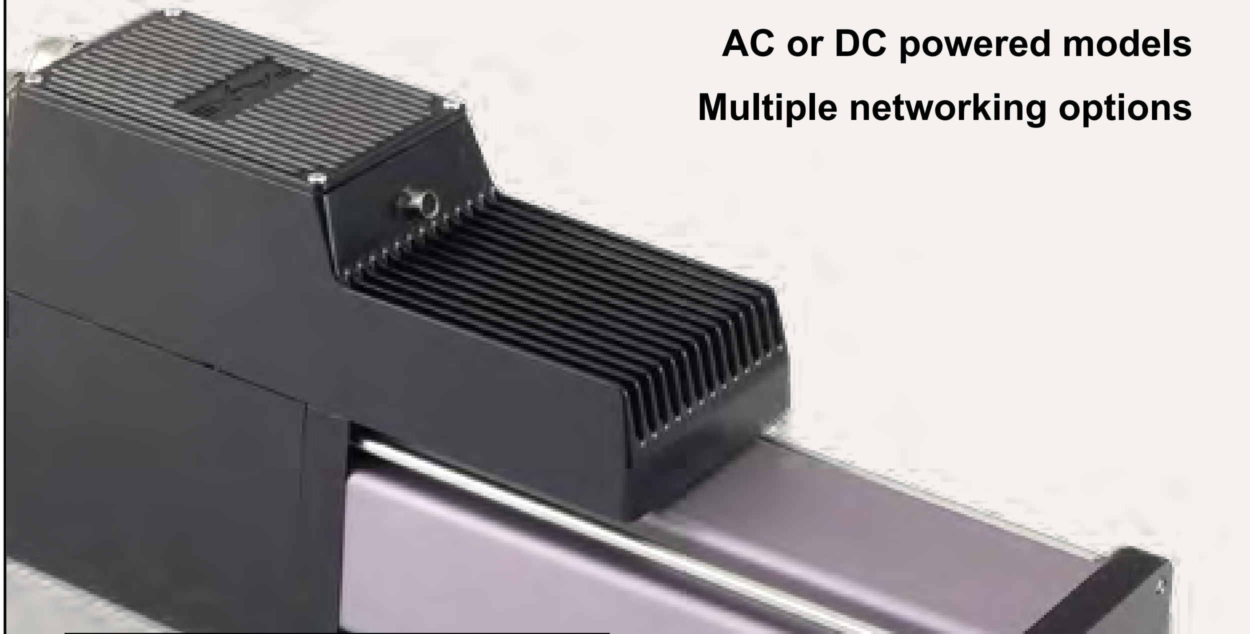
TRITEX II™ SERIES

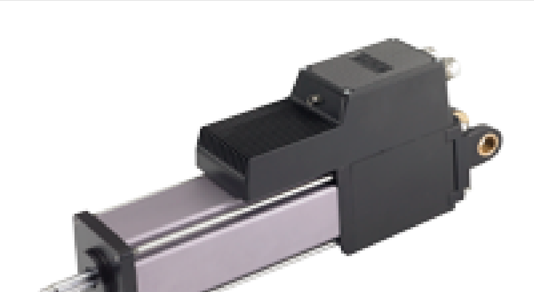
FULLY INTEGRATED SERVO DRIVE/MOTOR/ACTUATOR

Linear or Rotary configurations

AC or DC powered models

Multiple networking options





Tritex II Linear
AC Actuator

Tritex II Rotary
AC Actuator

Tritex™ Series

Fully Integrated Drive/Motor/Actuator

By combining the latest electronic power technology with advanced thermal management modeling technology, Exlar® has set a new benchmark for electric actuator performance versus size. Tritex II actuators now integrate an AC or DC powered servo drive, digital position controller, brushless motor and linear or rotary actuator in one elegant, compact, sealed package. Now you can distribute motion control and resolve your application challenges with one integrated device. Simply connect power, I/O, communications and go!

Dramatically Reduce Space Requirements

Tritex II actuators are the highest power density, smallest footprint servo drive devices on the market. Finally, you can incorporate a fully electronic solution in the space of your existing hydraulic or pneumatic cylinder. You can also eliminate troublesome ball screw actuators or bulky servo gear reducers. And the space previously consumed by panel mount servo drives and motion controllers is no longer needed. Tritex II actuators may also reduce the size of your machine design while significantly improving reliability.

Reduce Costs

Now you can eliminate the labor costs for mounting and wiring panels because the Tritex II houses the servo drive, digital positioner, and actuator in one convenient package. Cable costs are also significantly reduced by eliminating the need for expensive, high-maintenance specialty servo cables. All that is required is an economical standard AC or DC power cord, and standard communication cable for digital and analog I/O.

These actuators also eliminate the issues associated with power signals and feedback signals traveling long distances from servo drive to servo motor. With the Tritex II, the servo drive and motor are always integrated in the same housing.

Flexible Communications

Multiple feedback types, including absolute feedback, allow you to select the system that is best-suited for your application. Digital and analog I/O, plus popular communication networks, such as Modbus TCP, Ethernet/IP, PROFINET IO, and CANopen, allow the Tritex II to become an integral part of your control architecture or machine control processes.

Improves Power, Performance, and Reliability

Tritex II actuators give you unrivaled power, performance, and reliability. No longer are you limited to trivial amounts of force or speeds so slow that many motion applications are not possible.

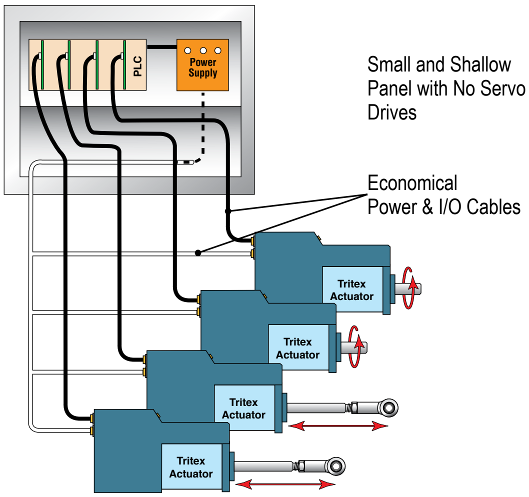
Tritex II AC Actuator

- Continuous force to 3225 lbf (14kN)
- Peak force to 5400 lbf (24kN)
- Speed to 33 in/sec (800 mm/sec)
- 1.5 kW servo amplifier
- Temperature operation range -40˚C to +65˚C
- AC power 100V – 240V, +/-10%

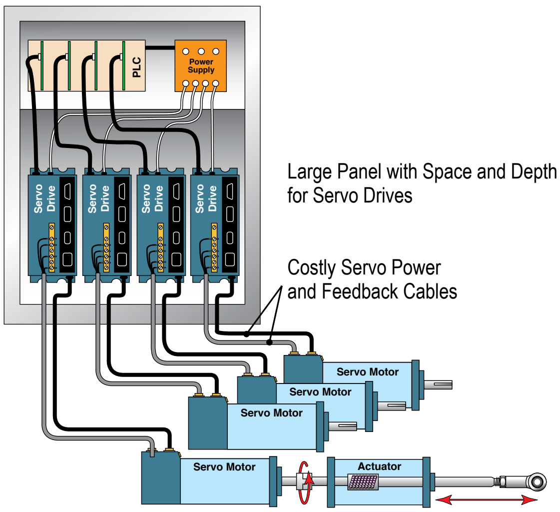
Tritex II DC Actuator

- Continuous force to 872 lbf (4kN)
- Peak force to 1190 lbf (5kN)
- Speed to 33 in/sec (800 mm/sec)
- 750W servo amplifier
- Temperature operation range -40˚C to +65˚C
- DC power 12-48 VDC nominal

Tritex II System



Alternative Systems



Linear Applications

Tritex II linear actuators employ a superior inverted roller screw mechanism for converting rotary motion to highly robust and long-life linear motion. These characteristics enable the Tritex actuator to solve applications that previously required pneumatic or hydraulic cylinders. No additional mechanisms (such as acme or ball screws) are necessary to convert the actuator's rotary power into linear motion in order to move the load.

Ideal for mobile and remote applications using DC power sources, the Tritex II DC actuators have the power needed to perform. The simple to configure, yet robust interface software allows either the AC or DC Tritex II actuators to perform nearly any motion control application. The Tritex II linear actuator can be programmed to follow an analog command signal, making it ideal for controlling valves and dampers in process control applications or adjustment mechanisms on mobile equipment.

Longer Stroke Lengths

If your application requires a stroke length greater than the 18 inches available with Tritex II linear units, consider mounting a rotary Tritex II actuator to an Exlar universal actuator. This combination extends stroke length up to 40 inches. Please contact Exlar for more details.

Rotary Applications

Tritex II rotary motors and gearmotors provide high response and precise control of a rotatable shaft, similar to that found in any electric motor. The difference is that with Tritex II you can program (via your PC) the rotational speed and position of the output shaft in response to external commands. For example, the motor can be commanded to rotate at a controlled velocity and to precisely stop at a preprogrammed position. You can also program the unit to run at a preset velocity until a switch input is received or a preprogrammed torque level is produced against a load. Alternatively, the rotary Tritex II actuators can be set up to follow an analog signal—either voltage or current—representing your choice of torque, velocity, or position.

Signals for initiating the preprogram-med velocity and position commands come from optically isolated inputs or directly via network communications. Likewise, isolated output commands of the status and events enable precise coordination with your system controls or machine operator.

Optional Internal Gear Reducer

If your application requires greater torque and less speed than the base unit provides, the Tritex II is available with an integral servo grade planetary gear reducer. Gear ratios of 4:1 to 100:1 allow the power of Tritex II to be applied over a broad range of torque requirements.

Tritex II Models

Tritex II AC Models

- T2M standard mechanical capacity actuator, 75, 90, and 115 mm
- T2X high mechanical capacity actuator, 75, 90, and 115 mm
- R2M rotary motor, 75, 90, and 115 mm
- R2G rotary gearmotor, 75, 90, and 115 mm

Tritex II DC Models

- TDM standard mechanical capacity actuator, 60, and 75 mm
- TDX high mechanical capacity actuator, 60 and 75 mm
- RDM rotary motor, 60, 75, and 90 mm
- RDG rotary gearmotor, 60, 75, and 90 mm

Feedback Types (All Models)

- Analog Hall w/1000 count resolution
- Incremental encoder with 8192 count resolution
- Absolute Feedback (analog hall with multi-turn, battery backup)

Communications & I/O

The I/O count and type varies with each actuator model and option selected. Please see page 69 for Tritex II AC and page 96 for Tritex II DC models.

Standard Communications (All Models):

- 1 RS485 port, Modbus RTU, opto-isolated for programming, controlling and monitoring

Tritex II rotary motor with connectors

Tritex II linear actuator with customer-supplied cable glands ports

Tritex II Series Operation

The Tritex II Series actuators can operate in one of five different motion-producing modes. These modes solve an endless variety of applications in industrial automation, medical equipment, fastening and joining, blow molding, injection molding, testing, food processing, and more.

Programmed functions are stored in the Tritex II non-volatile memory. A standard RS485 serial interface allows control, programming, and monitoring of all aspects of the motor or actuator as it performs your application. Optional communications protocols are available.

Tritex Option Boards

- Option boards offer adding functionality to the base Tritex II actuators
  - Terminal board for customer I/O
  - Isolated 4-20mA analog input and output
  - Customer specific
- Communication buses
  - EtherNet/IP
  - Modbus TCP
  - PROFINET IO
  - CANopen
  - Ethercat

Connectivity

- Internal terminals accessible through removable cover (select models)
- Threaded ports for cable glands (select models)
- Optional connectors
  - M23 Power - M23/M16 I/O
- M8 connector for RS485
- M12 connector for EtherNet options
- Custom connection options
- Embedded leads (select models)

Operating Modes

1. *Move to a position (or switch)*
   The Tritex II Series actuators allow you to execute up to 16 programmed positions or distances. You may also use a limit switch or other input device as the end condition of a move. This combination of index flexibility provides a simple solution for point-to-point indexing.
2. *Move to a preset force or torque*
   The Tritex II Series allows you to terminate your move upon the achievement of a programmed torque or force. This is an ideal mode for pressing and clamping applications.
3. *Position proportional to an analog signal*
   Ideal for process control solutions, the Tritex II Series provides the functionality to position a control valve by following an analog input signal. Therefore, it delivers precise valve control — which cannot be achieved by other electric, hydraulic, or pneumatic actuators.
4. *Velocity proportional to an analog signal*
   Tritex II actuators offer you the capability to control velocity with an analog signal. This is particularly useful with Tritex II rotary motors which offer precise control of the speed of any process or operation.
5. *Force/torque proportional to analog signal*
   Perfect for pressing and torquing applications, you can control torque with an analog input while in torque mode.

Selectable Input Functions

• Enable • Execute Move (0-15) • Dedicated Position • Jog+
• Jog- • Jog Fast • Home • Extend Switch • Retract Switch
• Home Switch • Teach Enable • Teach Move (1-16)
• Select Move • Stop • Hold • Reset Faults
• Alternate Mode (allows you to switch between 2 operating modes)

Selectable Output Functions

• Enabled • Homed • Ready (Enabled and Homed)
• Fault • Warning • Fault or Warning Active
• Move (0-15) in Progress • Homing • Jogging
• Jogging+ • Jogging- • Motion • In Position
• At Home Position • At Move (0-15) • Position
• Stopped • Holding • In Current Limit • In Current Fold Back
• Above Rated Current • Home

Expert User Interface

Expert, the Tritex II user interface software, provides you with a simple way to select all aspects of configuration and control required to set up and operate a Tritex II actuator. Easy-to-use tabbed pages provide access to input all of the parameters necessary to successfully configure your motion application. ‘Application’ files give you a convenient way to store and redistribute configurations amongst multiple computers, and ‘Drive’ files allow the same configuration to be distributed to multiple Tritex II actuators. Motion setup, homing, teach mode, tuning parameters, jogging, I/O configurations, and local control are all accomplished with ease using Expert software.

Protocol Options

The standard communication protocol for Tritex is an RS485 connection using Modbus RTU. The Modbus protocol provides a simple and robust method to connect industrial electronic devices on the same network. The Expert software acts as a Modbus Master and the Tritex II acts as the Slave device, only responding to requests commanded through the software. The Expert software allows full access to commissioning, configuring, monitoring, and controlling the Tritex II.

In addition the following protocol options are available by selecting the communication option boards. Exlar requires initial commissioning of a Tritex II actuator to be performed with the Modbus protocol.

Modbus TCP

Modbus TCP couples Modbus communication structure from Modbus RTU with EtherNet connectivity. The Modbus TCP option is fully supported by the Expert software and offers seamless commissioning, configuring, monitoring and controlling the Tritex II. A Modbus mapping table allows you to map all Communication protocol DSP301 is supported as well as DSP 402 supporting Profile Torque, Profile Velocity, Profile Position and Homing. Setup on the system is most easily achieved with the Expert software using the RS485 port. of the parameters you wish to read and modify into a register bank of up to 100 registers. This allows a PLC program to perform a single read operation and a single write operation to all the parameters.

EtherNet/IP

EtherNet/IP allows you to change, monitor, and control the Tritex II through implicit or explicit messaging initiated from your Rockwell PLC. Tritex parameters are set up through the Expert software using a Tritex II parameter to EtherNet/IP parameter mapping table. Up to 100 input, and 100 output 16 bit registers can be mapped to Tritex II parameters.

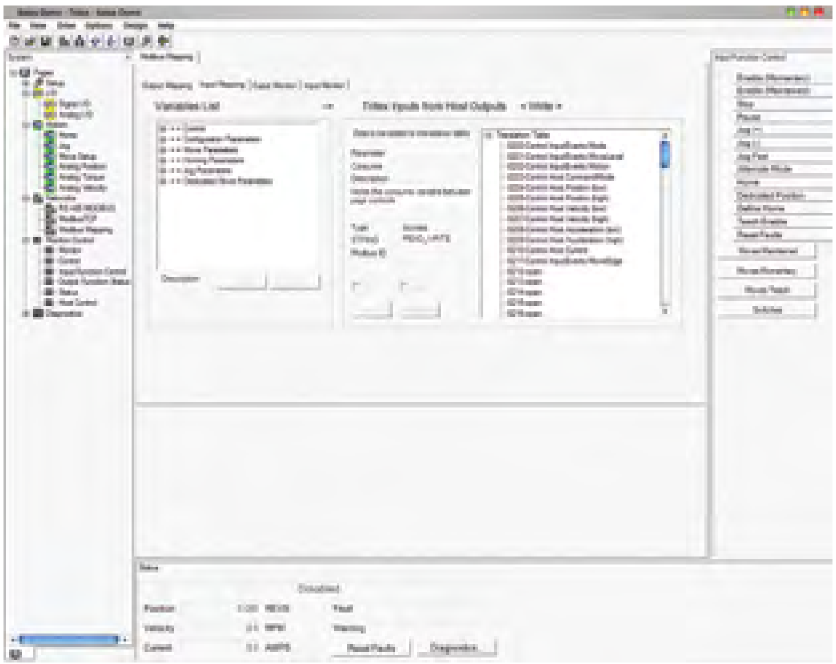
PROFINET IO

PROFINET IO allows you to change, monitor and control the Tritex II from your Siemens PLC. Tritex parameters are set up through the Expert software using a Tritex II parameter to PROFINET IO parameter mapping table. Up to 100 input and 100 output, 16 bit registers can be mapped to Tritex II parameters.

CANopen

The Tritex II with the CANopen network is intended to perform as a Slave, receiving commands from a CANopen Master. It does not have all the features of a stand-alone indexer, like other Tritex models. CANopen Communication protocol DSP 301 is supported as well as DSP 402 for Profile Torque, Profile Velocity, Profile Position, and Homing. Setup is most easily achieved with the Expert software using the RS485 port.

Modbus Mapping Screen



Motion Setup
Exlar configuration provides several templates for various applications. These can serve as your configuration, or as a starting point for your configuration. You can also begin by selecting configuration details specific to your application. At the click of a button, you can configure a move to position, move to switch, or move to force motion. Tritex II products offer absolute and incremental motion, as well as moves ending on a condition, such as a specific force or torque.

Control Page
The Expert control page gives you the ability to initiate all motion functions from one simple screen. This screen provides you with very easy system start-up and testing, without all the inconvenience of machine wiring.

The control page offers the capability to enable and disable the drive, and perform fast and slow jogs. This gives you the ability to verify motion, before needing any I/O wiring.

Monitoring and Diagnostics
All input functions can be monitored and activated from the Expert monitor page, and all output functions can be monitored. Critical fault and status data is available as a separate page, or as a fixed window on the bottom of each page of the software.

Configuring I/O
A drop down menu allows all I/O to be set up in a matter of minutes. Inputs can be configured to be maintained or momentary, depending on the application requirements. Input and output logic can be inverted with a single click.

Scope
The Expert Software includes a four-channel digital oscilloscope feature.

You can select up to four Tritex drive parameters to be monitored simultaneously.

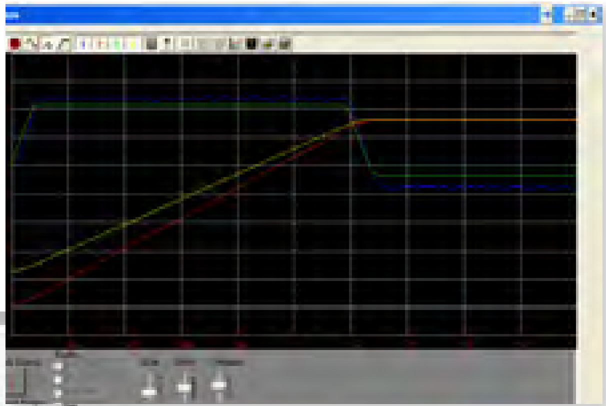
For high speed requirements, the data can be captured in the drive's memory at an adjustable rate, down to 100 micro seconds, and then uploaded for plotting. The plots can be saved or printed, and the captured data can be saved as a comma separated file for further analysis with Excel.

Homing
You can home to an input, by using a proximity or limit switch, or home to a specific force or torque.

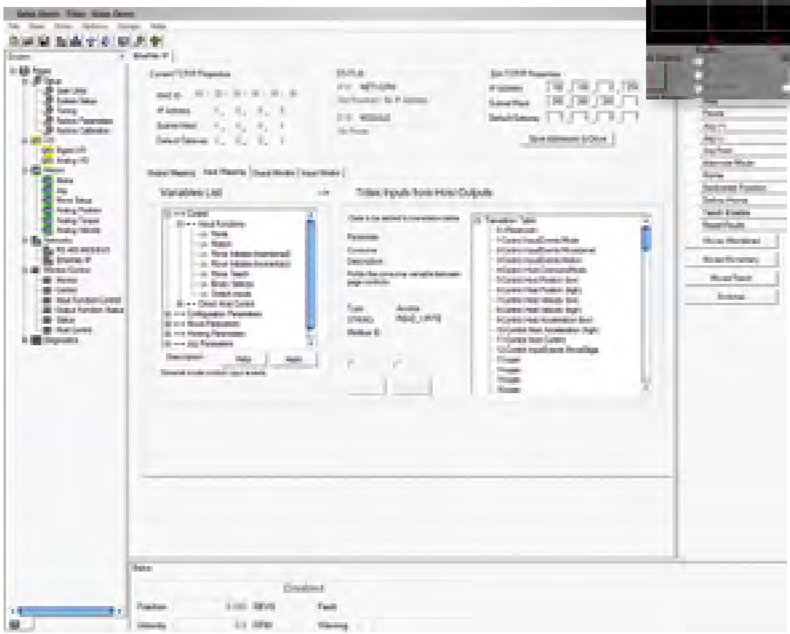
Homing to a force or torque is ideal for setting up applications that require motion referenced to a hard stop, like the closed position of a valve, or the final position of a press.

Teach Mode
In this mode, you can jog the actuator to the desired position, and activate an input. Alternatively, you can click a button in the Expert software and the current position of the actuator becomes the defined distance or absolute position associated with a particular move command.

Scope



EtherNet IP Mapping Screen



Process Control Functionality

Precise valve and damper control are perfect applications for Tritex II actuators. They outperform other electric, hydraulic and pneumatic actuators by providing small hysteresis and dead band, quick response to small signal changes, and stable dynamic responses. Fully programmable to follow an analog or digital signal representing either position or force, the Tritex II linear actuator is well suited for control valve applications with thrust requirements up to 3225 lbf or rotary torque applications up to 95 lbf-in continuous.

The Tritex II Rotary actuators are also ideal for directly operating quarter-turn valves. Gear ratios of 4:1 to 100:1 allow the power of Tritex II to be applied to a broad range of applications, providing high turndown without loss of accuracy.

Additionally, Tritex II actuators can be mounted on any valve from any manufacturer giving you maximum flexibility.

Valve Software

The valve software is simple to use and features a teach mode for foolproof stroke configuration. A programmable valve cut off position enables a firm valve seat on either new valves or retrofitted valves. Several diagnostics and auxiliary I/O options are also available.

Class I Division 2 Rating

Exlar Tritex II actuators are available for applications requiring CSA Class I Division 2 certification. Ordering a standard I/O interconnect with or without 4-20 mA Analog I/O, and the N option for the NPT port will provide you with a Class I Division 2 rated product.

Benefits for Process Control Applications

Extreme Accuracy

The Exlar actuators stroke the valve based on position, not air or oil pressure. Accuracy and repeatability are better than 0 .1%.

100% Duty Cycle

A roller screw provides a unique way of converting rotary motor motion to a linear force, and offers full modulation capability. Life is measured in hundreds of million strokes vs. thousands like typical electric actuators.

Built in Positioner

Tritex II actuators include a built in positioner with a 4-20 mA or digital signal to tell you the exact stroke position. An analog output is also available.

Flexibility

These actuators include digital I/O and analog control. This provides the user with options for additional control such as emergency stop, +/- jog, or various diagnostic conditions.

Low Power Consumption

The Tritex II actuator only uses the current needed for a given force. This extreme efficiency makes it suitable for use with solar panels and batteries.

Fast Response and Stroke Speeds

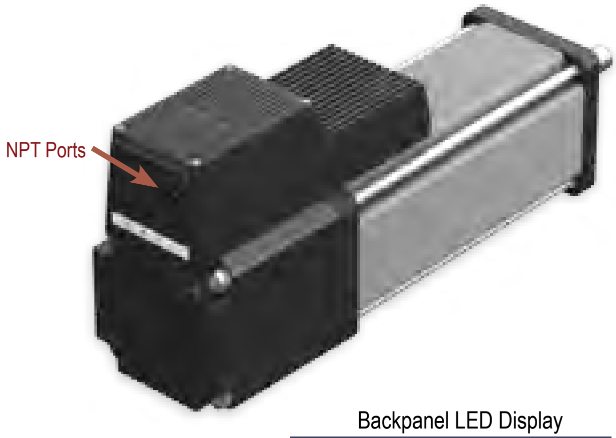
Most other electric actuators are known for being slow—a major disadvantage. Tritex II response rate is measured in milliseconds. Stoke speeds can be up to 33 in/sec.

Hydraulic Replacement
Tritex actuators have the same capabilities as a hydraulic equivalent, but without the cost or maintenance issues. High force, fast speeds and precise movements make it a superior substitute for hydraulic applications.

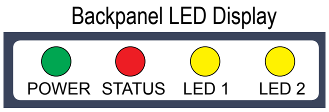
Absolute Feedback
The absolute feedback option gives the actuator memory after teaching the valve limits. So upon power loss, the battery backup will maintain the valve limits.

Manual Override
Two options are available. The hand wheel option gives you a manual engagement switch that can be used to disable the power to the actuator. The side drive option allows emergency operation in a power down condition, using a standard socket wrench.

Diagnostics
All inputs and outputs can be monitored including position, temperature, current, and many more. An oscilloscope feature allows you to select up to four parameters to be monitored simultaneously. The data can be captured in the drive's memory at an adjustable rate, down to 100 micro sec, and then uploaded for plotting.



Tritex II AC linear actuator with threaded ports.



Tritex II Agency Approval
If your application requires CSA Class I, Division 2 Certification, please order the "N" connection option for the NPT port. This, in combination with one of the following I/O option boards, will provide Class I, Division 2 Certification:

• SIO • EIN • TCN • IA4 • PIN • CON

Shown below are additional agency approvals applied to Tritex II Actuators.

Tritex II DC Standards/Agency Approvals

Agency/Standard	Tritex II Models/Options
CE, EMC EN61800-3	All models
CSA 139	All models, when supply voltage is 24 VDC or less
CSA Class I, Div 2, Groups A, B, C, D	75 and 90 mm frames require NPT connection option (N/A with 60 mm frame)
IP Rating	TDM = IP54S, TDX = IP66S, RDM/G = IP66
Vibration Rating	IEC 60068-2-64 random vibration standard, 5g rms, 50 to 500 Hz.
ODVA	EIP
PROFINET	PIO

Tritex II AC Standards/Agency Approvals

Agency/Standard	Tritex II Models/Options
CE, EMC EN61800-3, Safety EN 61800-5-1	All options
CSA 139	All options
CSA Class I, Div 2, Groups A, B, C, D	Requires NPT connection option. Option Board EIN, PIN, TCN and CON, SIO, or IA4
UL 508 C, Type 4 Enclosure T2M090/R2M090 T2M115/R2M115	Requires NPT connection option. Option Board EIN, PIN, TCN and CON, SIO, or IA4
IP Rating	T2M/TDM = IP54S, T2X/TDX = IP65S, T2M/X075, TDM/X075 = IP66S R2M/R2G/RDM/RDG = IP65S, R2M/G075, RDM/G075 = IP66S
Vibration Rating	IEC 61800-5-1 safely standard for drives. 1g peak, up to 150 Hz for <2 hrs. IEC 60068-2-64 random vibration standard, 2.5 g rms, 5 to 500 Hz.
ODVA	EIP

Up-to-date certifications for all products shown on www.exlar.com.

Tritex II AC

Return to table of contents

No Compromising on Power, Performance or Reliability

With forces to approximately 3,225 lbf (14 kN) continuous and 5,400 lbf peak (24 kN), and speeds to 33 in/sec (800 mm/sec), the AC Tritex II linear actuators also offer a benefit that no other integrated product offers: POWER! No longer are you limited to trivial amounts of force, or speeds so slow that many motion applications are not possible. And the Tritex II with AC power electronics operates with maximum reliability over a broad range of ambient temperatures: -40˚C to +65˚C. The AC powered Tritex II actuators contain a 1.5 kW servo amplifier and a very capable motion controller. With standard features such as analog following for position, compound moves, move chaining, and individual force/torque control for each move, the Tritex II Series is the ideal solution for most motion applications.

Tritex II AC Linear Actuator (90 mm)

Tritex II Models

- T2M standard mechanical capacity actuator, 75, 90, and 115 mm
- T2X high mechanical capacity actuator
- R2M rotary motor
- R2G rotary gearmotor

Power Requirements

- AC Power 100V - 240V, +/- 10%, single phase
- Built-in AC line filter
- Connections for external braking resistor

Feedback Types

- Analog Hall with 1000 count/motor rev resolution
- Incremental encoder with 8192 count resolution
- Absolute Feedback (analog hall with multi-turn, battery backup)

Connectivity

- Inernal terminals acessible through removable cover
- Threaded ports for cable glands
- Optional connectors:
  –M23 Power
  –M16 I/O (M23 on 75 mm)
- M8 connector for RS485
- M12 connector for Ethernet options
- Custom connection options

Technical Characteristics	
Frame Sizes in (mm)	2.9 (75), 3.5 (90), 4.5(115)
Screw Leads	0.1 (2), 0.2 (5), 0.5 (13), 0.75 (19)
Standard Stroke Lengths in (mm)	3 (75), 4 (100), 6 (150), 10 (250), 12 (300), 14 (350), 18 (450)
Force Range	up to 3225 lbf (14 kN)
Maximum Speed	up to 33.3 in/s (846 mm/s)

Operating Conditions and Usage		
Accuracy:		
Screw Lead Error	in/ft	0.001
Screw Lead Variation	in	0.0012
Screw Lead Backlash	in	0.004 (T2M), 0.008 (T2X maximum
Ambient Conditions:		
Standard Ambient Temperature	°C	0 to 65
Extended Ambient Temperature**	°C	-40 to 65
Storage Temperature	°C	-40 to 85
IP Rating		T2M = IP54S, T2X = IP65S T2M/X075 = IP66S, R2M/R2G = IP65S R2M/G075 = IP66S
NEMA ratings	T2M090/R2M090 T2M115/R2M115	UL Type 4 UL Type 4
Vibration		2.5 g rms, 5 to 500 hz

*Ratings for T2M075/R2M075 at 40°C, operation over 40°C requires de-rating. Ratings for T2M090/R2M090 and T2M115/R2M115 at 25°C, operation over 25°C requires de-rating.
**Consult Exlar for extended temperature operation.

