Field Networking 101

The combination of intelligent field devices, digital bus networks, and various open communications protocols is producing extraordinary results at process plants around the world.

Just as our ability to retrieve, share, and analyze data has increased tremendously by use of the Internet and PC network technology in our homes and at our desktops, so has our ability to control and manage our process plants improved. Digital connectivity in process manufacturing plants provides an infrastructure for the flow of real-time data from the process level, making it available throughout our enterprise networks. This data is being used at all levels of the enterprise to provide increased process monitoring and control, inventory and materials planning, advanced diagnostics, maintenance planning, and asset management. These digital networks are generally referred to as a "fieldbus network."

Today's advanced and scalable process control systems allow for multiple fieldbus networks to be deployed simultaneously using one engineering tool. This provides for a high degree of flexibility in control options and allows users to install the required devices and bus functionality for a specific control task. Proper selection and deployment of fieldbus networks are providing unprecedented results in process plants worldwide.

### Bus Network Overview

<table>
<thead>
<tr>
<th>Fieldbus Type</th>
<th>Ease of Use</th>
<th>Richness of Info.</th>
<th>Intrinsically Safe</th>
<th>Device Cost</th>
<th>Installed Cost*</th>
<th>Operating Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOUNDATION Fieldbus</td>
<td>High</td>
<td>High</td>
<td>Yes</td>
<td>High</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Profinet-PA</td>
<td>Medium</td>
<td>Medium</td>
<td>Yes</td>
<td>High</td>
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<td>Low</td>
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<tr>
<td>Profinet-PB</td>
<td>Medium</td>
<td>Low</td>
<td>No</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
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<tr>
<td>DeviceNet</td>
<td>Medium</td>
<td>Medium</td>
<td>No</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
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<tr>
<td>Modbus</td>
<td>Medium</td>
<td>Low</td>
<td>No</td>
<td>Medium</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>AS-Interface</td>
<td>High</td>
<td>Low</td>
<td>No</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
</tr>
</tbody>
</table>

* Total system, field device, and wiring costs in a Zone 2 (Class I, Div 2) hazardous area.

### Features and Benefits of Fieldbus Networks

Fieldbus networks provide an array of features and benefits that make them an excellent choice in nearly all process control environments.

- **Reduced field wiring costs**
  - Two wires from the control room to many devices
- **Reduced commissioning costs**
  - Less time and personnel needed to perform I/O wiring checkouts
  - No time spent calibrating intermediate signals (such as 4-20mA signals)
  - Digital values are delivered directly from field devices, increasing accuracy
- **Reduced engineering/operating costs**
  - Much smaller space required for panels, I/O racks, and connectivity boxes
  - Fewer I/O cards and termination panels for control system equipment
  - Lower power consumption by control system hardware
- **Reduced maintenance costs**
  - Diagnostics are predictive and delivered directly to the control and maintenance systems
- **Interoperability of different manufacturers**
  - Open architectures provide much easier and faster integration of a multiple vendor control strategy

- **More production uptime**
  - Initial commissioning and startup is much easier and faster than with conventional systems
  - Maintenance and shutdown periods can be planned and minimized, increasing productivity

### Fieldbus Networks

- **Sensor Bus Networks**
  - At the lowest level of process automation, the Sensor Bus is a low-cost way to extend the benefits of networking to simpler devices and still be able to connect with higher-level protocols using gateways.
  - Sensor buses focus solely on discrete devices and offer little connectivity for analog inputs.
  - AS-i (Actuator Sensor Interface) is the most common Sensor Bus worldwide.
  - Field devices typically connected to Sensor Bus Networks include on/off valves, limit switches, solenoid valves, and pressure, temperature, level, and flow switches.

- **Device Bus Networks**
  - Moving up a level in complexity, device buses provide for control of complex discrete devices and equipment power. Device Bus Networks are typically used for connectivity in areas with a high density of discrete devices, variable speed drives, and motor control centers.
  - The most commonly used Device Bus Networks include DeviceNet and Profinet-DP.
  - DeviceNet is used extensively in factory automation and is also proving useful in process automation.
  - Field devices typically connected to Device Bus Networks include on/off valves, motor control centers, variable frequency drives, and numerous discrete sensors and actuators.

- **Process Control Networks**
  - Process Control Networks are the most advanced fieldbus networks in use today. They provide connectivity of sophisticated process measuring and control equipment. While more complex in functionality, today's process control networks can be easily deployed for new or existing process equipment, and today's engineering tools allow for efficient, effective control. The advanced characteristics of the host interfaces and devices make connectivity, addressing, and commissioning much simpler than conventional devices.
  - FOUNDATION Fieldbus is emerging as a leader at this level, with strong market share in North America and increasing share throughout the world. Profinet PA is also a viable alternative, particularly good acceptance in Europe.
  - Field devices typically connected to Process Control Networks include control valves, temperature and pressure transmitters, level measurement equipment, flow meters, process analytical instruments, and on/off valves where appropriate.

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**Did You Know?**

TopWorx has expertise in a variety of bus protocols, including AS-Interface, FOUNDATION Fieldbus, DeviceNet, Profinet, and Modbus.
Today's process automation systems begin with low-cost, commercial PC-based technologies, then connect to proven fieldbus protocols appropriate for a variety of applications. The result? Precise control, predictive maintenance, and rich information - a proven recipe for improving process plant performance.

Did You Know? TopWorx offers an array of networking support services, including fieldbus network selection, design and implementation, as well as several training classes.
Batch processes contain a dense population of discrete and analog devices, and are well suited for multiple busses: a sophisticated Process Control Network for analog instrumentation, and a simpler Sensor or Device Bus Network for discrete devices.

TopWorx field networking solutions enable seamless integration of multiple busses in a single application.
The Continuous processes use sophisticated process measurement and flow control devices, and are well suited for Process Control Networks such as Foudnation Fieldbus or Profibus PA. TopWorx field networking solutions make it easy to connect analog and discrete devices into high level Process Control Networks.
The TopWorx Field Networking Program

With our experience in process plants and expertise in bus networking, TopWorx has created Networx™- the most complete, customer-focused, cost-effective field networking solutions available anywhere.

**Complete**
Networx is a comprehensive, single solution with everything you need to build a modern network. Networx field networking products bridge the gap between process control systems and field devices, minimizing installation costs and maximizing uptime and productivity.

And Networx support services help select, design, and implement the right bus network for your application, ensuring fast, easy commissioning and start-up, and trouble-free operation.

**Complementary**
Networx complements global process control system suppliers like Emerson Process Management, Rockwell Automation, Honeywell, ABB, Siemens, Yokogawa, Smar, and Foxboro with practical solutions that help customers implement field-bus technology more effectively.

In fact, several of these companies have shown their trust in TopWorx by frequently recommending our products and services to meet customers’ needs.

**Customer-Focused**
Networx is a direct response to the needs of today’s process plants. The focus of the program is to deliver practical networking solutions that help take the architecture into the field effectively and affordably.

Networx field networking solutions focus on the process field environment – where the real work gets done.

**Outstanding Value**
Networx is so complementary to today’s control architectures, so practical for field personnel, so simple to install and maintain, and so cost-effective that it is hard to justify not using it.

Interactive demo of how Networx can reduce costs in your plant.

www.topworx.com
Field Networking Solutions Overview

Power Supplies & Repeaters
TopWorx provides power supplies to meet every field network requirement. Since each bus protocol has its own power and data specification, TopWorx offers the appropriate power supplies required for the intended protocols.

Our selection includes:
- Bulk power supplies for control system and device level power needs
- Bus-level power supplies and conditioners for network communications isolation
- Repeaters for extending network power and communication limits

Cables, Connectors & Cordsets
Proper wiring, termination, and connectivity are the framework of any bus or network solution. Since the vast majority of networking problems occur at the physical layer, the proper wiring and connection techniques help to keep your fieldbus network robust and problem free.

Whether you choose plug-in style connections or terminal screw connections, TopWorx offers a vast selection of connectivity options. Our HazLink™ products are rugged enclosures that provide flexible wiring options in hazardous areas.

I/O Modules, Tees & Disconnect Switches
Often there is a need to connect conventional (non-bus) devices to a network. Our Input/Output modules do just that by enabling users to connect conventional analog and discrete devices to their industrial fieldbus networks.

I/O Modules allow users to cost-effectively use new or existing conventional devices in their fieldbus design.

Wiring Tees make it easy to connect field devices to bus lines using wire terminals or plug-in connectors.

Disconnect Switches enable users to repair or replace a field device, without disturbing the network, with the simple flip of a lever-operated switch.

I/O Modules, Wiring Tees and Disconnect Switches are available as stand-alone products or inside HazLink connectivity enclosures.

HazLink™ Connectivity Enclosures
Most bus networks were originally designed to be used for factory automation rather than process automation. Therefore, in the process industries there has been a need for easy, cost-effective ways to make wiring connections in hazardous areas.

Our HazLink™ products are rugged enclosures that provide flexible wiring options in hazardous areas.

Options include:
- I/O Modules
- Wiring Tees
- Disconnect Switches

Masters & Gateways
Masters provide control functions for sensor level bus networks and devices. Gateways provide the necessary protocol translation that enables the connection of sensor level buses to higher level buses.

Gateways became a node on the higher-level network and a Master for the sensor level bus. Masters and Gateways allow users the flexibility to easily deploy multiple fieldbus networks that correctly match their device and application requirements.

With Masters and Gateways, end-users may eliminate the cost of having multiple home run network cables from the Control System to the field devices, while still deploying cost-effective sensor bus devices in the field.

Masters and Gateways perform the following functions:
- Initialize the network
- Identify field devices
- Diagnose the network
- Control field devices

Networx Support Services
As part of our Networx program, TopWorx offers a system of support services to help process plants understand and implement bus networking technologies.

Networx Support Services can help:
- Select the appropriate bus network for your application
- Map out an accurate I/O plan
- Design a sound architecture and implementation plan
- Configure and connect the field devices
- Commission and start-up the process
- Support the operation all day every day
- Troubleshoot any potential problems

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Networx Support Services
Experience in process plants. Expertise in bus networking. Exceptional support for you.

With all of the attention given recently to the benefits of bus technology, many process manufacturers are excited about the potential results that sound so promising. But often they lack the resources and time to educate themselves on all of the new buzzwords and technologies that have suddenly become so important.

The fact is, many process manufacturers are ready to reap the rewards available through bus networking technologies, but they don’t always know how to do it, or even where to turn for help.

Enter TopWorx. As part of our Networx portfolio of field networking solutions, we have created a system of support services to make it easier for plant personnel to understand, implement, and enjoy the benefits of bus networking technologies.

With Networx Support Services, you know where to turn for help.

In the processing industries, availability is critical to success. And most process plants operate 24 hours a day, 7 days a week. So part of the vision of Networx Support Services is to make sure that if you need help, you can get it wherever and whenever you need it.

That’s why we have created a support structure to serve the needs of process plants. Whether you need training for your personnel, configuration of your devices, or quick answers during a start-up, Networx Support Services can help deliver the kind of support you need.

An important part of Networx Support Services is the partnerships that TopWorx enjoys with hundreds of companies around the world. These partnerships give TopWorx customers an array of choices to meet their unique needs.

To ensure consistent delivery of superior service from our channel partners to our customers, TopWorx has created a channel certification and specialization program for the selection, education, and certification of our partners.

Types of TopWorx Channel Partners include:

- **Certified Product Distributor**: These partners are authorized to sell and support one or more of the three TopWorx product groups: field networking, valve control, or position sensing products.
- **Certified Service Provider**: These partners are qualified to deliver Networx Support Services to our customers on behalf of TopWorx.
- **Certified Product Integrator**: These partners are able to integrate one or more of the three TopWorx product groups into larger, more sophisticated control architectures and automated systems.

Network Design
Design a sound architecture and implementation plan

I/O and Device Footprint
Map out an accurate I/O plan and device layout

Bus Network Selection
Select the appropriate bus network for your application

User Requirements
Understand the needs of your application

24/7 Support
Support the operation all day every day

Personnel Training
Train your staff on the theories and realities of bus networking

Commission and Start-up
Commission and start-up the process

Configure and Connect
Configure and connect the field devices

Courtesy of Steven Engineering, Inc.
230 Ryan Way, South San Francisco, CA 94080-6370
Main Office: (650) 588-9200
Outside Local Area: (800) 258-9200
www.stevenengineering.com
Technology Training delivers practical knowledge of bus networking.

Process plants sometimes lack the resources necessary to keep pace with rapidly changing technology and its impact on competitive strategy. Therefore, the key to success often is a company’s ability to quickly deliver technical knowledge to its personnel and convert that knowledge into practical solutions that can be applied to field operations.

As part of our Networx Support Services, TopWorx has created a means to deliver knowledge to your employees. We offer a number of training classes and seminars to educate staff personnel on the theories, realities, and practicalities of modern bus networking technologies, including AS-Interface, FOUNDATION Fieldbus, DeviceNet, and Profibus.

Our technology training program is building rapidly. New locations, dates, and courses are being added occasionally, so please visit our website at www.topworx.com for more updated learning opportunities.

NSS - TT101
Discovering Bus Networking

This course covers the world of bus networking using simple, easy to understand terms, and provides the basics that everyone should know about today’s most prominent bus protocols. At the end of the course, the student will see the benefits of modern bus technologies and the differences among the major protocols. The student will also understand how bus networking technologies improve the performance of process plants, and which bus or busses will deliver the quickest return on investment in his or her specific application.

Overview of Bus Networks
- Terminology and networking “buzzwords”
- Sensor Bus Networks (AS-Interface)
- Device Bus Networks (DeviceNet, Profibus DP)
- Process Control Networks (FOUNDATION)

Comparison of Bus Networks
- Common benefits of all bus networks
- Differences in various bus networks
- When and where to use each technology

Choosing the Appropriate Bus Network
- Which bus is right for you?

NSS - TT1AS
Practical AS-Interface

This course covers the practical issues of implementing an AS-i bus network. At the end of the course, the student will be able to design an AS-i system, select the proper components to build the network, and configure and connect AS-i and conventional field devices to the network. The student will also have a solid understanding of proper AS-i wiring practices in hazardous areas, as well as an appreciation for the financial aspect of project justification.

Overview of AS-Interface
- Key features and benefits of AS-i
- When to use AS-i
- Topologies, cable types, and constraints
- Components required to build an AS-i network

Hands-on AS-Interface
- Design an AS-i network
- Wire and configure masters, gateways, and devices
- Installation techniques in hazardous areas

Economics of AS-Interface
- Quantifying potential savings
- Justifying an AS-i project

NSS - TT1FF
Practical FOUNDATION Fieldbus

This course covers the practical issues of implementing FOUNDATION Fieldbus segments. At the end of the course, the student will be able to design fieldbus segments, select the proper components to build the segments, and configure and connect FF field devices to the network. The student will also have a solid understanding of proper wiring practices in hazardous areas, as well as an appreciation for the financial aspect of project justification.

Overview of FOUNDATION Fieldbus
- Theory of FF technology
- Key features and benefits of FF
- Topologies, cable types, and constraints
- Components required to build FF segments

Hands-on FOUNDATION Fieldbus
- Design of FF segments - power, voltage, device load constraints
- Wire and configure devices to a process control system
- Installation in hazardous areas

Economics of FOUNDATION Fieldbus
- Quantifying potential savings
- Justifying an FF project

NSS - TT1DN
Practical DeviceNet

This course covers the practical issues of implementing a DeviceNet device bus network. At the end of the course, the student will be able to design a DeviceNet system, select and assemble the proper components to build the network, and configure and connect DeviceNet and conventional field devices to the network. The student will also have a solid understanding of proper wiring practices in hazardous areas, as well as an appreciation for the financial aspect of project justification.

Overview of DeviceNet
- Key features and benefits of DeviceNet
- When to use DeviceNet
- Topologies, cable types, and constraints
- Components required to build a DeviceNet network

Hands-on DeviceNet
- Design a DeviceNet network
- Wire and configure devices to a process control system
- Installation techniques in hazardous areas

Economics of DeviceNet
- Quantifying potential savings
- Justifying a DeviceNet project
AS-Interface Overview

The AS-i (Actuator Sensor Interface) protocol was created in Germany in 1994 by a consortium of factory automation suppliers. Originally developed to be a low-cost method for addressing discrete sensors in factory automation applications, AS-i has since gained acceptance in process industries due to its high power capability, simplicity of installation and operation, and low cost adder for devices.

Each AS-i segment can network up to 31 devices. This provides for 124 inputs and 124 outputs, giving a maximum capacity of 248 I/O per network on a v2.0 segment. The AS-i v2.1 specification doubles this to 62 devices per segment, providing 248 inputs and 186 outputs for a total network capacity of 434 I/O points.

Both signal and power are carried on two wires. Up to 8 amps at 30VDC of power are available for field devices such as solenoid valves.

AS-i Network Highlights

- **Technology Developer**: AS-I Consortium
- **Year Introduced**: 1993
- **Openness**: Multiple vendors
- **Type of Network**: Sensor Bus
- **Physical Media**: 2-wire cable (flat or round)
- **Network Topology**: Bus, Ring, Tree, Star
- **Maximum Devices**
  - v2.0: 31 nodes (or 248 I/O points)
  - v2.1: 62 nodes (or 434 I/O points)
- **Maximum Distance**
  - Maximum Distance: 100 meters
  - Maximum Distance with repeaters: 300 meters (max. of 2 repeaters can be used)
- **Communication Methods**
  - Master/Slave with cyclic polling
  - Manchester Bit Encoding implemented via Alternating Pulse Modulation (APM)
- **Transmission Properties**
  - 5 miles latency max. on fully loaded segment
- **Primary usage**
  - v2.0: Discrete Signals
  - v2.1: Discrete Signals (supports 12 bit analog signals accessed over 5 cycles)

Power and Communications on same twisted pair
- Limited to 200mA per device power consumption
- Requires AS-I specific power supply on communications bus for de-coupling

Device Power Supply
- Devices can be supplied from bus (v2.0/200mA)
- Additional power can be supplied by AS-i power bus cable
- Having multiple power supplies (required for higher power outputs)

Wiring Types
- Normal 2 wire cable
- #16AWG (1.5mm)
- 2 wire flat AS-I cable
- (1.5mm conductors)
- Yellow for communications
- Black for additional power

Grounding aspects
- Ungrounded communications bus

Shielding
- Unshielded wire

Terminators
- No terminators required

Hazardous Area Installations
- Explosion Proof wiring required

Device Addressing
- Automatic when connected one at a time to the segment or with Handheld Addressing Unit

Governance Body
- AFDI (AS-I Trade Organization)

Web Site
- www.as-interface.com

AS-i is inexpensive, simple, supplies plenty of power and offers end users a variety of wiring strategies.

TopWorx Comments on AS-i

**Strengths**
- AS-i is inexpensive, especially in general purpose environments.
- AS-i simplicity. Unlike other communication protocols, AS-i is not designed to bring control system functionality to the field. AS-i is simply a better way to connect field devices to the control system. AS-i offers end users a variety of topologies (wiring strategies). And AS-i’s principle of operation makes it easy to install and configure as well as add new devices later.

**Drawbacks**
- AS-i supplies plenty of power. AS-i delivers plenty of power to operate virtually all field devices, including solenoid valves.

**Hazards**
- Since AS-i is an 8 amp bus, it cannot be intrinsically safe. (However, these limitations do not prevent the use of TopWorx’s AS-i Gateway to integrate intrinsically safe devices into a TopWorx system.)

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AS-Interface Sensor-Communications Module

The TopWorx Sensor-Communications Module (SCM) combines position sensors, AS-i communication, solenoid outputs, and wiring terminals into a compact enclosure that is potted and sealed from the environment.

SCM-ASi enclosure is resistant to high levels of impact, moisture, shock, and vibration.

All electronics are short-circuit protected, eliminating the expense of adding separate short-circuit protection.

Integrated position sensors provide valve position feedback.

BriteLite LEDs indicate valve position and facilitate sensor set up.

Calibration Switch facilitates initial setup. The three position On-Off-ASi switch enables the valve to be test cycled open and closed offline, then put onto the network when ready.

Onboard terminals provide connection points for auxiliary discrete inputs.

SCM-ASi Wiring Diagram

The Sensor-Communications Module delivers valve position feedback, communicates directly on the AS-i network, pilots the valve actuator, and provides extra wiring terminals for auxiliary inputs.

