	37116	80
SM2A30PRL	27297	126	SM2A31RPDEQDP	37133	w.o.	SM312CVMHSQD	27571	80	SM31REQD	37122	80
SM2A30PRLB	27384	126	SM2A31RPDQD	26968	82	SM312CVMHSQDP	35725	80	SM31REQDP	37128	80
SM2A30PRLBE	38783	w.o.	SM2A31RPDQDP	29565	82	SM312CVQD	26832	80	SM31RL	25725	80
SM2A30PRLC	33190	126	SM2A31RQD	26846	82	SM312CVQDP	29541	80	SM31RLE	37117	80
SM2A30PRLCE	38786	w.o.	SM2A912C	26641	w.o.	SM312D	25619	80	SM31RLEQD	37123	80
SM2A30PRLD	37141	w.o.	SM2A912CQD	26646	w.o.	SM312DBZ	26372	80	SM31RLEQDP	37129	80
SM2A30PRLQD	37147	w.o.	SM2A912CV	26642	w.o.	SM312DBZMHS	35715	80	SM31RLMHSQD	30232	80
SM2A30PRLNC	27299	126	SM2A912CVQD	26647	w.o.	SM312DBZMHSQD	35717	80	SM31RLMHSQDP	35708	80
SM2A30PRLNCB	27386	126	SM2A912D	26569	w.o.	SM312DBZMHSQDP	35718	80	SM31RLQD	26951	80
SM2A30PRLNCC	36122	126	SM2A912DQD	26570	w.o.	SM312DBZQD	26914	80	SM31RLQDP	29536	80
SM2A30PRLNCE	37142	w.o.	SM2A912DSR	26571	w.o.	SM312DBZQDP	29551	80	SM31RMHS	26412	80
SM2A30PRLNCEQD	37148	w.o.	SM2A912DSRQD	26572	w.o.	SM312DMHS	26909	80	SM31RMHSQD	29269	80
SM2A30PRLNCQD	27300	126	SM2A912F	26573	w.o.	SM312DMHSQDP	35714	80	SM31RMHSQDP	35668	80
SM2A30PRLNCQDB	27387	126	SM2A912FP	27722	w.o.	SM312DQD	26834	80	SM31RPD	26536	80
SM2A30PRLNCQDC	32092	126	SM2A912FQD	26574	w.o.	SM312DQD-75904	75904	343	SM31RPDE	37118	80
SM2A30PRLQD	27298	126	SM2A912LV	26575	w.o.	SM312DQDP	29539	80	SM31RPDEQD	37124	80
SM2A30PRLQDB	27385	126	SM2A912LVAG	26643	w.o.	SM312F	25620	81	SM31RPDEQDP	37130	80
SM2A30PRLQDC	35911	126	SM2A912LVAGQD	26653	w.o.	SM312FMHS	26106	81	SM31RPDMHS	27333	80
SM2A30SRL	27293	126	SM2A912LVQD	26577	w.o.	SM312FMHSQD	27000	81	SM31RPDMHSQD	35709	80
SM2A30SRLB	27380	126	SM2A91R	26579	w.o.	SM312FMHSQDP	35897	81	SM31RPDMHSQDP	35712	80
SM2A30SRLC	28463	126	SM2A91RF	26644	w.o.	SM312FP	25916	81	SM31RPDQD	26890	80
SM2A30SRLD	37144	w.o.	SM2A91RFQD	26649	w.o.	SM312FP1	60904	w.o.	SM31RPDQDP	29548	80
SM2A30SRLQD	37150	w.o.	SM2A91RQD	26648	w.o.	SM312FP1H	60906	w.o.	SM31RQD	26839	80
SM2A30SRLNC	27295	126	SM2A91RSR	26645	w.o.	SM312FP1HQD	60907	w.o.	SM31RQDP	28551	80
SM2A30SRLNCB	27382	126	SM2A91RSRQD	26650	w.o.	SM312FP1QD	60905	w.o.	SM502A	16658	w.o.
SM2A30SRLNCC	32127	126	SM303E	34131	w.o.	SM312FPB	47273	81	SM502A 24V	18853	w.o.
SM2A30SRLNCE	37145	w.o.	SM303EQ1	34161	w.o.	SM312FPBQD	47279	81	SM512C1	19175	w.o.
SM2A30SRLNCEQD	37151	w.o.	SM306E	33315	w.o.	SM312FPG	50968	81	SM512CV1	19176	w.o.
SM2A30SRLNCQD	27296	126	SM306EQ	34158	w.o.	SM312FPGQD	50988	81	SM512CX1	26062	w.o.
SM2A30SRLNCQDB	27383	126	SM30AW3R	34132	w.o.	SM312FPH	26986	81	SM512DB	17577	w.o.
SM2A30SRLNCQDC	35913	126	SM30AW3RE	37112	w.o.	SM312FPMHS	26071	81	SM512DBCV	18783	w.o.
SM2A30SRLQD	27294	126	SM30AW3REQ1	37114	w.o.	SM312FPMHSQD	27033	81	SM512DBP	19099	w.o.
SM2A30SRLQDB	27381	126	SM30AW3RQ1	34162	w.o.	SM312FPMHSQDP	35900	81	SM512DBX	19062	w.o.