Communications & I/O

Digital Inputs:
10 to 30 VDC Opto-isolated

Digital outputs:
30 VDC maximum
100 mA continuous output Isolated

Analog Input AC:
0-10V or +/-10V
0-10V mode, 12 bit resolution
+/-10V mode, 12 bit resolution on 90/115, 13 bit resolution on 75 assignable to Position, Velocity,
Torque, or Velocity Override commands.

Analog Output AC:
0-10V
12 bit resolution on 90/115, 11 bit resolution on 75

IA 4 option:
4-20 mA input
16 bit resolution Isolated
Assignable to Position, Velocity, or Torque command

4-20 mA output
12 bit resolution
Assignable to Position, Velocity, Current, Temperature, etc

Standard Communications:
- 1 RS485 port, Modbus RTU, opto-isolated for programming, controlling and monitoring

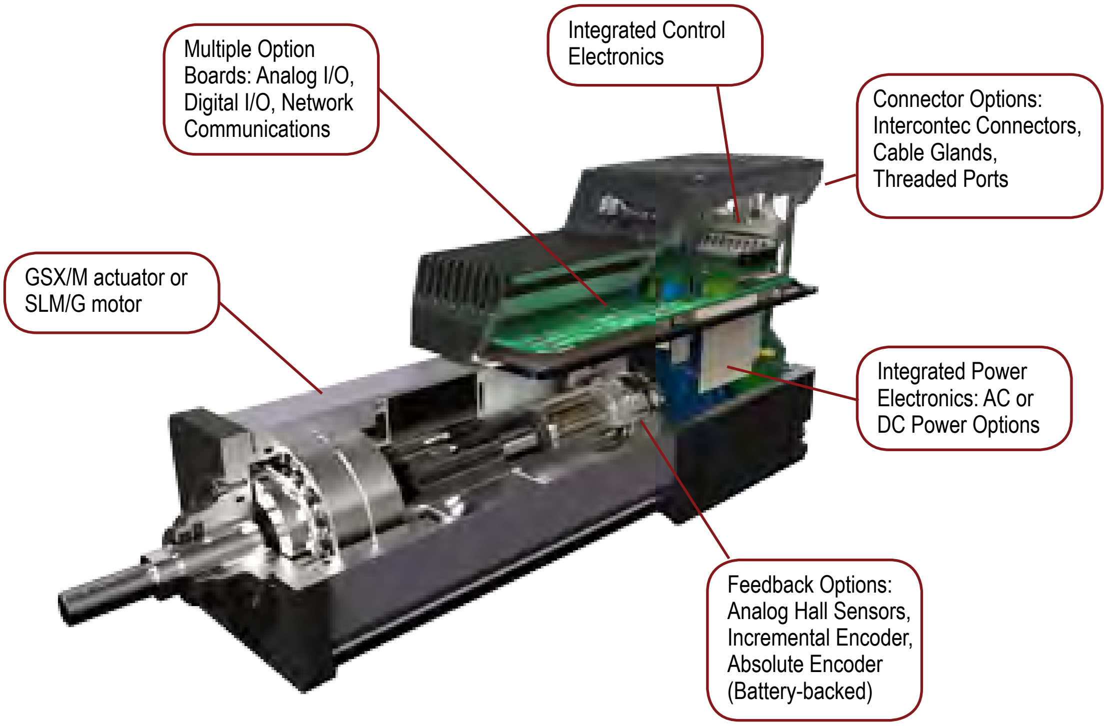
The IO count and type vary with the actuator model and option module selected.

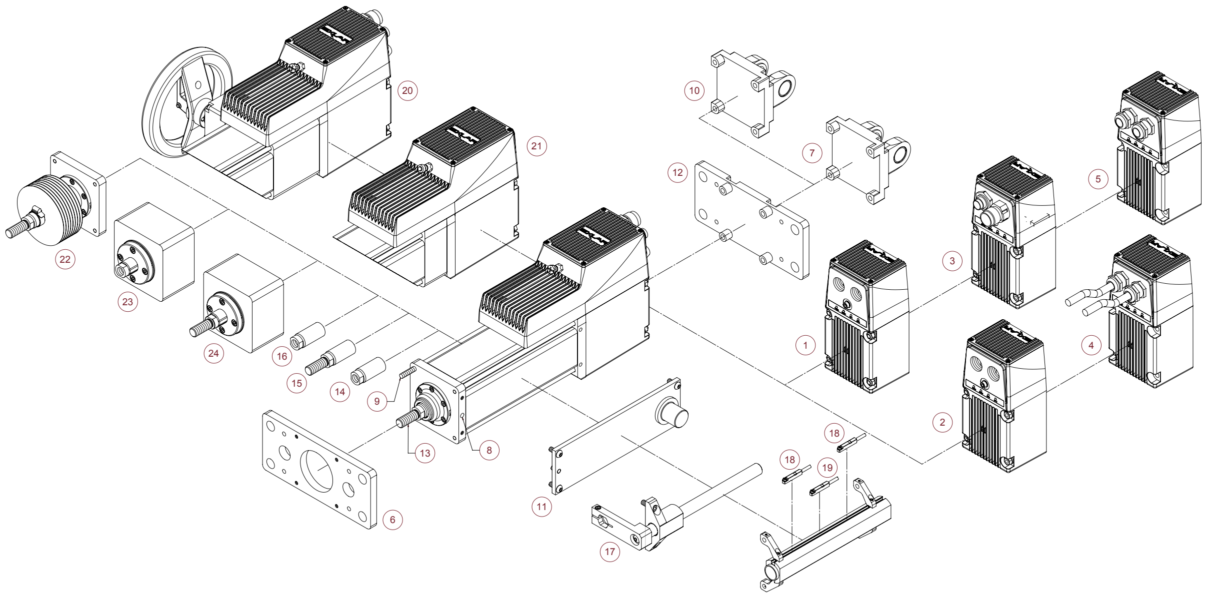
All models include isolated digital IO, and an isolated RS485 communication port when using Modbus RTU protocol.

Tritex II AC I/O

	75/90/115 mm frame with SIO, EIP, PIO, TCP	90/115 mm frame with IA4	75 mm frame with IA4	90/115 mm frame with CAN	75 mm frame with CAN
Isolated digital inputs	8	8	4	8	4
Isolated digital outputs	4	4	3	4	3
Analog input, non isolated	1	1	0	0	0
Analog output, non isolated	1	1	0	0	0
Isolated 4-20ma input	0	1	1	0	0
Isolated 4-20ma output	0	1	1	0	0

Product Features





1 - Standard Straight Threaded Port with Internal terminals, M20 x 1.5
2 - NPT Threaded Port via Adapter with Internal Terminals, 1/2" NPT
3 - Intercontec Style - Exlar standard, M16/M23 Style Connector 4 - Embedded leads 3 ft. standard*
5 - Embedded leads 3 ft. standard with "I" plug 6 - Front flange and front flange* 7- Rear clevis
8 - Side mount*, double side mount, metric side mount*, and metric double side mount 9 - Extended tie rods and metric extended tie rods 10 - Metric rear clevis
11 - Side trunnion and metric side trunnion 12 - Front flange and rear flange 13 - Male, metric thread and male metric thread SS
14 - Female, metric thread and female, metric thread SS 15 - Male, US standard thread and male, US standard thread SS
16 - Female, US standard thread and female, US standard thread SS 17 - External anti-rotate 18 - External limit switch - N.C., PNP 19 - External limit switch - N.O., PNP
20 - Manual drive, handwheel with interlock switch (T2X only) 21 - Rear brake 22 - Protective bellows 23 - Splined main rod- Female 24 - Splined main rod - Male

*Consult Factory

Industries and Applications

Hydraulic cylinder replacement
Ball screw replacement
Pneumatic cylinder replacement

Automotive
- Clamping
- Dispensing
- Automated Assembly
- Flexible Tooling

Food Processing
- Depositing
- Slicing
- Diverters / Product Conveyance
- Sealing

Process Control
- Oil & Gas Wellhead Valve Control
- Pipeline Valve Control
- Damper Control
- Knife Valve Control
- Chemical pumps

Entertainment / Simulation
- Ride Motion Bases
- Animatronics

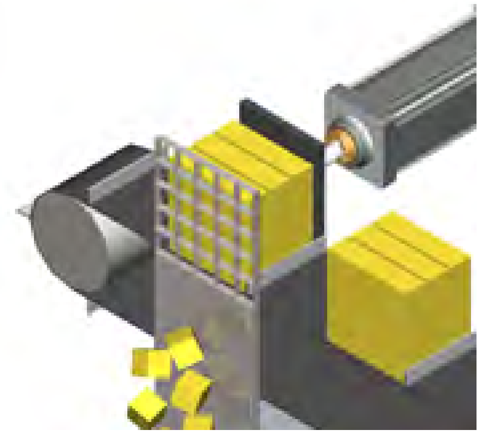
Medical Equipment
- Volumetric Pumps

Plastics
- Forming
- Part Eject
- Core Pull

Material Handling
- Robotic End Effectors
- Edge Guiding

Exlar actuators can provide precision at high force loads for fluid dispensing in a medical environment.

Efficient food processing and packaging operations demand robust technologies that are powerful, durable, precise, and safe for food. Exlar products are ideal for these for harsh, high-capacity production environments



Mechanical Specifications

T2M/X075

		Stator	1 Stack	2 Stack	3 Stack
Lead		RPM @ 240 VAC	4000	3000	2000
0.1	Continuous Force	lbf (N)	589 (2,620)	990 (4,404)	NA
	Peak Force	lbf (N)	1,178 (5,240)	1,980 (8,808)***	NA
	Max Speed	in/sec (mm/sec)	6.67 (169)	5.00 (127)	NA
	C_a (Dynamic Load Rating)	lbf (N)	3310 (14724)	3310 (14724)	3310 (14724)
0.2	Continuous Force	lbf (N)	334 (1,486)	561 (2,496)	748 (3,327)
	Peak Force	lbf (N)	668 (2,971)	1,122 (4,991)	1,495 (6,650)
	Max Speed	in/sec (mm/sec)	13.33 (339)	10.00 (254)	6.67 (169)
	C_a (Dynamic Load Rating)	lbf (N)	3570 (15880)	3570 (15880)	3570 (15880)
0.5	Continuous Force	lbf (N)	141 (627)	238 (1,059)	317 (1,410)
	Peak Force	lbf (N)	283 (1,259)	475 (2,113)	633 (2,816)
	Max Speed	in/sec (mm/sec)	33.33 (847)	25.00 (635)	16.67 (423)
	C_a (Dynamic Load Rating)	lbf (N)	3016 (13416)	3016 (13416)	3016 (13416)
Drive Current @ Continuous Force		Amps	3.1	3.8	3.6
Available Stroke Lengths		in (mm)	3 (76), 6 (150), 10 (254),12 (305), 14 (356), 18 (457)		
Inertia *(zero stroke)*		lb-in-s²/ Kg-m²	0.002655 (0.000003000)	0.002829 (0.000003196)	0.003003 (0.0000033963)
Inertia Adder *(per unit of stroke)*		lb-in-s²/in/ Kg-m²/mm	0.0001424 (0.0000001609)		
Approximate Weight		lb (kg)	10.8 (4.9) for 3 inch stroke, 1 stack. Add 1.1 (0.5) per inch of stroke. Add 1.1 (0.5) per motor stack. Add .8 (0.4) for brake.		
Operating Temperature Range*		-20C to 65C (-40˚C available, consult Exlar)			
Continuous AC Input Current**		Amps	4.3	4	3.6

* Ratings based on 40˚C conditions.
** Continuous input current rating is defined by UL and CSA
*** T2X peak force for 0.1 inch lead is 2073 lbf (9221 N). T2M peak force for 0.1 inch lead limited to 1620 lbf (7206 N).

T2M/X090

		Stator	1 Stack	2 Stack	2 Stack
Lead		RPM @ 240 VAC	4000	4000	3000
0.1	Continuous Force	lbf (N)	1,130 (5062)	1,488 (6619)	NA
	Peak Force	lbf (N)	2,260 (10053)	2,700 (12010)***	NA
	Max Speed	in/sec (mm/sec)	6.67 (169)	6.67 (169)	NA
	C_a (Dynamic Load Rating)	lbf (N)	3310 (14724)	3310 (14724)	3310 (14724)
0.2	Continuous Force	lbf (N)	640 (2847)	843 (3750)	1,113 (4951)
	Peak Force	lbf (N)	1,281 (5698)	1,687 (7504)	2,225 (9897)
	Max Speed	in/sec (mm/sec)	13.33 (338)	13.33 (338)	10.00 (254)
	C_a (Dynamic Load Rating)	lbf (N)	3570 (15880)	3570 (15880)	3570 (15880)
0.5	Continuous Force	lbf (N)	271 (1205)	357 (1588)	471 (2095)
	Peak Force	lbf (N)	542 (2410)	714 (3176)	942 (4190)
	Max Speed	in/sec (mm/sec)	33.33 (846)	33.33 (846)	25.00 (635)
	C_a (Dynamic Load Rating)	lbf (N)	3016 (13416)	3016 (13416)	3016 (13416)
Drive Current @ Continuous Force		Amps	5.7	7.5	7.5
Available Stroke Lengths		in (mm)	3 (75), 6 (150), 10 (254), 12 (300), 18 (450)		
Inertia *(zero stroke)*		lb-in-s²/ Kg-m²	0.002655 (0.000003000)	0.002829 (0.000003196)	0.003003 (0.0000033963)
Inertia Adder *(per unit of stroke)*		lb-in-s²/in/ Kg-m²/mm	0.0001424 (0.0000001609)		
Approximate Weight		lb (kg)	14 (6.35) for 3 inch stroke, 1 stack. Add 1 (0.5) per inch of stroke. Add 3 (1.4) per motor stack. Add 3 (1.4) for brake.		
Operating Temperature Range*		-20 to 65˚ C (-40˚C available, consult Exlar)			
Continuous AC Input Current**		Amps	6.3	6.3	6.3

* Ratings based on 25˚C conditions.
** Continuous input current rating is defined by UL and CSA.
*** T2X peak force for 0.1 inch lead is 2700 lbf (12010 N). T2M peak force for 0.1 inch lead limited to 1620 lbf (7206 N).

T2M/X115

		Stator	1 Stack	2 Stack	2 Stack
Lead		RPM @ 240 VAC	3000	2000	1500
0.1	Continuous Force	lbf (N)	2,060 (9,163)	3,224 (14,341)	NA
	Peak Force	lbf (N)	4,120 (18,327)	5,400 (24,020)	NA
	Max Speed	in/sec (mm/sec)	5.00 (127)	3.33 (84)	NA
	C_a (Dynamic Load Rating)	lbf (N)	4736 (21067)	7900 (35141)	7900 (35141)
0.2	Continuous Force	lbf (N)	1,177 (5,235)	1,843 (8,198)	2,380 (10,586)
	Peak Force	lbf (N)	2,354 (10,471)	3,685 (16,392)	4,760 (21,174)
	Max Speed	in/sec (mm/sec)	10.00 (254)	6.67 (169)	5.00 (127)
	C_a (Dynamic Load Rating)	lbf (N)	4890 (21751)	8300 (36920)	8300 (36920)
0.5	Continuous Force	lbf (N)	530 (2,358)	829 (3,688)	1,071 (4,764)
	Peak Force	lbf (N)	1,059 (4711)	1,658 (7,375)	2,142 (9,528)
	Max Speed	in/sec (mm/sec)	25.00 (635)	16.67 (423)	12.50 (317)
	C_a (Dynamic Load Rating)	lbf (N)	4218 (18763)	7030 (31271)	7030 (31271)
0.75	Continuous Force	lbf (N)	353 (1,570)	553 (2,460)	714 (3,176)
	Peak Force	lbf (N)	706 (3,140)	1,106 (4,920)	1,428 (6,352)
	Max Speed	in/sec (mm/sec)	37.5 (953)	25 (635)	17.75 (450)
	C_a (Dynamic Load Rating)	lbf (N)	3328 (14804)	6335 (28179)	6335 (28179)
Drive Current @ Continuous Force		Amps	8.5	8.5	8.5
Available Stroke Lengths		in (mm)	4 (102), 6 (150), 10 (254), 12 (300), 18 (450)		
Inertia *(zero stroke)*		lb-in-s²/ Kg-m²	0.01132 (0.000012790)	0.01232 (0.00001392)	0.01332 (0.00001505)
Inertia Adder *(per unit of stroke)*		lb-in-s²/in/ Kg-m²/mm	0.0005640 (0.0000006372)		
Approximate Weight		lb (kg)	34 (15.5) for 6 inch stroke, 1 stack. Add 2 (1) per inch of stroke. Add 8 (4) per motor stack. Add 4 (2) for brake.		
Operating Temperature Range*		-20 to 65˚ C (-40˚C available, consult Exlar)			
Continuous AC Input Current**		Amps	8.3	8.3	8.3

* Ratings based on 25˚C conditions.
** Continuous input current rating is defined by UL and CSA.
*** T2X peak force for 0.1 inch lead is 5400 lbf (24020 N). T2M peak force for 0.1 inch lead limited to 3966 lbf (17,642 N).

Tritex II AC

DEFINITIONS:

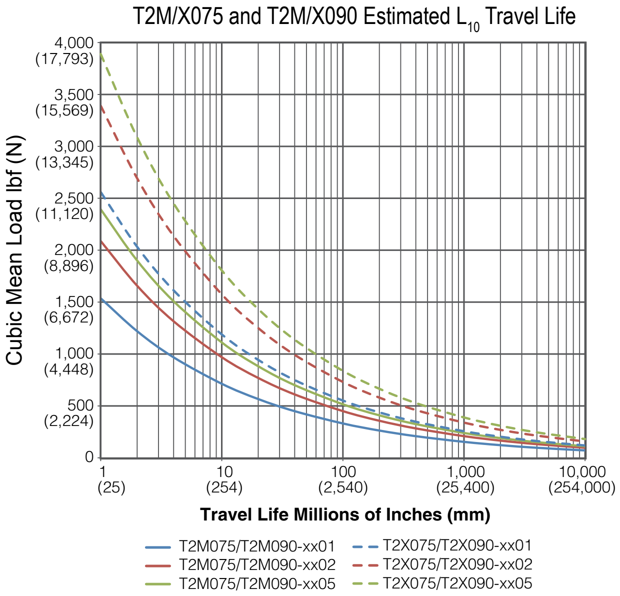
Continuous Force: The linear force produced by the actuator at continuous motor torque.

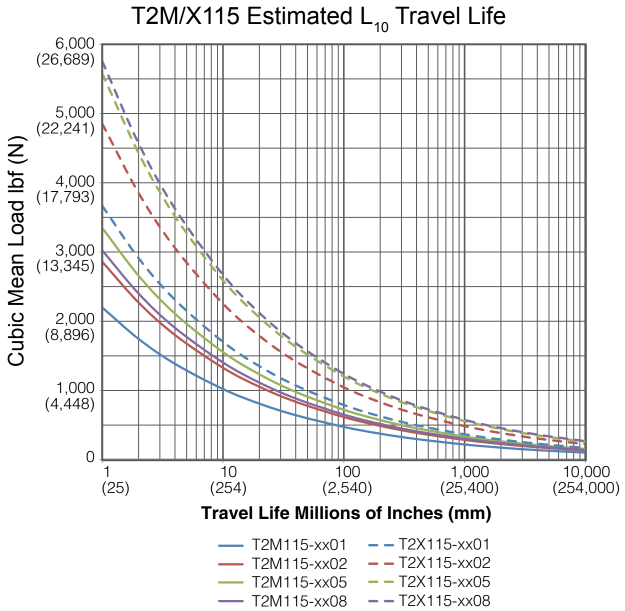
Peak Force: The linear force produced by the actuator at peak motor torque.

Max Speed: The maximum rated speed produced by the actuator at rated voltage.

C_a (Dynamic Load Rating): A design constant used in calculating the estimated travel life of the roller screw.

Estimated Service Life





The L_{10} expected life of a roller screw linear actuator is expressed as the linear travel distance that 90% of properly maintained roller screws are expected to meet or exceed. For higher than 90% reliability, the result should be multiplied by the following factors: 95% x 0.62; 96% x 0.53; 97% x 0.44; 98% x 0.33; 99% x 0.21. This is not a guarantee; these charts should be used for estimation purposes only.

The underlying formula that defines this value is:
Travel life in millions of inches, where:

C_a = Dynamic load rating (lbf)
F_{cml} = Cubic mean applied load (lbf)
ℓ = Roller screw lead (inches)

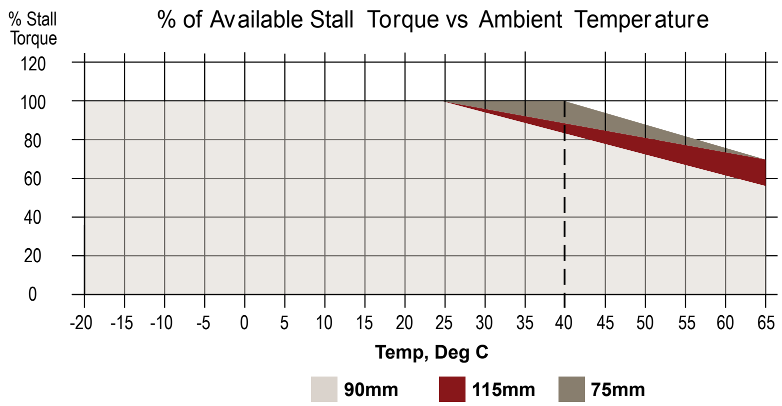
$$L_{10} = \left(\frac{C_a}{F_{cml}}\right)^3 \times \ell$$

All curves represent properly lubricated and maintained actuators.

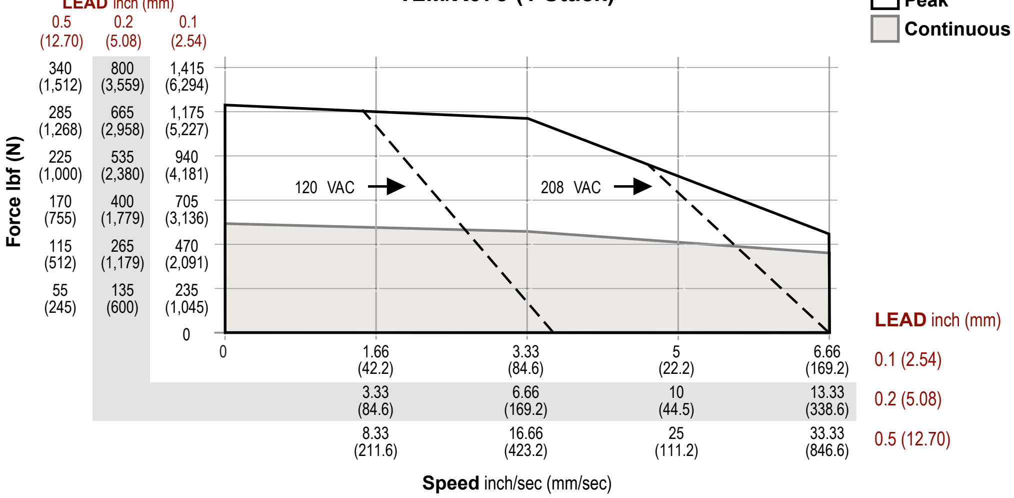
Speed vs. Force Curves

Temperature Derating

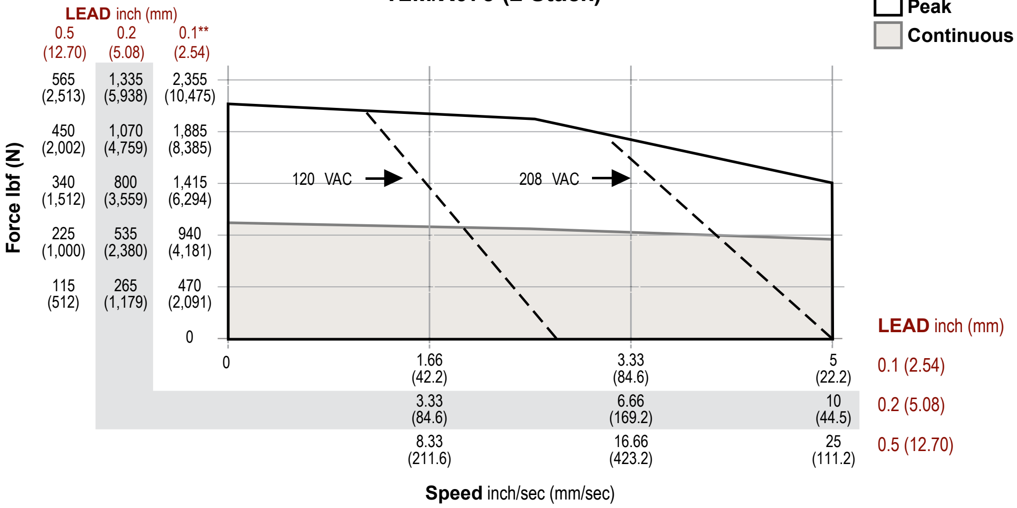
The speed/torque curves are based on 25° C ambient conditions. The actuators may be operated at ambient temperatures up to 65° C. Use the curve (shown right) for continuous torque/force deratings above 25° C.



T2M/X075 (1 Stack)*

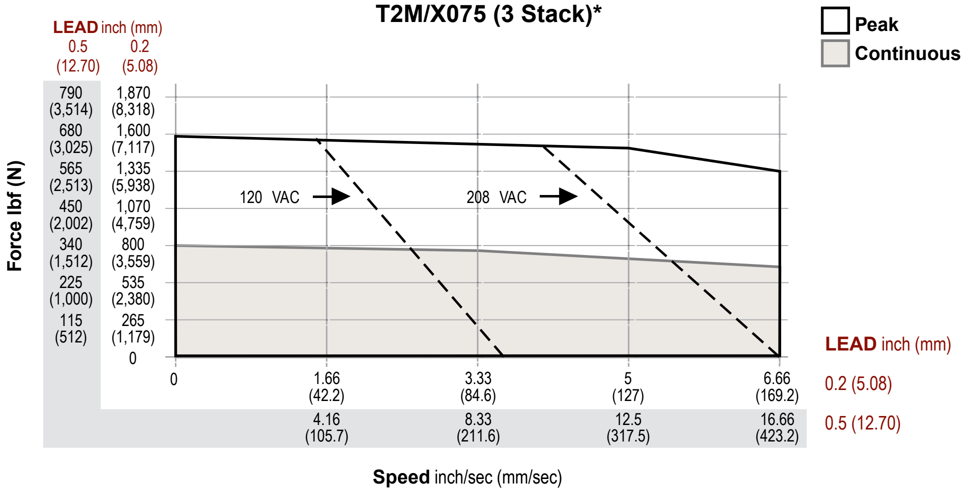


T2M/X075 (2 Stack)*

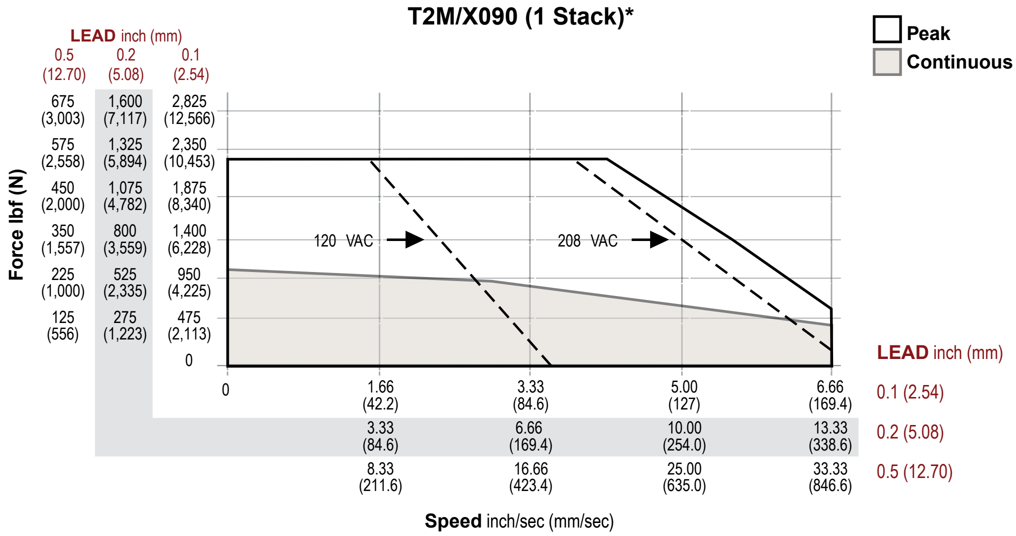


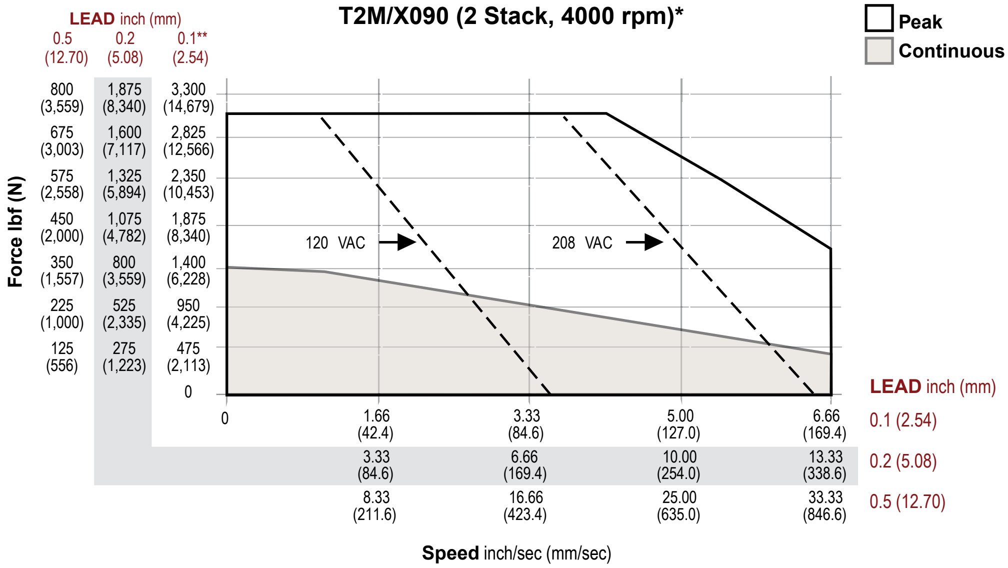
**T2X peak force for 0.1 inch lead is 2073 lbf (9221 N). T2M peak force for 0.1 inch lead limited to 1620 lbf (7206 N).