The TopWorx SCM-ASi is a compact, sealed module that can be used in a variety of enclosures suitable for use in any hazardous or corrosive process environment.

SCM-ASi Highlights

- 2 Discrete Inputs (DI)
- 2 Discrete Outputs (DO)
- Open/Closed valve position feedback
- Solenoid outputs for single or double acting
- Calibration Switch
- Britelite LEDs
- Conformance Tested
- Short Circuit Protection
- Maximum Output Current: 160mA per output
- Maximum Output Power: 4 watts per output
- Voltage: 24-30 VDC

The AS-i Sensor-Communications Module fits conveniently into a variety of valve control enclosures suitable for any process environment.

Lumitech DVC-ASI
Discrete Valve Controller
- Zone 2 (Class I, Div 2)
- Integral Solenoid Valve
- Direct Mount
See page 130 for more details.

Switchpak DXP-ASI
(Stainless Steel enclosure)
Discrete Valve Monitor
- Zone 1 (Class I, Div 1)
See page 134, 136 for more details.

Lumitech DVM-ASI
Discrete Valve Monitor
- Zone 2 (Class I, Div 2)
- Direct Mount
See page 132 for more details.

Did You Know?
TopWorx makes it easy to use AS-Interface in hazardous areas. HazLink connectivity enclosures offer multiple explosion proof wiring options, and Switchpak valve controllers and monitors are suitable for use in Zone 1 (Class I, Div 1) hazardous areas.
HazLink Connectivity Enclosures

The AS-Interface sensor bus network was originally designed to be used for factory automation rather than process automation. Therefore, in the process industries there has been a need for easy, cost-effective ways to make wiring connections in hazardous areas.

Our HazLink products are rugged junction enclosures that provide flexible wiring options in hazardous areas, making AS-Interface more suitable for use in the process industries.

<table>
<thead>
<tr>
<th>Item</th>
<th>I/O Modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>HazLink I/O Modules allow users to cost-effectively connect new or existing conventional devices into the AS-Interface network in Zone 1 (Class I, Div 1) hazardous areas.</td>
<td></td>
</tr>
</tbody>
</table>

NHL-ASIO  HazLink Connectivity Enclosure with AS-Interface I/O 2 input, 2 output knife-gate valve or cylinder controller

HazLink Features:
- Zone 1 (Class I, Div 1)
- (3) 1/2" NPT conduit outlets

HazLink Options:
- I/O Modules
- Wiring Tees
- Disconnect Switches

HazLink Wiring Tees make it easy to connect field devices to bus lines using wire terminals or plug-in connectors.

NHL-ASWT  AS-Interface tee with 3 x 2 position wiring terminals
NHL-ASCP  Short circuit protection

HazLink Disconnect Switches enable users to repair or replace a field device without disturbing the network with the simple flip of a lever-operated switch.

Disconnect Switches are designed to be locked if desired. Locking prevents tampering or accidental device connection or disconnection.

TopWorx offers Disconnect Switches in HazLink enclosures with or without short circuit protection.

NHL-ASDS  Disconnect switch
NHL-ASDC  Disconnect switch with short circuit protection

HazLink Connectivity Enclosures

Dimensions

<table>
<thead>
<tr>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-1/4 - 14 NPT conduit connection (3 places)</td>
</tr>
</tbody>
</table>

NHL-ASWT

NHL-ASDC

NHL-ASIO

NHL-ASDC

NHL-ASCP

Dimensions

<table>
<thead>
<tr>
<th>Dimensions</th>
</tr>
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<tbody>
<tr>
<td>2-1/4 - 14 NPT conduit connection (3 places)</td>
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</tbody>
</table>

NHL-ASWT

NHL-ASDC

NHL-ASIO

NHL-ASDC

NHL-ASCP

Dimensions

<table>
<thead>
<tr>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-1/4 - 14 NPT conduit connection (3 places)</td>
</tr>
</tbody>
</table>

NHL-ASWT

NHL-ASDC

NHL-ASIO

NHL-ASDC

NHL-ASCP

Dimensions

<table>
<thead>
<tr>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-1/4 - 14 NPT conduit connection (3 places)</td>
</tr>
</tbody>
</table>

NHL-ASWT

NHL-ASDC

NHL-ASIO

NHL-ASDC

NHL-ASCP

Dimensions

<table>
<thead>
<tr>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-1/4 - 14 NPT conduit connection (3 places)</td>
</tr>
</tbody>
</table>

NHL-ASWT

NHL-ASDC

NHL-ASIO

NHL-ASDC

NHL-ASCP
**AS-i to Modbus Gateways**

- **Operating Temperature:** 32°F to 131°F (0°C to 55°C)
- **Voltage of Insulation:** ≥ 500V
- **Protection Category:** Housing IP40, Terminals IP20

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Single Gateways</strong></td>
<td></td>
</tr>
<tr>
<td>NAS-GM11</td>
<td>RS 232C, AS-i</td>
</tr>
<tr>
<td>NAS-GM12</td>
<td>RS 232C, Standard</td>
</tr>
<tr>
<td>NAS-GM13</td>
<td>RS 485, AS-i</td>
</tr>
<tr>
<td>NAS-GM14</td>
<td>RS 485, Standard</td>
</tr>
<tr>
<td>NAS-GM15</td>
<td>RS 422, AS-i</td>
</tr>
<tr>
<td>NAS-GM16</td>
<td>RS 422, Standard</td>
</tr>
<tr>
<td><strong>Dual Gateways</strong></td>
<td></td>
</tr>
<tr>
<td>NAS-GM21</td>
<td>RS 232C, AS-i</td>
</tr>
<tr>
<td>NAS-GM22</td>
<td>RS 232C, Standard</td>
</tr>
<tr>
<td>NAS-GM23</td>
<td>RS 485, AS-i</td>
</tr>
<tr>
<td>NAS-GM24</td>
<td>RS 485, Standard</td>
</tr>
<tr>
<td>NAS-GM25</td>
<td>RS 422, AS-i</td>
</tr>
<tr>
<td>NAS-GM26</td>
<td>RS 422, Standard</td>
</tr>
</tbody>
</table>

**Additional Specifications**
- **AS-i Specification:** 2.1 (Gateways), 2.0 (Dual Gateways)
- **Power Supply:** Standard
- **Operating Voltage:** 30VDC AS-i voltage
- **Operating Current:**
  - Single Gateways: 200mA (from AS-i), 70mA (from AS-i 1), 70mA (from AS-i 2)
  - Dual Gateways: 200mA (from AS-i), 70mA (from AS-i 1), 70mA (from AS-i 2)
- **Serial Interface:**
  - D-sub-data transmission cords, page 117
  - Master simulators for testing, page 78

**AS-i to DeviceNet Gateways**

- **Operating Temperature:** 32°F to 131°F (0°C to 55°C)
- **Mounting:** DIN rail
- **Voltage of Insulation:** ≥ 500V
- **Protection Category:** Housing IP40, Terminals IP20

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AS-i to DeviceNet Gateways</strong></td>
<td></td>
</tr>
<tr>
<td>NAS-GD01</td>
<td>Yes, Single, 2.1</td>
</tr>
<tr>
<td>NAS-GD02</td>
<td>Yes, Dual, 2.1</td>
</tr>
<tr>
<td>NAS-GD03</td>
<td>No, Single, 2.0</td>
</tr>
</tbody>
</table>

**Additional Specifications**
- **Serial Interface:**
  - RS 232C, RS 422, RS 485
  - ≥ 500V
- **Power Supply:** Standard
- **Operating Voltage:** 30VDC AS-i voltage
- **Operating Current:**
  - Single Gateway: 200mA (from AS-i), 70mA (from AS-i 1), 70mA (from AS-i 2)
  - Dual Gateway: 200mA (from AS-i 1), 70mA (from AS-i 2)
- **Graphical Display:**
  - Yes

**Gateways function as a master on the AS-i network and as a single node on the Modbus network.**

**Dual Gateways function as two complete masters on the AS-i network and as a single node on the Modbus network.**

These devices include demonstration software that performs addressing, monitoring, and diagnostics of the network.
### AS-i to Profibus DP Gateways

**General Specifications**

- **Operating Temperature:** 32°F to 131°F (0°C to 55°C)
- **Mounting:** DIN rail
- **Voltage of insulation:** ≥ 500V
- **Permitted Category:** Housing IP40, Terminals IP20
- **AS-i Specification:** 2.1

**Functions as a master on the AS-i network and as a single node on the Profibus DP network.**

**Dual Gateways** function as two complete masters on the AS-i network and as 256 bit digital I/O module per the AS-i network for Ethernet. Modbus is used as the fieldbus application layer. These devices include demonstration software that performs addressing, monitoring, and diagnostics of the network.

**Additional Specifications**

- **Connection Type:** Screw terminals

**Single Gateways**

<table>
<thead>
<tr>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAS-GP11</td>
</tr>
<tr>
<td>NAS-GP12</td>
</tr>
</tbody>
</table>

**Power Supply**

- Yes: AS-i
- No: AS-i

**Dual Gateways**

<table>
<thead>
<tr>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAS-GP21</td>
</tr>
<tr>
<td>NAS-GP22</td>
</tr>
<tr>
<td>NAS-GP23</td>
</tr>
<tr>
<td>NAS-GP24</td>
</tr>
</tbody>
</table>

**Power Supply**

- Yes: AS-i
- No: AS-i
- Standard

**Part Number & Description**

<table>
<thead>
<tr>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gateway with graphical display</td>
</tr>
<tr>
<td>Gateway</td>
</tr>
</tbody>
</table>

**Features:**

- D-sub-data transmission cords, page 117
- Master simulators for testing, page 99

---

### AS-i to Ethernet TCP-IP Dual Gateways

**AS-i to Ethernet TCP-IP Dual Gateways**

Dual AS-i to Ethernet Gateways control the field devices on the AS-Interface network, and connect the AS-i network to Ethernet TCP-IP. The Dual Gateway controls two AS-i networks and appears as a single node on Ethernet. These devices include demonstration software that performs addressing, monitoring, and diagnostics of the network.

**General Specifications**

- **Operating Temperature:** 32°F to 131°F (0°C to 55°C)
- **Voltage of Insulation:** ≥ 500V
- **Protection Category:** Housing IP40, Terminals IP20
- **AS-i Specification:** 2.1

**Part Number & Description**

<table>
<thead>
<tr>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAS-GE01</td>
</tr>
</tbody>
</table>

**Part Number & Description**

<table>
<thead>
<tr>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial Interface</td>
</tr>
</tbody>
</table>

**Power Supply**

- Yes: AS-i
- No: AS-i
- Standard

**Part Number & Description**

<table>
<thead>
<tr>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Supply</td>
</tr>
</tbody>
</table>

**Features:**

- 230 Ryan Way, South San Francisco, CA 94080-6370 • Main Office: (650) 588-9200 • Outside Local Area: (800) 258-9200 • www.stevenengineering.com

---

**General Specifications**

- **Connection Type:** Screw terminals

**Part Number & Description**

<table>
<thead>
<tr>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAS-GP25</td>
</tr>
<tr>
<td>NAS-GP26</td>
</tr>
<tr>
<td>NAS-GP27</td>
</tr>
<tr>
<td>NAS-GP28</td>
</tr>
</tbody>
</table>

**Power Supply**

- Yes: AS-i
- No: AS-i
- Standard

**Part Number & Description**

<table>
<thead>
<tr>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Supply</td>
</tr>
</tbody>
</table>

**Features:**

- 230 Ryan Way, South San Francisco, CA 94080-6370 • Main Office: (650) 588-9200 • Outside Local Area: (800) 258-9200 • www.stevenengineering.com
Quick Disconnect I/O Modules

General Specifications
Protection Class: IP67

Heavy Duty I/O Modules

These modules provide QDC connectors for input and output devices. The AS-i bus communication and external power cables can be connected via QDC style connector or AS-i flat cable using pinching technology. These modules have outputs rated at a total of 2A.

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAS-1A01</td>
<td>4 discrete inputs</td>
</tr>
<tr>
<td>NAS-1A02</td>
<td>2 discrete inputs and 2 discrete outputs</td>
</tr>
<tr>
<td>NAS-1A03</td>
<td>4 discrete inputs and 4 discrete outputs</td>
</tr>
<tr>
<td>NAS-1A04</td>
<td>4 discrete outputs</td>
</tr>
</tbody>
</table>

Passive Junctions

These junctions provide an easy method of connecting and expanding an AS-i network using AS-i round cable and QDC style connectors. QDC connectors allow for easy connecting and disconnecting of the device and prevent accidental shorting of communication and power wiring.

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAS-1B01</td>
<td>8 ports, eurofast, with minifast trunk connectors 1</td>
</tr>
<tr>
<td>NAS-1B02</td>
<td>8 ports, eurofast</td>
</tr>
<tr>
<td>NAS-1B03</td>
<td>6 ports, eurofast</td>
</tr>
<tr>
<td>NAS-1B04</td>
<td>4 ports, eurofast</td>
</tr>
<tr>
<td>NAS-1B05</td>
<td>8 ports, minifast</td>
</tr>
</tbody>
</table>

I/O Modules & Couplers

These standard consortium-style Input/Output modules are used for interfacing conventional devices with an AS-i network. I/O modules must be combined with a coupler to use either round or flat AS-i bus cable.

Input Modules

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAS-2A11</td>
<td>4 inputs, 100mA</td>
</tr>
<tr>
<td>NAS-2A12</td>
<td>4 inputs, 200mA</td>
</tr>
<tr>
<td>NAS-2A13</td>
<td>4 inputs, 100mA, SPDT</td>
</tr>
<tr>
<td>NAS-2A14</td>
<td>4 inputs, 200mA, SPDT</td>
</tr>
</tbody>
</table>

Output Modules

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAS-2A21</td>
<td>4 relay outputs, 1A with supplemental power</td>
</tr>
<tr>
<td>NAS-2A22</td>
<td>4 relay outputs, 1A - M12 supplemental power connection</td>
</tr>
<tr>
<td>NAS-2A23</td>
<td>4 solid-state outputs, 2A with supplemental power - watchdog</td>
</tr>
<tr>
<td>NAS-2A24</td>
<td>4 solid-state outputs, 2A with supplemental power - watchdog - NPN</td>
</tr>
</tbody>
</table>

Combo Input/Output Modules

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAS-2A31</td>
<td>2 inputs, 100mA; 2 relay outputs, 1A</td>
</tr>
<tr>
<td>NAS-2A32</td>
<td>2 inputs 100mA; 2 relay outputs, 1A - M12 power connection</td>
</tr>
<tr>
<td>NAS-2A33</td>
<td>2 inputs, 100mA; 2 solid-state outputs, 2A - watchdog</td>
</tr>
<tr>
<td>NAS-2A34</td>
<td>2 inputs, 100mA; 2 solid-state outputs, 2A - watchdog SPDT</td>
</tr>
<tr>
<td>NAS-2A35</td>
<td>2 inputs, 100mA; 2 solid-state outputs, 2A - NPN</td>
</tr>
</tbody>
</table>

For Ribbon Cable

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAS-2B11</td>
<td>Coupler module</td>
</tr>
<tr>
<td>NAS-2B12</td>
<td>Coupler module with terminal for additional supply</td>
</tr>
</tbody>
</table>

For Circular Cable

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAS-2B21</td>
<td>Coupler module</td>
</tr>
<tr>
<td>NAS-2B22</td>
<td>Coupler module with terminal block for additional supply</td>
</tr>
<tr>
<td>NAS-2B23</td>
<td>Coupler module with shielded terminal</td>
</tr>
<tr>
<td>NAS-2B24</td>
<td>Coupler module with shielded terminal without accessories</td>
</tr>
</tbody>
</table>

1. Connector and Cordsets, page 49-50
2. Power Supplies, pages 48 & 116
3. Outside Local Area: (800) 258-9200
4. Outside Local Area: (650) 588-9200

Additional Specifications

Operating Temperature: -10° to 158°F (-25° to 70°C)
Material: PA6-GF30; nickel-plated brass connectors

Protection Class: IP67

User Coupler Modules

Coupler Modules provide a base for connecting the Standard User I/O Modules above to the AS-i Interface network cabling. They can also provide terminal block connections for a supplemental power source when using higher current discrete actuating devices.

Choose a coupler module that matches your specific AS-i wiring and output power requirements.
### Analog Stations

These analog stations are compliant with AS-i specification 2.1, which provides limited support for analog devices. These modules provide 16 bit resolution of analog signals.

Your AS-i master device must be AS-i 2.1 compliant.

- Cord sets, cable & connectors, pages 49-51
- Power Supplies, pages 48 & 116

### General Specifications
- **Operating Temperature:** -32°F to 158°F (-25°C to 70°C)
- **Protection Class:** IP65
- **AS-i Specification:** 2.1
- **Input Stations Operating Current:** <80mA total
- **Output Stations Operating Current:** 24mA total

#### Analog Stations

These modules provide support for non-time sensitive analog signals via an AS-i interface and are recommended for monitoring applications.

Up to 40mA of current is available per device from the AS-i bus or a supplemental power source.

On input stations, power for sensors can be supplied by AS-i or an external source via the black ribbon cable.

On output stations, power for actuators can be supplied by AS-i or external voltage via the black ribbon cable.

#### Input Stations
- NAS-4A11: Two 4-20mA inputs, 1µA resolution
- NAS-4A12: Two 0-10V inputs, 1mV resolution
- NAS-4A13: Four Pt100 inputs, 0.1°C resolution

#### Output Stations
- NAS-4A21: Two 4-20mA outputs, 1µA resolution
- NAS-4A22: Two 0-10V outputs, 1mV resolution

### Junction Box I/O Modules

These Input/Output modules provide screw terminal connections for conventional input/output devices to be connected to an AS-i network. The I/O modules are powered via the AS-i network. For modules with outputs, the outputs are powered by a conventional external 24VDC power supply that can be connected directly to the module.

#### Additional Specifications
- **Output Modules**
  - **Operating Current:** ≤ 40mA
  - **Load Capacity per relay:**
    - 115VAC, 500mA
    - 24VDC, 500mA
    - 60VA max

- **Input Modules**
  - **Operating Current:** ≤ 60mA, ≤ 30mA with filter
- **Combo Modules**
  - **Operating Current:** ≤ 30mA (2 I/O), ≤ 60mA (4 I/O)
  - **Load Capacity per output:**
    - 24VDC, 500mA
    - 1A total (2 I/O)
    - 2A total (4 I/O)

- **Power Input:** 24VDC power supplies, page 116

#### General Specifications
- **Operating Temperature:** -13°F to 140°F (-25°C to 60°C)
- **Protection Class:** IP20
- **Approvals:** Class I, Div 2

#### Part Number & Description

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input Modules</strong></td>
<td></td>
</tr>
<tr>
<td>NAS-3A11</td>
<td>4 inputs</td>
</tr>
<tr>
<td>NAS-3A12</td>
<td>4 inputs with input filter</td>
</tr>
<tr>
<td><strong>Output Modules</strong></td>
<td></td>
</tr>
<tr>
<td>NAS-3A21</td>
<td>4 Form C relay outputs</td>
</tr>
<tr>
<td><strong>Combo Input/Output Modules</strong></td>
<td></td>
</tr>
<tr>
<td>NAS-3A31</td>
<td>2 inputs, 2 outputs with watchdog</td>
</tr>
<tr>
<td>NAS-3A32</td>
<td>4 inputs, 4 outputs with watchdog</td>
</tr>
</tbody>
</table>

Courtesy of Steven Engineering, Inc. 230 Ryan Way, South San Francisco, CA 94080-6370  Main Office: (650) 588-6000  Outside Local Area: (800) 258-9200  www.stevenengineering.com
### AS-i Power Supplies & Repeaters

AS-i networks require AS-i specific power supplies to maintain proper voltage and communications on the AS-i bus.