SM2A30SRLQDC	34367	126	SM30CC-306	45133	420	SM312FPQD	26837	81	SM512LB	18589	w.o.
SM2A312C	30645	83	SM30CC-312	27388	420	SM312FPQDP	29544	81	SM512LBD	18674	w.o.
SM2A312C2	34065	83	SM30CC-330	47359	w.o.	SM312FQD	26836	81	SM512LBDX	19798	w.o.
SM2A312C2QD	27628	83	SM30PRL	27291	126	SM312FQDP	29543	81	SM512LBF0	17578	w.o.
SM2A312C2QDP	35976	83	SM30PRLB	27378	126	SM312FV	25649	81	SM51EB	18585	w.o.
SM2A312CQD	33730	83	SM30PRLC	28295	126	SM312FVB	47272	81	SM51EB6	18587	w.o.
SM2A312CQDP	35724	83	SM30PRLD	37140	w.o.	SM312FVBQD	47278	81	SM51EBL	18651	w.o.
SM2A312CV	25992	83	SM30PRLQD	37146	w.o.	SM312FVG	50969	81	SM51RB	18586	w.o.
SM2A312CV2	26185	83	SM30PRLQDP	27292	126	SM312FVGQD	50987	81	SM51R86	18588	w.o.
SM2A312CV2QD	26911	83	SM30PRLQDB	27379	126	SM312FVMHS	26586	81	SM51RBL	18653	w.o.
SM2A312CV2QDP	29561	83	SM30PRLQDC	33220	126	SM312FVMHSQD	27143	81	SM53E	16483	w.o.
SM2A312CVG	27057	83	SM30RW3R	34133	w.o.	SM312FVMHSQDP	35898	81	SM53EFO	16830	w.o.
SM2A312CVGQD	27332	83	SM30RW3RE	37113	w.o.	SM312FVQD	26990	81	SM53R	16484	w.o.
SM2A312CVGQDP	29567	83	SM30RW3REQ1	37115	w.o.	SM312FVQDP	29549	81	SM53RFO	16831	w.o.
SM2A312CVQD	26840	83	SM30RW3RQ1	34163	w.o.	SM312LP	49769	80	SM53RL	19368	w.o.
SM2A312CVQDP	29560	83	SM30SN6R	33316	w.o.	SM312LPMHS	50396	80	SM912C	26012	w.o.
SM2A312D	25965	82	SM30SN6RE	37108	w.o.	SM312LPMHSQD	50398	80	SM912CQD	26802	w.o.
SM2A312DBZ	26473	82	SM30SN6REQ	37110	w.o.	SM312LPMHSQDP	50399	80	SM912CV	26031	w.o.
SM2A312DBZQD	27429	82	SM30SN6RQ	34159	w.o.	SM312LPQD	49771	80	SM912CVQD	26030	w.o.
SM2A312DBZQDP	29568	82	SM30SP6R	33558	w.o.	SM312LPQD-76885	76885	343	SM912D	25172	w.o.
SM2A312DQD	26841	82	SM30SP6REQ	37111	w.o.	SM312LPQDP	49772	80	SM912DQD	25361	w.o.
SM2A312DQDP	29558	82	SM30SP6RQ	34160	w.o.	SM312LV	25618	80	SM912DQDH	26340	w.o.
SM2A312F	25966	83	SM30SRL	27289	126	SM312LVAG	25776	80	SM912DSR	25290	w.o.
SM2A312FP	26057	83	SM30SRLB	27376	126	SM312LVAGMHS	28905	80	SM912DSRQD	26397	w.o.
SM2A312FPQD	26844	83	SM30SRLBE	38788	w.o.	SM312LVAGMHSQD	34921	80	SM912F	25516	w.o.
SM2A312FPQDP	29563	83	SM30SRLC	28568	126	SM312LVAGMHSQDP	35713				

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SM912FV	25613	w.o.	SMA95RSRQD	26022	w.o.	SMBAMS18P	73134	384	SMBPVD100AB	71339	394
SM912FVQD	26039	w.o.	SMA990CV	26550	w.o.	SMBAMS18RA	73136	384	SMBPVD225A	71340	394
SM912LV	25171	w.o.	SMA990CVMB	26976	w.o.	SMBAMS30P	73135	384	SMBPVD225AB	71341	394
SM912LVAG	26186	w.o.	SMA990CVMBQD	27008	w.o.	SMBAMS30PL52	77906	384	SMBQ12A	74341	393
SM912LVAGQD	26398	w.o.	SMA990CVQD	26896	w.o.	SMBAMS30PL52R	77905	385	SMBQ12T	73722	394
SM912LVQD	25336	w.o.	SMA990F	26551	w.o.	SMBAMS30RA	73137	385	SMBQ20H	79041	394
SM912LVQDH	26341	w.o.	SMA990FMB	26979	w.o.	SMBAMS30RLJ	77144	385	SMBQ20L	79040	395
SM91EAN	39515	w.o.	SMA990FMBQD	27011	w.o.	SMBAMS30RLS	77145	385	SMBQ20LV	79042	395
SM91EANQD	39517	w.o.	SMA990FP	26552	w.o.	SMBAMSBR	73138	386	SMBQ20U	79043	395
SM91EBN	41282	w.o.	SMA990FPMB	26980	w.o.	SMBAMSLT3IP	73442	386	SMBQ50	66226	395
SM91EBNQD	41284	w.o.	SMA990FPMBQD	27012	w.o.	SMBAMSLT3P	73132	386	SMBQ50IP	71205	w.o.