T2M/X075 (3 Stack)*

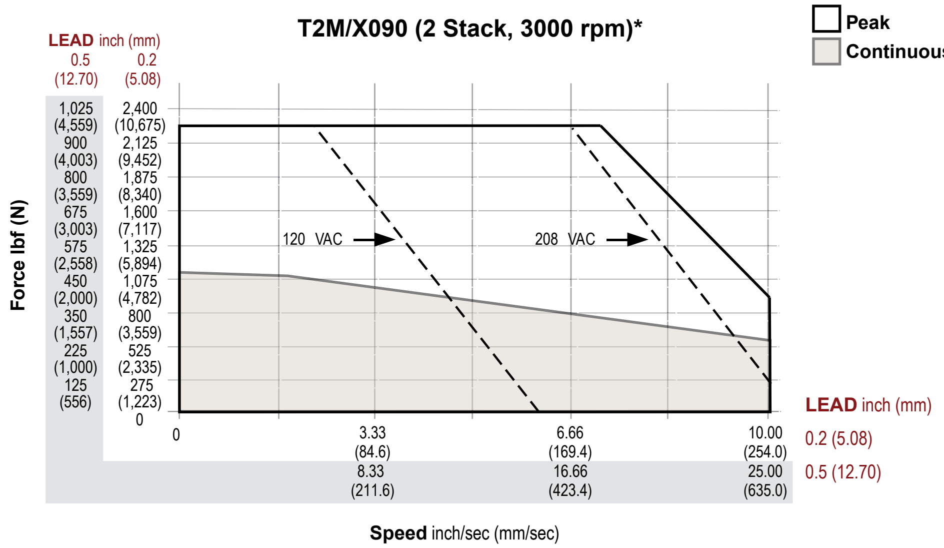


*Test data derived using NEMA recommended aluminum heatsink 10" x 10" x 3/8" at 40°C ambient.



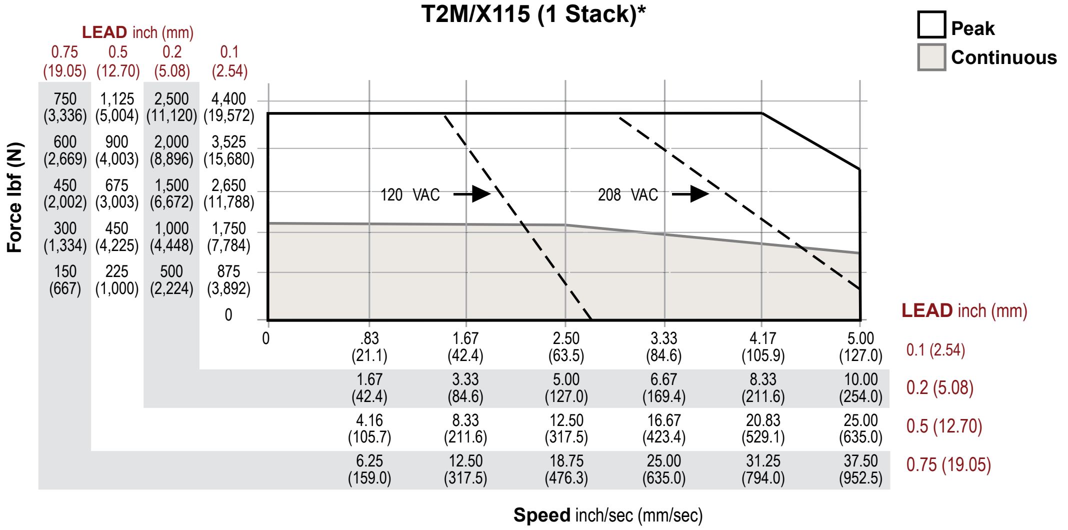


**T2X peak force for 0.1 inch lead is 2700 lbf (12010 N). T2M peak force for 0.1 inch lead limited to 1620 lbf (7206 N).

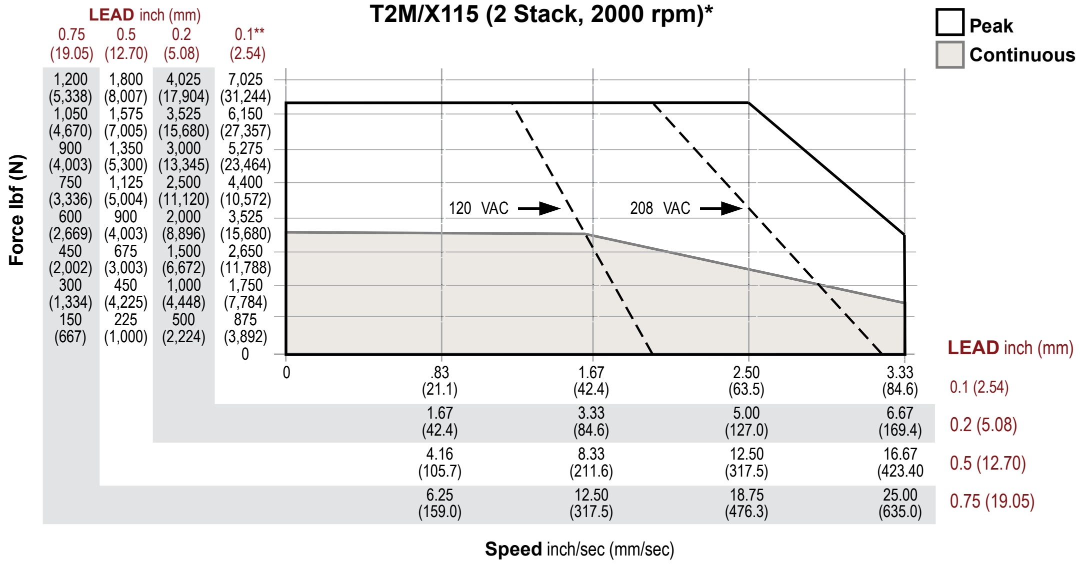


*Test data derived using NEMA recommended aluminum heatsink 10" x 10" x 3/8" at 25°C ambient.

T2M/X115 (1 Stack)*

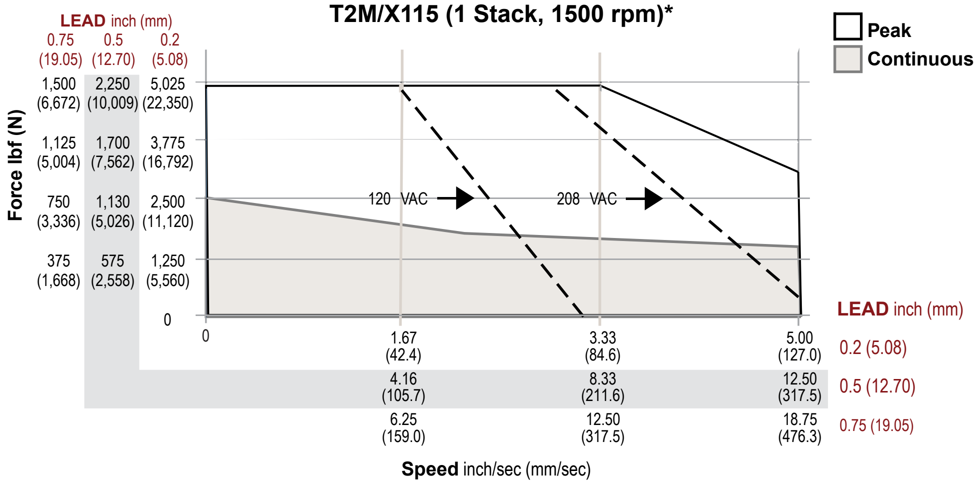


T2M/X115 (2 Stack, 2000 rpm)*



**T2X peak force for 0.1 inch lead is 5400 lbf (24020 N). T2M peak force for 0.1 inch lead limited to 3966 lbf (17,642 N).

T2M/X115 (1 Stack, 1500 rpm)*



*Test data derived using NEMA recommended aluminum heatsink 12" x 12" x 1/2" at 25°C ambient.

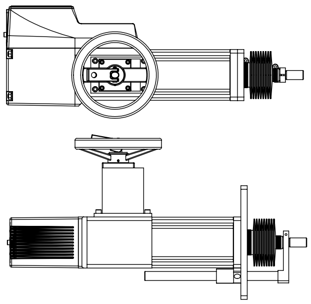
Options

AR = External Anti-rotate Assembly
This option provides a rod and bushing to restrict the actuator rod from rotating when the load is not held by another method. Shorter actuators have single sided anti-rotation attachments. Longer lengths require attachments on both sides for proper operation. For AR dimensions, see page 78.

PF = Preloaded Follower
The dynamic load rating of zero backlash, preloaded screws is 63% of the dynamic load rating of the standard non-preloaded screws. The calculated travel life of a preloaded screw will be 25% of the calculated travel life of the same size and lead of a non-preloaded screw for the same application. Preloaded follower option includes angular contact bearings and is not available with LT Linear feedback option.

L1, L2, L3 = Adjustable External Travel Switches
This option allows up to 3 external switches to be included. These switches provide travel indication to the controller and are adjustable. See drawing on page 54. Must purchase external anti-rotate with this option.

HW = Manual Drive, Handwheel
This option provides a manual drive handwheel on the side of the actuator. The handwheel has an engage/disengage lever that is tied to an interrupt switch. Not available with holding brake unless application details have been discussed with your local sales representative.



PB = Protective Bellows
This option provides an accordion style protective bellows to protect the main actuator rod from damage due to abrasives or other contaminants in the environment in which the actuator must survive. The standard material of this bellows is S2 Neoprene Coated Nylon, Sewn Construction. This standard bellows is rated for environmental temperatures of -40 to 250 degrees F. Longer strokes may require the main rod of the actuator to be extended beyond standard length. Not available with extended tie rod mounting option. Please contact your local sales representative.

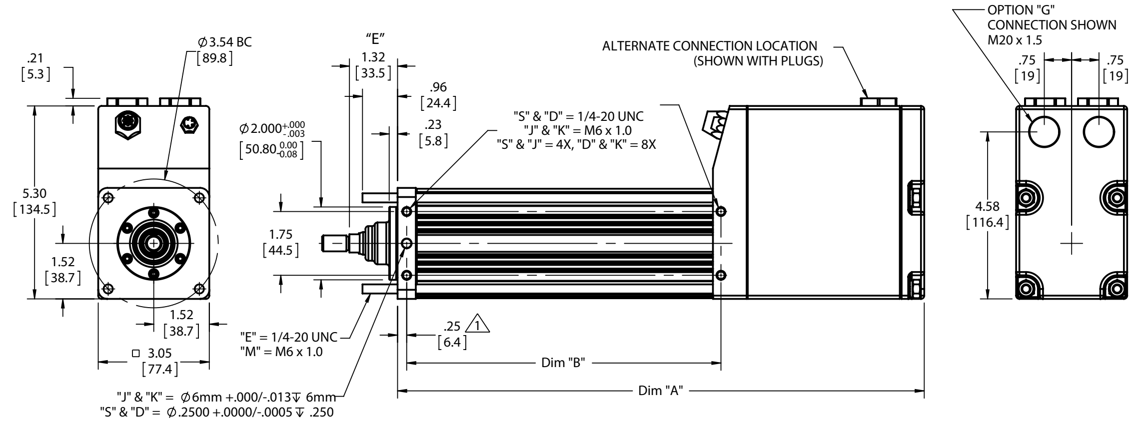
RB = Rear Electric Brake
This option provides an internal holding brake. The brake is spring activated and electrically released.

SR = Splined Main Rod
A ball spline shafting main rod with a ball spline nut that replaces the standard front seal and bushing assembly. This rod restricts rotation without the need for an external mechanism. The rod diameter will be the closest metric equivalent to our standard rod sizes. Since this option is NOT sealed, it is not suitable for environments in which contaminants may enter the actuator.

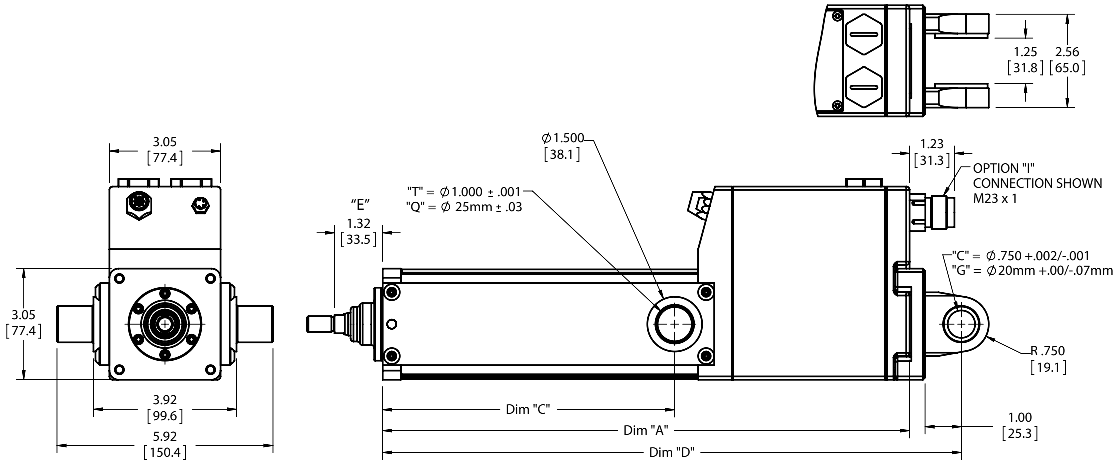
Note: Adding this option affects the overall length and mounting dimensions.

Dimensions

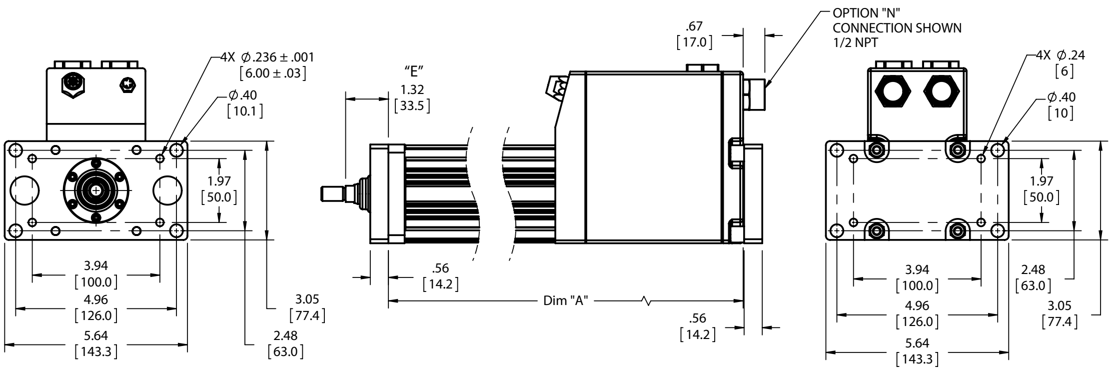
T2M/X075 Double Side Mount or Extended Tie Rod Mount



T2M/X075 Side Trunnion Mount or Rear Clevis Mount



T2M/X075 Front, Rear, or Front and Rear Flange Mount

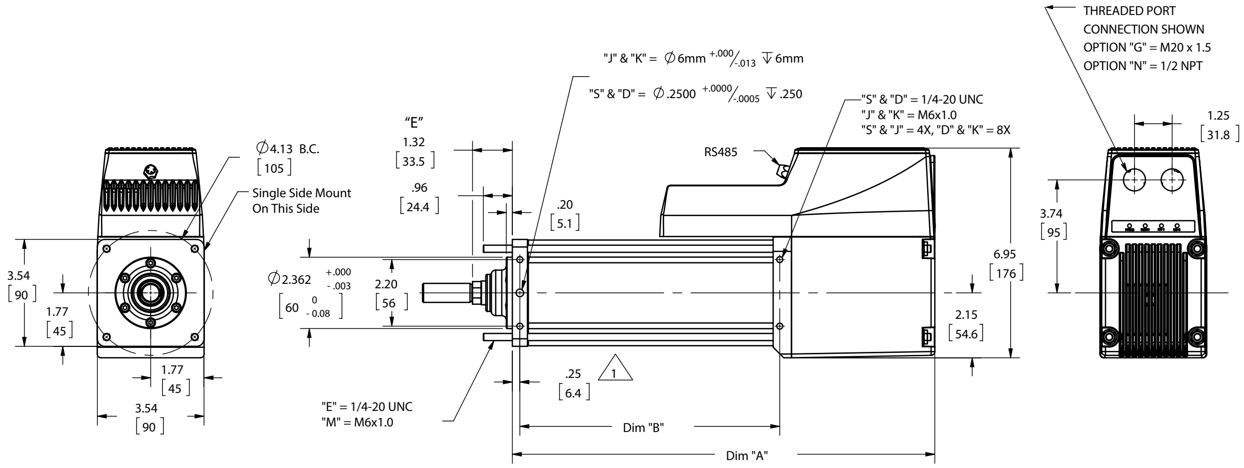


DIM	3 in (75 mm) stroke in (mm)	6 in (150 mm) stroke in (mm)	10 in (250 mm) stroke in (mm)	12 in (300 mm) stroke in (mm)	14 in (350 mm) stroke in (mm)	18 in (450 mm) stroke in (mm)
A	11.98 (304.3)	14.45 (367.0)	18.95 (481.3)	20.95 (532.1)	22.95 (582.9)	26.95 (684.5)
B	6.15 (156.2)	8.62 (218.9)	13.12 (333.2)	15.12 (384.0)	17.12 (434.8)	21.12 (536.4)
C	5.38 (136.7)	8.00 (203.2)	10.00 (254.0)	12.00 (304.8)	14.00 (355.6)	18.00 (457.2)
D	13.40 (340.4)	15.87 (403.1)	20.37 (517.4)	22.37 (568.2)	24.37 (619.0)	28.37 (720.6)

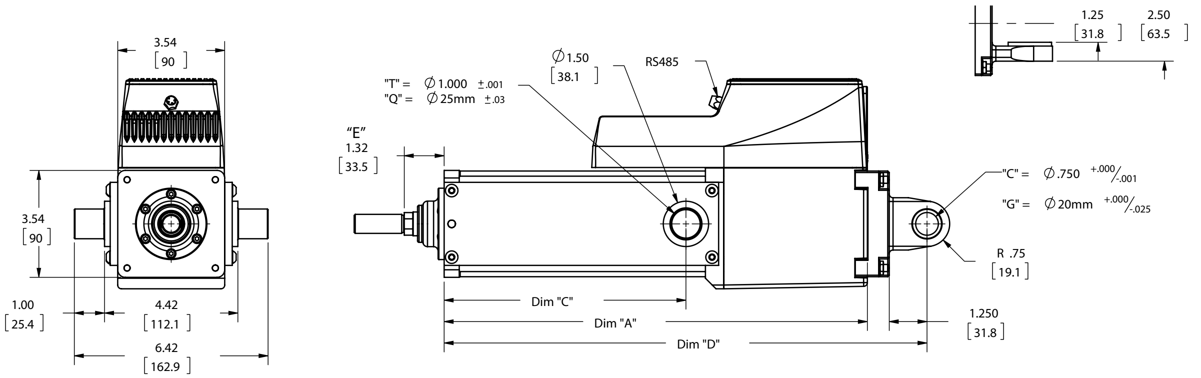
* Add 1.61 inches to dimensions "A", "B" and "D" if ordering a brake. Add 1.2 inches to dimensions "A", "C" and "D" and dimension if ordering a splined ⚠1 main rod.
**Add 2 in (50.8 mm) to dimension "E" if ordering protective bellows.

Pre-sale drawings and models are representative and are subject to change. Certified drawings and models are available for a fee. Consult your local Exlar representative for details.

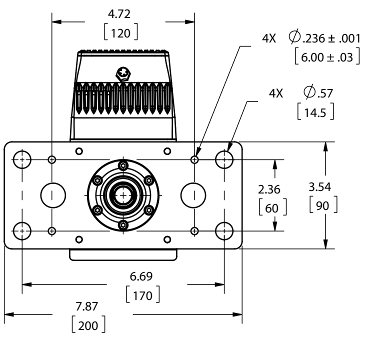
T2M/X090 Double Side Mount or Extended Tie Rod Mount

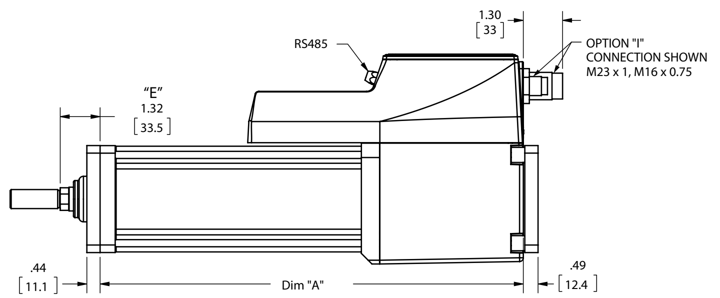


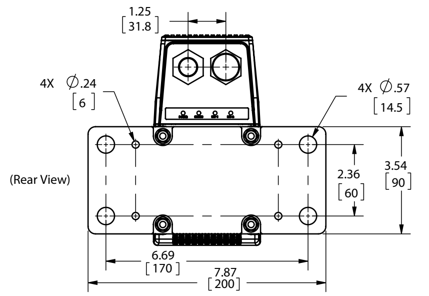
T2M/X090 Side Trunnion Mount or Rear Clevis Mount



T2M/X090 Front, Rear, or Front and Rear Flange Mount







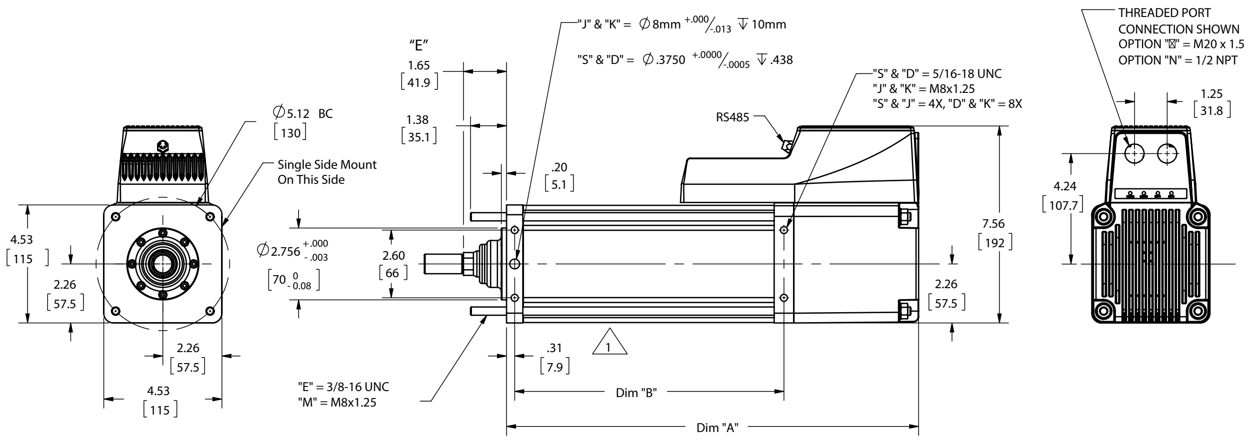
DIM	3 in (75 mm) stroke in (mm)	6 in (150 mm) stroke in (mm)	10 in (250 mm) stroke in (mm)	12 in (300 mm) stroke in (mm)	18 in (450 mm) stroke in (mm)
A	11.54 (293.1)	14.01 (355.9)	18.53 (470.7)	20.53 (521.5)	26.53 (673.9)
B	6.15 (156.1)	8.62 (218.9)	13.12 (333.3)	15.12 (384.1)	21.12 (536.4)
C	5.38 (136.7)	8.01 (203.4)	10.00 (254.0)	12.00 (304.8)	18.00 (457.2)
D	13.52 (343.3)	15.99 (406.1)	20.49 (520.4)	22.49 (571.2)	28.49 (723.6)

* Add 1.61 inches to dimensions “A”, “B” and “D” if ordering a brake. Add 1.78 inches to dimensions “A”, “C” and “D” and dimension if ordering a splined ⚠ main rod.

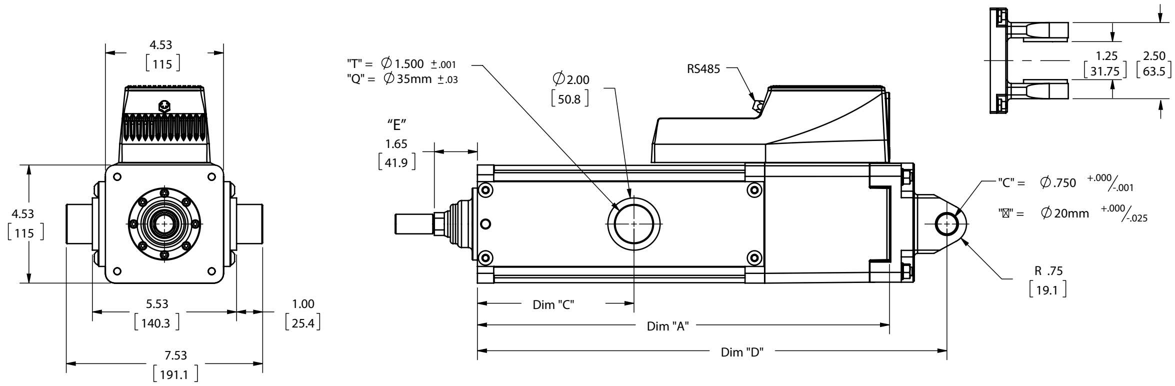
**Add 2 in (50.8 mm) to dimension “E” if ordering protective bellows.

Pre-sale drawings and models are representative and are subject to change. Certified drawings and models are available for a fee. Consult your local Exlar representative for details.

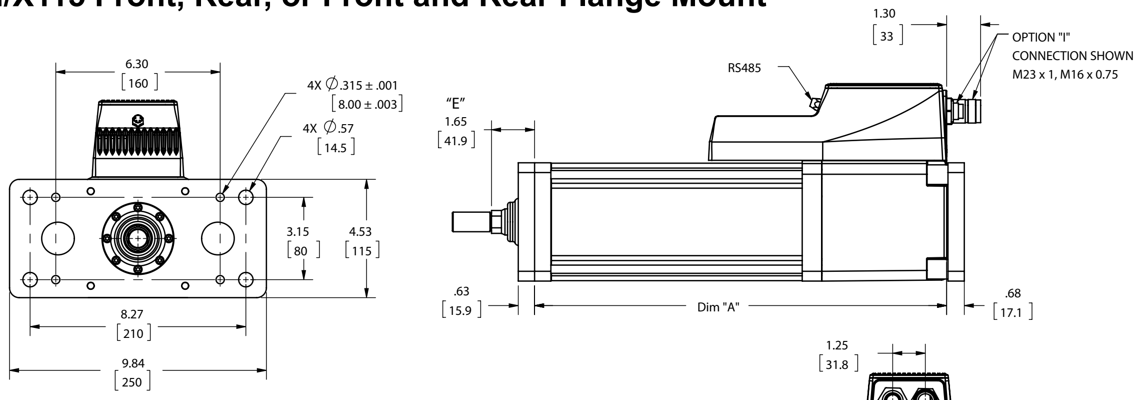
T2M/X115 Double Side Mount or Extended Tie Rod Mount

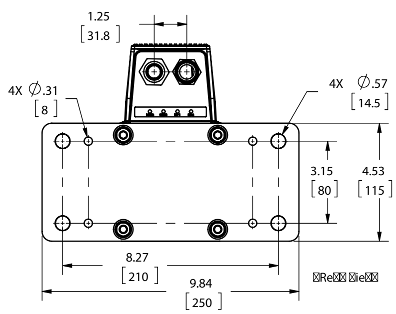


T2M/X115 Side Trunnion Mount or Rear Clevis Mount



T2M/X115 Front, Rear, or Front and Rear Flange Mount





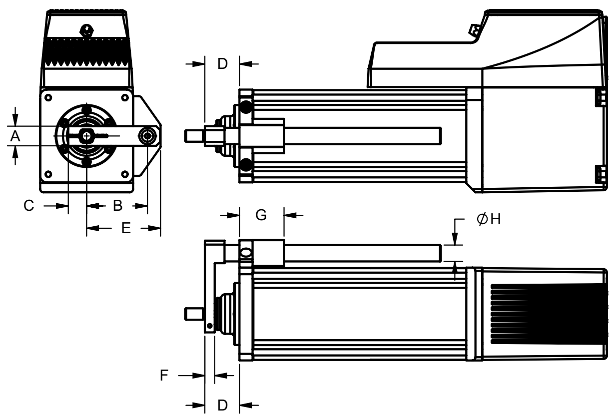
DIM	4 in (102 mm) stroke in (mm)	6 in (152 mm) stroke in (mm)	10 in (254 mm) stroke in (mm)	12 in (305 mm) stroke in (mm)	18 in (457 mm) stroke in (mm)
A	13.79 (350.3)	15.79 (401.1)	19.79 (502.7)	21.79 (553.5)	27.79 (705.9)
B	8.31 (211.1)	10.31 (261.8)	14.31 (363.5)	16.31 (414.3)	22.31 (566.7)
C	4.00 (101.6)	6.00 (152.4)	10.00 (254.0)	12.00 (304.8)	18.00 (457.2)
D	15.99 (406.1)	17.99 (456.9)	21.99 (558.5)	23.99 (609.3)	29.99 (761.7)

* Add 2.33 inches to dimensions "A", "B" and "D" if ordering a brake. Add 1.77 inches to dimensions "A", "C" and "D" and dimension if ordering a splined Δ main rod.

**Add 2 in (50.8 mm) to dimension "E" if ordering protective bellows.

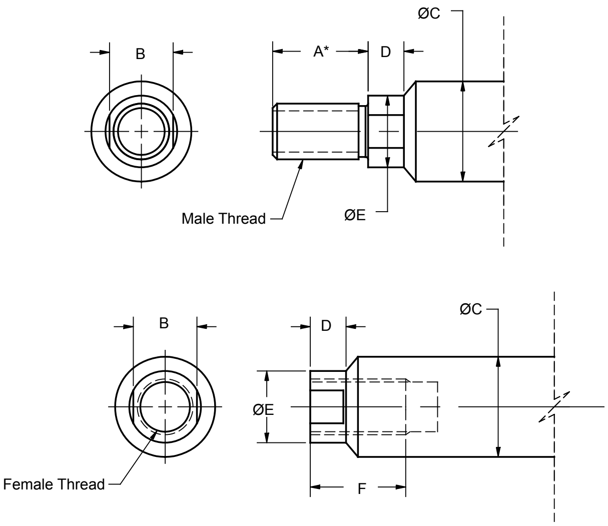
Pre-sale drawings and models are representative and are subject to change. Certified drawings and models are available for a fee. Consult your local Exlar representative for details.