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AS-i Power Supply Units</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Specifications</strong></td>
<td></td>
</tr>
<tr>
<td>Operating Temperature:</td>
<td>14°F to 158°F (-10°C to 70°C)</td>
</tr>
<tr>
<td>Protection Class:</td>
<td>IP30</td>
</tr>
<tr>
<td>Operating Voltage:</td>
<td>115/230VAC, selectable</td>
</tr>
<tr>
<td>Output Voltage:</td>
<td>29.5 to 31.6VDC</td>
</tr>
<tr>
<td><strong>AS-i Repeater</strong></td>
<td></td>
</tr>
<tr>
<td>Repeaters can be used to extend the communications portion of an AS-i network beyond 100 m. A maximum of two repeaters may be used to achieve a maximum AS-i segment length of 300 m. The repeater can work in conjunction with the AS-i Power Extender below.</td>
<td></td>
</tr>
<tr>
<td><strong>Specifications</strong></td>
<td></td>
</tr>
<tr>
<td>Operating Voltage:</td>
<td>24VDC</td>
</tr>
<tr>
<td>Operating Current:</td>
<td>60mA per segment, 120mA total</td>
</tr>
<tr>
<td>Operating Temperature:</td>
<td>14°F to 131°F (-10°C to 55°C)</td>
</tr>
<tr>
<td>Protection Class:</td>
<td>IP65</td>
</tr>
<tr>
<td>Connections:</td>
<td>AS-i flat or round cable</td>
</tr>
</tbody>
</table>

| **Power Extender** |  |
| Extenders are designed to maintain the bus power within specifications when extending an AS-i network. This device can work in conjunction with the AS-i Repeater above to extend an AS-i network beyond the standard 100 m limitation. |  |
| **Specifications** |  |
| Operating Temperature: | 32°F to 158°F (0°C to 70°C) |
| Protection Class: | IP65 |
| Operating Voltage: | 35VDC |
| Operating Current: | 0.8A at 30V |

### Field Wirable Connectors

These plug-style, quick-disconnect (QDC) connectors are designed for easy installation in the field after AS-i cable has been routed through the conduit, wire-ways, panel enclosures, and other locations.

#### Minifast Connectors

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Item</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Specifications</strong></td>
<td></td>
</tr>
<tr>
<td>Housing:</td>
<td>Nylon, type PA 6.6 GF</td>
</tr>
<tr>
<td>Connector Insert:</td>
<td>Polyurethane, V2 acc. UL 94</td>
</tr>
<tr>
<td>Contact Material:</td>
<td>CuZn plated copper alloy</td>
</tr>
<tr>
<td>Coupling Nut:</td>
<td>Anodized aluminum</td>
</tr>
<tr>
<td>Protection:</td>
<td>NEMA 1, 3, 4, 6 &amp; 13</td>
</tr>
</tbody>
</table>

#### Eurofast Connectors

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Item</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Specifications</strong></td>
<td></td>
</tr>
<tr>
<td>Housing:</td>
<td>Polyamide, PBT Black</td>
</tr>
<tr>
<td>Connector Insert:</td>
<td>Polyamide; spacings to VDE 0110 Group C</td>
</tr>
<tr>
<td>Contact Material:</td>
<td>Nickel plated copper alloy</td>
</tr>
<tr>
<td>Coupling Nut:</td>
<td>Female - PBT, Male - Nickel Plated Brass</td>
</tr>
<tr>
<td>Protection:</td>
<td>NEMA 1, 3, 4 &amp; 6p</td>
</tr>
</tbody>
</table>

#### Female Connectors

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Item</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Specifications</strong></td>
<td></td>
</tr>
<tr>
<td>Housing:</td>
<td>Polyamide, PBT Black</td>
</tr>
<tr>
<td>Connector Insert:</td>
<td>Polyamide; spacings to VDE 0110 Group C</td>
</tr>
<tr>
<td>Contact Material:</td>
<td>Nickel plated copper alloy</td>
</tr>
<tr>
<td>Coupling Nut:</td>
<td>Female - PBT, Male - Nickel Plated Brass</td>
</tr>
<tr>
<td>Protection:</td>
<td>NEMA 1, 3, 4 &amp; 6p</td>
</tr>
</tbody>
</table>

#### Male Connectors

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Item</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Specifications</strong></td>
<td></td>
</tr>
<tr>
<td>Housing:</td>
<td>Polyamide, PBT Black</td>
</tr>
<tr>
<td>Connector Insert:</td>
<td>Polyamide; spacings to VDE 0110 Group C</td>
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<tr>
<td>Contact Material:</td>
<td>Nickel plated copper alloy</td>
</tr>
<tr>
<td>Coupling Nut:</td>
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</tr>
<tr>
<td>Protection:</td>
<td>NEMA 1, 3, 4 &amp; 6p</td>
</tr>
</tbody>
</table>

---

Courtesy of Steven Engineering, Inc.  
230 Ryan Way, South San Francisco, CA 94080-6370  
Main Office: (650) 588-9200  
Outside Local Area: (800) 258-9200  
www.stevenengineering.com
Molded Connector Cordsets

These cordsets provide AS-i cable with pre-installed, plug-in connectors, reducing installation time in the field.

Available in 1, 3, 5, and 10 meter lengths. Consult the factory for additional cordset lengths.

**Part Number & Description**

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molded Connector Cordsets</td>
<td>TopWorx offers AS-interface molded connector cordsets in AS-i 300V PVC yellow round data cable. Cordsets are available with a molded connector on each end or with one end bare to facilitate routing of cable through conduit or panel enclosures. All double cordsets have one straight male connector and one straight female connector. See page 51 for cable specifications.</td>
</tr>
</tbody>
</table>

**Connector Specifications**

| Plug Body | Molded polyurethane |
| Contacts | Gold plated brass |
| Coupling Nut | Stainless steel |
| Temperature | -40°F to 158°F (-40° to 70°C) |
| Rated Current | 0.04 A (preheat); 4.0 A (maximum) |

AS-i Bulk Cable

Cable that meets the requirements of EN50170-2-2:1996 for communication up to 12 Mbaud.

Available in 30, 75, and 150 meter spools. Consult the factory for additional cable lengths.

**Part Number & Description**

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS-i Bulk Cable</td>
<td>Cable is approved for 300V.</td>
</tr>
</tbody>
</table>

**Bulk Cable Types**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Cable Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>030</td>
<td>30 m</td>
</tr>
<tr>
<td>075</td>
<td>75 m</td>
</tr>
<tr>
<td>150</td>
<td>150 m</td>
</tr>
</tbody>
</table>

Consult factory for additional cable lengths.

AS-i Bulk Cable

To create your bulk cable part number, use the chart below to select the appropriate cable length for your application, where M = cable length.

**Example**

NAS-AC1-030 = PTE yellow flat data cable in 30 meter spool

Molded Connector Cordsets

TopWorx offers AS-interface molded connector cordsets in AS-i 300V PVC yellow round data cable double eurofast connector cordset, 1 m.

**Double Connector Cordsets**

<table>
<thead>
<tr>
<th>NAS-DEC</th>
<th>Eurofast Connectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAS-DMC</td>
<td>Minifast Connectors</td>
</tr>
</tbody>
</table>

**Single Connector Cordsets**

<table>
<thead>
<tr>
<th>Eurofast Connector</th>
<th>NAS-SEM</th>
<th>Male eurofast connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAS-SEF</td>
<td>Female eurofast connector</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Minifast Connector</th>
<th>NAS-SMM</th>
<th>Male minifast connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAS-SMF</td>
<td>Female minifast connector</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Cordset Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 m</td>
</tr>
<tr>
<td>3</td>
<td>3 m</td>
</tr>
<tr>
<td>5</td>
<td>5 m</td>
</tr>
<tr>
<td>10</td>
<td>10 m</td>
</tr>
</tbody>
</table>

Consult factory for additional cordset lengths.
### Diagnostic Tools

502.969.8000

Our selection of diagnostic tools is designed to reduce the total cost of ownership of AS-i networks and devices.

Our AS-i addressing unit can reduce startup and commissioning time by allowing the addressing of devices prior to field installation. Our AS-i bus testers provide addressing and advanced troubleshooting functionality to allow for quick identification and correction of network problems.

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Handheld Programming Unit</strong></td>
<td>NAS-0T1: Handheld programming unit</td>
</tr>
<tr>
<td><strong>Handheld AS-Interface System Tester</strong></td>
<td>NAS-0T2: AS-Interface System Tester</td>
</tr>
<tr>
<td><strong>Handheld Diagnosis and Addressing Tool</strong></td>
<td>NAS-0T3: Addressing and diagnosis device</td>
</tr>
</tbody>
</table>

#### Part Number & Description

- **NAS-0T1**
  - **Description:** Handheld programming unit
  - **General Specifications:**
    - Protection: IP20
    - Operating Temperature: 32°F to 122°F (0°C to 50°C)
    - Weight: 560g

- **NAS-0T2**
  - **Description:** AS-Interface System Tester
  - **General Specifications:**
    - Protection: IP20 (jacks); IP52 (housing)
    - Operating Temperature: 14°F to 122°F (-10°C to 50°C)

- **NAS-0T3**
  - **Description:** Addressing and diagnosis device
  - **General Specifications:**
    - Protection: IP20 (jacks); IP52 (housing)
    - Operating Temperature: 32°F to 122°F (0°C to 50°C)

---

52

Courtesy of Steven Engineering, Inc.
230 Ryan Way, South San Francisco, CA 94080-6370
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Outside Local Area: (800) 258-9200
www.stevenengineering.com

53

Notes

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52

53

Notes
The FOUNDATION Fieldbus (FF) protocol was created in 1994 by a group of process automation suppliers. Unlike other protocols, FF was developed specifically for the process industries. It is therefore capable of handling all of the complexities of process management, including process variables, real-time deterministic process control, and diagnostics.

**FOUNDATION Fieldbus Overview**

**Type of Network**
- Process Control Network

**Physical Media**
- Twisted pair, fiber

**Network Topology**
- Star, Bus

**Maximum Devices**
- 52 nodes/segment (16 nodes/segment on some Host systems)

**Maximum Devices using Intrinsically Safe wiring**
- 4-6 per repeated segment depending on power requirements of devices and the type of I.S. barrier used.

**Maximum Distance**
- Maximum Distance 1,900 meters
- Maximum Distance with repeaters 5,450 meters (max. of 4 repeaters can be used)

**Communication Methods**
- Client/server, Publisher/subscriber, Event

**Primary usage**
- Used for analog and discrete process control devices

**Power and Communications on same twisted pair**
- Requires FF power supply (conditioner) to protect the digital communications

**Device Power Supply**
- Can be supplied from bus (typical)

**Wiring Types**

- **Type A**: Shielded Twisted Pair #26AWG (0.13mm) 1900m (6232 ft.)
- **Type B**: Multi-twisted Pair with shield #22AWG (0.32mm) 1200m (3936 ft.)
- **Type C**: Multi-twisted Pair without shield #26AWG (0.13mm) 400m (1312 ft.)
- **Type D**: Multi-core without twisted pairs and having an overall shield #18AWG (0.8mm) 32 nodes/segment (16 nodes/segment on some Host systems)

**Grounding aspects**
- Wiring is ungrounded. If bus wires are grounded or shorted, communication to all devices is interrupted. (short circuit protection is recommended)

**Shielding**
- Shields should be grounded at only one point

**Terminals**
- 2 near each end of each bus segment

**Hazardous Area Installations**
- Intrinsically Safe devices available

**Device Addressing**
- Automatic when connected to segment

** Governing Body**
- Fieldbus Foundation

**Web Site**
- www.fieldbus.org

**Did You Know?**

TopWorx has recognized these issues and has created several cost-effective ways to extend the benefits of FF to on/off valves and other discrete devices.

**FOUNDATION Fieldbus Network Highlights**

- Both scheduled and on scheduled communications
- Maximum Devices 32 nodes/segment (16 nodes/segment on some Host systems)
- Maximum Distance 1,900 meters
- Maximum Distance with repeaters 5,450 meters (max. of 4 repeaters can be used)
- Communication Methods - Client/server, Publisher/subscriber, Event – Both scheduled and unscheduled communications
- Primary usage - Used for analog and discrete process control devices
- Power and Communications on same twisted pair - Requires FF power supply (conditioner) to protect the digital communications
- Device Power Supply - Can be supplied from bus (typical)
- Wiring Types (Recommended using Type A cable only for new installations)
  - **Type A**: Shielded Twisted Pair #26AWG (0.13mm) 1900m (6232 ft.)
  - **Type B**: Multi-twisted Pair with shield #22AWG (0.32mm) 1200m (3936 ft.)
  - **Type C**: Multi-twisted Pair without shield #26AWG (0.13mm) 400m (1312 ft.)
  - **Type D**: Multi-core without twisted pairs and having an overall shield #18AWG (0.8mm) 32 nodes/segment (16 nodes/segment on some Host systems)
- Grounding aspects - Wiring is ungrounded. If bus wires are grounded or shorted, communication to all devices is interrupted. (short circuit protection is recommended)
- Shielding - Shields should be grounded at only one point
- Terminals - 2 near each end of each bus segment
- Hazardous Area Installations - Intrinsically Safe devices available
- Device Addressing - Automatic when connected to segment
- Governing Body - Fieldbus Foundation
- Web Site - www.fieldbus.org

**FOUNDATION Fieldbus can handle process variables, deterministic process control, and diagnostics, and is the ideal protocol for the process industries.**

**Conventional I/O System vs. FOUNDATION Fieldbus Network**

**CONVENTIONAL I/O SYSTEM**

- **Advantages**
  - Technology is already understood
  - Lower device cost
  - Independent wiring from devices to the control system means wiring problems with one device don’t affect other field devices

- **Drawbacks**
  - Higher installed cost
  - Point-to-point wiring is expensive
  - Many wiring connections:
    - are labor intensive to install
    - create many points of failure
    - increase complexity when troubleshooting
    - require large amounts of cabinet or rack space for installation of terminal blocks
    - create time-consuming initial checkout and startup
    - Expansion requires duplicating the entire wiring scheme for each additional point

**FOUNDATION FIELDBUS NETWORK**

- **Advantages**
  - Excellent support for analog I/O
  - Incorporates discrete devices into same segments
  - Provides control in the field capabilities
  - Provides redundancy options for power and communications devices
  - Available for Intrinsically Safe installations
  - Largely supported by process control manufacturers
  - Complete digital communications to transmitter microprocessors:
    - Eliminates inaccuracies of A/D and D/A conversions of analog representative signals, such as 4-20mA
    - Eliminates calibration of representative signals to improve accuracy
    - Eliminates setting of upper and lower range limits at the device level
  - Devices contain diagnostic information and alarming capabilities
  - Interoperability certification ensures that various field devices work with a variety of host systems, regardless of manufacturer

- **Drawbacks**
  - Limited power requirements in Intrinsically Safe applications, extended for FISCO installations
  - Segment power, grounding, and loading must be considered when designing segments
  - Training for commissioning, troubleshooting, and calibration may be required
  - Requires proper grounding and power isolation for error free network communications

**TopWorx Comments on FOUNDATION Fieldbus**

**Strengths**
- FF is made for process control. FF was designed by the world’s leading process automation suppliers for the process industries.
- FF is proven worldwide. At the time of publication, FF systems have been implemented in over 25 countries.
- FF is intrinsically safe. In the processing world, hazardous areas are common. Other bus networks got their start in factory automation before migrating to the process industries, and thus often fall short in hazardous areas. But FF, designed for process automation, incorporates intrinsic safety. TopWorx solutions for discrete valves are intrinsically safe as well.

**Drawbacks**
- FF users want on/off solutions. Due to the sophistication of the FF protocol, occasionally a plant’s on/off valves become an afterthought in the design of the system.
- Later the realization hits that those valves are important, raising the question, “What are we going to do with the discretes?”

TopWorx has created several long-awaited discrete solutions that are two-wire, intrinsically safe, interoperability certified, and proven to work with process control systems such as Emerson’s Delta V.

**Did You Know?**

The TopWorx DVC-FF has received the Foundation Fieldbus “checkmark” from the Fieldbus Foundation, ensuring its interoperability with other devices and host systems.
The TopWorx Sensor-Communications Module (SCM) combines position sensors, FF communication, pilot valve outputs, and wiring terminals into a compact enclosure that is potted and sealed from the environment.

**SCM-FF Highlights**

- **Discrete Inputs (5)**: Open/Closed valve position feedback
- **Discrete Outputs (3)**: Pilot valve outputs for single or double acting
- **Calibration Switch**: Open-Close-FF
- **Status/Warning LEDs**: Open, Closed, Alarm State
- **FF Interoperability Tested**: Yes
- **Emerson Delta V Tested**: Yes
- **Intrinsically Safe**: Yes
- **Max Current Consumption**: <17mA (22mA with LEDs on full-time)
- **Voltage**: 9-32 VDC
- **Diagnostic Features**:
  - Cycle Counter
  - Cycle Time Alarms
  - Visual Alarm Indication
  - Diagnostic Switch
- **SCM-FF Wiring Diagram**

All micro-processor based electronics are completely potted and sealed, preventing premature failure due to moisture or contamination.

The FF Sensor-Communications Module fits conveniently into a variety of valve control enclosures suitable for any process environment.

**Lumitech DVC-FF**
- **Discrete Valve Controller**
  - Intrinsically Safe Zone 0 (Class I, Div 1)
  - Integral Pilot Valve
  - Direct Mount

See page 130 for more details.

**Lumitech DVM-FF**
- **Discrete Valve Monitor**
  - Intrinsically Safe Zone 0 (Class I, Div 1)
- **Switchpak DXP-FF**
- **Switchpak DXS-FF** (Stainless Steel enclosure)

See page 134, 136 for more details.
### HazLink Connectivity Enclosures

**502.969.8000**

Our HazLink products are rugged junction enclosures that provide flexible wiring options in hazardous areas, making it easy to connect conventional devices to the FOUNDATION Fieldbus network as well as make wiring connections and disconnect field devices in hazardous areas.

### HazLink Features:
- Zone 1 (Class I, Div 1)
- (3) \( \frac{3}{4} \) NPT conduit outlets

### HazLink Options:
- I/O Modules
- Wiring Tees
- Disconnect Switches

### HazLink I/O Modules

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NHL-FFIO</td>
<td>HazLink Connectivity Enclosure with FOUNDATION Fieldbus I/O 2 input, 2 output knifegate valve or cylinder controller</td>
</tr>
</tbody>
</table>

### General Specifications

- **Enclosure:** Die-cast aluminum, O-ring sealed
- **Coating:** Dichromate conversion epoxy, powder polyester coating (exposed)
- **O-ring:** Buna N
- **Cover:** Screw cover with O-ring seal
- **Conduit Outlets:** Three \( \frac{3}{4} \) NPT
- **Environment:** NEMA Type 4, 4X, 7 and 9
- **Approvals:** Explosion Proof
  - Zone 1 Class I, Div 1 & 2, Groups A,B,C,D
  - Class II, Div 1 & 2, Groups E,F,G

### HazLink Wiring Tees

- HazLink Wiring Tees make it easy to connect field devices to bus lines using wire terminals or plug-in connectors.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NHL-FFWT</td>
<td>FOUNDATION Fieldbus tee with 3 x 3 position wiring terminals</td>
</tr>
<tr>
<td>NHL-FFCP</td>
<td>Short circuit protection</td>
</tr>
</tbody>
</table>

### HazLink Disconnect Switches

- HazLink Disconnect Switches enable users to repair or replace a field device without disturbing the network with the simple flip of a lever-operated switch.

- **Disconnect Switches** are designed to be locked if desired. Locking prevents tampering or accidental device connection or disconnection.

- **TopWorx** offers Disconnect Switches in HazLink enclosures with or without short circuit protection.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NHL-FFDS</td>
<td>Disconnect switch</td>
</tr>
<tr>
<td>NHL-FFDC</td>
<td>Disconnect switch with short circuit protection</td>
</tr>
</tbody>
</table>

### Dimensions

- **Minimum clearance for adjustments and inspections:** 5.111 in. (12.98 cm)
- **Conduit connection:** 3/4" NPT (3 places)

### Courtesy of Steven Engineering

- 230 Ryan Way, South San Francisco, CA 94080-6370
- Main Office: (650) 588-9200
- Outside Local Area: (800) 258-9200
- www.stevenengineering.com
The products provide for the interconnection of a FOUNDATION Fieldbus network using standard wiring and DIN rail mountable terminal connections. The pluggable screw terminal connectors allow users to disconnect devices from the network without disconnecting individual wires.

### Spur Blocks & Expanders

Spur blocks provide for the connection of two trunk cable combinations and two fieldbus device drop (spur) cables. Expanders are used to provide additional device connections to the spur. Each expander block allows four additional drop cables for device connections. Multiple expander blocks may be added as needed to expand the spur.