SM91ECN	41286	w.o.	SMA990FPQD	26898	w.o.	SMBAMSQ60IP	73441	386	SMBQ60	67592	396
SM91ECNQD	41288	w.o.	SMA990FQD	26897	w.o.	SMBAMSQ60P	73133	387	SMBQ60IP	71206	w.o.
SM91EQDH	27180	w.o.	SMA990LT	26553	w.o.	SMBAMSR85P	74752	w.o.	SMBQC50	71679	396
SM91R	25173	w.o.	SMA990LTMB	26978	w.o.	SMBAMSRAB	79530	387	SMBQS12PD	59606	396
SM91RAN	39516	w.o.	SMA990LTMBQD	27010	w.o.	SMBASC	79689	404	SMBQS12S	59607	396
SM91RANQD	39554	w.o.	SMA990LTQD	26858	w.o.	SMBDX80DIN	77161	387	SMBQS18A	69721	397
SM91RBN	41283	w.o.	SMA990LV	26554	w.o.	SMBE12USS	78303	442	SMBQS18AF	67467	397
SM91RBNQD	41285	w.o.	SMA990LVAG	26555	w.o.	SMBF	53258	387	SMBQS18DIN	77599	307
SM91RCN	41287	w.o.	SMA990LVAGMB	26977	w.o.	SMBFP3	53264	388	SMBQS18RA	73812	397
SM91RCNQD	41289	w.o.	SMA990LVAGMBQD	27009	w.o.	SMBFP4	53263	388	SMBQS18Y	68865	398
SM91RF	27005	w.o.	SMA990LVAGQD	26899	w.o.	SMBFP4N	53257	388	SMBQS18YL	77835	398
SM91RFQD	25530	w.o.	SMA990LVMB	26975	w.o.	SMBFP6	53262	388	SMBQS30L	02809	398
SM91RQD	25360	w.o.	SMA990LVMBQD	27007	w.o.	SMBLASRA	77851	404	SMBQS30LT	02810	398
SM91RQDH	27179	w.o.	SMA990LVQD	26868	w.o.	SMBLGA	55815	389	SMBQS30Y	02811	399
SM91RSR	25288	w.o.	SMB127	53394	w.o.	SMBLGA	55906	389	SMBQS30YL	72741	399
SM91RSRQD	25443	w.o.	SMB12MM	27635	w.o.	SMBLS	26284	w.o.	SMBR55F01	67104	399
SMA30PEL	27287	126	SMB1812	74261	446	SMBLT31	68505	389	SMBR55F02	02903	w.o.
SMA30PELFB	27374	126	SMB1812SF	52520	w.o.	SMBLT32	69236	389	SMBR55FRA	58809	399
SMA30PELFC	28294	126	SMB1815SF	53279	376	SMBLT3IP	70973	390	SMBSL	58335	400
SMA30PELQD	27288	126	SMB18A	33200	377	SMBLT7	73711	390	SMBSP3	53256	w.o.
SMA30PELQDB	27375	126	SMB18C	32635	w.o.	SMBLT7F	73712	390	SMBT18Y	69554	400
SMA30PELQDC	32093	126	SMB18FA	74004	377	SMBLX	02915	390	SMBVLA62X62RA	74264	409
SMA30SEL	27285	126	SMB18FM	79421	377	SMBLXR	02914	391	SMBVLA62X62S	74263	409
SMA30SELB	27372	126	SMB18Q	32721	377	SMBP42ASM	75111	405	SMBVSI5	55554	400
SMA30SELC	28464	126	SMB18S	33203	w.o.	SMBP4ASM	75109	405	SMBVSI1C	56797	400
SMA30SELQD	27286	126	SMB18SF	52519	378	SMBP4L	72603	w.o.	SMBVSI1T	55496	401
SMA30SELQDB	27373	126	SMB18SM	29352	w.o.	SMBP4AL100	79118	405	SMBVSI1TC	56795	401
SMA30SELQDC	27562	126	SMB18UR	52517	378	SMBP4AL50	79442	405	SMBVS2RA	58603	401
SMA31E	26058	82	SMB18UR-2	69726	w.o.	SMBP4RA	72602	w.o.	SMBVS3S	62618	401
SMA31EL	26059	82	SMB19	31821	w.o.	SMBP4RAS	75289	406	SMBVS3T	62617	402
SMA31ELQD	26992	82	SMB250	16487	w.o.	SMBP4RAS	75289	406	SMBVS4SRA	69435	402
SMA31EPD	26567	82	SMB250C	16487	w.o.	SMBPPDE	02767	407	SMBWFTLR	71746	409
SMA31EPDQD	26969	82	SMB300	16697	w.o.	SMBPPOH	66813	407	SMBWFTLS	71747	409
SMA31EPDQDP	29564	82	SMB3012	74895	446	SMBPPEA	72019	438	SME312CV	53701	86
SMA31EQD	26842	82	SMB3018SC	53952	378	SMBPPEF	72089	438	SME312CV2	53704	86
SMA31EQDQD	29552	82	SMB30A	32723	378	SMBPPES	72088	438	SME312CV2MHS	56646	86
SMA912C	25968	w.o.	SMB30C	32636	w.o.	SMBPPF1	56245	441	SME312CV2MHSQD	56647	86
SMA912CQD	26803	w.o.	SMB30FA	74005	379	SMBPPF3	56264	w.o.	SME312CV2QD	53705	86
SMA912CV	26040	w.o.	SMB30FVK	75992	w.o.	SMBPPFB	56265	441	SME312CVB	53725	86
SMA912CVQD	26056	w.o.	SMB30MM	27162	379	SMBPPK	71041	441	SME312CVBMHS	56666	86
SMA912D	25177	w.o.	SMB30Q	32722	379	SMBPPK3	71383	441	SME312CVBMHSQD	56667	86