Anti-Rotate Option



DIM in (mm)	T2M/X075	T2M/X090	T2M/X115
A	0.82 (20.8)	0.75 (19.1)	1.13 (28.7)
B	2.20 (56.0)	2.32 (58.9)	3.06 (77.7)
C	0.60 (15.3)	0.70 (17.8)	1.00 (25.4)
D	1.32 (33.5)	1.32 (33.5)	1.65 (41.9)
E	2.70 (68.7)	2.82 (71.6)	3.63 (92.2)
F	0.39 (9.9)	0.38 (9.7)	0.50 (12.7)
G	1.70 (43.2)	1.70 (43.2)	1.97 (50.0)
ØH	0.63 (16.0)	0.63 (16.0)	0.75 (19.1)

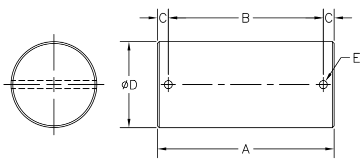
Actuator Rod End Option



DIM in (mm)	T2M/X075	T2M/X090	T2M/X115
A*	0.750 (19.1)*	1.250 (31.8)	1.500 (38.1)
B	0.500 (12.7)	0.625 (17.0)	0.750 (19.1)
ØC	0.625 (15.9)	0.787 (20.0)	1,000 (25.4)
D	0.281 (7.1)	0.281 (7.1)	0.381 (9.7)
ØE	0.562 (14.3)	0.725 (18.4)	0.875 (22.2)
F	0.750 (19.1)	1,000 (25.4)	1,000 (25.4)
Male–Inch “M”, “W”	7/16-20 UNF-2A	1/2-20 UNF-2A	3/4-16 UNF-2A
Male–Metric “A”, “R”	M12 x 1.75 6g	M16 x 1.5 6g	M16 x 1.5 6g
Female–Inch “F”, “V”	7/16-20 UNF-2B	1/2-20 UNF-2B	5/8-18 UNF-2B
Female–Metric “B”, “L”	M10 x 1.5 6h	M16 x 1.5 6h	M16 x 1.5 6h

*When ordering the male M12x1.75 main rod for the T2M/X075 dimension “A” will be 1.57 in (40 mm)

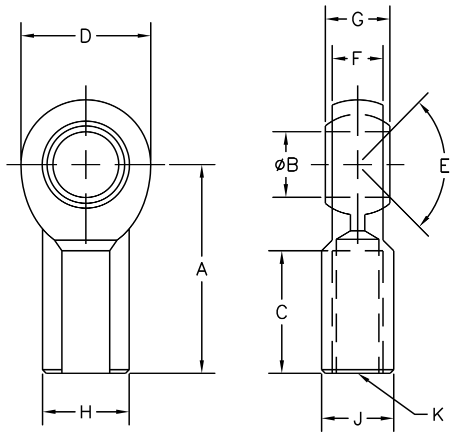
Clevis Pin



DIM	T2M/X075/T2M/X090	T2M/X075/T2M/X090	T2M/X115
in (mm)	CP050 Rod Eye, Rod Clevis	CP075 Rear Clevis	CP075 Rod Eye, Rod Clevis, Spherical Eye, Rear Clevis
A	2.28 (57.9)	3.09 (78.5)	3.09 (78.5)
B	1.94 (49.28)	2.72 (69.1)	2.72 (69.1)
C	0.17 (4.32)	0.19 (4.82)	1.19 (4.82)
ØD	0.50 -0.001/-0.002 (112.7 mm +0.00/-0.05)	0.75 -0.001/-0.002 (19.1 mm +0.00/-0.05)	0.75 -0.001/-0.002 (19.1 mm +0.00/-0.05)
ØE	0.106 (2.69)	0.14 (3.56)	0.14 (3.56)

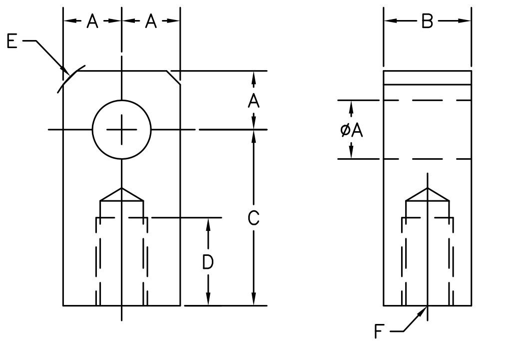
Pre-sale drawings and models are representative and are subject to change. Certified drawings and models are available for a fee. Consult your local Exlar representative for details.

Spherical Rod Eye



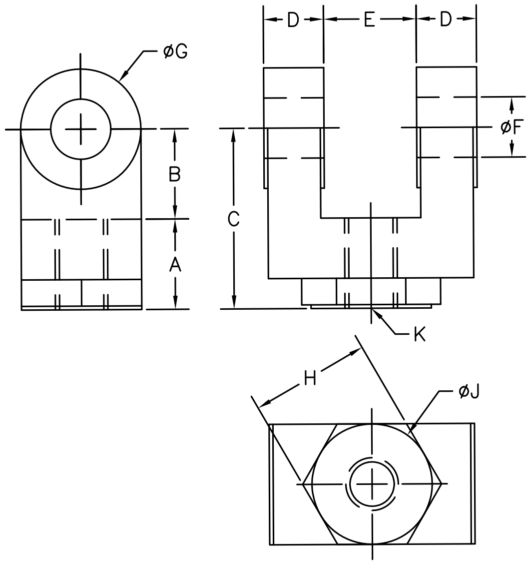
DIM in (mm)	T2M/X075	T2M/X090	T2M/X115
	SRM044	SRM050	SRM075
A	1.81 (46.0)	2.125 (54.0)	2.88 (73.2)
ØB	0.438 (11.13)	0.500 (12.7)	0.75 (19.1)
C	1.06 (26.9)	1.156 (29.4)	1.72 (43.7)
D	1.13 (28.7)	1.312 (33.3)	1.75 (44.5)
E	14 Deg	6 Deg	14 Deg
F	0.44 (11.1)	0.500 (12.7)	0.69 (17.5)
G	0.56 (14.2)	0.625 (15.9)	0.88 (22.3)
H	0.75 (19.1)	0.875 (22.2)	1.13 (28.7)
J	0.63 (16.0)	0.750 (19.1)	1.00 (25.4)
K	7/16-20	1/2-20	3/4-16

Rod Eye



DIM in (mm)	T2M/X075	T2M/X090	T2M/X115
	RE050	REI050	RE075
ØA	0.50 (12.7)	0.50 (12.7)	0.75 (19.05)
B	0.75 (19.1)	0.75 (19.05)	1.25 (31.8)
C	1.50 (38.1)	1.50 (38.1)	2.06 (52.3)
D	0.75 (19.1)	0.75 (19.05)	1.13 (28.7)
E	0.63 (15.9)	0.375 (9.53)	0.88 (22.2)
F	7/16-20	1/2-20	3/4-16

Rod Clevis



DIM in (mm)	T2M/X075	T2M/X090	T2M/X115
	RC050	RCI050	RC075
A	0.750 (19.05)	0.750 (19.05)	1.125 (28.58)
B	0.750 (19.05)	0.750 (19.05)	1.25 (31.75)
C	1.500 (38.1)	1.500 (38.1)	2.375 (60.3)
D	0.500 (12.7)	0.500 (12.7)	0.625 (15.88)
E	0.765 (19.43)	0.765 (19.43)	1.265 (32.12)
ØF	0.500 (12.7)	0.500 (12.7)	0.75 (19.1)
ØG	1.000 (25.4)	1.000 (25.4)	1.50 (38.1)
H	1.000 (25.4)	1.000 (25.4)	1.25 (31.75)
ØJ	1.000 (25.4)	N/A	1.25 (31.75)
K	7/16-20	1/2-20	3/4-16

Pre-sale drawings and models are representative and are subject to change. Certified drawings and models are available for a fee. Consult your local Exlar representative for details.

Mechanical Specifications

R2M/G075

Rotary Motor Torque and Speed Ratings

	Stator	1 Stack	2 Stack	2 Stack
	RPM at 240 VAC	4000	3000	2000
Continuous Torque	lbf-in (Nm)	13 (1.47)	21 (2.37)	28 (3.16)
Peak Torque	lbf-in (Nm)	25 (2.8)	42 (4.75)	56 (6.33)
Drive Current @ Continuous Torque	Amps	3.1	3.8	3.8
Operating Temperature Range*	-20 to 65° C (-40°C available, consult Exlar)			
Continuous AC Input Current**	Amps	4.3	4	3.6

*Ratings based on 40°C ambient conditions.
**Continuous input current rating is defined by UL and CSA.
For output torque of R2G gearmotors, multiply by ratio and efficiency. Please note maximum allowable output torques shown below.

Inertia

	Stator	1 Stack	2 Stack	3 Stack
R2M Motor Armature Inertia (+/-5%)	lb-in-sec^2 (kg-cm^2)	0.000545 (0.6158)	0.000973 (1.0996)	0.001401 (1.5834)
R2G Gearmotor Armature Inertia* (+/-5%)	lbf-in-sec^2 (kg-cm^2)	0.000660 (0.7450)	0.001068 (1.2057)	0.001494 (1.6868)

*Add armature inertia to gearing inertia for total R2G system inertia.

Radial Load and Bearing Life

RPM	50	100	250	500	1000	3000
R2M075 lbf (N)	278 (1237)	220 (979)	162 (721)	129 (574)	102 (454)	71 (316)
R2G075 lbf (N)	343 (1526)	272 (1210)	200 (890)	159 (707)	126 (560)	88 (391)

Side load ratings shown above are for 10,000 hour bearing life at 25 mm from motor face at given rpm.

Gearmotor Mechanical Ratings

Model	Ratio	Maximum Allowable Output Torque-Set by User lbf-in (Nm)	Output Torque at Motor Speed for 10,000 Hour Life		
			1000 RPM lbf-in (Nm)	2500 RPM lbf-in (Nm)	4000 RPM lbf-in (Nm)
R2G075-004	4:1	1618 (182.8)	384 (43.4)	292 (32.9)	254 (28.7)
R2G075-005	5:1	1446 (163.4)	395 (44.6)	300 (33.9)	260 (29.4)
R2G075-010	10:1	700 (79.1)	449 (50.7)	341 (38.5)	296 (33.9)

Two torque ratings for the R2G gearmotors are given in the table above. The left hand columns give the maximum (peak) allowable output torque for the indicated ratios of each size R2G gearmotor. This is not the rated output torque of the motor multiplied by the ratio of the reducer.

It is possible to select a configuration of the motor selection and gear ratio such that the rated motor torque, multiplied by the gear ratio exceeds these ratings. It is the responsibility of the user to ensure that the settings of the system do not allow these values to be exceeded.

The right hand columns give the output torque at the indicated speed which will result in 10,000 hour life (L10). The setup of the system will determine the actual output torque and speed.

Gearing Reflected Inertia

	Single Reduction	
Gear Stages	lbf-in-sec^2	(kg-cm^2)
4:1	0.000095	(0.107)
5:1	0.000062	(0.069)
10:1	0.000017	(0.019)

Backlash and Efficiency

	Single Reduction	Double Reduction
Backlash at 1% Rated Torque	10 Arc min	13 Arc min
Efficiency	91%	86%

Motor and Gearmotor Weights

		R2M075 without Gears	R2G075 with 1 Stage Gearing	Added Weight for Brake
1 Stack Stator	lb (kg)	7.4 (3.4)	9.8 (4.4)	1.0 (0.5)
2 Stack Stator	lb (kg)	9.2 (4.2)	11.6 (5.3)	
3 Stack Stator	lb (kg)	11 (4.9)	13.4 (6.1)	

R2M/G090

Rotary Motor Torque and Speed Ratings

	Stator	2 Stack	2 Stack	3 Stack
	RPM at 240 VAC	4000	3000	2000
Continuous Torque	lbf-in (Nm)	30 (3.4)	40 (4.5)	52 (5.9)
Peak Torque	lbf-in (Nm)	60 (6.8)	80 (9.0)	105 (11.9)
Drive Current @ Continuous Torque	Amps	7.5	7.5	6.6
Operating Temperature Range*	-20 to 65˚ C (-40˚C available, consult Exlar)			
Continuous AC Input Current**	Amps	6.3	6.3	6.3

*Ratings based on 25˚C ambient conditions.
**Continuous input current rating is defined by UL and CSA.

For output torque of R2G gearmotors, multiply by ratio and efficiency. Please note maximum allowable output torques shown below.

Inertia

	Stator	2 Stack	3 Stack
R2M Motor Armature Inertia (+/-5%)	lb-in-sec^2 (kg-cm^2)	0.00097 (1.09)	0.00140 (1.58)
R2G Gearmotor Armature Inertia* (+/-5%)	lbf-in-sec^2 (kg-cm^2)	0.00157 (1.77)	0.00200 (2.26)

*Add armature inertia to gearing inertia for total inertia.

Radial Load and Bearing Life

RPM	50	100	250	500	1000	3000
R2M090 lbf (N)	427 (1899)	340 (1512)	250 (1112)	198 (881)	158 (703)	109 (485)
R2G090 lbf (N)	350 (1557)	278 (1237)	205 (912)	163 (725)	129 (574)	89 (396)

Side load ratings shown above are for 10,000 hour bearing life at 25 mm from motor face at given rpm.

Gearmotor Mechanical Ratings

Model	Ratio	Maximum Allowable Output Torque-Set by User lbf-in (Nm)	Output Torque at Motor Speed for 10,000 Hour Life: 1000 RPM lbf-in (Nm)	2500 RPM lbf-in (Nm)	4000 RPM lbf-in (Nm)
R2G090-004	4:1	2078 (234.8)	698 (78.9)	530 (59.9)	460 (51.9)
R2G090-005	5:1	1798 (203.1)	896 (101.2)	680 (76.8)	591 (66.8)
R2G090-010	10:1	1126 (127.2)	1043 (117.8)	792 (89.4)	688 (77.7)
R2G090-016	16:1	2078 (234.8)	1057 (119.4)	803 (90.7)	698 (78.9)
R2G090-020	20:1	2078 (234.8)	1131 (127.8)	859 (97.1)	746 (84.3)
R2G090-025	25:1	1798 (203.1)	1452 (164.1)	1103 (124.6)	958 (108.2)
R2G090-040	40:1	2078 (234.8)	1392 (157.3)	1057 (119.4)	918 (103.7)
R2G090-050	50:1	1798 (203.1)	1787 (201.9)	1358 (153.4)	1179 (133.2)
R2G090-100	100:1	1126 (127.2)	1100 (124.3)	1100 (124.3)	1100 (124.3)

Two torque ratings for the R2G gearmotors are given in the table above. The left hand columns give the maximum (peak) allowable output torque for the indicated ratios of each size R2G gearmotor. This is not the rated output torque of the motor multiplied by the ratio of the reducer.
It is possible to select a configuration of the motor selection and gear ratio such that the rated motor torque, multiplied by the gear ratio exceeds these ratings. It is the responsibility of the user to ensure that the settings of the system do not allow these values to be exceeded.
The right hand columns give the output torque at the indicated speed which will result in 10,000 hour life (L10). The setup of the system will determine the actual output torque and speed.

Gearing Reflected Inertia

Single Reduction			Double Reduction		
Gear Stages	lbf-in-sec^2	(kg-cm^2)	Gear Stages	lbf-in-sec^2	(kg-cm^2)
4:1	0.000154	(0.174)	16:1	0.000115	(0.130)
5:1	0.000100	(0.113)	20:1, 25:1	0.0000756	(0.0854)
10:1	0.0000265	(0.0300)	40:1, 50:1, 100:1	0.0000203	(0.0230)

Backlash and Efficiency

	Single Reduction	Double Reduction
Backlash at 1% Rated Torque	10 Arc min	13 Arc min
Efficiency	91%	86%

Motor and Gearmotor Weights

		R2M090 without Gears	R2G090 with 1 Stage Gearing	R2G090 with 2 Stage Gearing	Added Weight for Brake
1 Stack Stator	lb (kg)	11 (4.9)	19 (8.6)	22 (10)	1.5 (0.7)
2 Stack Stator	lb (kg)	14 (6.4)	22 (10)	25 (11.3)	
3 Stack Stator	lb (kg)	17 (7.7)	25 (11.3)	28 (12.7)	

R2M/G115

Rotary Motor Torque and Speed Ratings

	Stator	1 Stack	2 Stack	2 Stack
	RPM at 240 VAC	3000	2000	1500
Continuous Torque	lbf-in (Nm)	47 (5.3)	73 (8.3)	95 (10.7)
Peak Torque	lbf-in (Nm)	94 (10.6)	146 (16.5)	190 (21.5)
Drive Current @ Continuous Torque	Amps	8.5	8.5	8.5
Operating Temperature Range*	-20 to 65˚ C (-40˚C available, consult Exlar)			
Continuous AC Input Current**	Amps	8.3	8.3	8.3

*Ratings based on 25˚C ambient conditions.
**Continuous input current rating is defined by UL and CSA.

For output torque of R2G gearmotors, multiply by ratio and efficiency. Please note maximum allowable output torques shown below.

Inertia

	Stator	1 Stack	2 Stack
R2M Motor Armature Inertia (+/-5%)	lb-in-sec² (kg-cm²)	0.00344 (3.89)	0.00623 (7.036)
R2G Gearmotor Armature Inertia*	lbf-in-sec² (kg-cm²)	0.00538 (6.08)	0.00816 (9.22)

*Add armature inertia to gearing inertia for total R2M system inertia.

Radial Load and Bearing Life

RPM	50	100	250	500	1000	3000
R2M115 lbf (N)	579 (2576)	460 (2046)	339 (1508)	269 (1197)	214 (952)	148 (658)
R2G115 lbf (N)	858 (3817)	681 (3029)	502 (2233)	398 (1770)	316 (1406)	218 (970)

Side load ratings shown above are for 10,000 hour bearing life at 25 mm from motor face at given rpm.

Gearmotor Mechanical Ratings

Model	Ratio	Maximum Allowable Output Torque-Set by User lbf-in (Nm)	Output Torque at Motor Speed for 10,000 Hour Life: 1000 RPM lbf-in (Nm)	2000 RPM lbf-in (Nm)	3000 RPM lbf-in (Nm)
R2G115-004	4:1	4696 (530.4)	1392 (157.3)	1132 (127.9)	1000 (112.9)
R2G115-005	5:1	4066 (459.4)	1455 (163.3)	1175 (132.8)	1040 (117.5)
R2G115-010	10:1	2545 (287.5)	1660 (187.6)	1350 (152.6)	1200 (135.6)
R2G115-016	16:1	4696 (530.4)	2112 (238.6)	1714 (193.0)	1518 (171.0)
R2G115-020	20:1	4696 (530.4)	2240 (253.1)	1840 (207.9)	1620 (183.0)
R2G115-025	25:1	4066 (459.4)	2350 (265.5)	1900 (214.7)	1675 (189.2)
R2G115-040	40:1	4696 (530.4)	2800 (316.4)	2240 (253.1)	2000 (225.9)
R2G115-050	50:1	4066 (459.4)	2900 (327.7)	2350 (265.5)	2100 (237.3)
R2G115-100	100:1	2545 (287.5)	2500 (282.5)	2500 (282.5)	2400 (271.2)

Two torque ratings for the R2G gearmotors are given in the table above. The left hand columns give the maximum (peak) allowable output torque for the indicated ratios of each size R2G gearmotor. This is not the rated output torque of the motor multiplied by the ratio of the reducer.
It is possible to select a configuration of the motor selection and gear ratio such that the rated motor torque, multiplied by the gear ratio exceeds these ratings. It is the responsibility of the user to ensure that the settings of the system do not allow these values to be exceeded.
The right hand columns give the output torque at the indicated speed which will result in 10,000 hour life (L10). The setup of the system will determine the actual output torque and speed.

Gearing Reflected Inertia

Single Reduction			Double Reduction		
Gear Stages	lbf-in-sec²	(kg-cm²)	Gear Stages	lbf-in-sec²	(kg-cm²)
4:1	0.000635	(0.717)	16:1	0.000513	(0.580)
5:1	0.000428	(0.484)	20:1, 25:1	0.000350	(0.396)
10:1	0.000111	(0.125)	40:1, 50:1, 100:1	0.0000911	(0.103)

Backlash and Efficiency

	Single Reduction	Double Reduction
Backlash at 1% Rated Torque	10 Arc min	13 Arc min
Efficiency	91%	86%

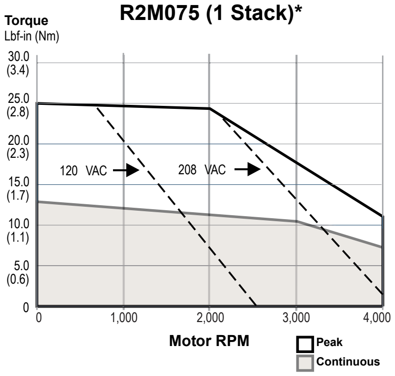
Motor and RTG115 Gearmotor Weights

		R2M115 without Gears	R2G115 with 1 Stage Gearing	R2G115 with 2 Stage Gearing	Added Weight for Brake
1 Stack Stator	lb (kg)	19 (8.6)	34 (15.4)	40 (18.1)	2.7 (1.2)
2 Stack Stator	lb (kg)	27 (12.2)	42 (19.1)	48 (21.8)	
3 Stack Stator	lb (kg)	35 (15.9)	50 (22.7)	56 (25.4)	

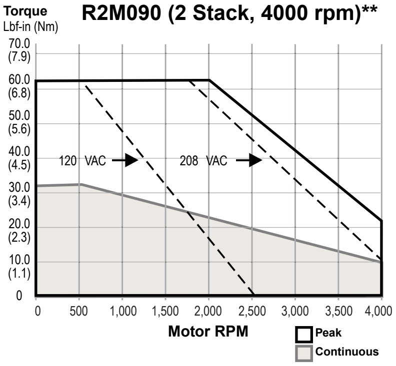
Speed vs. Force Curves

R2M075	R2M090	R2M115

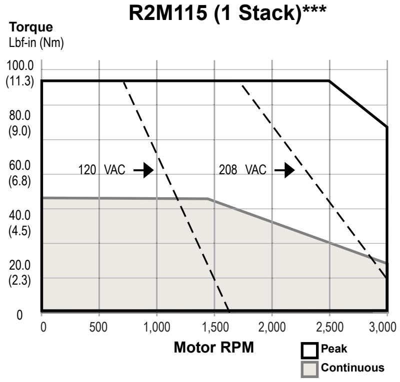
R2M075 (1 Stack)*



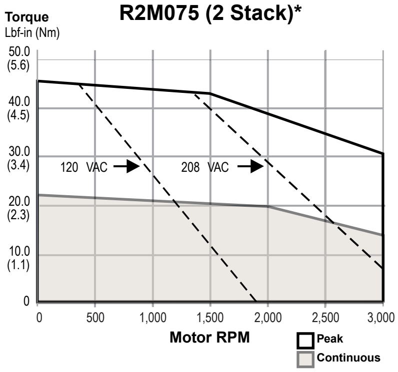
R2M090 (2 Stack, 4000 rpm)**



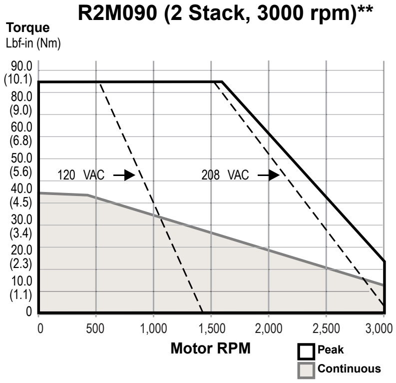
R2M115 (1 Stack)***



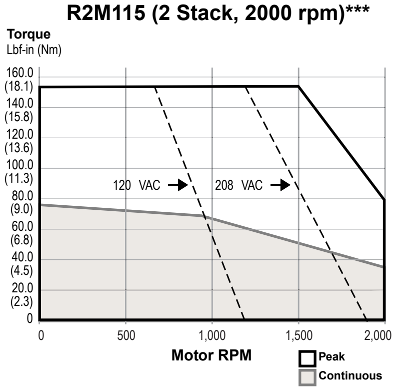
R2M075 (2 Stack)*



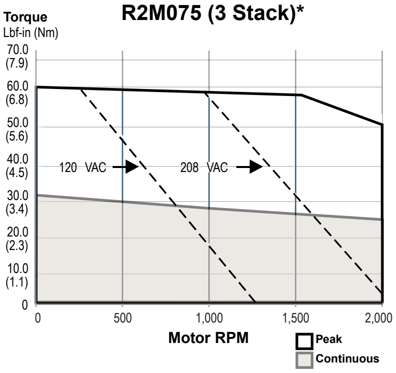
R2M090 (2 Stack, 3000 rpm)**



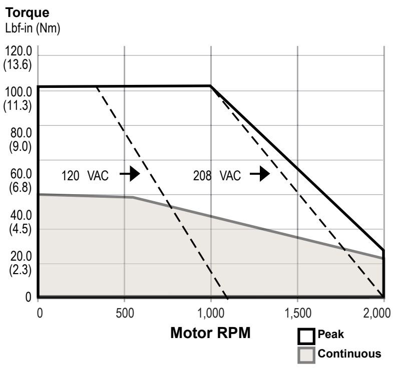
R2M115 (2 Stack, 2000 rpm)***



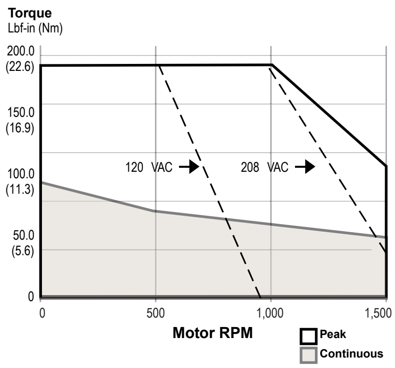
R2M075 (3 Stack)*



R2M090 (3 Stack)**



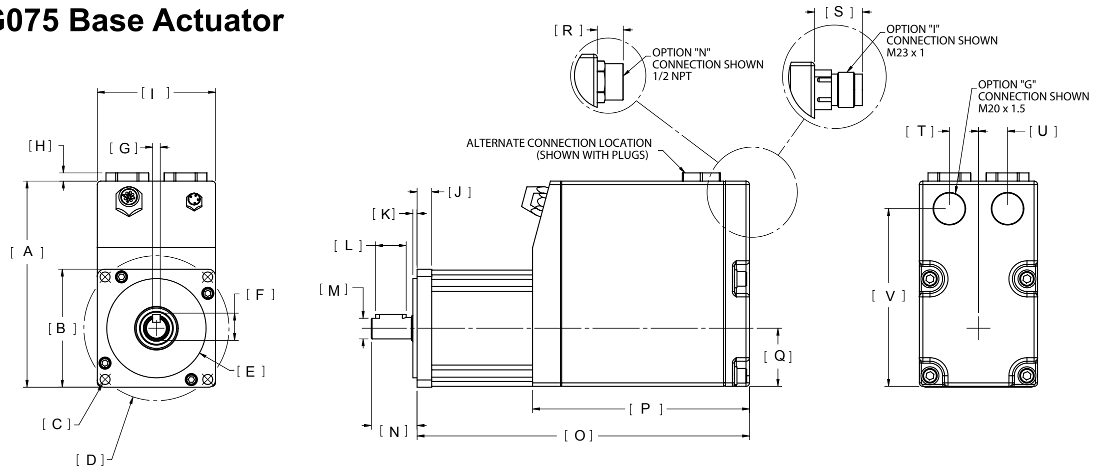
R2M115 (2 Stack, 1500 rpm)***



For R2G gearmotors, multiply torque by gear ratio and efficiency. Efficiencies: Divide speed by gear ratio; 1 Stage = 0.91, 2 Stage = 0.86
*R2M075 test data derived using NEMA recommended aluminum heatsink 10” x 10” x 3/8” at 40°C ambient.
**R2M090 test data derived using NEMA recommended aluminum heatsink 10” x 10” x 3/8” at 25°C ambient.
**R2M115 test data derived using NEMA recommended aluminum heatsink 12” x 12” x 1/2” at 25°C ambient.

Dimensions

R2M/G075 Base Actuator



		R2M075	R2G075			R2M075	R2G075
A	in	5.32	5.32	L	in	0.79	0.79
	mm	135.1	135.1		mm	20.0	20.0
B	in	□ 3.05	□ 3.05	M	in	Ø 0.5512 / 0.5508	Ø 0.6302 / 0.6298
	mm	77.4	77.4		mm	14 h6	16 j6
C	in	4X Ø 0.26 ON BC	4X Ø 0.26 ON BC	N	in	1.18	1.18
	mm	6.5	6.5		mm	30.0	30.0
D	in	Ø 3.74 BC	Ø 3.74 BC	O	in	See Below	See Below
	mm	95.0	95.0		mm	See Below	See Below
E	in	Ø 2.5587 / 2.5580	Ø 2.5587 / 2.5580	P	in	5.59	5.59
	mm	65 g6	65 g6		mm	142.0	142.0
F	in	0.70	0.70	Q	in	1.50	1.50
	mm	17.9	17.9		mm	38.1	38.1
G	in	Ø 0.1969 / 0.1957	Ø 0.1969 / 0.1957	R	in	0.67	0.67
	mm	5 h9	5 h9		mm	17.0	17.0
H	in	0.21	0.21	S	in	1.23	1.23
	mm	5.3	5.3		mm	31.3	31.3
I	in	3.05	3.05	T	in	0.75	0.75
	mm	77.4	77.4		mm	19.1	19.1
J	in	0.38	0.45	U	in	0.75	0.75
	mm	9.5	11.5		mm	19.1	19.1
K	in	0.11	0.11	V	in	4.58	4.58
	mm	2.8	2.8		mm	116.4	116.4

R2M075

With Brake Option			
DIM	1 Stack Stator	2 Stack Stator	3 Stack Stator
O	9.85 (250.2)	10.85 (275.6)	11.85 (301.0)

Without Brake Option			
DIM	1 Stack Stator	2 Stack Stator	3 Stack Stator
O	8.57 (217.7)	9.57 (243.1)	10.57 (268.5)

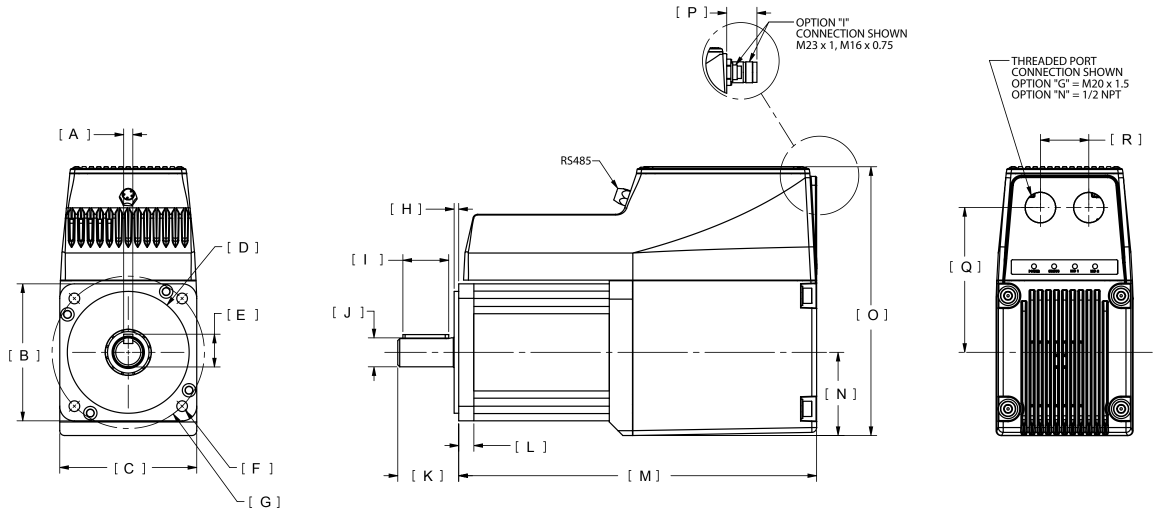
R2G075

Without Brake Option			
DIM	1 Stack Stator 1 Stage Gearhead	2 Stack Stator 1 Stage Gearhead	3 Stack Stator 1 Stage Gearhead
O	10.19 (258.8)	11.19 (284.2)	12.19 (309.6)

With Brake Option			
DIM	1 Stack Stator 1 Stage Gearhead	2 Stack Stator 1 Stage Gearhead	3 Stack Stator 1 Stage Gearhead
O	11.42 (290.1)	12.42 (315.5)	13.42 (340.9)

Pre-sale drawings and models are representative and are subject to change. Certified drawings and models are available for a fee. Consult your local Exlar representative for details.