#### Additional Specifications

- Surge Limit Start: 39V
- Approvals: Class I, Div. 1, Groups A,B,C,D

### Megablocks

These DIN rail mounted blocks provide a preassembled, fixed configuration for connection of 4 or 8 FOUNDATION Fieldbus devices. Additional blocks may be added for additional device connections. Integrated short circuit protection is available and will maintain network integrity in the event of a direct connection between two fieldbus conductors on an individual spur or drop cable. Megablocks require terminator NFF-1A05.

#### General Specifications

- Operating Temperature: -40°F to 158°F (-40°C to 70°C)

### Terminal Block Terminators & Protection

Proper Power Conditioning and Short Circuit Protection are vital to any robust and successful FOUNDATION Fieldbus installation.

#### Terminators

- FOUNDATION Fieldbus requires a terminator at each end of the main trunk line. Terminators reduce noise on the segments that is caused by signal reflections at the end of an open cable. The grounded terminating blocks are used at the beginning of the trunkline in the system cabinet, while the isolated terminating blocks are used at the end of the trunkline in the field.

#### Additional Specifications

- Approvals: Class I, Div. 1, Groups A,B,C,D
- Surge Limit Start: 39V (TI designation only)

#### Short Circuit Protection

- Short circuit protection will maintain network integrity in the event of a direct connection between the two fieldbus conductors on an individual spur or drop cable.

#### Additional Specifications

- Approvals: Class I, Div. 1, Groups A,B,C,D

### Item List

#### Part Number & Description

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFF-1A01</td>
<td>4-drop block</td>
</tr>
<tr>
<td>NFF-1A02</td>
<td>4-drop block with integrated short circuit protection 1</td>
</tr>
<tr>
<td>NFF-1A03</td>
<td>8-drop block</td>
</tr>
<tr>
<td>NFF-1A04</td>
<td>8-drop block with integrated short circuit protection 1</td>
</tr>
<tr>
<td>NFF-1A05</td>
<td>Megablock terminator, 39V limit</td>
</tr>
<tr>
<td>NFF-1B01</td>
<td>Fieldbus Spur Block with pluggable screw terminal connectors 2</td>
</tr>
<tr>
<td>NFF-1B02</td>
<td>Fieldbus Spur Block with fixed screw terminal connectors</td>
</tr>
<tr>
<td>NFF-1B03</td>
<td>Fieldbus Spur Block with cage clamp connectors</td>
</tr>
<tr>
<td>NFF-1B04</td>
<td>Fieldbus expander with pluggable screw terminal connectors 3</td>
</tr>
<tr>
<td>NFF-1B05</td>
<td>Fieldbus expander with fixed screw terminal connectors</td>
</tr>
<tr>
<td>NFF-1B06</td>
<td>Fieldbus expander with cage clamp connectors 3</td>
</tr>
</tbody>
</table>

1. SpecGuard compatible
2. Short circuit protection for nominal 20mA transmitter
3. Short circuit protection for nominal 40mA transmitter

### Megablocks

These DIN rail mounted blocks provide a preassembled, fixed configuration for connection of 4 or 8 FOUNDATION Fieldbus devices. Additional blocks may be added for additional device connections. Integrated short circuit protection is available and will maintain network integrity in the event of a direct connection between two fieldbus conductors on an individual spur or drop cable. Megablocks require terminator NFF-1A05.

#### General Specifications

- Operating Temperature: -40°F to 158°F (-40°C to 70°C)
Quick Disconnect Junctions & Accessories

These junction blocks are used for the interconnection of a FOUNDATION Fieldbus segment when using quick disconnect style connectors.

Available with or without short-circuit protection.

- Terminators, page 64

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Junctions with Short-Circuit Protection</strong></td>
<td></td>
</tr>
<tr>
<td>These junction blocks are used for the interconnection of a FOUNDATION Fieldbus segment when using quick disconnect style connectors.</td>
<td></td>
</tr>
<tr>
<td><strong>Additional Specifications</strong></td>
<td></td>
</tr>
<tr>
<td>Housing: Die-cast aluminum, black powder coated</td>
<td></td>
</tr>
<tr>
<td>Operating Current: 5.0 A (repetitive), 4.0 A (continuous)</td>
<td></td>
</tr>
<tr>
<td>Operating Voltage: 300 V</td>
<td></td>
</tr>
<tr>
<td>No. of Pins: 9</td>
<td></td>
</tr>
<tr>
<td><strong>Minifast Passive Junctions</strong></td>
<td></td>
</tr>
<tr>
<td>NFF-3A11</td>
<td>Minifast 8-port passive junction</td>
</tr>
<tr>
<td>NFF-3A12</td>
<td>Minifast 6-port passive junction</td>
</tr>
<tr>
<td>NFF-3A13</td>
<td>Minifast 4-port passive junction</td>
</tr>
<tr>
<td><strong>Eurofast Passive Junctions</strong></td>
<td></td>
</tr>
<tr>
<td>NFF-3A21</td>
<td>Eurofast 8-port passive junction</td>
</tr>
<tr>
<td>NFF-3A22</td>
<td>Eurofast 6-port passive junction</td>
</tr>
<tr>
<td>NFF-3A23</td>
<td>Eurofast 4-port passive junction</td>
</tr>
<tr>
<td><strong>Minifast 4-port Passive Junction</strong></td>
<td></td>
</tr>
<tr>
<td>NFF-3B01</td>
<td>8-port junction with short-circuit protection</td>
</tr>
<tr>
<td>NFF-3B02</td>
<td>6-port junction with short-circuit protection</td>
</tr>
<tr>
<td>NFF-3B03</td>
<td>4-port junction with short-circuit protection</td>
</tr>
<tr>
<td><strong>Minifast 6-port Passive Junction</strong></td>
<td></td>
</tr>
<tr>
<td>NFF-3C01</td>
<td>4-port junction with short-circuit protection</td>
</tr>
<tr>
<td>NFF-3C02</td>
<td>6-port junction with short-circuit protection</td>
</tr>
<tr>
<td><strong>Minifast 8-port Passive Junction</strong></td>
<td></td>
</tr>
<tr>
<td>NFF-3C03</td>
<td>8-port junction with short-circuit protection</td>
</tr>
</tbody>
</table>

Tees & Terminators

Tees and terminators are designed for use with Quick Disconnect connectors on page 68.

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System Tees</strong></td>
<td></td>
</tr>
<tr>
<td>These minifast junction tees provide short circuit protection to 4 or 6 spurs in an overmold design that provides exceptional corrosion resistance.</td>
<td></td>
</tr>
<tr>
<td><strong>Additional Specifications</strong></td>
<td></td>
</tr>
<tr>
<td>Housing: Black polyurethane</td>
<td></td>
</tr>
<tr>
<td>Voltage Surge Protection: &gt;36VDC</td>
<td></td>
</tr>
<tr>
<td>Output Current Limit: 35mA per spur</td>
<td></td>
</tr>
<tr>
<td>No. of Pins: 4</td>
<td></td>
</tr>
<tr>
<td><strong>Minifast Passive Junctions</strong></td>
<td></td>
</tr>
<tr>
<td>NFF-3A11</td>
<td>Minifast 8-port passive junction</td>
</tr>
<tr>
<td>NFF-3A12</td>
<td>Minifast 6-port passive junction</td>
</tr>
<tr>
<td>NFF-3A13</td>
<td>Minifast 4-port passive junction</td>
</tr>
<tr>
<td><strong>Eurofast Passive Junctions</strong></td>
<td></td>
</tr>
<tr>
<td>NFF-3A21</td>
<td>Eurofast 8-port passive junction</td>
</tr>
<tr>
<td>NFF-3A22</td>
<td>Eurofast 6-port passive junction</td>
</tr>
<tr>
<td>NFF-3A23</td>
<td>Eurofast 4-port passive junction</td>
</tr>
<tr>
<td><strong>Minifast 4-port Passive Junction</strong></td>
<td></td>
</tr>
<tr>
<td>NFF-3B01</td>
<td>8-port junction with short-circuit protection</td>
</tr>
<tr>
<td>NFF-3B02</td>
<td>6-port junction with short-circuit protection</td>
</tr>
<tr>
<td>NFF-3B03</td>
<td>4-port junction with short-circuit protection</td>
</tr>
<tr>
<td><strong>Minifast 6-port Passive Junction</strong></td>
<td></td>
</tr>
<tr>
<td>NFF-3C01</td>
<td>4-port junction with short-circuit protection</td>
</tr>
<tr>
<td>NFF-3C02</td>
<td>6-port junction with short-circuit protection</td>
</tr>
<tr>
<td><strong>Minifast 8-port Passive Junction</strong></td>
<td></td>
</tr>
<tr>
<td>NFF-3C03</td>
<td>8-port junction with short-circuit protection</td>
</tr>
</tbody>
</table>

Tees & Terminators

Tees and terminators are designed for use with Quick Disconnect connectors on page 68.

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</tr>
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</tr>
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</tr>
<tr>
<td><strong>Additional Specifications</strong></td>
<td></td>
</tr>
<tr>
<td>Housing: Black polyurethane</td>
<td></td>
</tr>
<tr>
<td>Voltage Surge Protection: &gt;36VDC</td>
<td></td>
</tr>
<tr>
<td>Output Current Limit: 35mA per spur</td>
<td></td>
</tr>
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<td>No. of Pins: 4</td>
<td></td>
</tr>
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</tr>
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<td>NFF-3A11</td>
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<td>NFF-3A13</td>
<td>Minifast 4-port passive junction</td>
</tr>
<tr>
<td><strong>Eurofast Passive Junctions</strong></td>
<td></td>
</tr>
<tr>
<td>NFF-3A21</td>
<td>Eurofast 8-port passive junction</td>
</tr>
<tr>
<td>NFF-3A22</td>
<td>Eurofast 6-port passive junction</td>
</tr>
<tr>
<td>NFF-3A23</td>
<td>Eurofast 4-port passive junction</td>
</tr>
<tr>
<td><strong>Minifast 4-port Passive Junction</strong></td>
<td></td>
</tr>
<tr>
<td>NFF-3B01</td>
<td>8-port junction with short-circuit protection</td>
</tr>
<tr>
<td>NFF-3B02</td>
<td>6-port junction with short-circuit protection</td>
</tr>
<tr>
<td>NFF-3B03</td>
<td>4-port junction with short-circuit protection</td>
</tr>
<tr>
<td><strong>Minifast 6-port Passive Junction</strong></td>
<td></td>
</tr>
<tr>
<td>NFF-3C01</td>
<td>4-port junction with short-circuit protection</td>
</tr>
<tr>
<td>NFF-3C02</td>
<td>6-port junction with short-circuit protection</td>
</tr>
<tr>
<td><strong>Minifast 8-port Passive Junction</strong></td>
<td></td>
</tr>
<tr>
<td>NFF-3C03</td>
<td>8-port junction with short-circuit protection</td>
</tr>
</tbody>
</table>

Tees & Terminators

Tees and terminators are designed for use with Quick Disconnect connectors on page 68.

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<tr>
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<td></td>
</tr>
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<td>Housing: Black polyurethane</td>
<td></td>
</tr>
<tr>
<td>Voltage Surge Protection: &gt;36VDC</td>
<td></td>
</tr>
<tr>
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<td></td>
</tr>
<tr>
<td>No. of Pins: 4</td>
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</tr>
<tr>
<td><strong>Minifast Passive Junctions</strong></td>
<td></td>
</tr>
<tr>
<td>NFF-3A11</td>
<td>Minifast 8-port passive junction</td>
</tr>
<tr>
<td>NFF-3A12</td>
<td>Minifast 6-port passive junction</td>
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<tr>
<td>NFF-3A13</td>
<td>Minifast 4-port passive junction</td>
</tr>
<tr>
<td><strong>Eurofast Passive Junctions</strong></td>
<td></td>
</tr>
<tr>
<td>NFF-3A21</td>
<td>Eurofast 8-port passive junction</td>
</tr>
<tr>
<td>NFF-3A22</td>
<td>Eurofast 6-port passive junction</td>
</tr>
<tr>
<td>NFF-3A23</td>
<td>Eurofast 4-port passive junction</td>
</tr>
<tr>
<td><strong>Minifast 4-port Passive Junction</strong></td>
<td></td>
</tr>
<tr>
<td>NFF-3B01</td>
<td>8-port junction with short-circuit protection</td>
</tr>
<tr>
<td>NFF-3B02</td>
<td>6-port junction with short-circuit protection</td>
</tr>
<tr>
<td>NFF-3B03</td>
<td>4-port junction with short-circuit protection</td>
</tr>
<tr>
<td><strong>Minifast 6-port Passive Junction</strong></td>
<td></td>
</tr>
<tr>
<td>NFF-3C01</td>
<td>4-port junction with short-circuit protection</td>
</tr>
<tr>
<td>NFF-3C02</td>
<td>6-port junction with short-circuit protection</td>
</tr>
<tr>
<td><strong>Minifast 8-port Passive Junction</strong></td>
<td></td>
</tr>
<tr>
<td>NFF-3C03</td>
<td>8-port junction with short-circuit protection</td>
</tr>
</tbody>
</table>
## Tees & Terminators

Part Number & Description: 502.969.8000

### Terminators

- **Tees and terminators are designed for use with Quick Disconnect (QDC) connectors on page 68.**

### General Specifications

- **Protection Class:** IP67

### Item

**Part Number & Description**

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tee</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Device Gland Receptacle and Bulkhead Fittings</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Terminator Resistor</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Additional Specifications</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Operating Temperature:</strong> -40° to 170°F (-40° to 80°C)</td>
<td></td>
</tr>
<tr>
<td><strong>Connector:</strong> Oil resistant grey polyurethane body material and contact carrier, 300V rating</td>
<td></td>
</tr>
<tr>
<td><strong>Coupling Nut:</strong> Stainless steel</td>
<td></td>
</tr>
<tr>
<td><strong>Protection:</strong> NEMA 1, 3, 4, 6p</td>
<td></td>
</tr>
<tr>
<td><strong>No. of Pins:</strong> 4</td>
<td></td>
</tr>
<tr>
<td><strong>NFF-4C01</strong></td>
<td>Minifast terminator resistor with male minifast connector</td>
</tr>
<tr>
<td><strong>NFF-4C02</strong></td>
<td>Eurofast terminator resistor with male eurofast connector</td>
</tr>
<tr>
<td><strong>NFF-4D01</strong></td>
<td>Minifast device gland receptacle, 4.5 in, 9A, 600V</td>
</tr>
<tr>
<td><strong>NFF-4D02</strong></td>
<td>Eurofast device gland receptacle, 4.5 in, 4A, 300V</td>
</tr>
<tr>
<td><strong>NFF-4D03</strong></td>
<td>Minifast bulkhead fitting, 9A, 600V</td>
</tr>
<tr>
<td><strong>NFF-4D04</strong></td>
<td>Eurofast bulkhead fitting, 4A, 250V</td>
</tr>
</tbody>
</table>

### Terminators for Intrinsically Safe Applications

- **NFF-SA11** I.S. Fieldbus Repeater with 70mA output current
- **NFF-SA12** I.S. Fieldbus Repeater acc. to FISCO with 100mA output current

### For Standard Applications

- **NFF-SA21** Fieldbus Repeater with 400mA output current
- **NFF-SA22** Fieldbus Power Supply with 400mA output current

### General Specifications

- **Operating Temperature:** -4° to 140°F (-20° to 60°C)
- **Power Supply Nominal Voltage:** 20-35V DC

### Repeaters provide a means of maintaining signal quality over long distance cable runs or powering multiple I.S. segments on the same FF segment.

While I.S. segments can support a limited number of devices, a typical FF segment may contain 16 or 32 devices per segment. Multiple I.S. segments can be interconnected on the same FF segment.
### Fieldbus Power Conditioning

Power Conditioners require a 24V power supply. See our selection of power supplies on page 116.

#### Power Conditioners

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power Conditioners</strong></td>
<td></td>
</tr>
<tr>
<td>NFF-6A01</td>
<td>Isolator/Power supply (I.S.) 80mA output current (max.)</td>
</tr>
<tr>
<td>NFF-6A02</td>
<td>Fieldbus power supply 350mA output current (max.) Switch selectable Internal FF Terminator</td>
</tr>
<tr>
<td>NFF-6A03</td>
<td>Shunt-diode safety barrier for use with MTL-5995 100mA output current (max.)</td>
</tr>
<tr>
<td>NFF-6A04</td>
<td><strong>Redundant Fieldbus Power System</strong> 350mA output current (max.) Contains an internal FF terminator</td>
</tr>
</tbody>
</table>

**Operating Temperature:** -4°C to 140°F (-20°C to 60°C)

The NFF-6A01 model provides an integrated I.S. barrier and connections for hazardous area installations as well as non-I.S. safe area connections.

The NFF-6A02 has no integrated I.S. barrier functionality and requires use of the 791 for any hazardous area device connections.

The NFF-6A04 provides redundant power conditioning for an FF segment and can be supplied by redundant 24VDC power supplies.

### Fieldbus Power Conditioning

Power Conditioners provide a means of connecting a conventional power source to a FOUNDATION Fieldbus segment. Power Conditioning is required to maintain proper segment voltage and isolate FF communications.

#### Power Conditioners

**These** power conditioners are available with screw terminal, fixed terminal, or cage clamp connectors and are typically used with the Terminal Block Junctions and Accessories on page 60.

**Additional Specifications**

<table>
<thead>
<tr>
<th>Surge Limit Start</th>
<th>Output Current (330mA min. (Conditioners))</th>
</tr>
</thead>
<tbody>
<tr>
<td>39V (Conditioners)</td>
<td>2.5A max. (Multiplexer)</td>
</tr>
</tbody>
</table>

**Part Number & Description**

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFF-6B01</td>
<td>Power multiplexer, fixed terminal connectors</td>
</tr>
<tr>
<td>NFF-6B02</td>
<td>Power multiplexer, cage clamp connectors</td>
</tr>
</tbody>
</table>

**General Specifications**

**Operating Temperature:** -40°C to 158°F (-40°C to 70°C)
### Field Wirable Connectors

These plug style connectors are designed for easy installation in the field after the FOUNDATION Fieldbus wiring has been routed through the conduit, wire-ways, panel enclosures, and other locations. Available in minifast or eurofast.

<table>
<thead>
<tr>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFC-MFS</td>
</tr>
<tr>
<td>NFC-MM5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFC-EMS</td>
</tr>
<tr>
<td>NFC-EMR</td>
</tr>
</tbody>
</table>

#### General Specifications
- **Operating Temperature**: -40° to 185°F (-40° to 85°C)
- **Protection Class**: IP67

#### Additional Specifications
- **Materials**: CuZn plated copper alloy
- **Protection**: NEMA 1, 3, 4, 6 & 13

### Molded Connector Cordsets

These cordsets provide FOUNDATION Fieldbus cable with pre-installed, plug-in connectors, reducing installation time in the field.

<table>
<thead>
<tr>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NFC-DE*</td>
</tr>
<tr>
<td>NFC-EM*</td>
</tr>
</tbody>
</table>

* Cable Types

<table>
<thead>
<tr>
<th>Cordset Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part Number</td>
</tr>
<tr>
<td>---------------</td>
</tr>
<tr>
<td>NFC-DEC1</td>
</tr>
<tr>
<td>NFC-DE5</td>
</tr>
<tr>
<td>NFC-DE10</td>
</tr>
</tbody>
</table>

Consult factory for additional cordset lengths.
FOUNDATION Fieldbus Bulk Cable

502.969.8000

Cable that meets the requirements of ISA/SP50 and the FOUNDATION Fieldbus requirements for Type A cable.

Cable is sunlight resistant and rated from -40°F to 221°F (-40° to 105°C).

Available in 30, 75, and 150 meter spools. Consult the factory for additional cable lengths.

- Field wirable connectors, page 68

### Part Number & Description

**Item**

**Part Number & Description**

- NFF-FC1-030 = PVC yellow FOUNDATION Fieldbus 3-wire cable in 30 meter spool
- NFF-FC2-075 = PVC yellow FOUNDATION Fieldbus 3-wire armor cable
- NFF-FC2-150 = PVC yellow FOUNDATION Fieldbus 3-wire armor cable

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Cable Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>030</td>
<td>30 m</td>
</tr>
<tr>
<td>075</td>
<td>75 m</td>
</tr>
<tr>
<td>150</td>
<td>150 m</td>
</tr>
</tbody>
</table>

Consult factory for additional cable lengths.