SMA912DQD	25350	w.o.	SMB30RAVK	75993	w.o.	SMBPPK6	71384	441	SME312CVBQD	53726	86
SMA912DSR	25289	w.o.	SMB30S	33204	w.o.	SMBPPKB	71042	441	SME312CVG	53722	86
SMA912DSRQD	25383	w.o.	SMB30SC	52521	379	SMBPPKE3	71043	441	SME312CVGMHS	56663	86
SMA912F	25524	w.o.	SMB30SK	52523	380	SMBPPKE6	71097	441	SME312CVGMHSQD	56664	86
SMA912FQD	25517	w.o.	SMB30SM	27536	w.o.	SMBPPLK	74901	407	SME312CVGQD	53723	86
SMA912LV	25176	w.o.	SMB30SUS	52522	380	SMBPPLU	70549	407	SME312CVMHS	56643	86
SMA912LVAG	25558	w.o.	SMB30UR	52516	380	SMBPPOAL100	79443	406	SME312CVMHSQD	56644	86
SMA912LVAGQD	25555	w.o.	SMB312B	25519	380	SMBPPOAL50	79444	406	SME312CVW	53702	86
SMA912LVQD	25349	w.o.	SMB312F	25675	w.o.	SMBPPRA	69381	408	SME312CVW	55526	85
SMA915CV	25883	w.o.	SMB312PD	26651	381	SMBPPRH	79112	408	SME312CVMHS	57504	85
SMA915CVQD	25884	w.o.	SMB312S	25518	w.o.	SMBPPSU	76808	408	SME312CVMHSQD	58296	85
SMA915D	25881	w.o.	SMB4050YL	call	381	SMBPPU	69380	408	SME312CVWQD	55527	85
SMA915DQD	25882	w.o.	SMB42T	54137	381	SMBPVA1	56884	391	SME312D	53707	85
SMA915DSR	26019	w.o.	SMB46A	52518	381	SMBPVA10	56809	392	SME312DMHS	56649	85
SMA915F	25885	w.o.	SMB46DF	48740	w.o.	SMBPVA10A	62447	392	SME312DMHSQD	56650	85
SMA915FP	26487	w.o.	SMB46L	48747	382	SMBPVA10AB	70806	392	SME312DQD	53708	85
SMA915FPQD	26895	w.o.	SMB46S	48748	382	SMBPVA10C	71345	392	SME312DQDP	56640	85
SMA915FQD	25886	w.o.	SMB46U	48746	382	SMBPVA11	71790	391	SME312DV	64083	85
SMA915LV	25879	w.o.	SMB46X3	53395	w.o.	SMBPVA12	78680	w.o.	SME312DVQD	60335	85
SMA915LVAG	26017	w.o.	SMB500	16696	w.o.	SMBPVA13	56810	392	SME312F	53713	86
SMA915LVAGQD	26018	w.o.	SMB500SS	18512	w.o.	SMBPVA13A	62448	392	SME312FMHS	56654	86
SMA915LVQD	25880	w.o.	SMB55A	53259	382	SMBPVA13AB	70807	392	SME312FMHSQD	56655	86
SMA91E	25174	w.o.	SMB55F	53260	383	SMBPVA13C	71346	w.o.	SME312FP	53731	86
SMA91EF	25563	w.o.	SMB55RA	53261	383	SMBPVA16	56811	392	SME312FP1	61283	86
SMA91EFQD	25529	w.o.	SMB55S	53265	383	SMBPVA16A	62499	392	SME312FPB	54622	86
SMA91EQD	25312	w.o.	SMB700	16640	w.o.	SMBPVA16AB	70808	392	SME312FPBMHS	58284	86
SMA91ESR	25286	w.o.	SMB700F	26475	w.o.	SMBPVA16C	71347	w.o.	SME312FPBMHSQD	58285	86
SMA91ESRQD	25444	w.o.	SMB700M	17726	w.o.	SMBPVA2	54451	391	SME312FPBQD	54623	86
SMA91R	25175	w.o.	SMB700P	16489	w.o.	SMBPVA5	56500	392	SME312FPG	54628	86
SMA91RF	25562	w.o.	SMB700SS	17720	w.o.	SMBPVA5A	62446	392	SME312FPGMHS	58290	86
SMA91RQD	25313	w.o.	SMB800	25056	w.o.	SMBPVA5AB	70805	392	SME312FPGMHSQD	58291	86
SMA91RSR	25287	w.o.	SMB85B	32799	w.o.	SMBPVA5C	71344	392	SME312FPGQD	54629	86
SMA91RSRQD	25896	w.o.	SMB85R	32798	w.o.	SMBPVA6	64897	392	SME312FPMHS	56672	86
SMA95R	25887	w.o.	SMB8MM	67363	383	SMBPVA6-1	76097	w.o.	SME312FPMHSQD	56673	86
SMA95RF	26023	w.o.	SMB900	25285	w.o.	SMBPVA7	71342	393	SME312FPD	53732	86
SMA95RFQD	26024	w.o.	SMB900SS	27188	w.o.	SMBPVA8	71343	393	SME312FPW	55520	86
SMA95RQD	25888	w.o.	SMBABM	63041	404	SMBPVA9	71348	393	SME312FPWMHS	58293	86
SMA95RSR	26021	w.o.	SMBACM	63040	404	SMBPVD100A	71338	394	SME312FPWMHSQD	58294	86

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SME312FQD	53714	86	SMW915LV	26170	w.o.	T18AW3RE	37064	w.o.	T30AD9FF150Q	41078	w.o.