R2M/G090 Base Actuator



		R2M090	R2G090			R2M090	R2G090
A	in	0.2360 / 0.2348	0.2362 / 0.2350	J	in	Ø 0.7480 / 0.7475	Ø 0.8665 / 0.8659
	mm	6 h9	6 h9		mm	19 h6	22 j6
B	in	3.54	3.54	K	in	1.57	1.89
	mm	90	90		mm	40	48
C	in	3.54	3.54	L	in	0.39	0.63
	mm	90	90		mm	10	16
D	in	Ø 3.1492 / 3.1485	Ø 3.1492 / 3.1485	M	in	See Below	See Below
	mm	80 g6	80 g6		mm	See Below	See Below
E	in	0.85	0.96	N	in	2.15	2.15
	mm	21.5	24.5		mm	55	55
F	in	4X Ø 0.28 ON BC	4X Ø 0.257 ON BC	O	in	6.95	6.95
	mm	7	6.5		mm	177	177
G	in	Ø 3.94 BC	Ø 3.94 BC	P	in	1.30	1.30
	mm	100	100		mm	33	33
H	in	0.12	0.118	Q	in	3.74	3.74
	mm	3	3		mm	95	95
I	in	1.38	1.417	R	in	1.25	1.25
	mm	35	36		mm	32	32

R2M090

Without Brake Option		
DIM	2 Stack Stator	3 Stack Stator
M	10.25 (256.3)	11.25 (285.8)

With Brake Option		
DIM	2 Stack Stator	3 Stack Stator
M	11.6 (294.6)	12.6 (320.0)

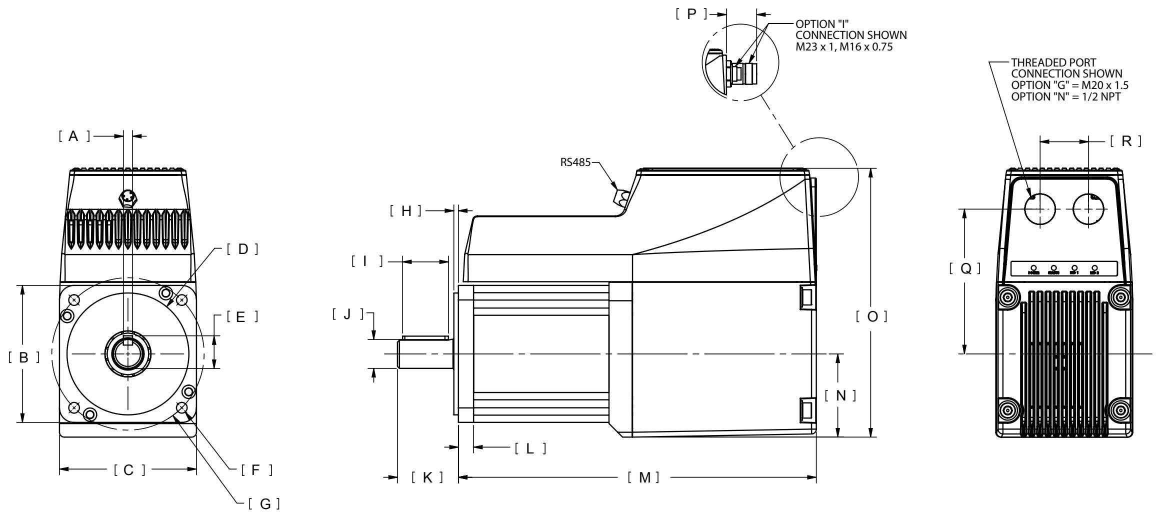
R2G090

Without Brake Option		
DIM	2 Stack Stator 1 Stage Gearhead	3 Stack Stator 1 Stage Gearhead
M	12.36 (313.9)	13.36 (339.3)
DIM	2 Stack Stator 2 Stage Gearhead	3 Stack Stator 2 Stage Gearhead
M	13.63 (346.2)	14.63 (371.6)

With Brake Option		
DIM	2 Stack Stator 1 Stage Gearhead	3 Stack Stator 1 Stage Gearhead
M	13.67 (347.2)	14.67 (372.6)
DIM	2 Stack Stator 2 Stage Gearhead	3 Stack Stator 2 Stage Gearhead
M	14.94 (379.5)	15.94 (404.9)

Pre-sale drawings and models are representative and are subject to change. Certified drawings and models are available for a fee. Consult your local Exlar representative for details.

R2M/G115 Base Actuator



		R2M115	R2G115			R2M115	R2G115
A	in	0.3150 / 0.3135	0.3937 / 0.3923	J	in	Ø 0.9449 / 0.9444	Ø 1.2603 / 1.2596
	mm	8 h9	10 h9		mm	24 h6	32 j6
B	in	4.53	4.530	K	in	1.97	2.55
	mm	115	115		mm	50	65
C	in	4.53	4.530	L	in	0.45	0.64
	mm	115	115		mm	12	16
D	in	Ø 4.3302 / 4.3294	Ø 4.3302 / 4.3294	M	in	See Below	See Below
	mm	110 g6	110 g6		mm	See Below	See Below
E	in	1.06	1.380	N	in	2.27	2.27
	mm	27	35		mm	58	58
F	in	4 X Ø 0.34 ON BC	4 X Ø 0.34 ON BC	O	in	7.56	7.56
	mm	8.5	8.5		mm	192	192
G	in	Ø 5.12 BC	Ø 5.12 BC	P	in	1.30	1.30
	mm	130	130		mm	33	33
H	in	0.16	0.16	Q	in	4.23	4.23
	mm	4	4		mm	108	108
I	in	1.41	1.58	R	in	1.25	1.25
	mm	35.9	40		mm	32	32

R2M115

Without Brake Option		
DIM	1 Stack Stator	2 Stack Stator
M	9.87 (250.7)	11.87 (301.5)

With Brake Option		
DIM	1 Stack Stator	2 Stack Stator
M	11.60 (294.6)	13.60 (345.4)

R2G115

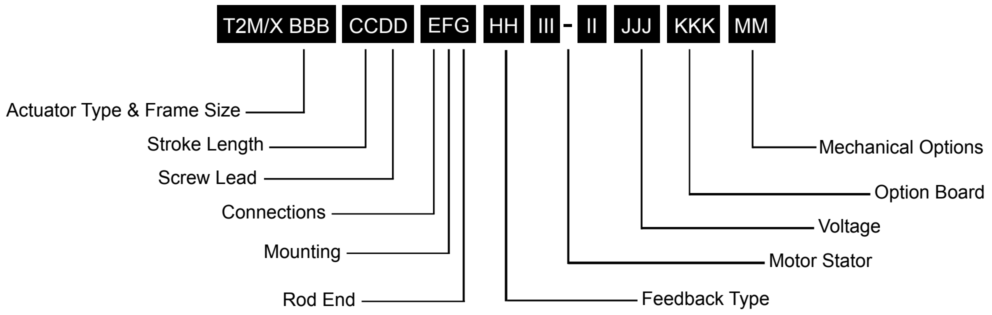
Without Brake Option		
DIM	1 Stack Stator 1 Stage Gearhead	2 Stack Stator 1 Stage Gearhead
M	13.88 (352.6)	15.88 (403.4)
DIM	1 Stack Stator 2 Stage Gearhead	2 Stack Stator 2 Stage Gearhead
M	15.49 (393.4)	17.49 (444.2)

With Brake Option		
DIM	1 Stack Stator 1 Stage Gearhead	2 Stack Stator 1 Stage Gearhead
M	15.43 (391.9)	17.43 (442.7)
DIM	1 Stack Stator 2 Stage Gearhead	2 Stack Stator 2 Stage Gearhead
M	17.04 (432.8)	19.04 (483.6)

Pre-sale drawings and models are representative and are subject to change. Certified drawings and models are available for a fee. Consult your local Exlar representative for details.

Notes

Tritex II AC Linear Ordering Guide



T2M/X = Actuator Type
T2M = Tritex II Linear Actuator, standard mechanical capacity
T2X = Tritex II Linear Actuator, high mechanical capacity

BBB = Actuator Frame Size
075 = 75 mm
090 = 90 mm
115 = 115 mm

CC = Stroke Length
03 = 3 inch (76 mm) (N/A T2M/X115)
04 = 4 inch (102 mm) (T2M/X115 only)
06 = 6 inch (150 mm)
10 = 10 inch (254 mm)
12 = 12 inch (305 mm)
18 = 18 inch (457 mm)

DD = Screw Lead (linear travel per screw revolution)
01 = 0.1 inch (2.54 mm)
02 = 0.2 inch (5.08 mm)
05 = 0.5 inch (12.7 mm)
08 = 0.75 inch (19.05 mm) (T2M/X115 only) [5]

E = Connections
G = Standard Straight Threaded Port with Internal terminals, M20 x 1.5
N = NPT Threaded Port via Adapter with Internal Terminals, 1/2" NPT
I = Intercontec Style - Exlar std, M16/M23 Style Connector
J = Embedded leads with "I" plug 3' standard

F = Mounting
C = Rear Clevis
D = Double Side Mount
E = Extended Tie Rod
F = Front Flange
G = Metric Rear Clevis
K = Metric Double Side Mount
M = Metric Extended Tie Rod
Q = Metric Side Trunnion
R = Rear Flange
T = Side Trunnion

G = Rod End
A = Male Metric Thread [1]
B = Female Metric Thread [1]
F = Female US Standard Thread [1]
L = Female Metric Thread SS [2]
M = Male US Standard Thread [1]
R = Male Metric Thread SS [2]
V = Female US Standard Thread SS [2]
W = Male, US Standard Thread SS [2]

HH = Feedback Type
HD = Analog Hall Device
IE = Incremental Encoder, 8192 count resolution
AF = Absolute Feedback

III-II = Motor Stator, All 8 Pole
T2M/X075 Stator Specifications
138-40 = 1 Stack, 230 VAC, 4000 rpm
238-30 = 2 Stack, 230 VAC, 3000 rpm
338-20 = 3 Stack, 230 VAC, 2000 rpm

T2M/X090 Stator Specifications
138-40 = 1 Stack, 230 VAC, 4000 rpm
238-40 = 2 Stack, 230 VAC, 4000 rpm
238-30 = 2 Stack, 230 VAC. 3000 rpm [9]

T2M/X115 Stator Specifications
138-30 = 1 Stack, 230 VAC, 3000 rpm
238-20 = 2 Stack, 230 VAC, 2000 rpm [11]
238-15 = 2 Stack, 230 VAC, 1500 rpm [9, 11] (N/A with 0.1" lead)

JJJ = Voltage
230 = 115-230 VAC, single phase

KKK = Option Board
SIO = Standard I/O Interconnect
IA4 = 4-20 mA Analog I/O
COP = CANOpen w/M12 connector
CON = CANOpen, without M12 [10]
EIP = SIO plus Ethernet/IP w/M12 connector
EIN = SIO plus Ethernet/IP without M12 connector [10]
PIO = SIO plus Profinet IO w/M12 connector
PIN = SIO plus Profinet IO without M12 connector [10]
TCP = SIO plus Modbus TCP w/M12 connector
TCN = SIO plus Modbus TCP without M12 connector [10]

MM = Mechanical Options [6]
AR = External Anti-rotate
PF = Preloaded Follower [3]
L1/2/3 = External Limit Switches [7]
HW = Manual Drive, Handwheel with Interlock Switch (T2X only)
RB = Rear Brake
PB = Protective Bellows (N/A with extended tie rod mounting option)
SR = Splined Main Rod [8, 2]
P5 = IP65 Sealed Housing (T2M only)

For options or specials not listed above or for extended temperature operation, please contact Exlar

NOTES:
1. Chrome-plated carbon steel. Threads not chrome-plated.
2. Consult Exlar when ordering splined stainless steel main rod.
3. The dynamic load rating of zero backlash, preloaded screws is 63% of the dynamic load rating of the std non-preloaded screws. The calculated travel life of a preloaded screw will be 25% of the calculated travel life of the same size and lead of a non-preloaded screw.
4. This housing option may indicate the need for special material main rods or mounting.
5. 0.75 lead not available above 12 inch stroke.
6. For extended temperature operation consult factory for model number.
7. Limit switch option requires AR option.
8. This option is not sealed and is not suitable for any environment in which contaminants come in contact with actuator and may enter the actuator.
9. N/A with 0.1 inch lead
10. Requires customer supplied Ethernet cable through I/O port for Class 1 Division 2 compliance only.
11. Not available with 4 inch stroke.

R2M/G AAA BBB CDEF GG HHH - HH III JJJ MM

Motor Type & Frame Size
Gear Ratio
Shaft Type
Connections
Coatings
Brake
Feedback Type
Motor Stator
Voltage
Option Board
Mechanical Options

R2M/G = Motor Type
R2M = Tritex II AC Rotary Motor
R2G = Tritex II AC Rotary Gearmotor

AAA = Frame Size
075 = 75 mm
090 = 90 mm
115 = 115 mm

BBB = Gear Ratio
Blank = R2M
Single Reduction Ratios
004 = 4:1
005 = 5:1
010 = 10:1
Double Reduction Ratios (N/A on 75 mm)
016 = 16:1 020 = 20:1
025 = 25:1 040 = 40:1
050 = 50:1 100 = 100:1

C = Shaft Type
K = Keyed
R = Smooth/Round

D = Connections
G = Standard Straight Threaded Port with Internal Terminals, M20 x 1.5
N = NPT Threaded Port with Internal Terminals, 1/2" NPT
I = Intercontec style - Exlar Standard, M16/M23 Style Connector
J = Embedded leads with "I" plug 3' standard

E = Coating Options
G = Exlar Standard
H = Type III Hard Coat Anodized
F = Smooth White Epoxy Coating

F = Brake Option
S = No Brake, Standard
B = Electric Brake, 24 VDC

GG = Feedback Type
HD = Analog Hall Device
IE = Incremental Encoder, 8192 Count Resolution
AF = Absolute Feedback

HHH-HH = Motor Stators
R2M/G075 Stator Specifications
138-40 = 1 Stack, 230 VAC, 4000 rpm
238-30 = 2 Stack, 230 VAC, 3000 rpm
338-20 = 3 Stack, 230 VAC, 2000 rpm

R2M/G090 Stator Specifications
238-40 = 2 Stack, 230 VAC, 4000 rpm
238-30 = 2 Stack, 230 VAC, 3000 rpm
338-20 = 3 Stack, 230 VAC, 2000 rpm

R2M/G115 Stator Specifications
138-30 = 1 Stack, 230 VAC, 3000 rpm
238-20 = 2 Stack, 230 VAC, 2000 rpm
238-15 = 2 Stack, 230 VAC, 1500 rpm

III = Voltage
230 = 115-230 VAC, Single Phase

JJJ = Option Board
SIO = Standard I/O Interconnect
IA4 = 4-20 mA Analog I/O
COP = CANOpen w/M12 connector
CON = CANOpen, without M12 connector [1]
EIP = SIO plus Ethernet/IP w/M12 connector
EIN = SIO plus Ethernet/IP without M12 connector [1]
PIO = SIO plus Profinet IO w/M12 connector
PIN = SIO plus Profinet IO without M12 connector [1]
TCP = SIO plus Modbus TCP w/M12 connector
TCN = SIO plus Modbus TCP without M12 connector [1]

MM = Mechanical Options [2]
HW = Manual Drive, Handwheel with Interlock Switch

Tritex II AC

For options or specials not listed above or for extended temperature operation, please contact Exlar

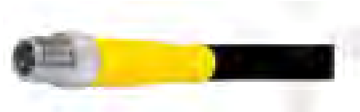
NOTES:
1. Requires customer supplied Ethernet cable through I/O port for Class 1 Division 2 compliance only.
2. For extended temperature operation consult factory for model number.

Cable and Accessories

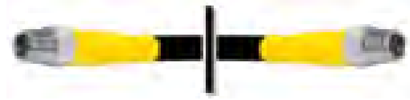
Tritex II AC Series Cable & Accessories	Part No.
Communications Accessories - Tritex uses a 4 pin M8 RS485 communications connector	
Recommended PC to Tritex communications cable-USB/RS485 to M8 connector - xxx = Length in feet, 006 or 015 only	CBL-T2USB485-M8-xxx
Multi-Drop RS485 Accessories	
RS485 splitter - M8 Pin plug to double M8 Socket receptacle	TT485SP
Multidrop Communications Cable M8 to M8 for use with TT485SP/RS485 splitter - xxx = Length in feet, 006 or 015 only	CBL-TTDAS-xxx
"G" Connection Accessories	
Nickel plated cable gland- M20 x 1.5 - CE shielding- 2 required	GLD-T2M20 x 1.5
Power cable prepared on one end for use with GLD-T2M20 x 1.5 xxx = Length in ft, Standard lengths 015, 025, 050, 075, 100	CBL-T2IPC-RAW-xxx
I/O cable prepared on one end for use with GLD-T2M20 x 1.5 xxx = Length in ft, Standard lengths 015, 025, 050, 075, 100	CBL-T2IOC-RAW-xxx
"N" Connection Accessories	
M20 x 1.5 to 1/2" NPT threaded hole adapter for use with conduit	ADAPT-M20-NPT1/2
"I" Connection	
Power cable with M23 6 pin xxx = Length in feet, std lengths 015, 025, 050, 075, 100	CBL-T2IPC-SMI-xxx
I/O cable (75 mm) with M23 19 pin xxx = Length in feet, std lengths 015, 025, 050, 075, 100	CBL-TTIOC-SMI-xxx
I/O cable (90 & 115 mm) with M16 19 pin xxx = Length in feet, std lengths 015, 025, 050, 075, 100	CBL-T2IOC-SMI-xxx
Multi-Purpose Communications Accessories for long runs, requires terminal block interconnections	
USB to RS485 convertor/cable - USB to RS485 flying leads - xxx = Length in feet, 006 or 015 only	CBL-T2USB485-xxx
Communications cable M8 to flying leads cable xxx = Length in feet, standard lengths 015, 025, 050, 075, 100	CBL-TTCOM-xxx
Option Board Cables and Accessories	
CAN Male to Female Molded 3 ft. cable	CBL-TTCAN-SMF-003
CAN Male to Female Molded 6 ft. cable	CBL-TTCAN-SMF-006
CAN Cable, no connectors – per foot	CBL-TTCAN-S
CAN Male connector, field wireable	CON-TTCAN-M
CAN Female connector, field wireable	CON-TTCAN-F
CAN Splitter	CON-TTCAN-SP
EIP, PIO and TCP option Ethernet cable - M12 to RJ45 cable xxx = Length in feet, std lengths 015, 025, 050, 075, 100.	CBL-T2ETH-R45-xxx
Electrical Accessories	
Dynamic Braking Resistor - 100W47Ohm	T2BR1
Replacement -AF Battery - used for absolute feedback option	T2BAT1
Replacement Normally Closed External Limit Switch (Turck Part number BIM-UNT-RP6X)	43404
Replacement Normally Open External Limit Switch (Turck Part number BIM-UNT-AP6X)	43403
Mechanical Accessories	
Clevis Pin for T2M/X090 male "M" rod end 1/2-20 thread	CP050
Clevis Pin for T2M/115 male "M" rod end 3/4-16 thread	CP075
Spherical Rod Eye for T2M/X090 male "M" rod end 1/2-20 thread	SRM050
Spherical Rod Eye for T2M/X115 male "M" rod end 3/4-16 thread	SRM075
Rod Eye for T2M/X090 male "M" rod end 1/2-20 thread	REI050
Rod Eye for T2M/X115 male "M" rod end 3/4-16 thread	RE075
Rod Clevis for T2M/X090 male "M" rod end 1/2-20 thread	RCI050
Rod Clevis for T2M/X115 male "M" rod end 3/4-16 thread	RC075
Jam Nut for T2M/X090 male rod end, 1/2 - 20	JAM1/2-20-SS
Jam Nut for T2M/X115 male rod end, 3/4-16	JAM3/4-16-SS

CBL-T2USB485-M8-xxx
Our recommended communications cable. No special drivers or setup required for use with MS Windows™.

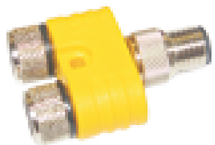
CBL-T2USB485-xxx
Use for terminal connections with CBL-TTCOM for long cable runs. No special drivers or setup required for use with MS Windows™.



CBL-TTCOM-xxx
Use with CBL-T2USB485-xxx for long cable runs.

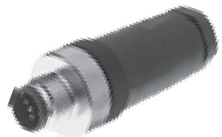


CBL-TTDAS-xxx
For use with TT485SP for multi-drop applications.



TT485SP
RS485 communications splitter. Use to daisy-chain multiple Tritex actuators.

CON-TTCAN-SP
CAN splitter



CON-TTCAN-M
M12 Field wireable connector

Return to table of contents

Tritex II DC

Linear & Rotary Actuators

No Comproming on Power, Performance or Reliability

With forces to approximately 950 lbs (4kN) continuous and 1,300 lbf peak (6 kN), and speeds to 33 in/sec (800 mm/sec), the DC Tritex II linear actuators also offer a benefit that no other integrated product offers: POWER! No longer are you limited to trivial amounts of force, or speeds so slow that many motion applications are not possible. And the new Tritex II with DC power electronics operates with maximum reliability over a broad range of ambient temperatures: -40˚C to +65˚C. The DC powered Tritex II actuators contain a 750 W servo amplifier and a very capable motion controller. With standard features such as analog following for position, compound moves, move chaining, and individual force/torque control for each move, the Tritex II Series is the ideal solution for most motion applications.

Tritex II Models

- TDM standard mechanical capacity actuator, 60, and 75 mm
- TDX high mechanical capacity actuator, 60, and 75 mm
- RDM rotary motor, 60, 75, and 90 mm
- RDG rotary gearmotor, 60, 75, and 90 mm

Power Requirements

- DC Power 12-48 VDC nominal
- Connections for external braking resistor

Feedback Types

- Analog Hall with 1000 count resolution
- Incremental encoder with 8192 count resolution
- Absolute Feedback (analog hall with multi-turn, battery backup)

Connectivity

- Internal terminals accessible through removable cover (75 and 90 mm models)
- Threaded ports for cable glands (75 and 90 mm models)
- Optional connectors - M23 Power - M23 I/O
- M8 connector for RS485
- M12 connector for EtherNet options
- Custom connection options
- Embedded leads

Tritex II Linear DC Actuator

Tritex II Rotary Motor with Connectors

Tritex II Linear Actuator with Customer-supplied Cable Glands Ports

Technical Characteristics	
Frame Sizes in (mm)	2.3 (60), 2.9 (75)
Screw Leads in (mm)	0.1 (2), 0.2 (5), 0.4 (10), 0.5 (13)
Standard Stroke Lengths in (mm)	3 (75), 6 (150), 10 (250), 12 (300), 14 (350), 18 (450)
Force Range	up to 872 lbf (3879 N)
Maximum Speed	up to 33.3 in/s (846 mm/s)

Operating Conditions and Usage		
Accuracy:		
Screw Lead Error	in/ft	0.001
Screw Lead Variation	in	0.0012
Screw Lead Backlash	in	0.004 (TDM), 0.008 (TDX) maximum
Ambient Conditions:		
Standard Ambient Temperature	°C	0 to 65
Extended Ambient Temperature**	°C	-40 to 65
Storage Temperature	°C	-40 to 85
IP Rating		TDM = IP54S, TDX = IP66S RDM/RDG = IP66S
NEMA Ratings		None
Vibration		5.0 g rms, 5 to 500 hz

*Ratings at 40°C, operation over 40°C requires de-rating. See page 96.
**Consult Exlar for extended temperature operation.

Communications & I/O

Digital Inputs:
9 to 30 VDC Opto-isolated

Digital outputs:
30 VDC maximum
100 mA continuous output
Isolated
Short circuit and over temperature protected

Analog Input DC:
0-10V or +/-10V
0-10V mode, 12 bit resolution
+/-10V mode, 13 bit resolution assignable to Position, Velocity, Torque, or Velocity override command

Analog Output DC:
0-10V
11 bit resolution

IA 4 option:
4-20 mA input
16 bit resolution
Isolated
Assignable to Position, Velocity, Torque, or Velocity Override command

4-20 mA output
12 bit resolution
Assignable to Position, Velocity, Current, Temperature, etc.

Standard Communications:
- 1 RS485 port, Modbus RTU, opto-isolated for programming, controlling and monitoring

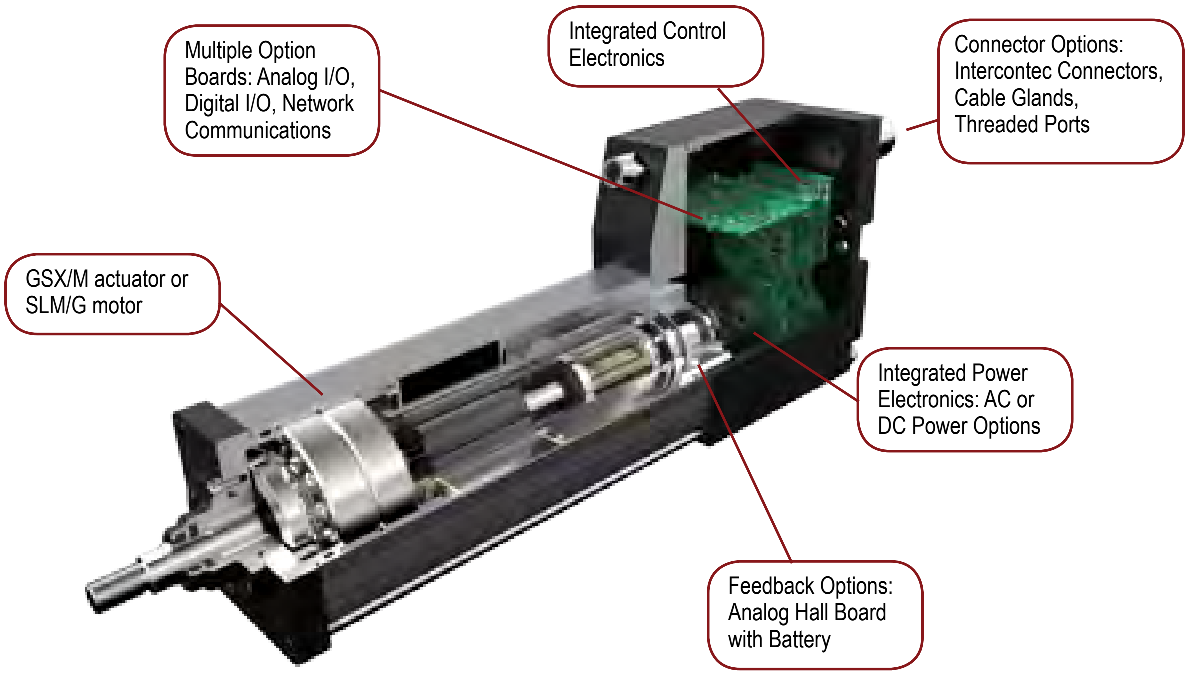
Tritex II DC I/O

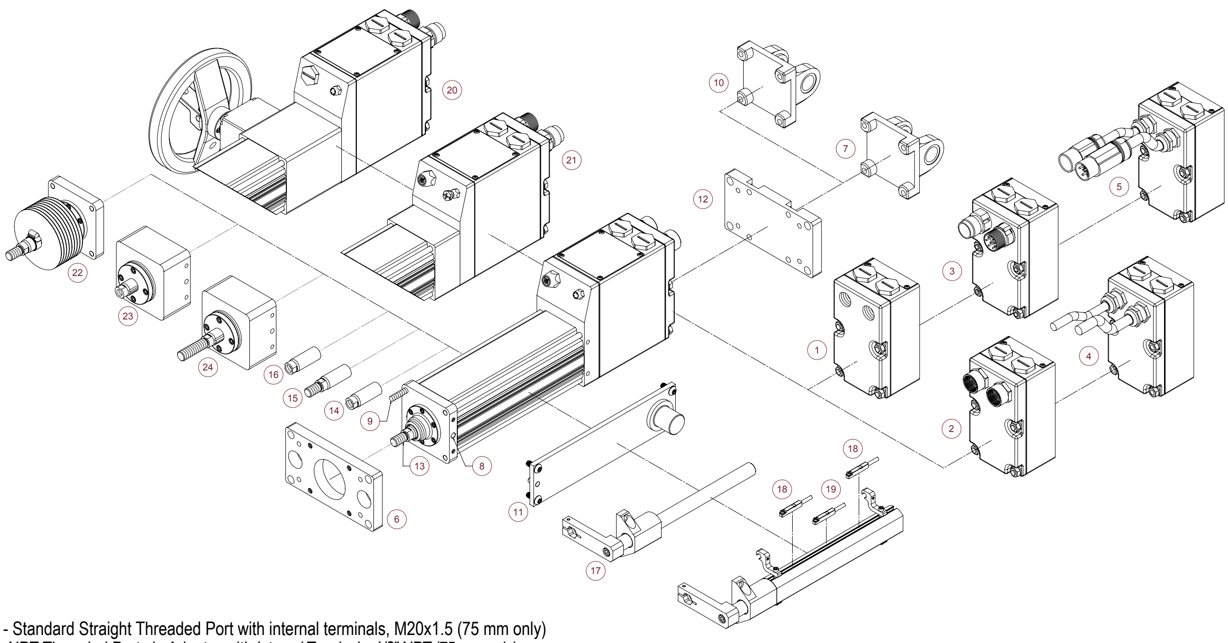
	60/75/90 mm frame with SIO, EIP, PIO, TCP	60/75/90 mm frame with IA4	60/75/90 mm frame with CAN
Isolated digital inputs	8	4	4
Isolated digital outputs	4	3	3
Analog input, non isolated	1	0	0
Analog output, non isolated	1	0	0
Isolated 4-20ma input	0	1	0
Isolated 4-20ma output	0	1	0

The IO count and type vary with the actuator model and option module selected.