### Additional Specifications

- **Type of Drain:** Foil
- **Connector Insert:** Polyethylene; V2 acc. UL 94
- **Contact Material:** CuZn-plated copper alloy
- **Coupling Nut:** Stainless steel
- **Rating:** 300V
- **Permutation:** NEMA 1, 3, 4, 6, 13

### Diagnostic Tools

Our selection of diagnostic tools is designed to reduce the total cost of ownership of FOUNDATION Fieldbus networks and devices.

These devices provide powerful FOUNDATION Fieldbus troubleshooting tools in a convenient handheld unit.

#### General Specifications

**Operating Temperature:** 32° to 122°F (0° to 50°C)

#### Fieldbus Monitor

The Monitor provides diagnostics on live Fieldbus segments and tests ten vital segment parameters, including Voltage, Communication Signal Levels, Noise, and LAS device presence.

Draws approximately 10mA of current from the Fieldbus network.

- **Part Number:** NFF-DT3
- **Description:** Fieldbus Monitor

#### Fieldbus Power & Signal Probe

The Power & Signal Probe is a simple tool that uses individual LEDs to indicate bus power and signal levels on individual points on a Fieldbus network segment.

Draws 12-15mA of current from the Fieldbus network.

- **Part Number:** NFF-DT4
- **Description:** Fieldbus Power & Signal Probe

#### Fieldbus Wiring Validator

The Validator is used to inject DC power and to test communication signal on newly installed FF wiring. It may be used with the Monitor to completely test new or existing wiring segments. The Validator must not be used in hazardous areas or to power wiring that runs into hazardous areas.

Also provides power for calibration of TopWorx DVC-FF and DVM-FF.

- **Part Number:** NFF-DT5
- **Description:** Fieldbus Wiring Validator

### Bulk Cable Types

- **NFF-FC1-030:** PVC yellow FOUNDATION Fieldbus 3-wire cable
- **NFF-FC2-075:** PVC yellow FOUNDATION Fieldbus 3-wire armor cable
- **NFF-FC2-150:** PVC yellow FOUNDATION Fieldbus 3-wire armor cable

To create your bulk cable part number, use the chart below to select the appropriate cable length for your application, where ††††† = cable length.

**Example**

NFF-FC1-030 = PVC yellow FF 3-wire cable in 30 meter spool

#### Cable that meets the requirements of ISA/SP50 and the FOUNDATION Fieldbus requirements for Type A cable.

Cable is sunlight resistant and rated from -40°F to 221°F (-40° to 105°C).

Available in 30, 75, and 150 meter spools. Consult the factory for additional cable lengths.
**DeviceNet Overview**

DeviceNet is a CAN based Layer 7 protocol originally developed by Allen-Bradley. Operation of the DeviceNet is based on an object-oriented communications model. DeviceNet is maintained by the Open DeviceNet Vendor Association (ODVA).

DeviceNet is designed to connect simple devices from multiple vendors that comply with the DeviceNet network standards. DeviceNet device profile standards provide interchangeability between device manufacturers.

Each DeviceNet segment can connect up to 64 devices. It is a four-wire system delivering 8 amps at 24VDC, sufficient for field devices such as solenoid valves. The four wires carry signal and power typically on a single cable. Multiple power supplies can be used for redundancy and additional power requirements.

DeviceNet uses a trunk (bus) line with drop cables connecting devices. The trunkline requires 121 ohm terminating resistors at each end of the trunk.

DeviceNet supports Master/Slave, Peer-to-Peer, and Multi-Master network models. Data can be transferred on a cyclic or change of state basis using a Producer/Consumer paradigm that conserves network bandwidth. DeviceNet is very commonly used for communications from host systems to motor control centers and variable speed drives.

### DeviceNet Network Highlights

<table>
<thead>
<tr>
<th>Type of Network</th>
<th>Device Bus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Media</td>
<td>Two Shielded twisted pairs in one shielded thick, thin or flat cable (one pair for signal, one pair for power)</td>
</tr>
<tr>
<td>Network Topology</td>
<td>Bus with drops</td>
</tr>
<tr>
<td>Maximum Devices</td>
<td>62 devices per segment</td>
</tr>
<tr>
<td>Maximum Distance</td>
<td>Maximum Distance with repeaters</td>
</tr>
<tr>
<td>125Kbps</td>
<td>500m (1640 ft)</td>
</tr>
<tr>
<td></td>
<td>6m (20 ft) individual drop cable length</td>
</tr>
<tr>
<td></td>
<td>156m (512 ft) cumulative drop cable length</td>
</tr>
<tr>
<td>500Kbps</td>
<td>250m (820 ft)</td>
</tr>
<tr>
<td></td>
<td>6m (20 ft) individual drop cable length</td>
</tr>
<tr>
<td></td>
<td>78m (258 ft) cumulative drop cable length</td>
</tr>
<tr>
<td>1250Kbps</td>
<td>100m (328 ft)</td>
</tr>
<tr>
<td></td>
<td>6m (20 ft) individual drop cable length</td>
</tr>
<tr>
<td></td>
<td>39m (128 ft) cumulative drop cable length</td>
</tr>
</tbody>
</table>

* Thin cable may be used as trunk. Maximum distance is 100 meters, regardless of data rate

**Communication Methods**

- Master/slave
- multi-master
- peer-to-peer
- change of state or cyclic
- uses Producer/Consumer Paradigm

**Primary usage**

- Motor Control Centers, Variable Speed Drives, Remote I/O applications

**Power and Communications on same cable**

24VDC power on power bus (multiple supplies may be used for additional power or as backup). A separate 24VDC power supply for communication bus is recommended.

**Device Power Supply**

- 24VDC on power bus

**Wiring Types**

<table>
<thead>
<tr>
<th>Wiring Types</th>
<th>(ODVA Type II cable), generally used for trunk cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness</td>
<td>Thin Cable, commonly used for drop cables</td>
</tr>
<tr>
<td>Color</td>
<td>Blue/White conductors for communications</td>
</tr>
<tr>
<td>PowerType</td>
<td>Red/Black conductors for power</td>
</tr>
</tbody>
</table>

**Grounding aspects**

- Ground only the power supply closest to the middle of the network

**Terminators**

- 121 ohm terminator at each trunk line end

**Web Site**

- www.odva.org

---

**Conventional I/O System vs. DeviceNet Network**

DeviceNet is feature-rich, yet cost effective.

### Advantages

- Technology is already understood
- Lower device cost
- Independent wiring from devices to the control system means wiring problems with one device don't affect other field devices

### Limitations

- Limited flexibility
- Trunk length is limited

### TopWorx Comments on DeviceNet

### Strengths

- DeviceNet is capable.
- DeviceNet delivers a solid combination of integration.

### Drawbacks

- Higher installed cost
- Point-to-point wiring is expensive

### Cost When Simplicity is Needed

- If customers have only discrete devices and need no added functionality, then some other protocols are less expensive.

### When to Use DeviceNet

- Generally speaking, TopWorx recommends DeviceNet when:
  - device populations are primarily discrete and secondarily analog
  - end users desire some diagnostic capability for predictive environments
  - plants are not intrinsically safe
The DeviceNet Sensor-Communications Module (SCM) combines position sensors, DeviceNet communication, solenoid outputs, and wiring terminals into a compact enclosure that is potted and sealed from the environment.

All micro-processor based electronics are completely potted and sealed, preventing premature failure due to moisture or contamination.

Integrated position sensors provide valve position feedback.

All electronics are short-circuit protected, eliminating the expense of adding separate short-circuit protection.

Britelite LEDs indicate valve position and facilitate sensor set up.

Calibration Switch facilitates initial setup. The three position On-Off-DN switch enables the valve to be test cycled open and closed offline, then put onto the network when ready.

SCM-DN enclosure is resistant to high levels of impact, moisture, shock, and vibration.

Onboard terminals provide connection points for auxiliary discrete and analog inputs.

The DeviceNet Sensor-Communications Module fits conveniently into a variety of valve control enclosures suitable for any process environment.

**SCM-DN Highlights**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 Discrete Inputs (DI)</td>
<td>Open/Closed valve position feedback</td>
</tr>
<tr>
<td>2 Discrete Outputs (DO)</td>
<td>1 Auxiliary Input for dry contact</td>
</tr>
<tr>
<td>1 Analog Input (AI)</td>
<td>Solenoid outputs for single or double acting</td>
</tr>
<tr>
<td>Calibration Switch</td>
<td>Optional 4-20mA input</td>
</tr>
<tr>
<td>Status/Warning LEDs</td>
<td>Open, Closed, Alarm State</td>
</tr>
<tr>
<td>ODVA Conformance Tested</td>
<td>Yes</td>
</tr>
<tr>
<td>Short Circuit Protection</td>
<td>Yes</td>
</tr>
<tr>
<td>Maximum Output Current</td>
<td>500mA per output</td>
</tr>
<tr>
<td>Maximum Output Power Voltage</td>
<td>12 watts per output</td>
</tr>
<tr>
<td>Voltage</td>
<td>11-30 VDC</td>
</tr>
<tr>
<td>Diagnostics</td>
<td>Records number of cycles</td>
</tr>
<tr>
<td>Cycle Counter</td>
<td>User settable values for Open &amp; Close cycle times</td>
</tr>
<tr>
<td>Cycle Time Alarms</td>
<td>Blinking LEDs</td>
</tr>
<tr>
<td>Visual Alarm Indication</td>
<td>125la, 250la, 500la</td>
</tr>
<tr>
<td>Auto Baud Rate Detection</td>
<td></td>
</tr>
</tbody>
</table>

**SCM-DN Wiring Diagram**

**Powered by**

TopWorx is an official member of Rockwell Automation’s “Encompass” program, a third-party product referencing program for qualified suppliers that complement Rockwell Automation’s solutions offering.

**Switchpak DXP-DN**

Discrete Valve Monitor
- Zone 1 (Class I, Div 1)
- Direct Mount

See page 134, 136 for more details.

**Lumitech DVM-DN**

Discrete Valve Monitor
- Zone 2 (Class I, Div 2)
- Direct Mount

See page 132 for more details.

**Lumitech DVC-DN**

Discrete Valve Controller
- Zone 2 (Class I, Div 2)
- Integral Solenoid Valve
- Direct Mount

See page 130 for more details.

**Switchpak DXS-DN**

Discrete Valve Monitor
- Zone 1 (Class I, Div 1)
- (Stainless Steel enclosure)

See page 134 for more details.

**Lumitech DVC-DN**

Discrete Valve Controller
- Zone 2 (Class I, Div 2)
- Integral Solenoid Valve
- Direct Mount

See page 130 for more details.
HazLink Connectivity Enclosures

DeviceNet

HazLink Connectivity Enclosures

HAZLINK Wiring Tees make it easy to connect field devices to bus lines using wire terminals or plug-in connectors.

### HazLink Wiring Tees

- **NHL-DNWT**: DeviceNet tee with 3 x 5 position wiring terminals
- **NHL-DNCP**: Short circuit protection

### HazLink Disconnect Switches

- **NHL-DNDS**: Disconnect switch
- **NHL-DNDC**: Disconnect switch with short circuit protection

### HazLink I/O Modules

HazLink I/O Modules allow users to cost-effectively connect new or existing conventional devices into the DeviceNet network in Zone 1 (Class I, Div 1) hazardous areas.

- **NHL-DNIO**: Hazlink Connectivity Enclosure with DeviceNet I/O 2 input, 2 output knife-gate valve or cylinder controller

### General Specifications

- **Enclosure**: Die-cast aluminum; O-ring sealed
- **Coating**: Dichromate conversion (inside); powder polyester coating (outside)
- **O-rings**: Buna N
- **Cover**: Screw cover with O-ring seal
- **Conduit Outlets**: Three 3/4" NPT
- **Environment**: NEMA Type 4, 4X, 7 and 9
- **Approvals**: Explosion Proof Zone 1 Class I, Div 1 & 2, Groups A,B,C,D Class II, Div 1 & 2, Groups E,F,G

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Courtesy of Steven Engineering, Inc. 230 Ryan Way, South San Francisco, CA 94080-6370 • Main Office: (650) 588-9200 • Outside Local Area: (800) 258-9200 • www.stevenengineering.com
AS-i to DeviceNet Gateways

DeviceNet AS-i to DeviceNet Gateways provide a means of easily connecting an AS-i network to a higher level DeviceNet network. The Gateway is recognized as a single node on the higher level DeviceNet network while controlling the field devices on the AS-interface network.

Functions as a master on the AS-i network and as a single node on the DeviceNet network. These devices include demonstration software that performs addressing, monitoring, and diagnostics of the network.

Additional Specifications

- Single Gateway
  - Operating Voltage: 30VDC AS-i voltage
  - Operating Current: 200mA (from AS-i circuit)

- Dual Gateway
  - Operating Voltage: 24VDC
  - Operating Current: 200mA from AS-i 1, 70mA from AS-i 2

**Note:**
- D-sub data transmission cords, page 117
- Master simulators for testing, below

DeviceNet Master Simulator

This device connects to a parallel port on a PC and allows direct connection to a DeviceNet segment. This is useful when scanning the segment for devices and monitoring low level attributes of slave devices.

General Specifications

- Operating Temperature: 32° to 131°F (0° to 55°C)
- Power Supply: Powered by the keyboard interface of the PC
- Transfer Rate: 125, 250 or 500 Kilobaud
- Interface: CAN interface with 8 pin D-sub-plug
- Length of Connector Cable: max. 2 m

Modbus to DeviceNet Gateway

DeviceNet The Modbus to DeviceNet Gateway allows the connection of slave devices to a DeviceNet network. The gateway becomes a single node on the DeviceNet network.

**General Specifications**

- baud Rate Selection: Auto/125k/250k/500k baud
- Address Selection: Switch selectable 0-63

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Modbus to DeviceNet Gateway</strong></td>
<td>NDN-1A02 Modbus to DeviceNet gateway, RS 232 interface</td>
</tr>
<tr>
<td><strong>Modbus to DeviceNet Gateway</strong></td>
<td>NDN-1A01 DeviceNet Master Simulator</td>
</tr>
</tbody>
</table>

**Modbus to DeviceNet Gateway**

The Modbus to DeviceNet Gateway allows the connection of Modbus capable slave devices to a DeviceNet network.

The DeviceNet address is set using DIP switches on the device and the DeviceNet baud rate is automatically determined when connected to the network. A single gateway is capable of communicating with one or more Modbus devices.

**Additional Specifications**

- Operating Temperature: 32° to 140°F (0° to 60°C)
- Maximum Power: 200mA/11VDC to 90mA/25VDC
### Terminal Block Analog I/O

DeviceNet Analog I/O adaptors and modules provide a means of easily integrating conventional analog devices into the DeviceNet network.

#### Analog I/O Adapters

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NDN-3A01</td>
<td>Adapter with 4 analog inputs</td>
</tr>
<tr>
<td>NDN-3A02</td>
<td>Adapter with 8 analog inputs</td>
</tr>
</tbody>
</table>

#### Analog Signal Conditioning

Analog I/O modules are designed for use with I/O adaptors above.

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>mA Input Module</td>
<td>NDN-3B11 4-20mA input</td>
</tr>
<tr>
<td></td>
<td>NDN-3B12 0-20mA input</td>
</tr>
<tr>
<td>mA Output Module</td>
<td>NDN-3B21 4-20mA output</td>
</tr>
<tr>
<td></td>
<td>NDN-3B22 0-20mA output</td>
</tr>
<tr>
<td>Voltage Input Module</td>
<td>NDN-3B31 0-10V input</td>
</tr>
<tr>
<td></td>
<td>NDN-3B32 0-5V input</td>
</tr>
<tr>
<td>RTD Input Module</td>
<td>NDN-3B41 -100° to 100°C Pt input</td>
</tr>
<tr>
<td></td>
<td>NDN-3B42 0° to 200°C Pt input</td>
</tr>
</tbody>
</table>

#### Analog Signal Conditioning

Analog I/O modules are designed for use with I/O adaptors above.

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NDN-3B11</td>
<td>Adapter with 4 analog inputs</td>
</tr>
<tr>
<td>NDN-3B12</td>
<td>Adapter with 8 analog inputs</td>
</tr>
</tbody>
</table>

#### Terminal Block Analog Input/Output adaptors and modules provide a means of easily integrating conventional analog devices into the DeviceNet network.

#### General Specifications

- **Operating Temperature:** 32°F to 158°F (0°C to 70°C)
- **Maximum Power:**
  - NDN-3A01: 8 watts: 730mA/11VDC to 320mA/25VDC
  - NDN-3A02: 15 watts: 1.4A/11VDC to 600mA/25VDC

---

### Terminal Block Discrete I/O

DeviceNet Discrete I/O modules provide a means of easily integrating conventional discrete devices into the DeviceNet network.

#### Discrete I/O Adapters

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NDN-2A01</td>
<td>Adapter with 4 discrete inputs/outputs</td>
</tr>
<tr>
<td>NDN-2A02</td>
<td>Adapter with 8 discrete inputs/outputs</td>
</tr>
</tbody>
</table>

#### Discrete I/O Modules

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NDN-2B11</td>
<td>AC input, 120V</td>
</tr>
<tr>
<td>NDN-2B12</td>
<td>DC input, 24V</td>
</tr>
<tr>
<td>NDN-2B13</td>
<td>AC input, 240V</td>
</tr>
</tbody>
</table>

#### Discrete Inputs/Outputs

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NDN-2B21</td>
<td>AC output, 120V</td>
</tr>
<tr>
<td>NDN-2B22</td>
<td>DC output, 40V</td>
</tr>
<tr>
<td>NDN-2B23</td>
<td>DC output, 220V</td>
</tr>
</tbody>
</table>

#### Terminal Block Discrete Input/Output adaptors and modules provide a means of easily integrating conventional discrete devices into the DeviceNet network.

#### General Specifications

- **Operating Temperature:** 22°F to 176°F (-30°C to 80°C)
- **Maximum Current:**
  - Input Modules: 50mA DC
  - Output Modules: 3A continuous
- **Maximum 1 cycle surge:** 100A peak

---

**Terminal Block Analog I/O**

Terminal Block Analog Input/Output adaptors and modules provide a means of easily integrating conventional analog devices into the DeviceNet network.

**Terminal Block Discrete I/O**

Terminal Block Discrete Input/Output adaptors and modules provide a means of easily integrating conventional discrete devices into the DeviceNet network.
DeviceNet Modular I/O

DeviceNet Modular I/O is DIN rail mountable and recommended for high density, low-cost applications. The modular I/O system is connected to the DeviceNet segment via the fieldbus coupler. Input/Output Modules can contain a mixture of analog, discrete, and specialty modules to meet your specific application requirements.

General Specifications
- Operating Temperature: 32° to 131°F (0° to 55°C)
- Protection Class: IP20
- Connection: Cage clamp wiring connections

DeviceNet I/O Coupler

The fieldbus coupler interfaces the I/O system to the DeviceNet network and may contain any assortment of discrete, analog and specialty modules listed below.

The fieldbus coupler supports a maximum 512 byte input image and a maximum 512 byte output image.

Terminals are provided for 24VDC external power source connection for powering field I/O devices (max 10A).

Discrete I/O Modules

These Discrete I/O modules are designed for use with the coupling module to provide a means of integrating conventional discrete devices into a Profibus network.

Discrete signals are transferred by the bus coupler bit by bit. When digital information exceeds 8 bits, a new byte is automatically started.

### Additional Specifications
- Approvals: Class 1, Div 2 (except Relay Output Modules)

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIN-4A01</td>
<td>DeviceNet fieldbus coupler, 125-500 Kbaud</td>
</tr>
</tbody>
</table>

Analog signals are transferred via bytes or words.

### Additional Specifications
- Approvals: Class 1, Div 2 (except Thermocouple modules)

Power Supply Modules

These modules can be added to distribute power to field devices via a DeviceNet I/O System. Power is supplied from an external source.

See our Power Supply section when 24VDC is required.