SME312FV	53728	86	SMW915LVAG	26172	w.o.	T18AW3REQ1	37066	w.o.	T30AW3FF200	32490	131
SME312FVB	54594	86	SMW915LVAGQD	26173	w.o.	T18AW3RQ1	33424	104	T30AW3FF200Q1	33430	131
SME312FVBMHS	56675	86	SMW915LVQD	26171	w.o.	T18GRXN	76393	363	T30AW3FF400	32491	131
SME312FVBMHSQD	56676	86	SMW95R	26174	w.o.	T18GRXNQ	76394	363	T30AW3FF400Q1	33431	131
SME312FVBQD	54595	86	SMW95RQD	26175	w.o.	T18GRXNQP	call	363	T30AW3FF600	32492	131
SME312FVQ	54625	86	SMW95RSR	26178	w.o.	T18GRXP	76391	363	T30AW3FF600Q1	34347	131
SME312FVGMHS	58287	86	SMW95RSRQD	26179	w.o.	T18GRXPQ	76392	363	T30AW3LP	32493	130
SME312FVGMHSQD	58288	86	SOP-E12-150SS	78081	442	T18GRXPQP	call	363	T30AW3LPQ1	33440	130
SME312FVGQD	54626	86	SOP-E12-300SS	78082	442	T18GRYN	76390	363	T30AW3R	32495	130
SME312FVMHS	56669	86	SP1000V	16501	w.o.	T18GRYNQ	74042	363	T30AW3RE	37072	w.o.
SME312FVMHSQD	56670	86	SP100AF	33170	w.o.	T18GRYNQP	call	363	T30AW3REQ1	37074	w.o.
SME312FVQD	53729	86	SP100C	19706	w.o.	T18GRYP	75099	363	T30AW3RQ1	33446	130
SME312FVW	55523	86	SP100CCF	25151	w.o.	T18GRYPQ	74041	363	T30GRXN	76407	363
SME312FVWMHS	58346	86	SP100D	19707	w.o.	T18GRYPQP	call	363	T30GRXNQ	76408	363
SME312FVWMHSQD	58347	86	SP100DB	25189	w.o.	T18GXYN	76397	363	T30GRXNQP	call	363
SME312FVWQD	55524	86	SP100E	19708	w.o.	T18GXYNQ	76398	363	T30GRXP	76405	363
SME312LP	53716	85	SP100FF	26988	w.o.	T18GXYNQP	call	363	T30GRXPQ	76406	363
SME312LPC	53710	85	SP100R	19709	w.o.	T18GXYP	76395	363	T30GRXPQP	call	363
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SME312LPCMHSQD	56639	85	SP12PEL	27524	w.o.	T18GXYPQP	call	363	T30GRY2NQ	74909	364
SME312LPQD	53711	85	SP12PRL	27526	w.o.	T18GYX7N	76404	365	T30GRY2NPQ	call	364
SME312LPMHS	56657	85	SP12PRLE	37159	w.o.	T18GYX7NQ	75614	365	T30GRY2P	74078	364
SME312LPMHSQD	56658	85	SP12RLEQD	37160	w.o.	T18GYX7NQP	call	365	T30GRY2PQ	74052	364
SME312LPQD	53717	85	SP12SEL	27523	w.o.	T18GYX7P	76403	365	T30GRY2PQP	call	364
SME312LV	55459	85	SP12SELQD	27744	w.o.	T18GYX7PQ	75613	365	T30GRYN	74622	363
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SME312WVMS	56660	85	SP300D	16488	w.o.	T18RW3FF100	33405	105	T30GRYPQ	74024	363
SME312WVMSQD	56661	85	SP300E	16492	w.o.	T18RW3FF100Q1	33411	105	T30GRYPQP	call	363
SME312WQD	53720	85	SP300EL	16493	w.o.	T18RW3FF25	58387	105	T30GXYN	76411	363
SMH241F	53266	402	SP300L	16494	w.o.	T18RW3FF25Q1	58394	105	T30GXYNQ	76412	363
SMI306EBQ	35269	128	SP300R	16495	w.o.	T18RW3FF50	33404	105	T30GXYNQP	call	363
SMI306ECQ	35270	128	SP300RL	16496	w.o.	T18RW3FF50Q1	33409	105	T30GXYP	76409	363
SMI306EQ	35268	128	SP300RLE	37156	w.o.	T18RW3L	34928	104	T30GXYPQ	76410	363
SMI306EYQ	35278	128	SP320D	26541	w.o.	T18RW3LP	33406	104	T30GXYPQP	call	363