All models include isolated digital IO, and an isolated RS485 communication port when using Modbus RTU protocol.

Product Features





1 - Standard Straight Threaded Port with internal terminals, M20x1.5 (75 mm only)
2 -NPT Threaded Port via Adapter with Internal Terminals, 1/2" NPT (75 mm only)
3 - Interconnect Style - Exlar standard, M23 Style Connector 4 - Embedded Leads, 3 ft. standard*
5 - Embedded Leads, with "I" plug, 3 ft. standard 6 - Front & Rear Flange and Front Flange* 7 - Rear Clevis
8 - Double Side Mount, Metric Side Mount*, Metric Double Side Mount, Side Mount* 9 - Extended Tie Rod and Metric Extended Tie Rod 10 - Metric Rear Clevis
11 - Metric Side Trunnion and Side Trunnion 12 - Female Metric Thread and Male Metric Thread SS 13 - Male Metric Thread and Male Metric Thread SS
14 - Female Metric Thread and Female Metric Thread SS 15 - Male US Standard Thread and Male, US Standard Thread SS
16 - Female US Standard Thread and Female US Standard Thread SS 17 - External Anti-rotate 18 - External Limit Switch - N.C., PNP 19 - External Limit Switch - N.O., PNP
20 - Manual Drive, Handwheel with Interlock Switch (TDX075 only) 21 - Rear Brake 22 - Protective Bellows 23 - Splined Main Rod - Female 24 - Splined Main Rod - Male

*Consult Factory

Industries and Applications

Hydraulic cylinder replacement
Ball screw replacement
Pneumatic cylinder replacement

Mobile Equipment
- Unmanned Vehicles

Process Control
- Oil & Gas Wellhead Valve Control
- Pipeline Valve Control
- Damper Control
- Knife Valve Control
- Chemical pumps

Entertainment / Simulation
- Ride Motion Bases
- Animatronics

Since no fluids and associated equipment (pumps, compressors, filters, accumulators, hose/tubing, oil testing, etc.) are required, electromechanical actuators offer greater energy efficiency, less environmental impact and lower total life-cycle cost.

The Tritex II Series DC actuators integrate a DC powered servo drive, digital position controller, brushless motor, and linear actuator in a compact, sealed package making it perfect for environments where AC power is difficult to achieve.

DEFINITIONS:

Continuous Force: The linear force produced by the actuator at continuous motor torque.

Peak Force: The linear force produced by the actuator at peak motor torque.

Max Speed: The maximum rated speed produced by the actuator at rated voltage.

C_a (Dynamic Load Rating): A design constant used in calculating the estimated travel life of the roller screw.

Notes

Mechanical Specifications

TDM/X060

		Stator	1 Stack	2 Stack	3 Stack
Lead		RPM @ 48 VDC	5000	5000	4000
0.1	Continuous Force	lbf (N)	339 (1508)	528 (2349)	N/A
	Peak Force	lbf (N)	641 (2851)	666 (2963)	N/A
	Max Speed @ 48 VDC	in/sec (mm/sec)	8.33 (211.6)	8.33 (211.6)	N/A
	C_a (Dynamic Load Rating)	lbf (N)	1568 (6970)	2075 (9320)	2075 (9320)
0.2	Continuous Force	lbf (N)	180 (801)	280 (1246)	347 (1544)
	Peak Force	lbf (N)	340 (1512)	354 (1575)	454 (2019)
	Max Speed @ 48 VDC	in/sec (mm/sec)	16.67 (423.4)	16.67 (423.4)	13.33 (338.6)
	C_a (Dynamic Load Rating)	lbf (N)	1219 (5422)	1540 (6850)	1540 (6850)
0.4	Continuous Force	lbf (N)	95 (423)	148 (658)	184 (818)
	Peak Force	lbf (N)	180 (801)	187 (832)	240 (1068)
	Max Speed @ 48 VDC	in/sec (mm/sec)	33.33 (846.6)	33.33 (846.6)	26.67 (677.4)
	C_a (Dynamic Load Rating)	lbf (N)	738 (3283)	1230 (5471)	1230 (5471)
Drive Current @ Continuous Force		Amps	14.75	21.5	21.5
Available Stroke Lengths	in (mm)		3 (75), 6 (150), 10 (254), 12 (300)		
Inertia *(zero stroke)*		lb-in-s²/ Kg-m²	0.0007758 (0.0000008766)	0.0008600 (0.0000009717)	0.0009442 (0.000001067)
Inertia Adder *(per unit of stroke)*		lb-in-s²/in/ Kg-m²/mm	0.00004667 (0.00000005273)		
Approximate Weight	lb (kg)		4 lbs – 3 in stroke, 1 stack, add 1 lb per inch of stroke, add 3 lbs per stack, add 3 lbs for brake. (1.8 kg – 75 mm stroke, 1 stack, add 0.5 kg per 25 mm of stroke, add 1.4 kg per stack, add 1.4 kg for brake.)		
Operating Temperature Range**			-20 to 65° C (-40°C available, consult Exlar)		
Maximum Continuous Power Supply Current*		Amps	11	15	15

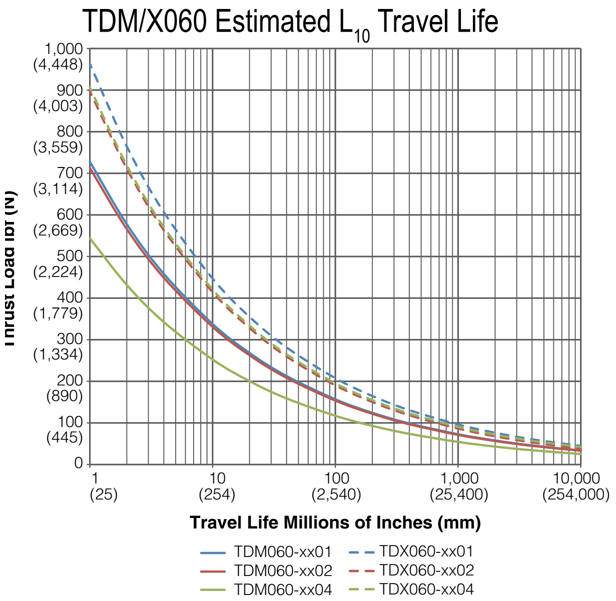
*Power supply current is based on software current limit, not thermal limit. Consideration for peak current should also be considered when sizing power supplies.
**Rating based on 40° C ambient conditions.

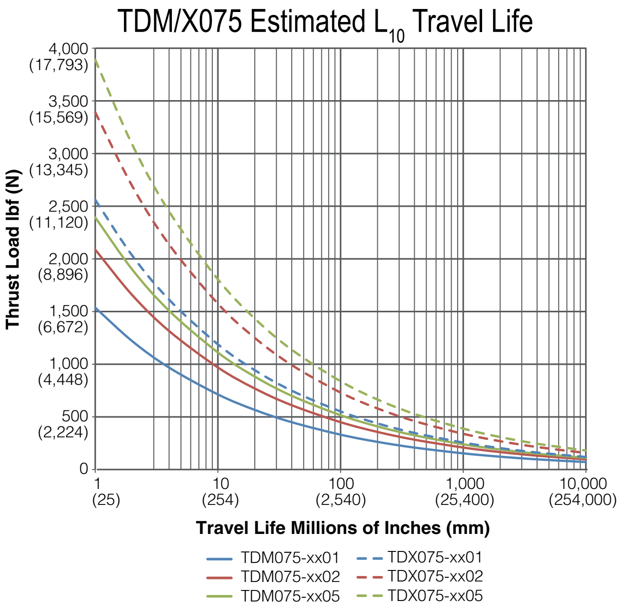
TDM/X075

		Stator	1 Stack	2 Stack	3 Stack
Lead		RPM @ 48 VDC	3000	3000	2000
0.1	Continuous Force	lbf (N)	613 (2727)	872 (3879)	NA
	Peak Force	lbf (N)	884 (3932)	1190 (5293)	NA
	Max Speed @ 48 VDC	in/sec (mm/sec)	5.00 (127)	5.00 (127)	NA
	C_a (Dynamic Load Rating)	lbf (N)	3310 (14724)	5516 (24536)	5516 (24536)
0.2	Continuous Force	lbf (N)	347 (1544)	494 (2197)	774 (3443)
	Peak Force	lbf (N)	501 (2229)	674 (2998)	1095 (4871)
	Max Speed @ 48 VDC	in/sec (mm/sec)	10.00 (254)	10.00 (254)	6.67 (169.4)
	C_a (Dynamic Load Rating)	lbf (N)	3570 (15880)	5800 (25798)	5800 (25798)
0.5	Continuous Force	lbf (N)	147 (654)	209 (930)	328 (1459)
	Peak Force	lbf (N)	212 (943)	286 (1272)	464 (2064)
	Max Speed @ 48 VDC	in/sec (mm/sec)	25.00 (635)	25.00 (635)	16.67 (423.4)
	C_a (Dynamic Load Rating)	lbf (N)	3016 (13416)	4900 (21795)	4900 (21795)
Drive Current @ Continuous Force		Amps	18.5	22.5	22.5
Available Stroke Lengths	in (mm)		3 (75), 6 (150), 10 (254), 12 (300), 14 (355), 18 (450)		
Inertia *(zero stroke)*		lb-in-s²/ Kg-m²	0.01132 (0.000012790)	0.01232 (0.00001392)	0.01332 (0.00001505)
Inertia Adder *(per unit of stroke)*		lb-in-s²/in/ Kg-m²/mm	0.0005640 (0.0000006372)		
Approximate Weight	lb (kg)		11 lbs – 3 in stroke, add 1 lb per inch of stroke, add 3 lbs per stack, add 3 lbs for brake. (5 kg – 75 mm stroke, 1 stack, add 0.5 kg per 25 mm of stroke, add 1.4 kg per stack, add 1.4 kg for brake.)		
Operating Temperature Range**			-20 to 65° C (-40°C available, consult Exlar)		
Maximum Continuous Power Supply Current*		Amps	15	18	18

*Power supply current is based on software current limit, not thermal limit. Consideration for peak current should also be considered when sizing power supplies.
**Rating based on 40° C ambient conditions.

Estimated Service Life





The L_{10} expected life of a roller screw linear actuator is expressed as the linear travel distance that 90% of properly maintained roller screws are expected to meet or exceed. For higher than 90% reliability, the result should be multiplied by the following factors: 95% x 0.62; 96% x 0.53; 97% x 0.44; 98% x 0.33; 99% x 0.21. This is not a guarantee; these charts should be used for estimation purposes only.

The underlying formula that defines this value is:
Travel life in millions of inches, where:

- C_a = Dynamic load rating (lbf)
- F_{cml} = Cubic mean applied load (lbf)
- ℓ = Roller screw lead (inches)

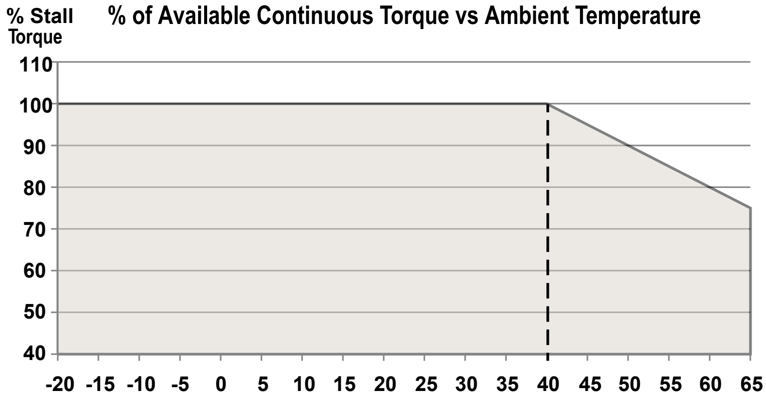
$$L_{10} = \left(\frac{C_a}{F_{cml}}\right)^3 \times \ell$$

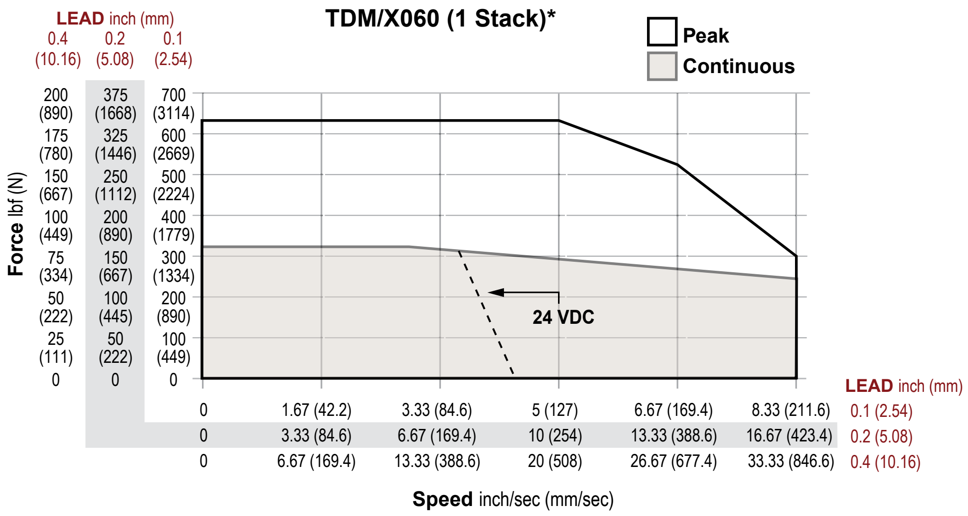
All curves represent properly lubricated and maintained actuators.

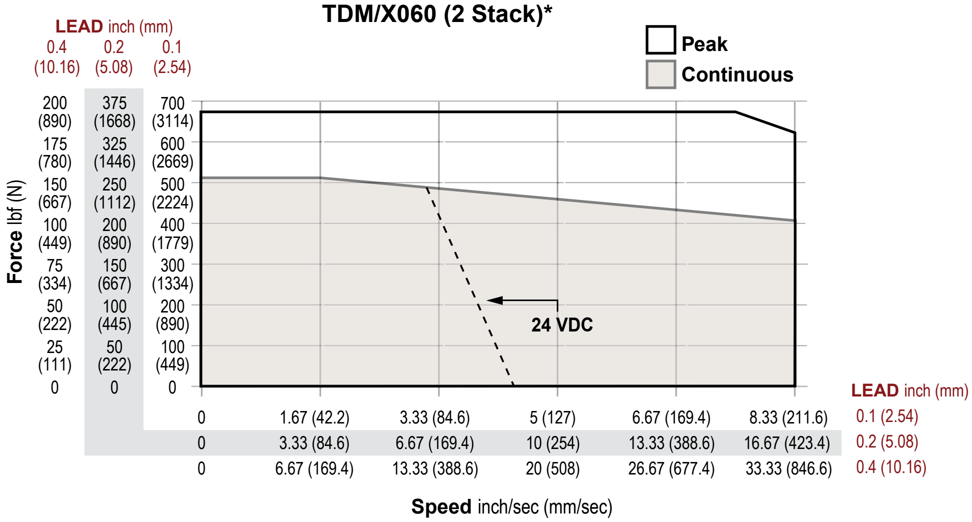
Speed vs. Force Curves

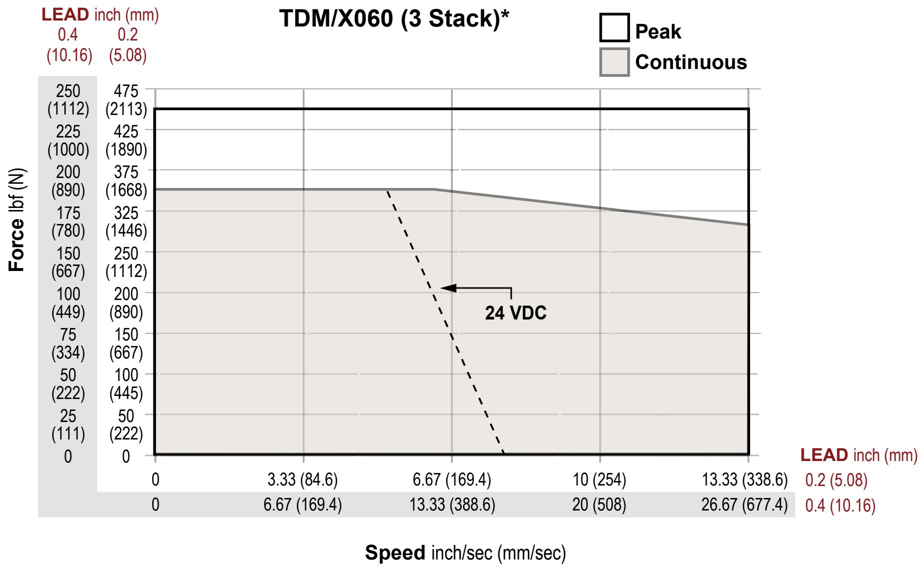
Temperature Derating

The speed/torque curves are based on 40° C ambient conditions. The actuators may be operated at ambient temperatures up to 65° C. Use the curve (shown right) for continuous torque/force deratings above 40° C.

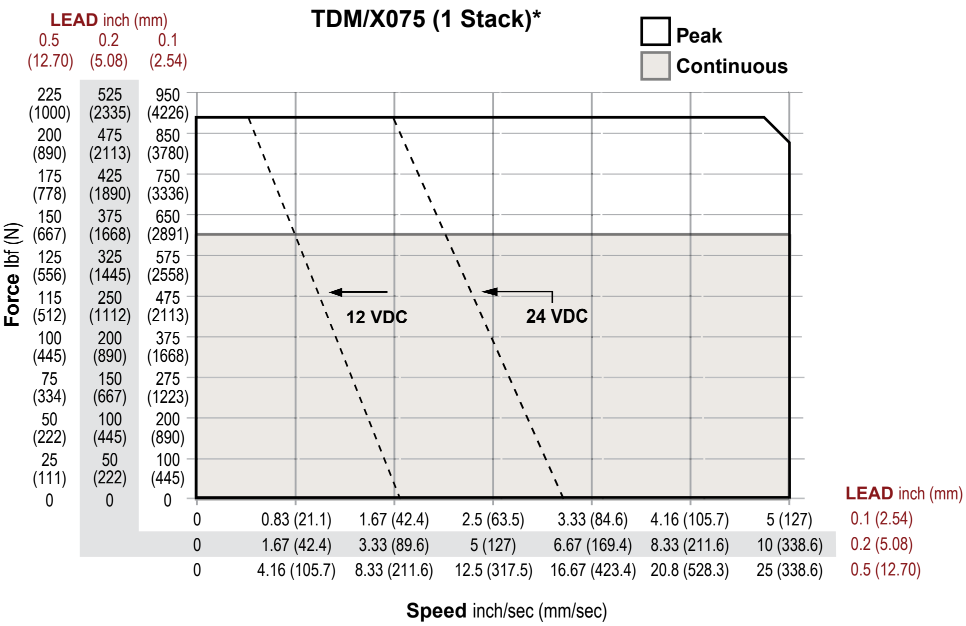


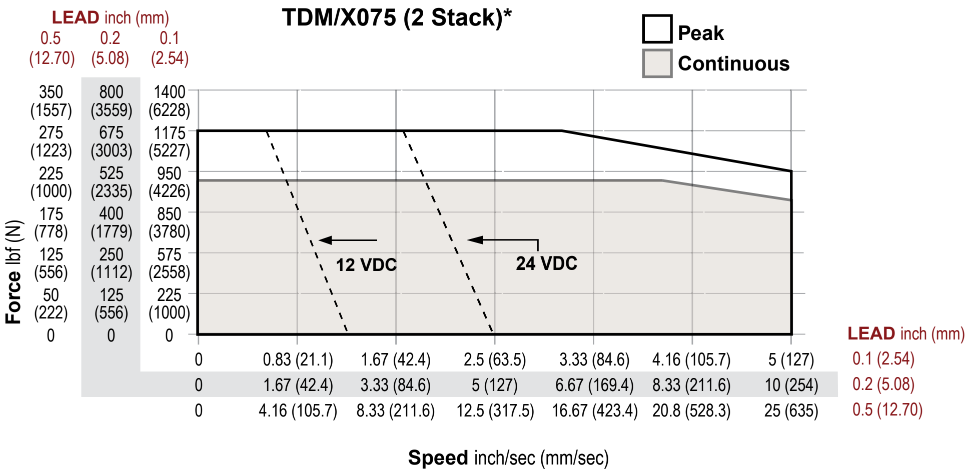


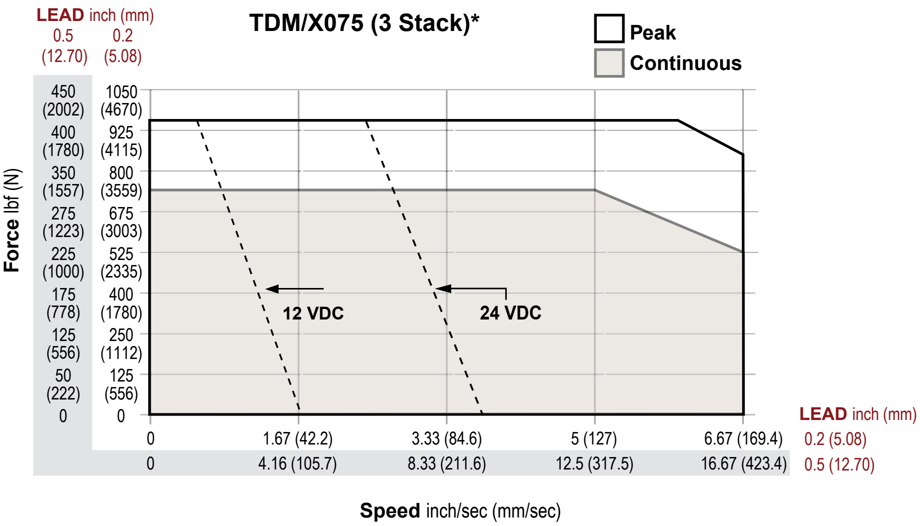




*Test data derived using NEMA recommended aluminum heatsink 10” x 10” x 3/8” at 40°C ambient.







*Test data derived using NEMA recommended aluminum heatsink 10” x 10” x 3/8” at 40°C ambient.

Options

AR = External Anti-rotate Assembly

This option provides a rod and bushing to restrict the actuator rod from rotating when the load is not held by another method. Shorter actuators have single sided anti-rotation attachments. Longer lengths require attachments on both sides for proper operation. For AR dimensions, see page 102.

PF = Preloaded Follower

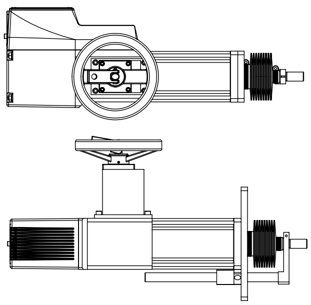
The dynamic load rating of zero backlash, preloaded screws is 63% of the dynamic load rating of the standard non-preloaded screws. The calculated travel life of a preloaded screw will be 25% of the calculated travel life of the same size and lead of a non-preloaded screw for the same application. Preloaded follower option includes angular contact bearings and is not available with LT Linear feedback option.

L1, L2, L3 = Adjustable External Travel Switches

This option allows up to 3 external switches to be included. These switches provide travel indication to the controller and are adjustable. See drawing on page 54. Must purchase external anti-rotate with this option.

HW = Manual Drive, Handwheel

This option provides a manual drive handwheel on the side of the actuator. The handwheel has an engage/disengage lever that is tied to an interrupt switch. Not available with holding brake unless application details have been discussed with your local sales representative.



RB = Rear Electric Brake

This option provides an internal holding brake. The brake is spring activated and electrically released.

PB = Protective Bellows

This option provides an accordion style protective bellows to protect the main actuator rod from damage due to abrasives or other contaminants in the environment in which the actuator must survive. The standard material of this bellows is S2 Neoprene Coated Nylon, Sewn Construction. This standard bellows is rated for environmental temperatures of -40 to 250 degrees F. Longer strokes may require the main rod of the actuator to be extended beyond standard length. Not available with extended tie rod mounting option. Please contact your local sales representative.

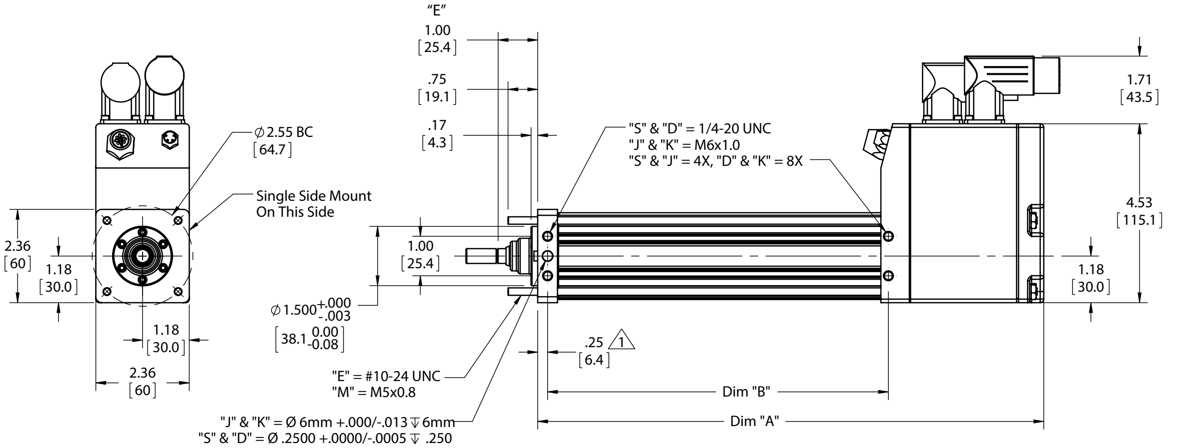
SR = Splined Main Rod

A ball spline shafting main rod with a ball spline nut that replaces the standard front seal and bushing assembly. This rod restricts rotation without the need for an external mechanism. The rod diameter will be the closest metric equivalent to our standard rod sizes. Since this option is NOT sealed, it is not suitable for environments in which contaminants may enter the actuator.

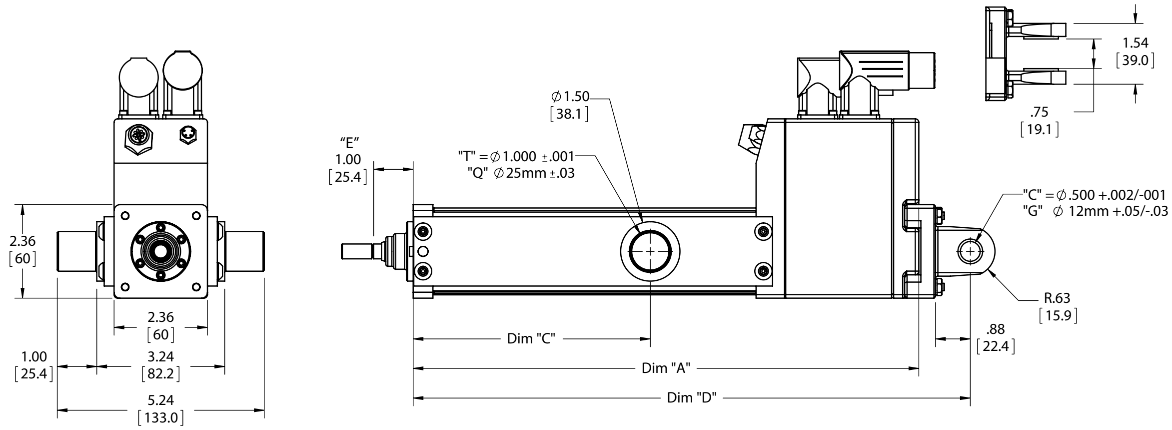
Note: Adding this option affects the overall length and mounting dimensions.

Dimensions

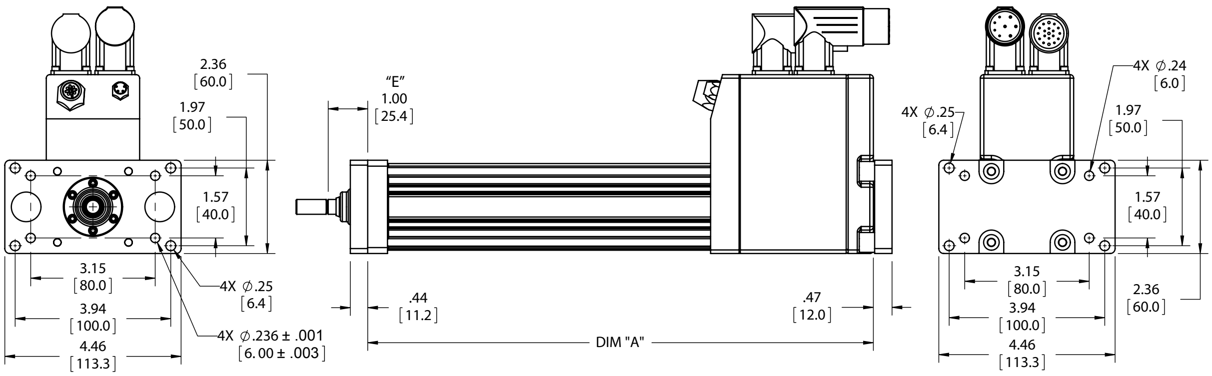
TDM/X060 Double Side Mount or Extended Tie Rod Mount



TDM/X060 Side Trunnion Mount or Rear Clevis Mount



TDM/X060 Front, Rear, or Front and Rear Flange Mount

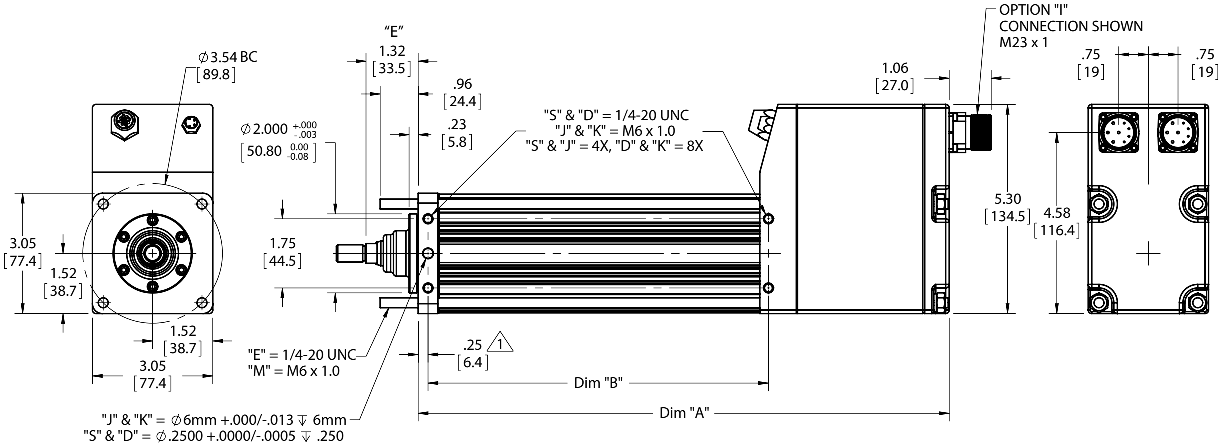


DIM	3 inch (75 mm) stroke in (mm)	6 inch (150 mm) stroke in (mm)	10 inch (250 mm) stroke in (mm)	12 inch (300 mm) stroke in (mm)
A	9.79 (248.7)	12.79 (324.9)	16.79 (426.5)	18.79 (477.3)
B	5.62 (142.8)	8.62 (218.9)	12.62 (320.6)	14.62 (371.4)
C	3.00 (76.2)	6.00 (152.4)	10.00 (254.0)	12.00 (304.8)
D	11.10 (281.9)	14.10 (358.1)	18.10 (459.7)	20.10 (510.5)

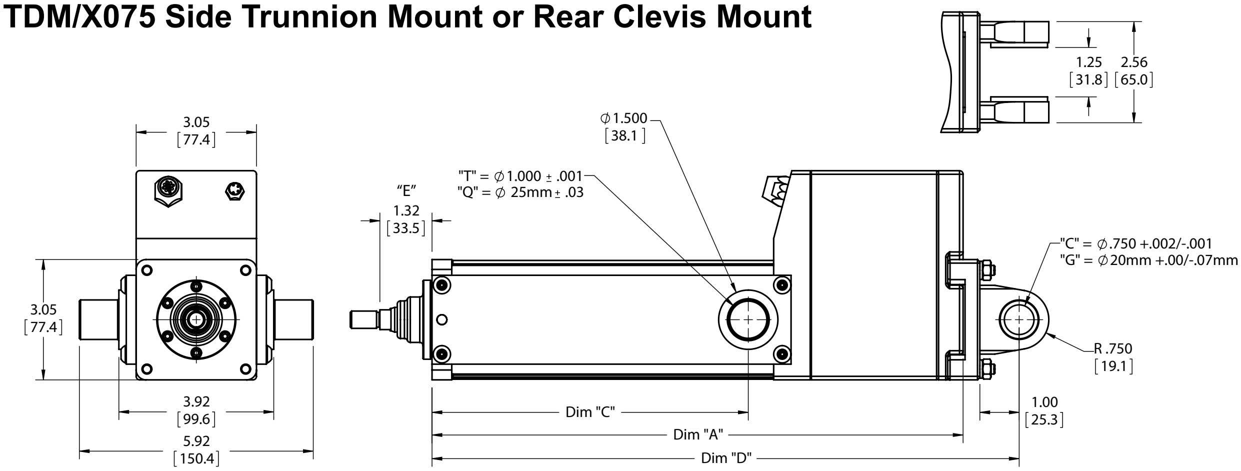
* Add 1.75 inches to dimensions “A”, “B” and “D” if ordering a brake. Add .50 inches to dimensions “A”, “C” and “D” and dimension if ordering a splined 1 main rod.
**Add 2 inches (50.8 mm) to “E” if ordering protective bellows.