### Additional Specifications
- Approvals: Class 1, Div 2 (except Relay Output Modules)

Relay Outputs

2-channel relay output, non-floating, 2 SPST contacts

Switching current: 2.0A AC/DC

### Additional Specifications
- Approvals: Class 1, Div 2 (except Thermocouple modules)

Separation & End Modules

A separation module provides a visual and an electrical separation between field I/O power types (i.e. 24VDC from 120VAC modules).

One end module is required at the physical end of each I/O System, with one per Bus Coupler.

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NMI-AT01</td>
<td>2-channel analog output, 0-10VDC</td>
</tr>
<tr>
<td>NMI-AT02</td>
<td>2-channel analog output, 0-20mA</td>
</tr>
<tr>
<td>NMI-AT03</td>
<td>2-channel analog output, 0-10mA</td>
</tr>
</tbody>
</table>

DIN Analog I/O Modules

These Analog I/O modules are designed for use with the Fieldbus Coupling module to provide a means of integrating conventional analog devices into a Profibus network.

Analog signals are transferred by the bus coupler via bytes or words.

### Additional Specifications
- Approvals: Class 1, Div 2 (except Thermocouple modules)

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NMI-AN01</td>
<td>2-channel analog input, RTD, PT100 sensor type</td>
</tr>
<tr>
<td>NMI-AN02</td>
<td>2-channel analog input, 0-10VDC, single ended</td>
</tr>
<tr>
<td>NMI-AN03</td>
<td>2-channel analog input, 0-10VDC, single ended</td>
</tr>
<tr>
<td>NMI-AN04</td>
<td>2-channel analog input, type K thermocouple (-14°F to 2492°F)</td>
</tr>
<tr>
<td>NMI-AN05</td>
<td>2-channel analog input, type J thermocouple (-14°F to 2192°F)</td>
</tr>
<tr>
<td>NMI-AN06</td>
<td>2-channel analog input, 0-20mA, Overload protection, 16Bit</td>
</tr>
<tr>
<td>NMI-AN07</td>
<td>2-channel, 4-20 mA, Overload protection, 16Bit</td>
</tr>
</tbody>
</table>

### Power Supply Modules

These modules can be added to distribute power to field devices via a DeviceNet I/O System. Power is supplied from an external source.

See our Power Supply section when 24VDC is required.

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NMI-PS01</td>
<td>24VDC, 2A power supply</td>
</tr>
<tr>
<td>NMI-PS02</td>
<td>24VDC, max. 6.3A with diagnostics and fuse-holder</td>
</tr>
<tr>
<td>NMI-PS03</td>
<td>230VAC, max. 6.3A with diagnostics and fuse-holder</td>
</tr>
<tr>
<td>NMI-PS04</td>
<td>120VAC, max. 6.3A with fuse-holder, no diagnostics</td>
</tr>
</tbody>
</table>

### Separation & End Modules

A separation module provides a visual and an electrical separation between field I/O power types (i.e. 24VDC from 120VAC modules).

One end module is required at the physical end of each I/O System, with one per Bus Coupler.

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NMI-SM01</td>
<td>Separation module</td>
</tr>
<tr>
<td>NMI-EM01</td>
<td>End module</td>
</tr>
</tbody>
</table>
Quick Disconnect I/O Modules

DeviceNet. Quick Disconnect Input/Output Modules provide a method of connecting conventional field devices to a DeviceNet Network with quick-disconnect (QDC) style connectors in a rugged, field mountable unit.

General Specifications
- Housing Material: Glass filled nylon with nickel plated brass connectors
- Operating Temperature: -13° to 158°F (-25° to 70°C)
- Protection Class: NEMA 1,3,4,12,13; IP67

I/O Modules with Advanced Diagnostics

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I/O Modules with Advanced Diagnostics</td>
<td></td>
</tr>
<tr>
<td>With Per Point Diagnostics</td>
<td></td>
</tr>
<tr>
<td>Additional Specifications</td>
<td></td>
</tr>
<tr>
<td>Compatibility: NPN/PNP</td>
<td></td>
</tr>
<tr>
<td>Open-circuit Detection: Individual</td>
<td></td>
</tr>
<tr>
<td>Short-circuit Protection: Individual</td>
<td></td>
</tr>
<tr>
<td>Base Rate Selection: Auto/125k/250k/500k baud</td>
<td></td>
</tr>
<tr>
<td>Address Selection: Switch selectable 0-63</td>
<td></td>
</tr>
<tr>
<td>No. of Pins: 5</td>
<td></td>
</tr>
<tr>
<td>NDN-5A01</td>
<td>8 Inputs, 8 Outputs, Max Output Load: 0.5A</td>
</tr>
<tr>
<td>NDN-5A02</td>
<td>16 Inputs, 8 Outputs, Max Output Load: 0.5A</td>
</tr>
<tr>
<td>NDN-5A03</td>
<td>4 Inputs, 4 Outputs, Max Output Load: 0.5A</td>
</tr>
<tr>
<td>NDN-5A04</td>
<td>8 Inputs, 8 Outputs, Max Output Load: 0.5A</td>
</tr>
<tr>
<td>NDN-5A05</td>
<td>8 Inputs, 8 Outputs, Max Output Load: 2.0A</td>
</tr>
</tbody>
</table>

I/O Modules with Standard Diagnostics

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I/O Modules with Standard Diagnostics</td>
<td></td>
</tr>
<tr>
<td>With Group Diagnostics</td>
<td></td>
</tr>
<tr>
<td>Additional Specifications</td>
<td></td>
</tr>
<tr>
<td>Compatibility: PNP (default)</td>
<td></td>
</tr>
<tr>
<td>Open-circuit Detection: Individual</td>
<td></td>
</tr>
<tr>
<td>Short-circuit Protection: Group</td>
<td></td>
</tr>
<tr>
<td>Base Rate Selection: Auto/125k/250k/500k baud</td>
<td></td>
</tr>
<tr>
<td>Address Selection: Switch selectable 0-63</td>
<td></td>
</tr>
<tr>
<td>No. of Pins: 5</td>
<td></td>
</tr>
<tr>
<td>NDN-5B01</td>
<td>8 Inputs, 8 Outputs, Max Output Load: 0.5A</td>
</tr>
<tr>
<td>NDN-5B02</td>
<td>4 Inputs, 4 Outputs, Max Output Load: 0.5A</td>
</tr>
<tr>
<td>NDN-5B03</td>
<td>8 Inputs, 8 Outputs, Max Output Load: 0.5A</td>
</tr>
<tr>
<td>NDN-5B04</td>
<td>16 Inputs, 16 Outputs, Max Output Load: 0.5A</td>
</tr>
<tr>
<td>NDN-5B05</td>
<td>8 Inputs, 8 Outputs, Max Output Load: 0.5A</td>
</tr>
<tr>
<td>NDN-5B06</td>
<td>8 Inputs, 8 Outputs, Max Output Load: 1.4A</td>
</tr>
</tbody>
</table>

Quick Disconnect Junctions & Accessories

DeviceNet. Junction modules and Junction Tees are used to easily construct the physical layer of a DeviceNet network. These modules provide QDC connections for the trunkline, drop lines, and individual host devices.

General Specifications
- Protection Class: P67

Eurofast Junction Modules

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eurofast Junction Modules</td>
<td></td>
</tr>
<tr>
<td>Additional Specifications</td>
<td></td>
</tr>
<tr>
<td>Housing: Polyethylene</td>
<td></td>
</tr>
<tr>
<td>Connectors: Nickel-plated brass</td>
<td></td>
</tr>
<tr>
<td>Coupling Nuts: Stainless steel</td>
<td></td>
</tr>
<tr>
<td>Operating Temperature: 42° to 176°F (-20° to 75°C)</td>
<td></td>
</tr>
<tr>
<td>No. of Pins: 5</td>
<td></td>
</tr>
<tr>
<td>NDN-6A01</td>
<td>8 Inputs, 8 Outputs, Max Output Load: 0.5A</td>
</tr>
<tr>
<td>NDN-6A02</td>
<td>8 Ports, eurofast, with minifast trunk connectors</td>
</tr>
<tr>
<td>NDN-6A03</td>
<td>2 Inputs, 8 Outputs, Max Output Load: 0.5A</td>
</tr>
<tr>
<td>NDN-6A04</td>
<td>6 Ports, eurofast, with minifast trunk connectors, voltage monitoring with low and high voltage LED indication</td>
</tr>
<tr>
<td>NDN-6A05</td>
<td>6 Ports, eurofast, with minifast trunk connectors, voltage monitoring with low and high voltage LED indication</td>
</tr>
<tr>
<td>NDN-6A06</td>
<td>6 Ports, eurofast, with minifast trunk connectors, voltage monitoring with low and high voltage LED indication</td>
</tr>
<tr>
<td>NDN-6A07</td>
<td>6 Ports, eurofast, with minifast trunk connectors, voltage monitoring with low and high voltage LED indication</td>
</tr>
</tbody>
</table>

Eurofast Junctions & Accessories

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eurofast Junctions &amp; Accessories</td>
<td></td>
</tr>
<tr>
<td>Eurofast: Male</td>
<td></td>
</tr>
<tr>
<td>Female: Eurofast</td>
<td></td>
</tr>
<tr>
<td>NDN-6B01</td>
<td>4-port junction tee, minifast bus connection, eurofast device ports</td>
</tr>
<tr>
<td>NDN-6B02</td>
<td>6-port junction tee, minifast bus connection, eurofast device ports</td>
</tr>
<tr>
<td>NDN-6B03</td>
<td>4-port junction tee, minifast bus connection and device ports</td>
</tr>
<tr>
<td>NDN-6B04</td>
<td>6-port junction tee, minifast bus connection and device ports</td>
</tr>
<tr>
<td>NDN-6B05</td>
<td>6-port junction tee, minifast bus connection and device ports</td>
</tr>
<tr>
<td>NDN-6B06</td>
<td>6-port junction tee, minifast bus connection and device ports</td>
</tr>
</tbody>
</table>

Terminators

Two terminators are required per each DeviceNet trunkline. The terminators should be located at each physical end of the trunkline.

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminators</td>
<td></td>
</tr>
<tr>
<td>Additional Specifications</td>
<td></td>
</tr>
<tr>
<td>Connector: Polyethylene, 30V rating</td>
<td></td>
</tr>
<tr>
<td>Contact Material: Gold plated copper alloy</td>
<td></td>
</tr>
<tr>
<td>Coupling Nuts: Nickel-plated brass</td>
<td></td>
</tr>
<tr>
<td>Protection: NEMA 1,3,4,6s</td>
<td></td>
</tr>
<tr>
<td>Operating Temperature: -40° to 170°F (-40° to 70°C)</td>
<td></td>
</tr>
<tr>
<td>No. of Pins: 5</td>
<td></td>
</tr>
<tr>
<td>NDN-6C01</td>
<td>Male eurofast connector, internal resistor</td>
</tr>
<tr>
<td>NDN-6C02</td>
<td>Female eurofast connector, internal resistor</td>
</tr>
</tbody>
</table>

Minifast Bus Terminator

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minifast Bus Terminator</td>
<td></td>
</tr>
<tr>
<td>Male Minifast Connector: Internal Resistor</td>
<td></td>
</tr>
<tr>
<td>Female Minifast Connector: Internal Resistor</td>
<td></td>
</tr>
<tr>
<td>NDN-6C01</td>
<td>Male minifast connector, internal resistor</td>
</tr>
<tr>
<td>NDN-6C02</td>
<td>Female minifast connector, internal resistor</td>
</tr>
</tbody>
</table>

84

85

Courtesy of Steven Engineering, Inc. • 230 Ryan Way, South San Francisco, CA 94080-6370 • Main Office: (650) 588-6000 • Outside Local Area: (650) 588-9290 • www.stevenengineering.com
## Bus Extenders & Repeaters

**Part Number & Description**

**Item** | **Part Number & Description**
--- | ---
**Bus Extenders/Repeaters** | **DeviceNet Repeater**

**General Specifications**
- **Maximum Voltage:** 11 to 25VDC
- **Maximum Power:** 1.3 watts
- **Operating Temperature:** 32° to 158°F (-25° to 70°C)
- **Protection:** IP65

**Repeater**
This module provides a QD style DeviceNet repeater to overcome DeviceNet system wiring limitations.

**Specifications**
- **Housing:** Glass filled nylon; nickel plated brass connectors
- **Operating Temperature:** -3° to 158°F (-20° to 70°C)
- **Bus Power:** 11-25VDC
- **Node Current Consumption:** 125mA segment A, 30mA segment B
- **Protection:** NEMA 1, 3, 4, 12, 13; IP67

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NDN-7A01</td>
<td>Bus extender/repeater</td>
</tr>
<tr>
<td>NDN-7A02</td>
<td>Fiber-optic bus extender/repeater with ST connectors</td>
</tr>
<tr>
<td>NDN-7B01</td>
<td>DeviceNet Repeater</td>
</tr>
</tbody>
</table>

**DeviceNet Repeater**
For use with thin and medium DeviceNet cable only.

**Eurofast Connectors**
For use with thin and medium DeviceNet cable only.

**Field Wirable Connectors**
These plug style connectors are designed for easy installation in the field after the DeviceNet wiring has been routed through the conduit, wire-ways, panel enclosures, and other locations.

**General Specifications**
- **Operating Temperature:** -40° to 185°F (-40° to 85°C)
- **Protection Class:** IP67

**Minifast Connectors**

**Additional Specifications**
- **Housing:** Nylon
- **Connector Insert:** Polyurethane
- **Contact Material:** CuZn plated copper alloy
- **Coupling Nuts:** Anodized aluminum
- **Protection:** NEMA 1, 3, 4, 13
- **Rating:** 3A, 300VDC
- **No. of Pins:** 5

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female Connectors</td>
<td>NDN-MFT Minifast female field wirable connector, thin cable</td>
</tr>
<tr>
<td>Male Connectors</td>
<td>NDN-MMF Minifast male field wirable connector, thin cable</td>
</tr>
<tr>
<td>Female Connectors</td>
<td>NDN-MFH Minifast female field wirable connector, thick cable</td>
</tr>
<tr>
<td>Male Connectors</td>
<td>NDN-MMH Minifast male field wirable connector, thick cable</td>
</tr>
</tbody>
</table>

**Eurofast Connectors**

**Female Connectors**

**Additional Specifications**
- **Housing:** Polyurethane, PBT Black
- **Connector Insert:** PBT
- **Contact Material:** Nickel plated copper alloy
- **Coupling Nuts:** Female - PBT, Male - Nickel Plated Brass
- **Protection:** NEMA 1, 3, 4, 13
- **Rating:** 3A, 300VDC
- **No. of Pins:** 5

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female Connectors</td>
<td>NFC-ERF Eurofast right angle female field wirable connector, thick cable</td>
</tr>
<tr>
<td>Male Connectors</td>
<td>NFC-EMS Eurofast straight male field wirable connector, thin cable</td>
</tr>
<tr>
<td>FC-EMR Eurofast right angle male field wirable connector, thin cable</td>
<td></td>
</tr>
</tbody>
</table>

**Male Connectors**

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female Connectors</td>
<td>NFC-ERS Eurofast straight female field wirable connector, thin cable</td>
</tr>
<tr>
<td>Male Connectors</td>
<td>NFC-MFR Eurofast right angle female field wirable connector, thin cable</td>
</tr>
</tbody>
</table>

**Minifast Connectors**

**Female Connectors**

**Additional Specifications**
- **Housing:** Nylon
- **Connector Insert:** Polyurethane
- **Contact Material:** CuZn plated copper alloy
- **Coupling Nuts:** Anodized aluminum
- **Protection:** NEMA 1, 3, 4, 13
- **Rating:** 3A, 300VDC
- **No. of Pins:** 5

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female Connectors</td>
<td>NFC-EMR Eurofast right angle male field wirable connector, thin cable</td>
</tr>
<tr>
<td>Male Connectors</td>
<td>NFC-EMS Eurofast straight male field wirable connector, thin cable</td>
</tr>
</tbody>
</table>
Molded Connector Cordsets

These cordsets provide DeviceNet cable with pre-installed, plug-in connectors, reducing installation time in the field.

Available in 1, 3, 5, and 10 meter lengths. Consult the factory for additional cordset lengths.

### Part Number & Description

To complete your cordset part number:

1. Select your connector types
2. Select your cable type from the list below (* = cable type)
3. Select your cordset length from the chart below († = cordset length)

**Example**

NDM-DMC1-1 = DeviceNet "Thin" double connector cordset, 1 m

### Double Minifast Connector Cordsets

NDN-DMC-†

### Single Minifast Connector Cordsets

NDN-MM†-C Male Connector

NDN-MF†-C Female Connector

**Cable Types**

<table>
<thead>
<tr>
<th>DC1</th>
<th>DeviceNet &quot;Thin&quot; cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC2</td>
<td>DeviceNet &quot;Medium&quot; cable</td>
</tr>
<tr>
<td>DC3</td>
<td>DeviceNet &quot;Medium&quot; cable, 300V</td>
</tr>
<tr>
<td>DC4</td>
<td>DeviceNet &quot;Thick&quot; cable, 600V</td>
</tr>
</tbody>
</table>

**Cordset Length**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Cordset Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 m</td>
</tr>
<tr>
<td>3</td>
<td>3 m</td>
</tr>
<tr>
<td>5</td>
<td>5 m</td>
</tr>
<tr>
<td>10</td>
<td>10 m</td>
</tr>
</tbody>
</table>

Consult factory for additional cordset lengths.

DeviceNet Bulk Cable

Cable that meets the requirements of ODVA.

Available in 30, 75, and 150 meter spools. Consult the factory for additional cable lengths.

**Bulletin**

- Field wirable connectors, page 87

### Part Number & Description

To create your bulk cable part number, use the chart below to select the appropriate cable length for your application, where † = cable length.

**Example**

NDN-DC1-030 = DeviceNet "Thin" cable in 30 meter spool

### Bulk Cable Types

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Cable Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>NDN-DC1</td>
<td>30 m</td>
</tr>
<tr>
<td>NDN-DC2</td>
<td>60 m</td>
</tr>
<tr>
<td>NDN-DC3</td>
<td>150 m</td>
</tr>
</tbody>
</table>

Consult factory for additional cable lengths.

DeviceNet Medium Cable meets ODVA Type III cable requirements. This cable can be used as trunkline cable in networks with a maximum length of 300 meters.

DeviceNet Thick Cable meets ODVA Type II cable requirements. This cable can be used as trunkline cable in networks with a maximum length of 500 meters.

General Specifications

**Materials**
PVC

**Rating**
To 176°F (80°C)

Available in 30, 75, and 150 meter spools. Consult the factory for additional cable lengths.

- Field wirable connectors, page 87

**Cable Types**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Cable Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>NDN-DC1</td>
<td>30 m</td>
</tr>
<tr>
<td>NDN-DC2</td>
<td>60 m</td>
</tr>
<tr>
<td>NDN-DC3</td>
<td>150 m</td>
</tr>
</tbody>
</table>

Consult factory for additional cable lengths.

Molded Connector Cordsets

Toppila offers DeviceNet molded connector cordsets in DeviceNet Thin, Medium, and Thick (300V and 600V) cable.

Cordsets are available with a molded connector on each end or with one end bare to facilitate routing of cable through conduit or panel enclosures.

All double cordsets have one straight male connector and one straight female connector.

**See page 89 for cable specifications.**

**Connector Specifications**

**Plug Body:** Molded polyurethane

**Contacts:** Gold plated brass

**Coupling Nut:** Nickel plated brass

**Temperature:** -40° to 158°F (-40° to 70°C)

**Protection:** NEMA 1,3,4,6,13; IP67

**Rated Current:** 9.0A (minifast)
DeviceNet

Our handheld diagnostic and troubleshooting device with a simple user interface is a powerful startup, verification, and troubleshooting tool for any DeviceNet network, featuring NetAlert diagnostic capabilities.