SMI306EQ	35277	128	SP3D1	50404	w.o.	T18RW3LPQ1	33419	104	T30GYX7N	76419	365
SMI30AN6RBQ	35272	128	SP3ER1	50405	w.o.	T18RW3LQ1	34929	104	T30GYX7NQ	75616	365
SMI30AN6RCQ	35273	128	SP3ER2	50406	w.o.	T18RW3R	33407	104	T30GYX7NPQ	call	365
SMI30AN6RQ	35271	128	SP510	16499	w.o.	T18RW3RQ1	33425	104	T30GYX7P	76418	365
SMI30AN6RYCQ	35280	128	SP510D	16500	w.o.	T18S2P6DQ	45755	w.o.	T30GYX7PQ	75615	365
SMI30AN6RYQ	35279	128	SP8ER1	51620	w.o.	T18S2P6FF25Q	58397	w.o.	T30GYX7PQP	call	365
SMI30RN6RBQ	35275	128	SP8ER2	51621	w.o.	T18SN6D	33814	102	T30RW3FF200	33426	105
SMI30RN6RCQ	35276	128	SP-DPB1	72782	447	T18SN6DQ	34630	102	T30RW3FF200Q1	33432	105
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SMI912FPQD	27219	w.o.	STBVP6Q	64180	239	T18SN6L	34655	102	T30RW3R	33429	104
SMI912FQD	25684	w.o.	STBVP6Q5	64181	239	T18SN6LP	32467	102	T30RW3RE	37073	w.o.
SMI912LVAGQD	27218	w.o.	STBVR81	64190	239	T18SN6LPM5V	43095	w.o.	T30RW3REQ1	37075	w.o.
SMI912LVQD	25681	w.o.	STBVR81L	64193	239	T18SN6LPQ	33416	102	T30RW3RQ1	33447	104
SMI91EFQD	25690	w.o.	STBVR81LQ	64194	239	T18SN6LQ	34739	102	T30SN6FF200	32479	130
SMI91EQD	25688	w.o.	STBVR81LQ6	64195	239	T18SN6R	32469	102	T30SN6FF200Q	33434	130
SMI91ESRQD	25689	w.o.	STBVR81Q	64191	239	T18SN6RE	37060	w.o.	T30SN6FF400	32480	130
SMI91REQD	37163	w.o.	STBVR81Q6	64192	239	T18SN6REQ	37062	w.o.	T30SN6FF400Q	33435	130
SMI91RFQD	25687	w.o.	STP07	69985	422	T18SN6RQ	33421	102	T30SN6FF600	32481	130
SMI91RSREQD	37164	w.o.	STP25	69986	422	T18SP6D	34629	102	T30SN6FF600Q	34348	130
SMI91RSRQD	25686	w.o.	STPX07	69987	422	T18SP6DQ	34631	102	T30SN6LP	32482	130
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SMICC-312	36356	420	STPX75	75320	422	T18SP6FF100Q	33415	102	T30SN6R	32484	130
SMICC-330	36357	420	SU923QD	26771	w.o.	T18SP6FF25	56559	102	T30SN6RE	37068	w.o.
SMP1	71734	w.o.	SU925QD-24	27024	w.o.	T18SP6FF25Q	41618	102	T30SN6REQ	37070	w.o.
SMP2	71829	w.o.	SUA923QD	26772	w.o.	T18SP6FF50	32470	102	T30SN6RQ	33443	130
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SMU315CV2	55249	88	SUB923QD	26773	w.o.	T18SP6L	34683	102	T30SP6FF200	32485	130
SMU315D	52570	88	SUB925QD	26218	w.o.	T18SP6LP	32472	102	T30SP6FF200Q	33436	130
SMU315F	52577	89			T18SP6LPQ	33417	102	T30SP6FF400	32486	130	
SMU315FP	55043	89			T18SP6LQ	34740	102	T30SP6FF400Q	33437	130	
SMU315FV	52573	89	T183E	32477	104	T18SP6R	32473	102	T30SP6FF600	32487	130
SMU315LP	52574	88	T183EQ1	33423	104	T18SP6RE	37061	w.o.	T30SP6FF600Q	34349	130
SMU315LV	52572	88	T186E	32468	102	T18SP6REQ	37063	w.o.	T30SP6LP	32488	130
SMU315W	52571	88	T186EQ	33420	102	T18SP6RQ	33422	102	T30SP6LPQ	33439	130
SMU31E	52575	88	T186UE	38269	285	T18VN6UR	38512	285	T30SP6R	32489	130
SMU31EL	55898	88	T186UEQ	38509	285	T18VN6URQ	38513	285	T30SP6RE	37069	w.o.