Pre-sale drawings and models are representative and are subject to change. Certified drawings and models are available for a fee. Consult your local Exlar representative for details.

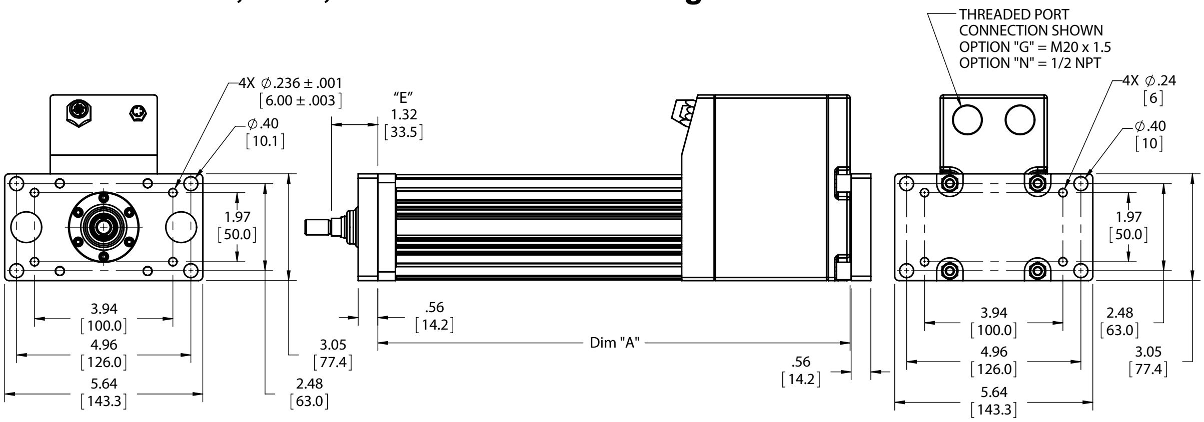
TDM/X075 Double Side Mount or Extended Tie Rod Mount



TDM/X075 Side Trunnion Mount or Rear Clevis Mount



TDM/X075 Front, Rear, or Front and Rear Flange Mount

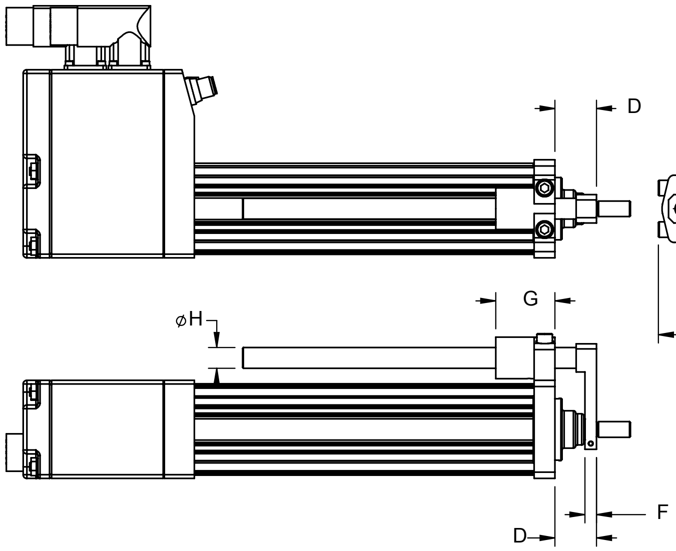


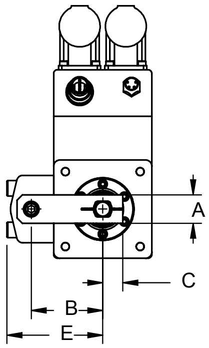
DIM	3 inch (75 mm) stroke in (mm)	6 inch (150 mm) stroke in (mm)	10 inch (250 mm) stroke in (mm)	12 inch (300 mm) stroke in (mm)	14 inch (350 mm) stroke in (mm)	18 inch (450 mm) stroke in (mm)
A	10.98 (278.9)	13.45 (341.6)	17.95 (455.9)	19.95 (506.7)	21.95 (557.5)	25.95 (659.1)
B	6.15 (156.2)	8.62 (218.9)	13.12 (333.2)	15.12 (384.0)	17.12 (434.8)	21.12 (536.4)
C	5.38 (136.7)	8.00 (203.2)	10.00 (254.0)	12.00 (304.8)	14.00 (355.6)	18.00 (457.2)
D	12.40 (315.0)	14.87 (377.7)	19.37 (492.0)	21.37 (542.8)	23.37 (593.6)	27.37 (695.2)

* Add 1.61 inches to dimensions "A", "B" and "D" if ordering a brake. Add1.2 inches to dimensions "A", "C" and "D" and dimension if ordering a splined ⚠1 main rod.
**Add 2 inches (50.8 mm) to "E" if ordering protective bellows.

Pre-sale drawings and models are representative and are subject to change. Certified drawings and models are available for a fee. Consult your local Exlar representative for details.

Anti-Rotate Option

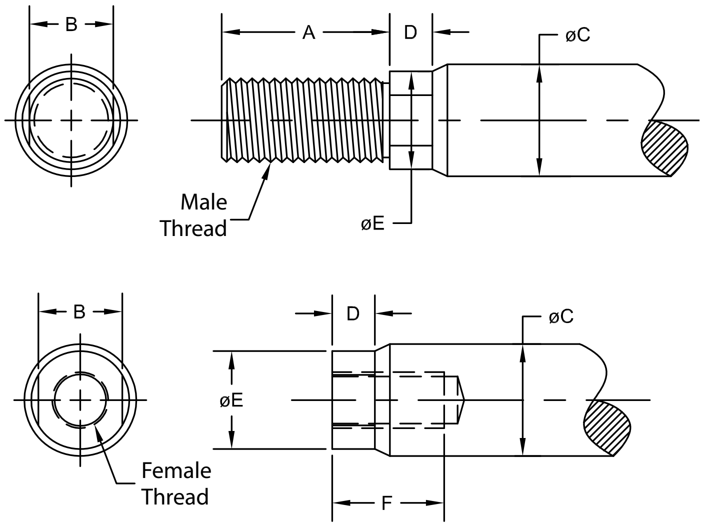




DIM	TDM/X060	TDM/X075
A	0.68 (17.3)	0.82 (20.9)
B	1.72 (43.7)	2.21 (56.1)
C	0.48 (12.2)	0.60 (15.2)
D	1.00 (25.4)	1.32 (33.5)
E	2.31 (58.7)	2.71 (68.8)
F	0.28 (7.1)	0.39 (9.9)
G	1.43 (36.3)	1.70 (43.2)
ØH	0.50 (12.7)	0.63 (15.9)

Actuator Rod End Option

* A Dim = 40mm

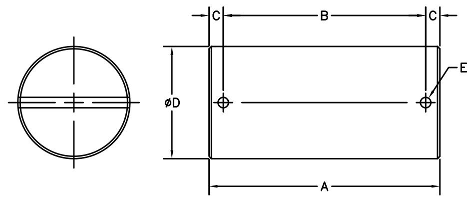


DIM	TDM/X060	TDM/X075
A	0.813 (20.7)	0.750 (19.1)
B	0.375 (9.5)	0.500 (12.7)
ØC	0.500 (12.7)	0.625 (15.9)
D	0.200 (5.1)	0.281 (7.1)
ØE	0.440 (11.2)	0.562 (14.3)
F	0.750 (19.1)	0.750 (19.1)
Male–Inch	3/8-24 UNF-2A	7/16-20 UNF-2A
Male–Metric	M8 x 1-6g	M12 x 1.75-6g*
Female–Inch	5/16-24 UNF-2B	7/16-20 UNF-2B
Female–Metric	M8 x 1-6h	M10 x 1.5-6h

*When ordering the male M12x1.75 main rod for the TDM/X075 dimension "A" will be 1.57 in (40 mm)

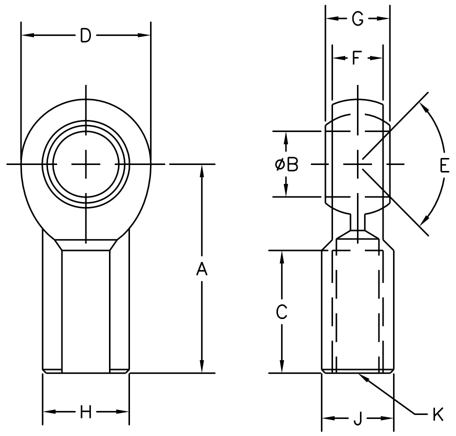
Pre-sale drawings and models are representative and are subject to change. Certified drawings and models are available for a fee. Consult your local Exlar representative for details.

Clevis Pin



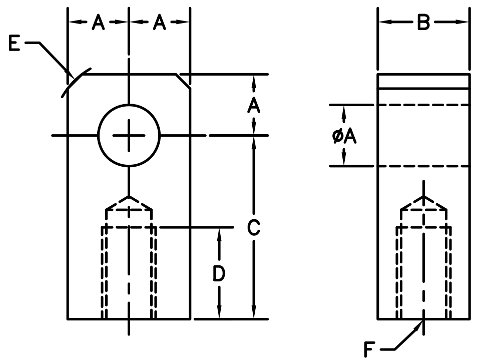
DIM	TDM/X060 CP050 in (mm) Rear Clevis, RE050 & RC050	TDM/X075 CP075 in (mm) Rear Clevis
A	2.28 (57.9)	3.09 (78.5)
B	1.94 (49.28)	2.72 (69.1)
C	0.17 (4.32)	1.19 (4.82)
ØD	0.50 (12.7) -0.001/-0.002	0.75 (19.1) -0.001/-0.002
ØE	0.095 (2.41)	0.14 (3.56)

Spherical Rod Eye



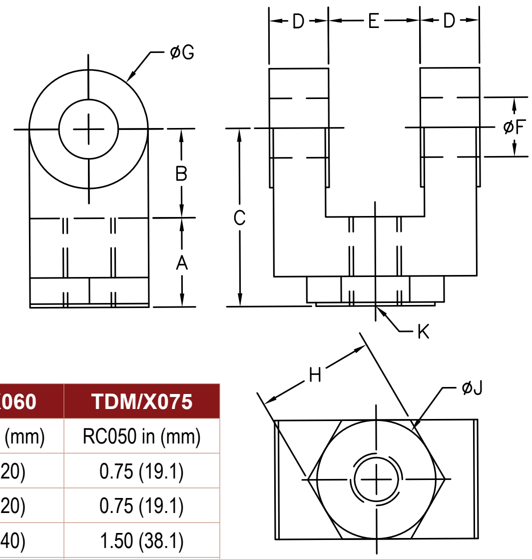
DIM	TDM/X060 SRM038 in (mm)	TDM/X075 SRM044 in (mm)
A	1.625 (41.3)	1.81 (46.0)
ØB	0.375 (9.525)	0.438 (11.13)
C	0.906 (23.0)	1.06 (26.9)
D	1.0 (25.6)	1.13 (28.7)
E	12 Deg	14 Deg
F	0.406 (10.3)	0.44 (11.1)
G	0.500 (12.7)	0.56 (14.2)
H	0.688 (17.7)	0.75 (19.1)
J	0.562 (14.3)	0.63 (16.0)
K	3/8-24	7/16-20

Rod Eye



DIM	TDM/X060 RE038 in (mm)	TDM/X075 RE050 in (mm)
ØA	0.50 (12.7)	0.50 (12.7)
B	0.560 (14.2)	0.75 (19.1)
C	1.000 (25.4)	1.50 (38.1)
D	0.500 (12.7)	0.75 (19.1)
E	0.25 x 45 (6.35)	0.63 (15.9)
F	3/8-24	7/16-20

Rod Clevis



DIM	TDM/X060 RC038 in (mm)	TDM/X075 RC050 in (mm)
A	0.787 (20)	0.75 (19.1)
B	0.787 (20)	0.75 (19.1)
C	1.574 (40)	1.50 (38.1)
D	0.183 (4.65)	0.50 (12.7)
E	0.375 (9.5)	0.765 (19.43)
ØF	0.375 (9.5)	0.50 (12.7)
ØG	0.75 (19.1)	1.00 (25.4)
H	N/A	1.00 (25.4)
ØJ	N/A	1.00 (25.4)
K	3/8-24	7/16-20

Pre-sale drawings and models are representative and are subject to change. Certified drawings and models are available for a fee. Consult your local Exlar representative for details.

Mechanical Specifications

RDM/G060

Rotary Motor Torque and Speed Ratings

	Stator	1 Stack	2 Stack	3 Stack
	RPM at 48 VDC	5000	5000	4000
Continuous Torque	lbf-in (Nm)	6.8 (0.76)	10.5 (1.18)	13 (1.47)
Peak Torque	lbf-in (Nm)	12.8 (1.44)	13.3 (1.5)	17 (1.92)
Drive Current @ Continuous Torque	Amps	14.8	21.5	21.5
Operating Temperature Range**	-20 to 65° C (-40°C available, consult Exlar)			
Maximum Continuous Power Supply Current*	Amps	8	11	13

*Power supply current is based on software current limit, not thermal limit. Consideration for peak current should also be considered when sizing power supplies.
For output torque of RDG gearmotors, multiply by ratio and efficiency. Please note maximum allowable output torques found at bottom of page.
**Ratings based on 40° C ambient conditions.

Inertia

	Stator	1 Stack	2 Stack	3 Stack
RDM Motor Armature Inertia (+/-5%)	lb-in-sec^2 (kg-cm^2)	0.000237 (0.268)	0.000413 (0.466)	0.000589 (0.665)
RDG Gearmotor Armature Inertia*	lbf-in-sec^2 (kg-cm^2)	0.000226 (0.255)	0.000401 (0.453)	0.000576 (0.651)

*Add armature inertia to gearing inertia for total inertia.

Radial Load and Bearing Life

RPM	50	100	250	500	1000	3000
RDM060 lbf (N)	250 (1112)	198 (881)	148 (658)	116 (516)	92 (409)	64 (285)
RDG060 lbf (N)	189 (841)	150 (667)	110 (489)	88 (391)	70 (311)	48 (214)

Side load ratings shown above are for 10,000 hour bearing life at 25 mm from motor face at given rpm.

Gearmotor Mechanical Ratings

Model	Ratio	Maximum Allowable Output Torque-Set by User lbf-in (Nm)	Output Torque at Motor Speed for 10,000 Hour Life		
			1000 RPM lbf-in (Nm)	3000 RPM lbf-in (Nm)	5000 RPM lbf-in (Nm)
RDG060-004	4:1	603 (68.1)	144 (16.2)	104 (11.7)	88 (9.9)
RDG060-005	5:1	522 (58.9)	170 (19.2)	125 (14.1)	105 (11.9)
RDG060-010	10:1	327 (36.9)	200 (22.6)	140 (15.8)	120 (13.6)
RDG060-016	16:1	603 (68.1)	224 (25.3)	160 (18.1)	136 (15.4)
RDG060-020	20:1	603 (68.1)	240 (27.1)	170 (19.2)	146 (16.5)
RDG060-025	25:1	522 (58.9)	275 (31.1)	200 (22.6)	180 (20.3)
RDG060-040	40:1	603 (68.1)	288 (32.5)	208 (23.5)	180 (20.3)
RDG060-050	50:1	522 (58.9)	340 (38.4)	245 (27.7)	210 (23.7)
RDG060-100	100:1	327 (36.9)	320 (36.1)	280 (31.6)	240 (27.1)

Two torque ratings for the RDG gearmotors are given in the table above. The left hand columns give the maximum (peak) allowable output torque for the indicated ratios of each size RDG gearmotor. This is not the rated output torque of the motor multiplied by the ratio of the reducer.
It is possible to select a configuration of the motor selection and gear ratio such that the rated motor torque, multiplied by the gear ratio exceeds these ratings. It is the responsibility of the user to ensure that the settings of the system do not allow these values to be exceeded.
The right hand columns give the output torque at the indicated speed which will result in 10,000 hour life (L10). The setup of the system will determine the actual output torque and speed.

Gearing Reflected Inertia

Single Reduction			Double Reduction		
Gear Stages	lbf-in-sec^2	(kg-cm^2)	Gear Stages	lbf-in-sec^2	(kg-cm^2)
4:1	0.0000132	(0.149)	16:1	0.0000121	(0.0137)
5:1	0.0000087	(0.00984)	20:1, 25:1	0.0000080	(0.00906)
10:1	0.0000023	(0.00261)	40:1, 50:1, 100:1	0.0000021	(0.00242)

Backlash and Efficiency

	Single Reduction	Double Reduction
Backlash at 1% Rated Torque	10 Arc min	13 Arc min
Efficiency	91%	86%

Motor and Gearmotor Weights

		RDM060 without Gears	RDG060 with 1 Stage Gearing	RDG060 with 2 Stage Gearing	Added Weight for Brake
1 Stack Stator	lb (kg)	3.0 (1.4)	7.5 (3.4)	9.3 (4.2)	0.6 (0.3)
2 Stack Stator	lb (kg)	4.1 (1.9)	8.6 (3.9)	10.4 (4.7)	
3 Stack Stator	lb (kg)	5.2 (2.4)	9.7 (4.4)	11.5 (5.2)	

RDM/G075

Rotary Motor Torque and Speed Ratings

	Stator	1 Stack	2 Stack	3 Stack
	RPM at 48 VDC	4000	3000	2000
Continuous Torque	lbf-in (Nm)	13 (1.46)	18.5 (2.09)	29 (3.28)
Peak Torque	lbf-in (Nm)	18.9 (2.08)	28 (3.16)	41 (4.63)
Drive Current @ Continuous Torque	Amps	22	22	22
Operating Temperature Range**	-20 to 65˚ C (-40˚C available, consult Exlar)			
Maximum Continuous Power Supply Current*	Amps	15	18	18

*Power supply current is based on software current limit, not thermal limit. Consideration for peak current should also be considered when sizing power supplies. For output torque of RDG gearmotors, multiply by ratio and efficiency. Please note maximum allowable output torques shown below.
**Ratings based on 40˚ C ambient conditions.

Inertia

	Stator	1 Stack	2 Stack	3 Stack
RDM Motor Armature Inertia (+/-5%)	lb-in-sec^2 (kg-cm^2)	0.000545 (0.6158)	0.000973 (1.0996)	0.001401 (1.5834)
RDG Gearmotor Armature Inertia* (+/-5%)	lbf-in-sec^2 (kg-cm^2)	0.000660 (0.7450)	0.001068 (1.2057)	0.001494 (1.6868)

*Add armature inertia to gearing inertia for total inertia.

Radial Load and Bearing Life

RPM	50	100	250	500	1000	3000
RDM075 lbf (N)	278 (1237)	220 (979)	162 (721)	129 (574)	102 (454)	71 (316)
RDG075 lbf (N)	343 (1526)	272 (1210)	200 (890)	159 (707)	126 (560)	88 (391)

Side load ratings shown above are for 10,000 hour bearing life at 25 mm from motor face at given rpm.

Gearmotor Mechanical Ratings

Model	Ratio	Maximum Allowable Output Torque-Set by User lbf-in (Nm)	Output Torque at Motor Speed for 10,000 Hour Life		
			1000 RPM lbf-in (Nm)	2500 RPM lbf-in (Nm)	4000 RPM lbf-in (Nm)
RDG075-004	4:1	1618 (182.8)	384 (43.4)	292 (32.9)	254 (28.7)
RDG075-005	5:1	1446 (163.4)	395 (44.6)	300 (33.9)	260 (29.4)
RDG075-010	10:1	700 (79.1)	449 (50.7)	341 (38.5)	296 (33.4)

Two torque ratings for the RDG gearmotors are given in the table above. The left hand columns give the maximum (peak) allowable output torque for the indicated ratios of each size RDG gearmotor. This is not the rated output torque of the motor multiplied by the ratio of the reducer.

It is possible to select a configuration of the motor selection and gear ratio such that the rated motor torque, multiplied by the gear ratio exceeds these ratings. It is the responsibility of the user to ensure that the settings of the system do not allow these values to be exceeded.

The right hand columns give the output torque at the indicated speed which will result in 10,000 hour life (L10). The setup of the system will determine the actual output torque and speed.

Gearing Reflected Inertia

	Single Reduction (+/-5%)	
Gear Stages	lbf-in-sec^2	(kg-cm^2)
4:1	0.000095	(0.107)
5:1	0.000062	(0.069)
10:1	0.000117	(0.019)

Backlash and Efficiency

	Single Reduction
Backlash at 1% Rated Torque	10 Arc min
Efficiency	91%

Motor and Gearmotor Weights

		RDM075 without Gears	RDG075 with 1 Stage Gearing	Added Weight for Brake
1 Stack Stator	lb (kg)	7.4 (3.4)	9.8 (4.4)	1.0 (0.5)
2 Stack Stator	lb (kg)	9.2 (4.2)	11.6 (5.3)	
3 Stack Stator	lb (kg)	11 (4.9)	13.4 (6.1)	

RDM/G090

Rotary Motor Torque and Speed Ratings

	Stator	1 Stack	2 Stack	3 Stack
	RPM at 48 VDC	3300	1800	1400
Continuous Torque	lbf-in (Nm)	17 (1.92)	28 (3.16)	41 (4.63)
Peak Torque	lbf-in (Nm)	21.8 (2.46)	36 (4.07)	52.8 (5.97)
Drive Current @ Continuous Torque	Amps	22	22	22
Operating Temperature Range**	-20 to 65˚ C (-40˚C available, consult Exlar)			
Maximum Continuous Power Supply Current*	Amps	18	18	18

*Power supply current is based on software current limit, not thermal limit. Consideration for peak current should also be considered when sizing power supplies.
For output torque of RDG gearmotors, multiply by ratio and efficiency. Please note maximum allowable output torques shown below.
**Ratings based on 40˚ C ambient conditions.

Inertia

	Stator	1 Stack	2 Stack	3 Stack
RDM Motor Armature Inertia (+/-5%)	lb-in-sec^2 (kg-cm^2)	0.00054 (0.609)	0.00097 (1.09)	0.00140 (1.58)
RDG Gearmotor Armature Inertia* (+/-5%)	lbf-in-sec^2 (kg-cm^2)	0.00114 (1.29)	0.00157 (1.77)	0.00200 (2.26)

*Add armature inertia to gearing inertia for total inertia.

Radial Load and Bearing Life

RPM	50	100	250	500	1000	3000
RDM090 lbf (N)	427 (1899)	340 (1512)	250 (1112)	198 (881)	158 (703)	109 (485)
RDG090 lbf (N)	350 (1557)	278 (1237)	205 (912)	163 (725)	129 (574)	89 (396)

Side load ratings shown above are for 10,000 hour bearing life at 25 mm from motor face at given rpm.

Gearmotor Mechanical Ratings

Model	Ratio	Maximum Allowable Output Torque-Set by User lbf-in (Nm)	Output Torque at Motor Speed for 10,000 Hour Life: 1000 RPM lbf-in (Nm)	2500 RPM lbf-in (Nm)	3300 RPM lbf-in (Nm)
RDG090-004	4:1	2078 (234.8)	698 (78.9)	530 (59.9)	488 (55.1)
RDG090-005	5:1	1798 (203.1)	896 (101.2)	680 (76.8)	626 (70.7)
RDG090-010	10:1	1126 (127.2)	1043 (117.8)	792 (89.5)	729 (82.4)
RDG090-016	16:1	2078 (234.8)	1057 (119.4)	803 (90.7)	739 (83.5)
RDG090-020	20:1	2078 (234.8)	1131 (127.8)	859 (97.1)	790 (89.3)
RDG090-025	25:1	1798 (203.1)	1452 (164.1)	1103 (124.6)	1015 (114.7)
RDG090-040	40:1	2078 (234.8)	1392 (157.3)	1057 (119.4)	973 (109.9)
RDG090-050	50:1	1798 (203.1)	1787 (201.9)	1358 (153.4)	1249 (141.1)
RDG090-100	100:1	1126 (127.2)	1100 (124.3)	1100 (124.3)	1100 (124.3)

Two torque ratings for the RDG gearmotors are given in the table above. The left hand columns give the maximum (peak) allowable output torque for the indicated ratios of each size RDG gearmotor. This is not the rated output torque of the motor multiplied by the ratio of the reducer.

It is possible to select a configuration of the motor selection and gear ratio such that the rated motor torque, multiplied by the gear ratio exceeds these ratings. It is the responsibility of the user to ensure that the settings of the system do not allow these values to be exceeded.
The right hand columns give the output torque at the indicated speed which will result in 10,000 hour life (L10). The setup of the system will determine the actual output torque and speed.