### Item

<table>
<thead>
<tr>
<th>Handheld Diagnostic Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>The NDN-DT8 provides two modes for monitoring and troubleshooting DeviceNet segments. AUTO search mode rapidly measures key DeviceNet parameters and provides a good, warning, or fault indication. In Expert mode, the NDN-DT8 can be used to monitor a wide array of DeviceNet segment parameters including max/min bus power voltage, max/min CAN bus voltage, error rate, error counter, percent of bandwidth used, as well as device specific traffic and error rates.</td>
</tr>
</tbody>
</table>

### Part Number & Description

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NDN-DT8</td>
<td>Diagnostic and troubleshooting tool</td>
</tr>
<tr>
<td></td>
<td>- includes carrying bag with strap</td>
</tr>
</tbody>
</table>

### General Specifications

- **Power Supply:** Network 11-30VDC < 150mA
- **Battery:** 2D AA alkaline batteries
- **Connectors:** (1) micro per ODVA (M12); adaptor cables; (2) included for mini-change and pluggable screw terminal
- **Band Rates:** 125K, 250K, and 500K (Auto-detect)
- **Analog Accuracy:** Bus power ± 100mV; Bus signal ± 20mV


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230 Ryan Way, South San Francisco, CA 94080-6370
Main Office: (650) 588-9200
Outside Local Area: (800) 258-9200
www.stevenengineering.com
Profibus Overview

The Profibus protocol was created in 1989 in Germany by a consortium of factory automation suppliers. Originally developed to enable discrete manufacturing, it has expanded into process automation and enterprise-wide applications.

Profibus encompasses several Industrial Bus Protocol Specifications, including Profibus-DP, Profibus-PA, Profibus-FMS, and PROFInet.

Profibus-DP is a device level bus that supports both analog and discrete signals. Profibus-DP has widespread usage for such items as remote I/O systems, motor control centers, and variable speed drives. Profibus-DP communicates at speeds from 9.6 Kbps to 12 Mbps over distances from 100 to 1,200 meters. Profibus-DP doesn’t natively support Intrinsically Safe installations.

Profibus-PA is a full-function fieldbus that is generally used for process level instrumentation. Profibus-PA communicates at 31.25 Kbps and has a maximum distance of 1,900 meters per segment. Profibus-PA is designed to support Intrinsically Safe applications.

Profibus-FMS is a control bus generally used for communications between DCS and PLC systems, while PROFInet is a protocol being developed to allow Profibus communications across Ethernet Networks.

Profibus Network Highlights

<table>
<thead>
<tr>
<th>Type of Network</th>
<th>Device Bus</th>
<th>Process Control Network</th>
<th>Control (cell level) Network</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Media</td>
<td>Twisted pair, fiber</td>
<td>Bus, Ring, Star</td>
<td></td>
</tr>
<tr>
<td>Maximum Devices</td>
<td>max. 126 stations on one bus (maximum of 244 bytes input and output data possible for each slave)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Distance</td>
<td>93,750bps and less – 1200 meters</td>
<td>500Kbps – 400 meters</td>
<td>1.5Mbps – 200 meters</td>
</tr>
<tr>
<td></td>
<td>1.5Mbps – 100 meters</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PA</td>
<td>1,900 meters</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max Distance with repeater</td>
<td>9,500 meters with repeaters (max. 4 repeaters can be used)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication Methods</td>
<td>Peer-to-peer, multicast or cyclic master-slave (uses token passing sequence)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PA</td>
<td>Client/server, Publisher/Subscriber, Event Both Scheduled and Unscheduled communications</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Primary usage

- DP Used for Discrete and Analog for PLC, Variable Speed Drives, Remote I/O communications
- PA Analog and discrete process control devices

Power and Communications

- DP Power is supplied separately from communications bus (can be supplied on a parallel power bus)
- PA Requires PA power supply (conditioner) to protect the digital communications

Device Power Supply

- DP Devices are powered separately from communications bus
- PA Can be supplied from bus (optional)

Wiring Types

- DP Shielded twisted pair #22 AWG
- PA Shielded twisted pair #18 AWG (0.8mm) 1900m (6232 ft.)

Device Addressing

- DP switch settings or handheld software

Governing Body

- PROFIBUS International (Pt)

Web Site

- www.profibus.com

TopWorx Comments on Profibus

Strengths

- Profibus offers more choices. Profibus is the only bus protocol that offers different solutions for process automation (PA), factory automation (DP), and enterprise-wide (Net).

- Profibus is well accepted across multiple industries, especially in Europe.

Limitations

- Profibus has had limited success gaining market share in North America, particularly in the process industries.

Conventional I/O System vs. Profibus Network

Profibus offers a variety of solid solutions for all levels of process automation.

Profibus-PA-FMS NETWORKS

Advantages

- Based on RS-485 physical layer
- Multiple bus transmission speeds and wiring length combinations:
  - Up to 1000 m distance at 9.6Kbps/sec, expandable to 2000 m using repeaters
  - Up to 250 m at maximum speed of 19.2Kbps/sec.
- Supports both discrete and analog signals
- I/O modules allow connection of conventional analog and discrete devices
- Interfaces available for many variable speed drives, motor control centers, and field devices
- Supports 32 devices per segment, 62 with repeaters
- Supports many-master and multi master systems
- Simple integration of new devices to an existing system

Drawbacks

- Not available for Intrinsically Safe installations
- No control in the field capabilities
- Segment wiring, power, grounding, shielding and termination requirements must be adhered to in the design and installation

Profibus-DP NETWORK

Advantages

- Technology is already understood
- Lower device cost
- Independent wiring from devices to the control system means wiring problems with one device don’t affect other field devices

Drawbacks

- Higher installed cost
- Point-to-point wiring is expensive
- Many wiring connections:
  - are labor intensive to install
  - create time-consuming initial checkout and startup
  - require large amounts of cabinet or rack space for installation of terminal blocks
  - create new data histories

TopWorx Comments on Profibus

Strengths

- Profibus offers more choices. Profibus is the only bus protocol that offers different solutions for process automation (PA), factory automation (DP), and enterprise-wide (Net).

- Profibus is well accepted across multiple industries, especially in Europe.

Limitations

- Profibus has had limited success gaining market share in North America, particularly in the process industries.
The TopWorx Sensor-Communications Module (SCM) combines position sensors, Profibus communication, solenoid outputs, and wiring terminals into a compact enclosure that is potted and sealed from the environment.

All electronics are short-circuit protected, eliminating the expense of adding separate short-circuit protection.

Integrated position sensors provide valve position feedback.

Onboard terminals provide connection points for auxiliary discrete and analog inputs.

SCM-PB Highlights

- **4 Discrete Inputs (DI)**: Open/Closed valve position feedback
- **2 Discrete Outputs (DO)**: Solenoid outputs for single or double acting
- **Optional 4-20mA Input**
- **Calibration Switch**
  - Open
  - Close
  - Profibus
- **Status/Warning LEDs**
  - Open
  - Close
  - Alarm State
- **PTO Conformance Tested**
- **Yes**
- **Short Circuit Protection**
- **Yes**
- **Maximum Current**
  - 160mA per output
- **Power**
  - 4 watts per output
- **Voltage**
  - 24VDC
- **Diagnostic Features**
  - Cycle Counter
  - Cycle Time Alarms
  - Visual Alarm Indication
  - Records number of cycles
  - User settable values for Open & Close cycle times
  - Blinking LEDs

Did You Know?
The Profibus Sensor-Communications Module enables TopWorx discrete valve controllers to connect directly to the Profibus-DP network, eliminating the need and expense of AS-i to Profibus gateways.

Lumitech DVC-PB
- **Discrete Valve Controller**
  - Zone 2 (Class I, Div 2)
  - Integral Solenoid Valve
  - Direct Mount

See page 130 for more details.

Lumitech DVM-PB
- **Discrete Valve Monitor**
  - Zone 2 (Class I, Div 2)
  - Direct Mount

See page 132 for more details.

Switchpak DXP-PB
- **Discrete Valve Monitor**
  - Zone 1 (Class I, Div 1)

(Stainless Steel enclosure)

See page 134, 136 for more details.
**HazLink Connectivity Enclosures**

The Profibus DP device bus network was originally designed to be used for factory automation rather than process automation. Therefore, in the process industries there has been a need for easy, cost-effective ways to make wiring connections in hazardous areas.

Our HazLink products are rugged junction enclosures that provide flexible wiring options in hazardous areas, making AS-Interface more suitable for use in the process industries.

### HazLink Features:
- Zone 1 (Class I, Div 1)
- (3) ⅜ NPT conduit outlets

### HazLink Options:
- I/O Modules
- Wiring Tees
- Disconnect Switches

### HazLink Connectivity Enclosures

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Specifications</td>
<td>Enclosure: Die-cast aluminum, O-ring sealed</td>
</tr>
<tr>
<td></td>
<td>Coating: Dichromate conversion epoxy, powder polyester coating orange</td>
</tr>
<tr>
<td></td>
<td>O-rings: Buna N</td>
</tr>
<tr>
<td></td>
<td>Cover: Screw cover with O-ring seal</td>
</tr>
<tr>
<td></td>
<td>Conduit Outlets: Three ⅜ NPT</td>
</tr>
<tr>
<td></td>
<td>Environment: NEMA Type 4, 4X, 7 and 9</td>
</tr>
<tr>
<td></td>
<td>Approvals: Explosion Proof</td>
</tr>
<tr>
<td></td>
<td>Zone 1, Class I, Div 1 &amp; 2, Groups A,B,C,D</td>
</tr>
<tr>
<td></td>
<td>Zone 8, Class I, Div 1 &amp; 2, Groups E,F,G</td>
</tr>
</tbody>
</table>

### HazLink I/O Modules

HazLink I/O Modules allow users to cost-effectively connect new or existing conventional devices into the Profibus DP network in Zone 1 (Class I, Div 1) hazardous areas.

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NHL-PBIO</td>
<td>HazLink Connectivity Enclosure with Profibus I/O</td>
</tr>
<tr>
<td></td>
<td>4 input, 2 output knife gate valve or cylinder controller</td>
</tr>
</tbody>
</table>

### HazLink Wiring Tees

HazLink Wiring Tees make it easy to connect field devices to bus lines using wire terminals or plug-in connectors.

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NHL-PBWT</td>
<td>Profibus tee with 3 x 5 position wiring terminals</td>
</tr>
<tr>
<td>NHL-PBDC</td>
<td>Short circuit protection</td>
</tr>
</tbody>
</table>

### HazLink Disconnect Switches

HazLink Disconnect Switches enable users to repair or replace a field device without disturbing the network with the simple flip of a lever-operated switch.

Disconnect Switches are designed to be locked if desired. Locking prevents tampering or accidental device connection or disconnection.

TopWorx offers Disconnect Switches in HazLink enclosures with or without short circuit protection.

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NHL-PBDS</td>
<td>Disconnect switch</td>
</tr>
<tr>
<td>NHL-PBDC</td>
<td>Disconnect switch with short circuit protection</td>
</tr>
</tbody>
</table>

### Dimensions

![Diagram of dimensions](image)
### AS-i to Profibus DP Gateways

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AS-i to Profibus DP Gateways</strong></td>
<td></td>
</tr>
<tr>
<td>Gateway</td>
<td>NAS-GP11</td>
</tr>
<tr>
<td>Gateway with graphical display</td>
<td>NAS-GP12</td>
</tr>
</tbody>
</table>

Functions as a master on the AS-i network and as a single node on the Profibus DP network.

Dual Gateways function as two complete masters on the AS-i network and as a single node on the Profibus DP network.

These devices include demonstration software that performs addressing, monitoring, and diagnostics of the network.

**Additional Specifications**
- **Connection Type:** Screw terminals

**Gateway**
- **Operating Voltage:** 30VDC AS-i voltage
- **Operating Current:** 200mA (from AS-i circuit)

**Dual Gateway**
- **Operating Voltage:** 18VDC
  - AS-i Power: 200mA (max AS-i), 70mA (from AS-i)
  - Standard Power: 70mA (from each AS-i), 150mA at 18VDC (from power)

### Profibus DP Master Simulator

- **NPB-1A01** Profibus DP Master Simulator

The Profibus DP Master Simulator is used to connect a PC to a Profibus DP segment for configuration of Profibus DP slave devices, including the configuration of Profibus DP gateways. This tool is particularly useful for Profibus devices in the IP67 protection class that do not have DIP switches for address configuration.

**General Specifications**
- **Operating Temperature:** 32° to 131°F (0° to 55°C)
- **Mounting:** DIN rail
- **Voltage of insulation:** ≥ 500V
- **Protection Category:** Housing (IP40), Terminals (IP20)
- **AS-i Specification:** 2.1

**Profibus DP Master Simulator**

The Master Simulator includes RS 232 / RS 485 converter and monitoring software.

**Operating Temperature:** 32° to 131°F (0° to 55°C)
**Operating Current:** < 60mA
**Power Supply:** From the RS485 interface of the Profibus slave (5V)
**Transfer Rate:** 19200 Baud
**Interfaces:** Standard PC RS232 interface with 9-pin D-sub-plug (female); RS485 interface with 9-pin D-sub-plug (male)
**Cable Length:** RS 232 and RS 485: max. 2 m

### General Specifications

**Operating Temperature:** 32° to 131°F (0° to 55°C)

**Mounting:** DIN rail

**Voltage of insulation:** ≥ 500V

**Protection Category:** Housing (IP40), Terminals (IP20)

**Transfer Rate:** 19200 Baud

**Interfaces:** Standard PC RS232 interface with 9-pin D-sub-plug (female); RS485 interface with 9-pin D-sub-plug (male)

**Cable Length:** RS 232 and RS 485: max. 2 m

**Voltagenge of insulation:** ≥ 500V

**Protection Category:**
- Housing IP40, Terminals IP20

**AS-i Specifications**

**Serial Interface:**
- Yes
- No

**Power Supply:**
- AS-i
- Standard

**Additional Specifications**

- D-sub data transmission cords, page 117
- Master simulators for testing, page 99

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230 Ryan Way, South San Francisco, CA 94080-6370 • Main Office: (650) 588-9200 • Outside Local Area: (800) 258-9200 • [www.stevenengineering.com](http://www.stevenengineering.com)
Discrete I/O Modules

These Discrete I/O modules are designed for use with the coupling module above to provide a means of integrating conventional discrete I/O into a Profibus DP network.

Discrete signals are transferred by the bus coupler bit by bit. When digital information exceeds 8 bits, a new byte is automatically started.

Additional Specifications:
Class 1, Div 2 (except Relay Output Modules)

Inputs
- NMI-DK01: 4-channel digital input, 24VDC, 3.0 ms input filter
- NMI-DK02: 2-channel digital input, 120VAC

Outputs
- NMI-DT01: 4-channel digital output with diagnostics, 24VDC
  0.5A output current
- NMI-DT02: 2-channel digital output with diagnostics, 24VDC
  2.0A output current

Relay Outputs
- NMI-DR01: 2-channel relay output, non-floating, 2 SPST contacts
  Switching voltage: 250V AC/30VDC
  Switching current: 2.0A AC/DC
- NMI-DR02: 2-channel relay output, 2 SPST contacts
  Switching voltage: 250V AC/30VDC
  Switching current: 2.0A AC/DC
- NMI-DR03: 2-channel relay output, 2 SPDT contacts
  Switching voltage: 120VAC/30VDC
  Switching current: 0.5A AC/1.0A DC

Power Supply Modules

These modules can be added to distribute power to field devices via the I/O system. Power is supplied from an external source.

See our Power Supply section when 24VDC is required.

Separation & End Modules

A separation module provides a visual and an electrical separation between field I/O power types (e.g., 24VDC from 120VAC modules).

One end module is required at the physical end of each I/O System, with one per Bus Coupler.

DIN Analog I/O Modules

These Analog I/O modules are designed for use with the Fieldbus Coupling module to provide a means of integrating conventional analog devices into a Profibus network.

Analog signals are transferred via bytes or words.

Additional Specifications:
Class 1, Div 2 (except Thermocouple modules)

Inputs
- NMI-AN01: 2-channel analog input, RTD, PT100 sensor type
- NMI-AN02: 2-channel analog input, 0-10VDC, single ended
- NMI-AN03: 4-channel analog input, 0-10VDC, single ended
- NMI-AN04: 2-channel analog input, type K thermocouple (-148°F to 2489°F)
- NMI-AN05: 2-channel analog input, type J thermocouple (-148°F to 2192°F)
- NMI-AN06: 2-channel analog input, 0-20mA, Overload protection, 16Bit
- NMI-AN07: 2-channel, 4-20 mA, Overload protection, 16Bit

Outputs
- NMI-AT01: 2-channel analog output, 0-10VDC
- NMI-AT02: 2-channel analog output, 0-20mA
- NMI-AT03: 2-channel analog output, 4-20mA

NMI-PS01: 24VDC, 2A power supply
NMI-PS02: 24VDC, max. 6.3A with diagnostics and fuse holder
NMI-PS03: 230VAC, max. 6.3A with diagnostics and fuse holder
NMI-PS04: 120VAC, max. 6.3A with fuse holder, no diagnostics

NMI-SM01: Separation module
NMI-EM01: End module
Quick Disconnect I/O Modules & Accessories

Quick Disconnect Input/Output Modules provide a method of connecting conventional field devices to a Profibus DP Network with quick disconnect (QDC) style connectors in a rugged, field mountable unit.

GDC Accessories provide physical layer connectivity for a Profibus DP network.

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
<th>Inputs</th>
<th>Outputs</th>
<th>Output Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminator</td>
<td>NPB-3B01</td>
<td>8</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>NPB-3A01</td>
<td>8</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>NPB-3A02</td>
<td>-16</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>NPB-3A03</td>
<td>-8</td>
<td>8</td>
<td>0.5A</td>
</tr>
<tr>
<td></td>
<td>NPB-3A04</td>
<td>-8</td>
<td>8</td>
<td>2.5A</td>
</tr>
<tr>
<td></td>
<td>NPB-3A05</td>
<td>-16</td>
<td>8</td>
<td>0.5A</td>
</tr>
<tr>
<td></td>
<td>NPB-3A06</td>
<td>8</td>
<td>8</td>
<td>0.5A</td>
</tr>
<tr>
<td></td>
<td>NPB-3A07</td>
<td>8</td>
<td>8</td>
<td>0.5A</td>
</tr>
<tr>
<td>NPB-3B01</td>
<td>Terminating resistor</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

General Specifications

- **Housing Material:** Glass filled nylon; nickel plated brass connectors
- **Operating Temperature:** -40°F to 176°F (-40°C to 80°C)
- **Protection Class:** NEMA 1,3,4,12,13; IP67

Robust I/O Modules

These modules allow for the address to be selected via two rotary switches under protective cover and have a communication rate up to 12 Mbps, auto-adjusted to the master device.

Additional Specifications

- **Connectivity:** PNP
- **Internal Current Consumption:** less than 10mA per input station (only)
- **Input Voltage:** 16 to 30VDC
- **Input Current:** 150mA per 8 inputs, short-circuit protection
- **Output Voltage:** 16 to 30VDC
- **Output Current:** 0.5A
- **Output Short-circuit Protection:** Group

- **No. of Pins:** 5

Requires external power source that is connected via minifast connector on front. See our selection of Power Supplies on page 116.

Tees provide a means of connecting and disconnecting devices to the Profibus network with no interruption or loss of communications to other devices on the bus.

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
<th>Inputs</th>
<th>Outputs</th>
<th>Output Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus Tee</td>
<td>NPB-3C01</td>
<td>-5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>NPB-3D01</td>
<td>8</td>
<td>8</td>
<td>0.5A</td>
</tr>
<tr>
<td></td>
<td>NPB-3D01</td>
<td>8</td>
<td>8</td>
<td>0.5A</td>
</tr>
<tr>
<td></td>
<td>NPB-3D01</td>
<td>8</td>
<td>8</td>
<td>0.5A</td>
</tr>
<tr>
<td></td>
<td>NPB-3D01</td>
<td>8</td>
<td>8</td>
<td>0.5A</td>
</tr>
<tr>
<td>NPB-3B01</td>
<td>Terminating resistor</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

General Specifications

- **Protection:** IP67

These Quick Disconnect (QDC) Accessories provide physical layer connectivity for a Profibus DP network.

- **Connectivity:** PNP
- **Internal Current Consumption:** 300V rating
- **Temperature:** -40°F to 176°F (-40°C to 80°C)
- **Protection:** NEMA 1,3,4,12,13; IP67

Power Tee

This tee is rated at 6A and 600V and is used when providing external power to multiple Profibus DP slave devices.

See our selection of power supplies on page 116.

**Additional Specifications**

- **Connector:** Oil resistant polyurethane, contact carrier, 300V rating
- **Contact Material:** Gold plated brass
- **Temperature:** -40°F to 221°F (-40°C to 105°C)
- **Protection:** NEMA 1,3,4,6p
- **Rating:** 6A, 600V
- **No. of Pins:** 5

Terminator

Terminators are required at each physical end of a Profibus DP to prevent signal reflections and to provide a defined idle level on the bus. This minimizes communication errors on the bus and maximizes transmission efficiency.