SMU31R	52576	88	T18AW3D	34922	104	T18VP6UR	38510	285	T30SP6REQ	37071	w.o.
SMU31RL	55897	88	T18AW3DQ1	34923	104	T18VP6URQ	38511	285	T30SP6RQ	33444	130
SMW915CV	26162	w.o.	T18AW3FF100	32475	105	T18XRYN	76401	363	T30UDNA	55547	273
SMW915CVQD	26163	w.o.	T18AW3FF100Q1	33410	105	T18XRYNQ	76402	363	T30UDNAQ	55548	273
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SMW915DQD	26165	w.o.	T18AW3FF25Q1	58393	105	T18XRYP	76399	363	T30UDNBQ	56886	273
SMW915DSR	26166	w.o.	T18AW3FF50	32474	105	T18XRYPQ	76400	363	T30UDPAQ	55544	273
SMW915DSRQD	26167	w.o.	T18AW3FF50Q1	33408	105	T18XRYPQP	call	363	T30UDPB	55550	273
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SMW915FP	26495	w.o.	T18AW3LP	32476	104	T303EQ1	33445	130	T30UHNA	56891	273
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T30UHNBQ	58807	273	T8RN6D50Q	66658	50	UC-LJ3	18826	w.o.	VS3AP5R	62631	65
T30UHPA	56888	273	T8RN6R	66665	50	UC-LS10E	26064	w.o.	VS3AP5RQ	62632	65
T30UHPAQ	56889	273	T8RN6RQ	66666	50	UC-LS10EL	26066	w.o.	VS3AP5XLP	62623	65
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T30UINAQ	55978	273	T8RP6D50Q	66662	50	UC-LW	18830	w.o.	VS3RN5R	62629	65
T30UINB	55983	273	T8RP6R	66669	50	UC-R55	55009	445	VS3RN5RQ	62630	65
T30UINB-CRFV	74838	273	T8RP6RQ	66670	50	UC-RF	16532	w.o.	VS3RN5XLP	62621	65
T30UINB-CRFV	74838	273	TGR	20077	209	UPFA-1-100	65888	203	VS3RN5XLPQ	62622	65
T30UINBQ	55984	273	TGR3/8MPFMQ	23268	195	UPFA-2-100	65889	203	VS3RN5XLV	63713	65
T30UINBQ-CRFV	74839	273	TGR-6.68	22866	w.o.	UWG18-5.0	77342	444	VS3RN5XLVQ	63714	65
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T30UIPB	55980	273	TGRM8MM-16.5	70288	w.o.				VS3RP5XLP	62625	65
T30UIPB-CRFV	74840	273	TGRM8MM-18	70261	w.o.	VFT-1.3MVSA	22680	w.o.	VS3RP5XLPQ	62626	65
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T30UIPBQ-CRFV	74841	273	TGRMSSMCG-2	24675	w.o.	VFT-M8MVSMS1	59232	w.o.	VS3RP5XLVQ	63718	65
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T30UUNAQ	55990	274	TGRMSSMCGMC-1.5	24663	w.o.	VFT-M8MVSMS12L	64438	w.o.	VS4AN5RQ	69428	68
T30UUNB	55995	274	TGRMSSMCGMC-31.5	24664	w.o.	VFT-SF.13TS	22500	w.o.	VS4AP5R	69425	68
T30UUNB-CRFV	74842	274	TGRMSSMQ-.75	23212	w.o.	VFT-SF.13VS	23050	w.o.	VS4AP5RQ	69430	68
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T30XRYNQ	call	363	TM18BM6DQ	69852	w.o.	VS1AP5C10Q	63086	59	VTBN6GRQ	75940	358
T30XRYP	76413	363	TM18BM6DQP	71735	w.o.	VS1AP5C20	55299	59	VTBN6L	67501	358
T30XRYPQ	76414	363	TM18BM6LP	66809	w.o.	VS1AP5C20Q	63093	59	VTBN6LQ	67502	358
T30XRYPQ	call	363	TM18BM6LPQ	66810	w.o.	VS1AP5CV10	56494	59	VTBN6Q	67499	358
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T8AN6D100	68684	50	TM18N6LPQP	02890	w.o.	VS1AP5CV20Q	59178	59	VTBN6RLQ	71408	358
T8AN6D100Q	68685	50	TM18P6DQP	02601	w.o.	VS1RN5C10	55294	59	VTBN6RQ	71369	358
T8AN6D50	66655	50	TM18P6LPQP	02602	w.o.	VS1RN5C10Q	63084	59	VTBNB	71870	358
T8AN6D50Q	66656	50	TR100-1	09253	w.o.	VS1RN5C20	55298	59	VTBNBL	71904	358
T8AN6R	66663	50	TR100-12	25098	w.o.	VS1RN5C20Q	63091	59	VTBNBLQ	71905	358
T8AN6RQ	66664	50	TR100-4	09325	w.o.	VS1RN5CV10	56493	59	VTBNBQ	71871	358
T8AP6D100	68688	50	TR100-6	25198	w.o.	VS1RN5CV10Q	63085	59	VTBP6	67504	358
T8AP6D100Q	68689	50				VS1RN5CV20	56497	59	VTBP6B	71873	358