**Specifications**

- **Connector:** Polyurethane body material & contact carrier, 300V rating
- **Coupling Nut:** Nickel plated brass
- **Temperature:** -40°F to 176°F (-40°C to 80°C)
- **Protection:** NEMA 1,3,4,6p
- **Rating:** 300VDC
- **No. of Pins:** 5

**Contactor:** Oil resistant polyurethane, contact carrier, 300V rating

- **Contact Material:** Gold plated brass
- **Temperature:** -40°F to 221°F (-40°C to 105°C)
- **Protection:** NEMA 1,3,4,6p
- **Rating:** 6A, 600V
- **No. of Pins:** 5

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Field Wirable Connectors

These plug style connectors are designed for easy installation in the field after the Profibus wiring has been routed through the conduit, wire-ways, panel enclosures, and other locations.

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female Connectors</td>
<td></td>
</tr>
<tr>
<td>NPB-EFS</td>
<td>Straight female field wirable connector</td>
</tr>
<tr>
<td>NPB-EFR</td>
<td>Right angle female field wirable connector</td>
</tr>
<tr>
<td>Male Connectors</td>
<td></td>
</tr>
<tr>
<td>NPB-EMS</td>
<td>Straight male field wirable connector</td>
</tr>
<tr>
<td>NPB-EMR</td>
<td>Right angle male field wirable connector</td>
</tr>
<tr>
<td>NPB-4A01</td>
<td>Right angle 9-pin Sub D connector</td>
</tr>
</tbody>
</table>

Profibus-DP Field Wirable D9 Connector

Molded Connector Cordsets

These cordsets provide Profibus DP cable with pre-installed, plug-in connectors, reducing installation time in the field.

Available in 1, 3, 5, and 10 meter lengths. Consult the factory for additional cordset lengths.

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number &amp; Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molded Connector Cordsets</td>
<td></td>
</tr>
<tr>
<td>To create your cordset part number:</td>
<td></td>
</tr>
<tr>
<td>1) Select your connector types</td>
<td></td>
</tr>
<tr>
<td>2) Select your cable type from the list below (* = cable type)</td>
<td></td>
</tr>
<tr>
<td>3) Select your cordset length from the chart below (3 = cordset length)</td>
<td></td>
</tr>
<tr>
<td>Examples:</td>
<td></td>
</tr>
<tr>
<td>NPB-DEPC1-1 = Profibus DP PVC double connector cordset, 1 m</td>
<td></td>
</tr>
<tr>
<td>Double Eurofast Connector Cordsets</td>
<td></td>
</tr>
<tr>
<td>NPB-DE*-*</td>
<td></td>
</tr>
<tr>
<td>Single Eurofast Connector Cordsets</td>
<td></td>
</tr>
<tr>
<td>NPB-EM*-*</td>
<td></td>
</tr>
<tr>
<td>NPB-EF*-*</td>
<td></td>
</tr>
<tr>
<td>Male eurofast connector</td>
<td></td>
</tr>
<tr>
<td>Female eurofast connector</td>
<td></td>
</tr>
<tr>
<td>* Cable Types</td>
<td>Cordset Length</td>
</tr>
<tr>
<td>PC1 = Profibus DP PVC cable</td>
<td>Part Number</td>
</tr>
<tr>
<td>1</td>
<td>1 m</td>
</tr>
<tr>
<td>3</td>
<td>3 m</td>
</tr>
<tr>
<td>5</td>
<td>5 m</td>
</tr>
<tr>
<td>10</td>
<td>10 m</td>
</tr>
</tbody>
</table>

TopWorx offers Profibus DP molded connector cordsets in Profibus DP PVC and PUR cable.

Cordsets are available with a molded connector on each end or with one end bare to facilitate routing of cable through conduit or panel enclosures.

All double cordsets have one straight male connector and one straight female connector.

See page 106 for cable specifications.

Connector Specifications

- **Plug Body**: Molded polyurethane
- **Contacts**: Gold plated brass
- **Coupling Nut**: Nickel plated brass
- **Temperature**: -40°F to 158°F (-40° to 70°C)
- **Protection Class**: NEMA 1,3,4,6,13; IP67
- **Rated Current**: 4.0A (eurofast)

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Profibus Bulk Cable

- Field wirable connectors, page 104

Available in 30, 75, and 150 meter spools. Consult the factory for additional cable lengths.

### Part Number & Description

To create your bulk cable part number, use the chart below to select the appropriate cable length for your application, where ††††† = cable length.

#### General Specifications

- Rating: 300V, 176°F (80°C)
- Type of Drain Wire: Foil/Braid; 22AWG

#### Bulk Cable Types

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Cable Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPB-PC1-†††††</td>
<td>Profibus DP PVC cable, abrasion resistant</td>
</tr>
<tr>
<td>NPB-PC2-†††††</td>
<td>Profibus DP PUR cable, oil and abrasion resistant</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Cable Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>030</td>
<td>30 m</td>
</tr>
<tr>
<td>075</td>
<td>75 m</td>
</tr>
<tr>
<td>150</td>
<td>150 m</td>
</tr>
</tbody>
</table>

Consult factory for additional cable lengths.

### Diagnostic Tools

Our Profibus diagnostic tool is a powerful, handheld Profibus network test tool that can be used for installation, startup, and troubleshooting.

#### Diagnostic Tools

- Profibus Test Tool Set
  - Handheld testing device
  - Transportation case
  - 2 accumulators
  - Power supply
  - RS-232 cable
  - Profibus stub line & T-connection cable
  - Several gender changers
  - Detailed manual containing troubleshooting hints & guidelines

#### General Specifications

- Connections: DB9 connector
- Profibus Data Range: 9600 bps to 12 Mbits
- Measuring inaccuracy with connected devices: ±10%
- Measuring inaccuracy without connected devices: ±5%
- Operating Temperature: 50° to 104°F (10° to 40°C)
- Protection: NEMA 3, IP50

#### Plug Charger Specifications

- Input Voltage Range: 100-240VAC, 50-60 Hz
- Max. Input Current: 130mA
- Power Input: max. 12VA
- Operating Temperature: 32° to 86°F (0° to 30°C)
- Protection: IP50

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Modbus Network Overview

The Modbus protocol was originally developed by Modicon in 1978 to exchange information between products on the factory floor. This protocol became a de facto standard for exchanging data and communication information between PLC systems.

Modbus devices communicate over a serial network in a master/slave (request/response) type relationship using one of two transmission modes: ASCII (American Standard Code for Information Interchange) mode or RTU (Remote Terminal Unit) mode.

In ASCII mode, two eight-bit bytes of information are sent as two ASCII characters. The primary advantage of ASCII mode is the flexibility of the timing sequence. Up to a one second interval can occur between character transmissions without causing communication errors.

In RTU mode, data is sent as two four-bit, hexadecimal characters, providing for higher throughput than in ASCII mode for the same baud rate.

Enhancements to Modbus include Modbus Plus and Modbus/TCP protocols, both of which allow Modbus information to be encapsulated in a network structure to support peer-to-peer communications. Modbus Plus communicates via a single twisted pair of wires and uses a token passing sequence for peer communication sequences. Modbus/TCP is an open standard designed to facilitate Modbus message transfer using TCP/IP protocol and standard Ethernet networks.

TopWorx’s Modbus devices are designed to operate as slave devices on a Modbus network for discrete valve control.

Modbus Network Highlights

- **Type of Network**
  - ASCII/RTU: Device Bus
  - ModbusPlus: Control Bus

- **Physical Media**
  - Shielded twisted pairs in one shielded cable

- **Network Topology**
  - Bus, tree, star with drops

- **Maximum Devices**
  - ASCII/RTU: 32 (up to 64 with repeaters)
  - ModbusPlus: 32 (up to 64 with repeaters)

- **Maximum Distance**
  - ASCII/RTU: 350m
  - ModbusPlus: 150m (400m with repeaters)

- **Communication Methods**
  - ASCII/RTU: Master-Slave Query-Response Cycle
  - RTU: Peer-to-Peer (Token passing logical ring)

- **Power Supply**
  - 12VDC, not used for devices

- **Power and Communications**
  - Communications only on bus
  - 12VDC, max. 300mA (100mA typical)

- **Device Power Supply**
  - Devices must be powered separately from communications bus

- **Wiring Types**
  - (Open-end wiring on application)
  - Shielded Twisted Pair
  - #14AWG (0.8mm)

- **Grounding aspects**
  - Floating communications bus

- **Shielding**
  - Grounded at one end

- **Area Classification**
  - General Purpose

- **Device Addressing**
  - Switch or software selectable

- **Governing Body**
  - MODBUS.ORG

- **Web Site**
  - www.modbus.org

Conventional I/O System vs. Modbus Network

Modbus is a well understood and broadly used protocol for industrial digital communications.

TopWorx Comments on Modbus

**Strengths**

- Modbus is well accepted and well understood by many in the world of industrial communications.
- Modbus delivers cost-effective simplicity with a bit of added functionality supporting limited diagnostic information.

**Limitations**

- Technology is already understood
- Slightly lower device cost
- Independent wiring from devices to the control system means wiring problems with one device don’t affect other field devices

**Advantages**

- Well understood and documented protocol
- Widely supported protocol by many host PLC, DCS and process systems
- Protocol is already in use in many facilities

**Drawbacks**

- Limited use as a device bus
- Limited diagnostic capabilities for device applications
- Separate power required for device operations

**Recommended**

- When similar Modbus devices are being used
- When Modbus network is pre-existing
- When Modbus protocol is well understood and is being used extensively as a facility standard

**When to Use Modbus**

- Generally speaking, TopWorx recommends Modbus when:
  - Device populations are primarily discrete
  - End users already have an existing control system that supports Modbus
  - End users have a legacy control system that does not support other common protocols
  - Plants are not intrinsically safe

**When not to use Modbus**

- When device populations are mainly discrete
- When end users already have an existing control system that supports Modbus
- When end users have a legacy control system that does not support other common protocols
- When plants are not intrinsically safe
The TopWorx Sensor-Communications Module combines position sensors, Modbus communication, solenoid outputs, and wiring terminals into a compact enclosure that is potted and sealed from the environment.

- **SCM-MB Highlights**
  - **3 Discrete Inputs (DI)**: Open/Closed valve position feedback
  - **2 Discrete Outputs (DO)**: Solenoid outputs for single or double acting
  - **Calibration Switch**: Open-Close-Modbus
  - **Status/Warning LEDs**: Open, Closed, Alarm State
  - **Short Circuit Protection**: Yes
  - **Maximum Current**: 500mA per output
  - **Maximum Power**: 12 watts per output
  - **Voltage**: 11-30 VDC
  - **Diagnostics**: Cycle Counter, Cycle Time Alarms, Visual Alarm Indication
  - **SCM-MB Wiring Diagram**

- **Modbus Sensor-Communications Module**

- **Device Bus Network**

- **AVAILABLE ENCLOSURES**

- **Lumitech DVC-MB**
  - Discrete Valve Controller
  - Zone 2 (Class I, Div 2)
  - Integral Solenoid Valve
  - Direct Mount
  - See page 130 for more details.

- **Lumitech DVM-MB**
  - Discrete Valve Monitor
  - Zone 2 (Class I, Div 2)
  - Direct Mount
  - See page 132 for more details.

- **Switchpak DXP-MB**
  - Discrete Valve Monitor
  - Zone 1 (Class I, Div 1)
  - Stainless Steel enclosure
  - See page 134, 136 for more details.

- **Switchpak DXS-MB**
  - Discrete Valve Monitor
  - Zone 1 (Class I, Div 1)
  - Stainless Steel enclosure
  - See page 134 for more details.

The Modbus Sensor-Communications Module fits conveniently into a variety of valve control enclosures suitable for any process environment.

- **SCM-MB** enclosure is resistant to high levels of impact, moisture, shock, and vibration.

- All micro-processor based electronics are completely potted and sealed, preventing premature failure due to moisture or contamination.

- Britelite LEDs indicate valve position and facilitate sensor set up.

- Integrated position sensors provide valve position feedback.

- Calibration Switch facilitates initial setup. The three position On-Off-MB switch enables the valve to be test cycled open and closed offline, then put onto the network when ready.

- Onboard terminals provide connection points for auxiliary discrete and analog inputs.

- Calibration Switch facilitates initial setup. The three position On-Off-MB switch enables the valve to be test cycled open and closed offline, then put onto the network when ready.

- Integrated position sensors provide valve position feedback.

- Calibration Switch facilitates initial setup. The three position On-Off-MB switch enables the valve to be test cycled open and closed offline, then put onto the network when ready.

- Integrated position sensors provide valve position feedback.
HazLink Connectivity Enclosures

HazLink Features:
- Zone 1 (Class I, Div 1)
- (3) ¾” NPT conduit outlets

HazLink Options:
- I/O Modules
- Wiring Tees
- Disconnect Switches

General Specifications
- Enclosure: Die-cast aluminum; O-ring sealed
- Coating: Dichromate conversion (inside); powder polyester coating (outside)
- O-rings: Buna N
- Cover: Screw cover with O-ring seal
- Conduit Outlets: Three ¾” NPT
- Environment: NEMA Type 4, 4X, 7, and 9
- Approvals: Explosion Proof Zone 1
- Class I, Div 1 & 2, Groups A, B, C, D
- Class II, Div 1 & 2, Groups E, F, G

HazLink I/O Modules allow users to cost-effectively connect new or existing conventional devices into the Modbus network in Zone 1 (Class I, Div 1) hazardous areas.

NHL-MBIO
- HazLink Connectivity Enclosure with Modbus I/O
- 2 input, 2 output knife gate valve or cylinder controller

HazLink Wiring Tees make it easy to connect field devices to bus lines using wire terminals or plug-in connectors.

NHL-MBWT
- Modbus tee with 3 x 5 position wiring terminals

NHL-MBCP
- Short circuit protection

HazLink Disconnect Switches enable users to repair or replace a field device without disturbing the network with the simple flip of a lever-operated switch.

NHL-MBDS
- Disconnect switch

NHL-MBDC
- Disconnect switch with short circuit protection

Dimensions

HazLink Connectivity Enclosures
## AS-i to Modbus Gateways

### General Specifications
- **Operating Temperature:** 32°F to 131°F (0°C to 55°C)
- **Voltage of Insulation:** ≥ 500V
- **Protection Category:** Housing IP40, Terminals IP20

### Specifications
- **Modbus to DeviceNet Gateway**
  - **Bus Rate Selection:** Auto/125k/250k/500k baud
  - **Address Selection:** Switch selectable 0-63

### Item | Part Number & Description
---|---
**AS-i to Modbus Gateways** |  
Gateways function as a master on the AS-i network and as a single node on the Modbus network. 
Dual Gateways function as two complete masters on the AS-i network and as a single node on the Modbus network. 
These devices include demonstration software that performs addressing, monitoring, and diagnostics of the network. 

**Additional Specifications**
- **AS-i Specification:** 2.1 (Gateways); 2.0 (Dual Gateways)
- **Power Supply:** With AS-i Power Supply

#### Single Gateways

<table>
<thead>
<tr>
<th>Serial Interface</th>
<th>Power Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAS-GM11</td>
<td>RS 232C</td>
</tr>
<tr>
<td>NAS-GM12</td>
<td>RS 232C</td>
</tr>
<tr>
<td>NAS-GM13</td>
<td>RS 485</td>
</tr>
<tr>
<td>NAS-GM14</td>
<td>RS 485</td>
</tr>
<tr>
<td>NAS-GM15</td>
<td>RS 422</td>
</tr>
<tr>
<td>NAS-GM16</td>
<td>RS 422</td>
</tr>
</tbody>
</table>

#### Dual Gateways

<table>
<thead>
<tr>
<th>Serial Interface</th>
<th>Power Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAS-GM21</td>
<td>RS 232C</td>
</tr>
<tr>
<td>NAS-GM22</td>
<td>RS 232C</td>
</tr>
<tr>
<td>NAS-GM23</td>
<td>RS 485</td>
</tr>
<tr>
<td>NAS-GM24</td>
<td>RS 485</td>
</tr>
<tr>
<td>NAS-GM25</td>
<td>RS 422</td>
</tr>
<tr>
<td>NAS-GM26</td>
<td>RS 422</td>
</tr>
</tbody>
</table>

## Modbus to DeviceNet Gateway

### General Specifications
- **Bus Rate Selection:** Auto/125k/250k/500k baud
- **Address Selection:** Switch selectable 0-63

### Item | Part Number & Description
---|---
**Modbus to DeviceNet Gateway** |  
The Modbus to DeviceNet allows the connection of Modbus capable slave devices to a DeviceNet network. 
The DeviceNet address is set using DIP switches on the device and the DeviceNet baud rate is automatically determined when connected to the network. A single gateway is capable of communicating with one or more Modbus devices. 

**Additional Specifications**
- **Operating Temperature:** 32°F to 140°F (0°C to 60°C)
- **Maximum Power:** 200mA/11VDC to 90mA/25VDC

#### Modbus to DeviceNet Gateway

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NDN-1A02</td>
<td>Modbus to DeviceNet gateway, RS 232 interface</td>
</tr>
</tbody>
</table>

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 Courtesy of Steven Engineering, Inc.  
230 Ryan Way, South San Francisco, CA 94080-6370  
Main Office: (650) 588-8000  
Outside Local Area: (800) 258-9200  
www.stevenengineering.com
In addition to protocol-specific power supplies, TopWorx also offers a variety of standard 24VDC power supplies.

### 24VDC Power Supplies

**These DIN rail mountable power supplies are compact and economical solutions to 24VDC power requirements.**

#### General Specifications
- **Protection Class**: NEMA 1; IP30
- **Operating Temperature**: 14° to 131°F (-10° to 50°C)
- **Connection**: 12 AWG, 2.5mm², pluggable

#### Part Number & Description
- **NXS-1101**: 24VDC at 2.5A output
- **NXS-1102**: 24VDC at 6A output
- **NXS-1101**: 24VDC at 6A output, parallel connection with integral diode
- **NXS-1101**: 24VDC at 12A output
- **NXS-1101**: 24VDC at 12A output, parallel connection with integral diode
- **NXS-1101**: 24VDC at 20A output, parallel connection with integral diode

### Redundant 24VDC Power Supplies

This DIN rail mountable redundant power supply system offers up to 90A at 24VDC or 75A with n+1 redundancy. The chassis can hold either 3 or 6 power modules that provide 15A at 24VDC each.

#### General Specifications
- **Input Line Voltage**: 115Vrms nominal, 50-60 Hz
- **Output Voltage**: 24VDC ± 1%, adjustable from 22.5 to 28V on chassis
- **Output Current**: 1 to 15A nominal per power module
- **EMI Compatibility**: EN-50081-2, EN-50082-2
- **Operating Temperature**: -13° to 131°F (-25° to 55°C)

#### Part Number & Description
- **NXS-2101**: 24VDC at 45A output, 30A with redundancy
- **NXS-2102**: 24VDC at 90A output, 75A with redundancy

### D-sub-data Transmission Cords

These connector cords work in conjunction with TopWorx Masters and Gateways to facilitate attachment to a computer for configuration or programming.

#### General Specifications
- **Connection**: D-sub plug; D-sub socket
- **Length**: 1.8 m

#### Part Number & Description
- **NXS-3101**: D-sub data transmission 9-pin cordset

### Quick Disconnect Guards

Quick Disconnect Guards are designed for the protection of Minifast and Eurofast connectors in Class I, Div. 2 applications. The Guards prevent against mechanical separation of male and female connectors.

#### General Specifications
- **Material**: Nylon 6
- **Operating Temperature**: -22° to 212°F (-30° to 100°C)
- **Environmental**: Sun resistant, UV stable
- **Flammability**: UL94 (5=V-0; 4=V-1; 3=V-2; 1=HB)

#### Part Number & Description
- **NXS-4101**: Standard minifast shield
- **NXS-4102**: Standard eurofast shield
- **NXS-4103**: Field wirable minifast shield
- **NXS-4104**: Field wirable eurofast shield

In addition to protocol-specific power supplies, TopWorx also offers a variety of standard 24VDC power supplies.