T8AP6D50	66659	50				VS1RN5CV20Q	63092	59	VTBP6BL	71907	358
T8AP6D50Q	66660	50	UC-300AG	26092	445	VS1RP5C10	55296	59	VTBP6BLQ	71908	358
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T8LBRXNQP	76738	w.o.	UC-300C2	26160	445	VS1RP5C20Q	63094	59	VTBP6GRL	75027	358
T8LBRXP	76737	w.o.	UC-300E	26470	445	VS1RP5CV10	56495	59	VTBP6GRLQ	75029	358
T8LBRXPQP	76736	w.o.	UC-300EL	26099	445	VS1RP5CV10Q	63088	59	VTBP6GRQ	75937	358
T8LGBXNQP	76730	w.o.	UC-300EPD	27504	445	VS1RP5CV20	56499	59	VTBP6L	67507	358
T8LGBXP	76729	w.o.	UC-300F	26028	445	VS1RP5CV20Q	63095	59	VTBP6LQ	67508	358
T8LGBXPQP	76728	w.o.	UC-300FP	26271	445	VS25E	57250	62	VTBP6Q	67505	358
T8LGRXN	76722	362	UC-300FP2	59726	445	VS25EQ	69449	62	VTBP6R	71371	358
T8LGRXNQP	76421	362	UC-300L	26027	445	VS25EV	55401	62	VTBP6RL	71410	358
T8LGRXP	76721	362	UC-300LP	52273	445	VS25EVQ	59161	62	VTBP6RLQ	71411	358
T8LGRXPQP	76420	362	UC-300RPD	27503	445	VS2AN5CV15	61744	62	VTBP6RQ	67994	358
T8LGXYN	76725	362	UC-45C	46137	445	VS2AN5CV15Q	63074	62			
T8LGXYNQP	76423	362	UC-45C4	46139	445	VS2AN5CV30	61748	62			
T8LGXP	76724	362	UC-45D	46131	445	VS2AN5CV30Q	63078	62			
T8LGXPQP	76422	362	UC-45F	46133	445	VS2AN5R	55402	62			
T8LGYX7N	76741	365	UC-45FP	46135	445	VS2AN5RQ	63097	62			
T8LGYX7NQP	76427	365	UC-45L	44705	445	VS2AP5CV15	61745	62			
T8LGYX7P	76740	365	UC-45LL	44673	445	VS2AP5CV15Q	63075	62			
T8LGYX7PQP	76426	365	UC-45LLP	46141	445	VS2AP5CV30	61749	62			
T8LOXXP	76720	w.o.	UC-45LP	46126	445	VS2AP5CV30Q	63079	62			
T8LRGX7NQP	76744	w.o.	UC-600C.7	28906	w.o.	VS2AP5R	55404	62			
T8LRGX7P	76743	w.o.	UC-600D-AC	62335	w.o.	VS2AP5RQ	61596	62			
T8LRGX7PQP	76742	w.o.	UC-900AG	25592	w.o.	VS2RN5CV15	61746	62			
T8LBXPQP	75757	w.o.	UC-900AGB	26509	w.o.	VS2RN5CV15Q	63076	62			
T8LBXYP	76735	w.o.	UC-900C	26026	w.o.	VS2RN5CV30	61750	62			
T8LBXYPQP	76732	w.o.	UC-900DSR	25624	w.o.	VS2RN5CV30Q	63080	62			
T8LXRP	76715	w.o.	UC-900F	26025	w.o.	VS2RN5R	55403	62			
T8LXRPQP	75755	w.o.	UC-900FP	26777	w.o.	VS2RN5RQ	63098	62			
T8LXRYN	76727	362	UC-900J	25796	w.o.	VS2RP5CV15	61747	62			
T8LXRYNQP	76425	362	UC-900L	26002	w.o.	VS2RP5CV15Q	63077	62			
T8LXRYP	76726	362	UC-900LG	27126	w.o.	VS2RP5CV30	61751	62			
T8LXRYPQP	76424	362	UC-C	16523	w.o.	VS2RP5CV30Q	63081	62			
T8LXXWP	76718	w.o.	UC-C4	16699	w.o.	VS2RP5R	55405	62			
T8LXXWPQP	75758	w.o.	UC-C6	16524	w.o.	VS2RP5RQ	59175	62			
T8LXXYP	76716	w.o.	UC-CMPL	25445	w.o.	VS35EV	62635	65			
T8LXXYPQP	75756	w.o.	UC-D	16526	w.o.	VS35EVQ	62636	65			
T8RN6D100	68686	50	UC-DJ	19127	w.o.	VS3AN5R	62627	65			
			UC-EF	16527	w.o.	VS3AN5RQ	62628	65			
			UC-F	16528	w.o.	VS3AN5XLP	62619	65			
			UC-L	16530	w.o.	VS3AN5XLPQ	62620	65			

The Banner Warranty

Banner Engineering Corporation warrants its products to be free from defects for a period of one year. Banner Engineering Corporation will repair or replace, free of charge, any product of its manufacture found to be defective at the time it is returned to the factory during the warranty period. This warranty does not cover damage or liability for the improper application of Banner products. This warranty is in lieu of any other warranty either expressed or implied.



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