Gearing Reflected Inertia

Single Reduction			Double Reduction		
Gear Stages	lbf-in-sec^2	(kg-cm^2)	Gear Stages	lbf-in-sec^2	(kg-cm^2)
4:1	0.0000154	(0.174)	16:1	0.000115	(0.130)
5:1	0.0000100	(0.113)	20:1, 25:1	0.0000756	(0.0854)
10:1	0.0000265	(0.0300)	40:1, 50:1, 100:1	0.0000203	(0.0230)

Backlash and Efficiency

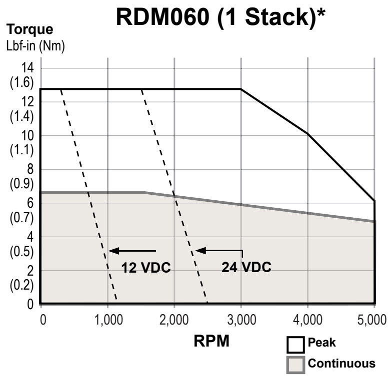
	Single Reduction	Double Reduction
Backlash at 1% Rated Torque	10 Arc min	13 Arc min
Efficiency	91%	86%

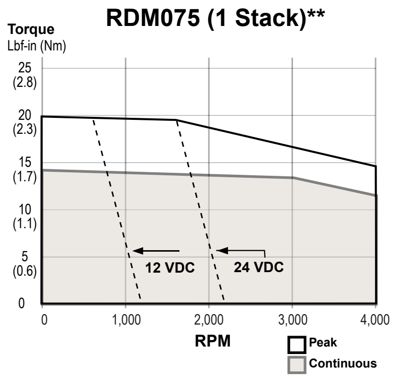
Motor and Gearmotor Weights

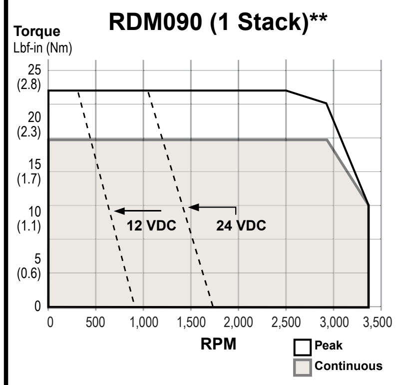
		RDM090 without Gears	RDG090 with 1 Stage Gearing	RDG090 with 2 Stage Gearing	Added Weight for Brake
1 Stack Stator	lb (kg)	12.5 (5.7)	20.5 (9.3)	23.5 (10.7)	1.5 (0.7)
2 Stack Stator	lb (kg)	15.5 (7.0)	23.5 (10.7)	26.5 (12)	
3 Stack Stator	lb (kg)	18.5 (8.4)	26.5 (12.0)	29.5 (13.4)	

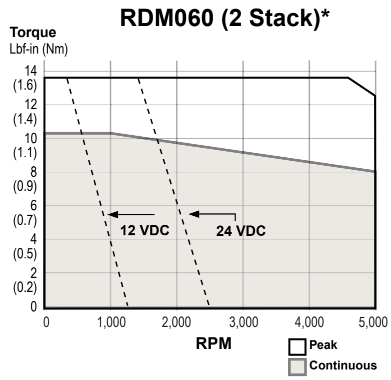
Speed vs. Force Curves

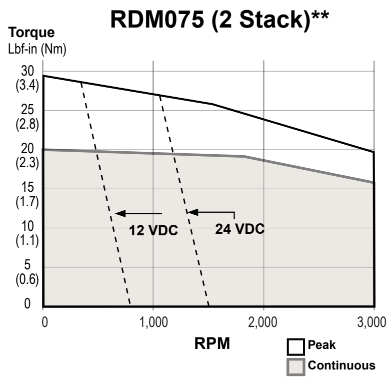
RDM060	RDM075	RDM090

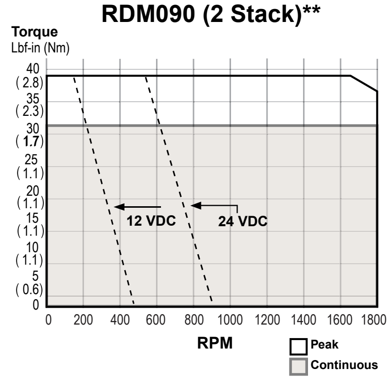


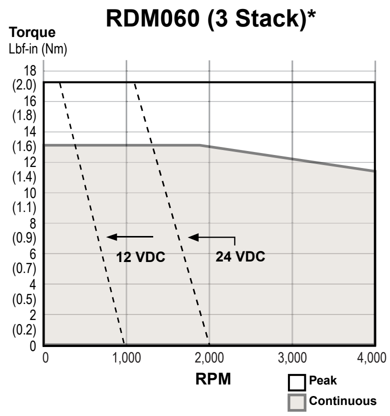


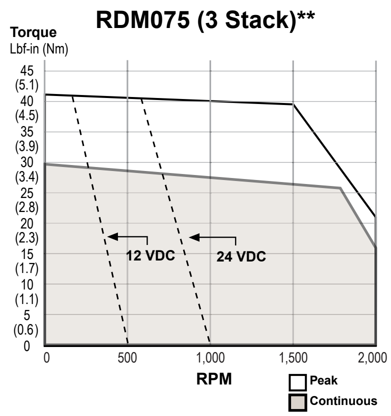


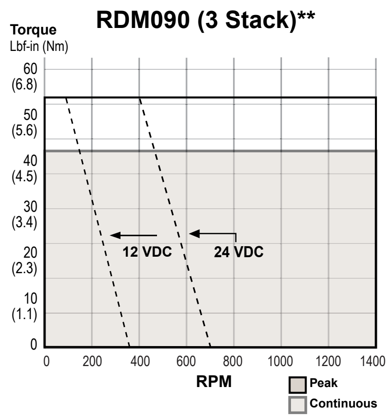








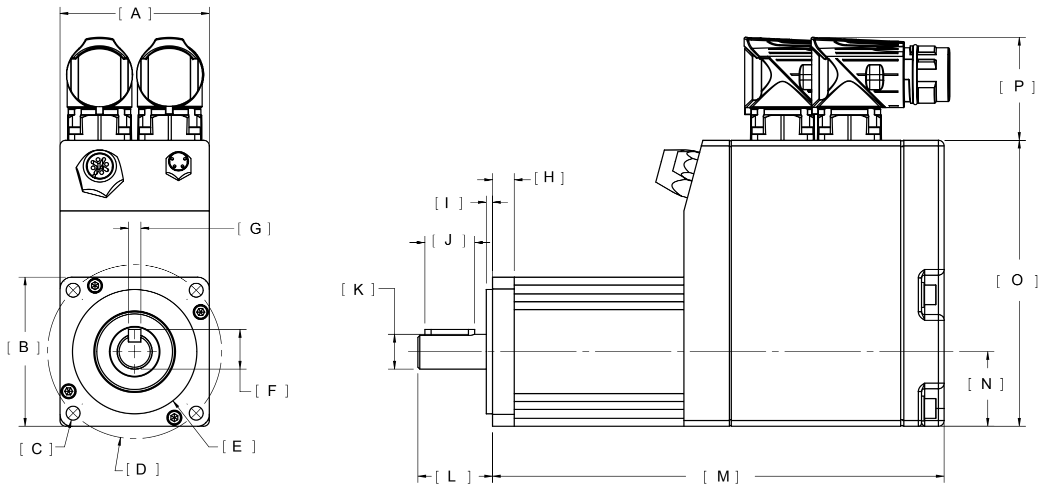




For RDG gearmotors, multiply torque by ratio and efficiency. Divide speed by gear ratio.
* RDM060 test data derived using NEMA recommended aluminum heatsink 10" x 10" x 1/4" at 40°C ambient
**RDM075 and RDM090 test data derived using NEMA recommended aluminum heatsink 10" x 10" x 3/8" at 40°C ambient

Dimensions

RDM/G060 Base Actuator



		RDM060	RDG060			RDM060	RDG060
A	in	2.36	2.36	I	in	0.10	0.12
	mm	60	60		mm	2.5	3.0
B	in	2.36	2.36	J	in	0.79	0.98
	mm	60	60		mm	20.0	25.0
C	in	4X Ø 0.22	4X Ø 0.22	K	in	Ø 0.5512 / 0.5507	Ø 0.6302 / 0.6298
	mm	5.6	5.6		mm	14 h6	16 j6
D	in	Ø 2.75 BC	Ø 2.75 BC	L	in	1.18	1.43
	mm	70.0	70.0		mm	30.0	36.3
E	in	Ø 1.9681 / 1.9675	Ø 1.9681 / 1.9675	M	in	See Below	See Below
	mm	50 g6	50 g6		mm	See Below	See Below
F	in	0.63	0.70	N	in	1.18	1.18
	mm	15.9	17.9		mm	30.0	30.0
G	in	Ø 0.1969 / 0.1957	Ø 0.1969 / 0.1957	O	in	4.53	4.53
	mm	5 h9	5 h9		mm	115.1	115.1
H	in	0.34	0.38	P	in	1.63	1.63
	mm	8.7	9.7		mm	41.4	41.4

RDM060

Without Brake Option			
DIM	1 Stack Stator	2 Stack Stator	3 Stack Stator
M	7.146 (185.1)	8.396 (213.3)	9.646 (245.0)

With Brake Option			
DIM	1 Stack Stator	2 Stack Stator	3 Stack Stator
M	7.856 (199.5)	9.106 (231.3)	10.356 (263.0)

RDG060

Without Brake Option			
DIM	1 Stack Stator 1 Stage Gearhead	2 Stack Stator 1 Stage Gearhead	3 Stack Stator 1 Stage Gearhead
M	9.434 (240)	10.684 (271)	11.934 (303)
DIM	1 Stack Stator 2 Stage Gearhead	2 Stack Stator 2 Stage Gearhead	3 Stack Stator 2 Stage Gearhead
M	10.479 (266)	11.729 (298)	12.979 (330)

With Brake Option			
DIM	1 Stack Stator 1 Stage Gearhead	2 Stack Stator 1 Stage Gearhead	3 Stack Stator 1 Stage Gearhead
M	10.144 (258)	11.394 (289)	12.644 (321)
DIM	1 Stack Stator 2 Stage Gearhead	2 Stack Stator 2 Stage Gearhead	3 Stack Stator 2 Stage Gearhead
M	11.189 (284)	12.439 (316)	13.689 (348)

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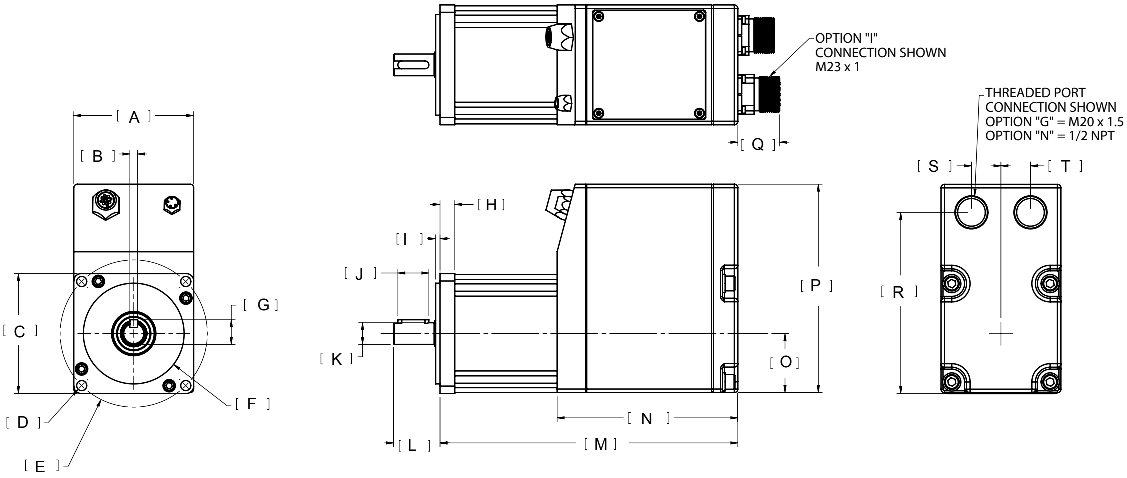
RDM/G075 Base Actuator



		RDM075	RDG075			RDM075	RDG075
A	in	3.05	3.05	**K**	in	Ø 0.5512 / 0.5508	Ø 0.6302 / 0.6298
	mm	77.4	77.4		mm	14 h6	16 j6
B	in	Ø 0.1969 / 0.1957	Ø 0.1969 / 0.1957	**L**	in	1.18	1.18
	mm	5 h9	5 h9		mm	30.0	30.0
C	in	□ 3.05	□ 3.05	**M**	in	See Below	See Below
	mm	77.4	77.4		mm	See Below	See Below
D	in	4X Ø 0.26 ON BC	4X Ø 0.26 ON BC	**N**	in	4.59	4.59
	mm	6.5	6.5		mm	116.6	116.6
E	in	Ø 3.74 BC	Ø 3.74 BC	**O**	in	1.5	1.5
	mm	95.0	95.0		mm	38.1	38.1
F	in	Ø 2.5587 / 2.5580	Ø 2.5587 / 2.5580	**P**	in	5.30	5.30
	mm	65 g6	65 g6		mm	134.5	134.5
G	in	0.63	0.70	**Q**	in	1.06	1.06
	mm	15.9	17.9		mm	27.0	27.0
H	in	0.38	0.45	**R**	in	4.61	4.61
	mm	9.5	11.5		mm	117.0	117.0
I	in	0.11	0.11	**S**	in	0.75	0.75
	mm	2.8	2.8		mm	19.1	19.1
J	in	0.79	0.79	**T**	in	0.75	0.75
	mm	20.0	20.0		mm	19.1	19.1

RDM075

Without Brake Option			
DIM	1 Stack Stator	2 Stack Stator	3 Stack Stator
M	7.57 (192.3)	8.57 (217.7)	9.57 (243.1)

With Brake Option			
DIM	1 Stack Stator	2 Stack Stator	3 Stack Stator
M	8.85 (224.8)	9.85 (250.2)	10.85 (275.6)

RDG075

Without Brake Option			
DIM	1 Stack Stator 1 Stage Gearhead	2 Stack Stator 1 Stage Gearhead	3 Stack Stator 1 Stage Gearhead
M	9.19 (233.4)	10.19 (258.8)	11.19 (284.2)

With Brake Option			
DIM	1 Stack Stator 1 Stage Gearhead	2 Stack Stator 1 Stage Gearhead	3 Stack Stator 1 Stage Gearhead
M	10.42 (264.7)	11.42 (290.1)	12.42 (315.5)

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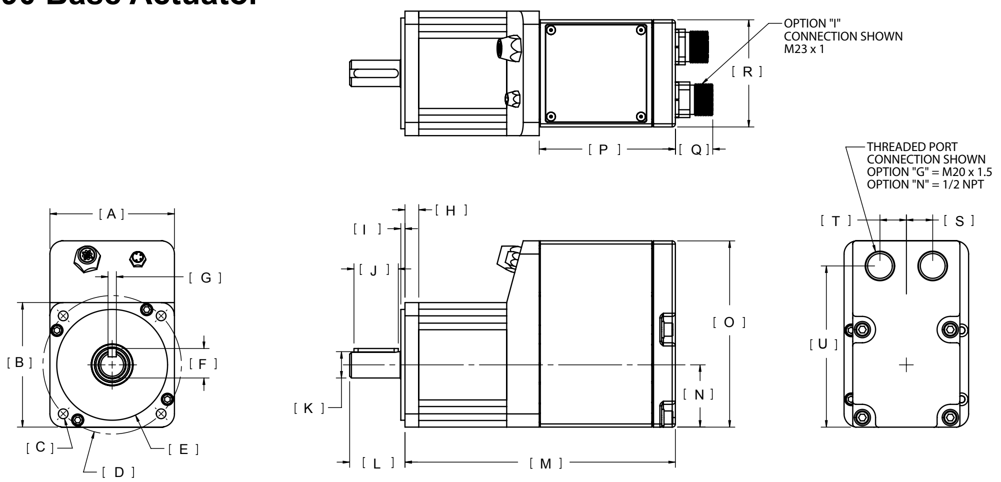
RDM/G090 Base Actuator



		RDM90	RDG090			RDM090	RDG090
A	in	3.54	3.54	L	in	1.57	1.89
	mm	90	90		mm	39.6	48.0
B	in	3.54	3.54	M	in	See Below	See Below
	mm	90	90		mm	See Below	See Below
C	in	4X Ø 0.28	4X Ø 0.26	N	in	1.77	1.77
	mm	7.0	6.5		mm	45.0	45.0
D	in	Ø 3.94 BC	Ø 3.94 BC	O	in	5.30	5.30
	mm	100.0	100.0		mm	134.5	134.5
E	in	Ø 3.1492 / 3.1485	Ø 3.1492 / 3.1485	P	in	3.87	3.87
	mm	80 g6	80 g6		mm	98.3	98.3
F	in	0.85	0.96	Q	in	1.06	1.06
	mm	21.5	24.3		mm	27.0	27.0
G	in	Ø 0.2362 / 0.2350	Ø 0.2362 / 0.2350	R	in	3.05	3.05
	mm	6 h9	6 h9		mm	77.4	77.4
H	in	0.39	0.63	S	in	0.75	0.75
	mm	10.0	15.9		mm	19.1	19.1
I	in	0.12	0.12	T	in	0.75	0.75
	mm	3.0	3.0		mm	19.1	19.1
J	in	1.26	1.42	U	in	4.58	4.58
	mm	32.0	36.0		mm	116.4	116.4
K	in	Ø 0.7480 / 0.7475	Ø 0.8665 / 0.8659				
	mm	19 h6	22 j6				

RDM090

Without Brake Option			
DIM	1 Stack Stator	2 Stack Stator	3 Stack Stator
M	7.69 (195.3)	8.69 (220.7)	9.69 (246.1)

With Brake Option			
DIM	1 Stack Stator	2 Stack Stator	3 Stack Stator
M	9.0 (228.6)	10.00 (254.0)	11.00 (279.4)

RDG090

Without Brake Option			
DIM	1 Stack Stator 1 Stage Gearhead	2 Stack Stator 1 Stage Gearhead	3 Stack Stator 1 Stage Gearhead
M	10.80 (274.3)	11.80 (299.7)	12.80 (325.1)
DIM	1 Stack Stator 2 Stage Gearhead	2 Stack Stator 2 Stage Gearhead	3 Stack Stator 2 Stage Gearhead
M	12.06 (306.3)	13.06 (331.7)	14.06 (357.1)

With Brake Option			
DIM	1 Stack Stator 1 Stage Gearhead	2 Stack Stator 1 Stage Gearhead	3 Stack Stator 1 Stage Gearhead
M	12.13 (308.1)	13.11 (333.0)	14.11 (358.4)
DIM	1 Stack Stator 2 Stage Gearhead	2 Stack Stator 2 Stage Gearhead	3 Stack Stator 2 Stage Gearhead
M	13.37 (339.6)	14.37 (365.0)	15.37 (390.4)

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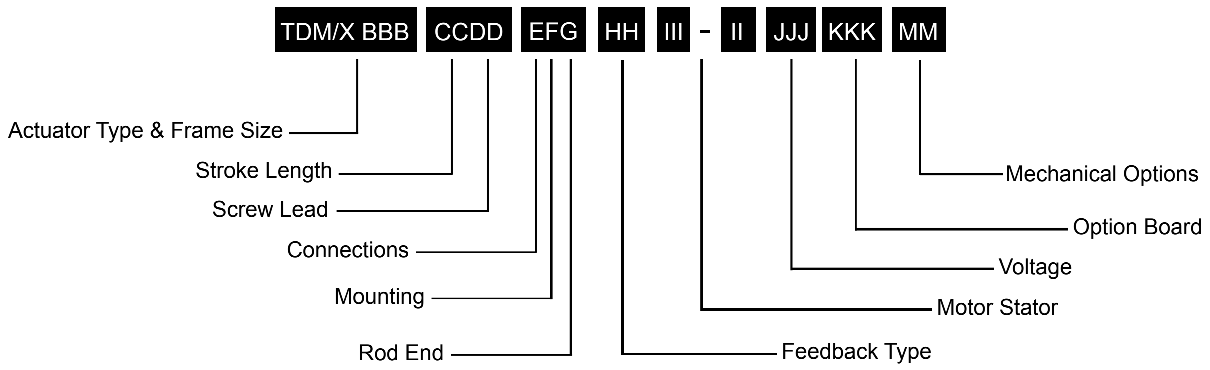
Notes

Tritex II DC Linear Ordering Guide



TDM/X = Actuator Type
TDM = Tritex II Linear Actuator, standard mechanical capacity
TDX = Tritex II Linear Actuator, high mechanical capacity

BBB = Actuator Frame Size
060 = 60 mm
075 = 75 mm

CC = Stroke Length
03 = 3 inch (76 mm)
06 = 6 inch (150 mm)
10 = 10 inch (254 mm)
12 = 12 inch (305 mm)
18 = 18 inch (457 mm) (75 mm only)

DD = Screw Lead (linear travel per screw revolution)
01 = 0.1 inch (2.54 mm)
02 = 0.2 inch (5.08 mm)
04 = 0.4 inch (10.16 mm) (60 mm only)
05 = 0.5 inch (12.7 mm) (75 mm only)

E = Connections
G = Standard Straight Threaded Port with internal terminals, M20x1.5 (75 mm only)
N = NPT Threaded Port via Adapter with Internal Terminals, 1/2" NPT (75 mm only)
I = Intercontec Style - Exlar standard, M23 Style Connector
J = Embedded Leads, with "I" plug, 3 ft. standard

F = Mounting
C = Rear Clevis
G = Metric Rear Clevis
D = Double Side Mount
K = Metric Double Side Mount
E = Extended Tie Rod
M = Metric Extended Tie Rod
F = Front Flange
R = Rear Flange
T = Side Trunnion
Q = Metric Side Trunnion

G = Rod End
M = Male US Standard Thread [1]
A = Male Metric Thread [1]
F = Female US Standard Thread [1]
B = Female Metric Thread [1]
W = Male, US Standard Thread SS [10]
R = Male Metric Thread SS
V = Female US Standard Thread SS [10]
L = Female Metric Thread SS [10]

HH = Feedback Type
HD = Analog Hall Device
IE = Incremental Encoder, 8192 count resolution
AF = Absolute Feedback [11]

III-II = Motor Stator, All 8 Pole
TDM/X060 Stator Specifications
1B8-50 = 1 Stack, 48 VDC, 5000 rpm
2B8-50 = 2 Stack, 48 VDC, 5000 rpm
3B8-40 = 3 Stack, 48 VDC. 4000 rpm [4]

TDM/X075 Stator Specifications
1B8-30 = 1 Stack, 48 VDC, 3000 rpm
2B8-30 = 2 Stack, 48 VDC, 3000 rpm
3B8-20 = 3 Stack, 48 VDC, 2000 rpm [4]

JJJ = Voltage
048 = 12-48 VDC

KKK = Option Board
SIO = Standard IO Interconnect
IA4 = 4-20 mA Analog I/O
COP = CANOpen
CON = CANOpen, non-connectorized [9]
EIP = SIO plus Ethernet/IP with M12 connector
EIN = SIO plus Ethernet/IP without M12 connector [9]
PIO = SIO plus Profinet IO with M12 connector
PIN = SIO plus Profinet IO without M12 connector [9]
TCP = SIO plus Modbus TCP with M12 connector
TCN = SIO plus Modbus TCP without M12 connector [9]

MM = Mechanical Options [5]
AR = External Anti-rotate
PF = Preloaded Follower [2]
L1/2/3 = External Limit Switches [6]
RB = Rear Brake
HW = Manual Drive, Handwheel with Interlock Switch (TDX075 only)
PB = Protective Bellows [8]
SR = Splined Main Rod [7,10]
P5 = IP65 Sealed Housing (TDM only)

For options or specials not listed above or for extended temperature operation, please contact Exlar

NOTES:
1. Chrome-plated carbon steel. Threads not chrome-plated.
2. The dynamic load rating of zero backlash, preloaded screws is 63% of the dynamic load rating of the standard non-preloaded screws. The calculated travel life of a preloaded screw will be 25% of the calculated travel life of the same size and lead of a non-pre loaded screw.
3. This housing option may indicate the need for special material main rods or mounting.
4. Not available on 0.1 inch lead.
5. For extended temperature operation consult factory for model number.
6. Limit switch option requires AR option.
7. This option is not sealed and is not suitable for any environment in which contaminants come in contact with actuator and may enter the actuator.
8. Not available with extended tie rod mounting option.
9. Requires customer supplied Ethernet cable through I/O port for Class 1 Division 2 compliance only.
10. Consult Exlar if ordering splined stainless steel main rod.
11. When ordering a TDM, RDM or RDG 60 mm or other sizes with top mounted connectors the battery backup for AF feedback must be mounted externally. A DIN rail mounted board and battery is supplied, Exlar PN 48224.

RDM/G AAA BBB CDE F GG HHH - HH III JJJ MM

- RDM/G AAA — Motor Type & Frame Size
- BBB — Gear Ratio
- C — Shaft Type
- D — Connections
- E — Housing
- F — Brake
- GG — Feedback Type
- HHH-HH — Motor Stator
- III — Voltage
- JJJ — Option Board
- MM — Mechanical Options

RDM/G = Motor Type
RDM = Tritex II DC Rotary Motor
RDG = Tritex II DC Rotary Gearmotor

AAA = Frame Size
060 = 60 mm
075 = 75 mm
090 = 90 mm

BBB = Gear Ratio
Blank = RDM
Single Reduction Ratios
004 = 4:1 005 = 5:1 010 = 10:1
Double Reduction Ratios (NA on 75 mm)
016 = 16:1 020 = 20:1
025 = 25:1 040 = 40:1
050 = 50:1 100 = 100:1

C = Shaft Type
K = Keyed
R = Smooth/Round

D = Connections
G = Standard straight threaded port with internal terminals, M20x1.5 (75 & 90 mm only)
N = NPT threaded port internal terminals, 1/2" NPT (75 & 90 mm only)
I = Intercontec style – Exlar standard, M23 Style Connector
J = Embedded Leads, with "I" plug, 3 ft. standard

E = Housing Options
G = Exlar Standard
H = Type III Hard Coat Anodized
F = White Epoxy Coating

F = Brake Option
S = No Brake, Standard
B = Electric Brake, 24 VDC

GG = Feedback Type
HD = Analog Hall Device
IE = Incremental Encoder, 8192 Count Resolution
AF = Absolute Feedback [3]

HHH-HH = Motor Stators - All 8 Pole
RDM/G060 Stator Specifications
1B8-50 = 1 Stack, 48 VDC, 5000 rpm
2B8-50 = 2 Stack, 48 VDC, 5000 rpm
3B8-40 = 3 Stack, 48 VDC, 4000 rpm

RDM/G075 Stator Specifications
1B8-40 = 1 Stack, 48 VDC, 4000 rpm
2B8-30 = 2 Stack, 48 VDC, 3000 rpm
3B8-20 = 3 Stack, 48 VDC, 2000 rpm

RDM/G090 Stator Specifications
1B8-33 = 1 Stack, 48 VDC, 3300 rpm
2B8-18 = 2 Stack, 48 VDC, 1800 rpm
3B8-14 = 3 Stack, 48 VDC, 1400 rpm

III = Voltage
048= 12-48 VDC

JJJ = Option Board
SIO = Standard I/O Interconnect
IA4 = + 4-20 mA Analog I/O
COP = CANOpen
CON = CANOpen, non-connectorized [2]
EIP = SIO plus EtherNet/IP with M12 connector
EIN = SIO plus EtherNet/IP without M12 connector [2]
PIO = SIO plus Profinet IO w/M12 connector
PIN = SIO plus Profinet IO without M12 connector [2]
TCP = SIO plus Modbus TCP w/M12 connector
TCN = SIO plus Modbus TCP without M12 connector [2]

MM = Mechanical Options [1]
HW = Manual Drive, Handwheel with Interlock Switch (75 & 90 mm only)

For options or specials not listed above or for extended temperature operation, please contact Exlar

NOTES:
1. For extended temperature operation consult factory for model number.
2. Requires customer supplied Ethernet cable through I/O port for Class 1 Division 2 compliance only. Also N/A on 60 mm.
3. When ordering a TDM, RDM or RDG 60 mm or other sizes with top mounted connectors the battery backup for AF feedback must be mounted externally. A DIN rail mounted board and battery is supplied, Exlar PN 48224."

Cables and Accessories

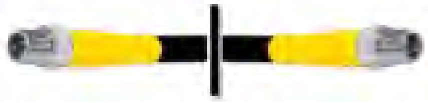
Tritex II DC Series Cable & Accessories	Part No.
Communications Accessories - Tritex uses a 4 pin M8 RS485 communications connector	
Recommended PC to Tritex communications cable-USB/RS485 to M8 connector - xxx = Length in feet, 006 or 015 only	CBL-T2USB485-M8-xxx
Multi-Drop RS485 Accessories	
RS485 splitter - M8 Pin plug to double M8 Socket receptacle	TT485SP
Multidrop Communications Cable M8 to M8 for use with TT485SP/RS485 splitter - xxx = Length in feet, 006 or 015 only	CBL-TTDAS-xxx
“G” Connection Accessories (N/A for 60 mm)	
Nickel plated cable gland- M20 x 1.5 - CE shielding- 2 required	GLD-T2M20 x 1.5
Power cable prepared on one end for use with GLD-T2M20 x 1.5 xxx = Length in ft, Standard lengths 015, 025, 050, 075, 100	CBL-TDIPC-RAW-xxx
I/O cable prepared on one end for use with GLD-T2M20 x 1.5 xxx = Length in ft, Standard lengths 015, 025, 050, 075, 100	CBL-T2IOC-RAW-xxx
“N” Connection Accessories (N/A for 60 mm)	
M20 x 1.5 to 1/2" NPT threaded hole adapter for use with conduit	ADAPT-M20-NPT1/2
“I” Connection	
Power cable with M23 8 pin xxx = Length in feet, std lengths 015, 025, 050, 075, 100	CBL-TTIPC-SMI-xxx
I/O cable with M23 19 pin xxx = Length in feet, std lengths 015, 025, 050, 075, 100	CBL-TTIOC-SMI-xxx
Multi-Purpose Communications Accessories for long runs, requires terminal block interconnections	
USB to RS485 convertor/cable - USB to RS485 flying leads - xxx = Length in feet, 006 or 015 only	CBL-T2USB485-xxx
Communications cable M8 to flying leads cable xxx = Length in feet, standard lengths 015, 025, 050, 075, 100	CBL-TTCOM-xxx
Option Board Cables and Accessories	
CAN Male to Female Molded 3 ft. cable	CBL-TTCAN-SMF-003
CAN Male to Female Molded 6 ft. cable	CBL-TTCAN-SMF-006
CAN Cable, no connectors – per foot	CBL-TTCAN-S
CAN Male connector, field wireable	CON-TTCAN-M
CAN Female connector, field wireable	CON-TTCAN-F
CAN Splitter	CON-TTCAN-SP
EIP, PIO and TCP option Ethernet cable - M12 to RJ45 cable xxx = Length in feet, standard lengths 015, 025, 050, 075, 100.	CBL-T2ETH-R45-xxx
Electrical Accessories	
48VDC, 10Amp Unregulated Power Supply	TTPS1048
48VDC, 15Amp Unregulated Power Supply	TTPS1548
Shunt resistor used for Dynamic Braking	TTSR1
Replacement -AF Battery - 75 mm frame only used for absolute feedback option	T2BAT1
Replacement -External Battery, Absolute Feedback option only (60mm frame)	T2BAT2
Replacement -AF Battery, DIN Rail mounted, Absolute Feedback option only (60mm frame)	48224
Surge Filter DIN rail mounted	TDCESF1
Replacement Normally Closed External Limit Switch (Turck Part No. BIM-UNT-RP6X)	43404
Replacement Normally Open External Limit Switch (Turck Part No. BIM-UNT-AP6X)	43403
Mechanical Accessories	
Clevis Pin for TDM/X060 Rod Clevis & Rear Clevis	CP050*
Clevis Pin for TDM/X075 Rear Clevis	CP075
Spherical Rod Eye for TDM/X060 male “M” rod end 3/8-24 thread	SRM038
Spherical Rod Eye for TDM/X075 male “M” rod end 7/16-20 thread	SRM044
Rod Eye for TDM/X075 male “M” rod end 7/16-20 thread	RE050
Rod Clevis for TDM/X060 male “M” rod end 3/8-24 thread	RC038
Rod Clevis for TDM/X075 male “M” rod end 7/16-20 thread	RC050
Jam Nut for TDM/X060 male rod end, 3/8-24	JAM3/8-24-SS
Jam Nut for TDM/X075 male rod end, 7/16-20	JAM7/16-20-SS

*Also available for TDM/X075 with RC050, RE050

CBL-T2USB485-M8-xxx
Our recommended communications cable. No special drivers or setup required for use with MS Windows™.

CBL-T2USB485-xxx
Use for terminal connections with CBL-TTCOM for long cable runs. No special drivers or setup required for use with MS Windows™.

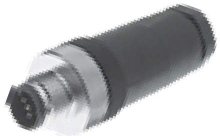
CBL-TTCOM-xxx
Use with CBL-T2USB485-xxx for long cable runs.



CBL-TTDAS-xxx
For use with TT485SP for multi-drop applications.

TT485SP
RS485 communications splitter. Use to daisy-chain multiple Tritex actuators.

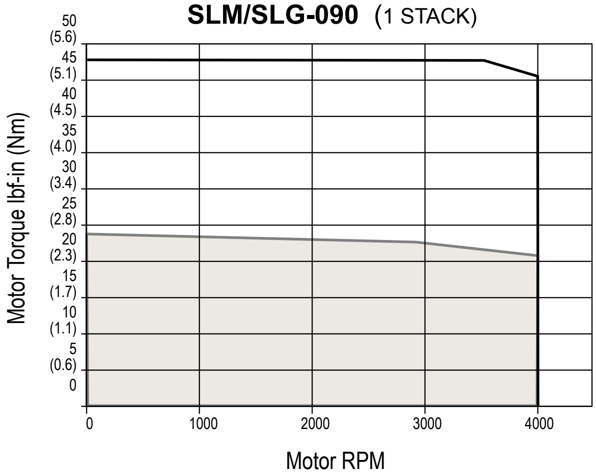
CON-TTCAN-SP
CAN splitter



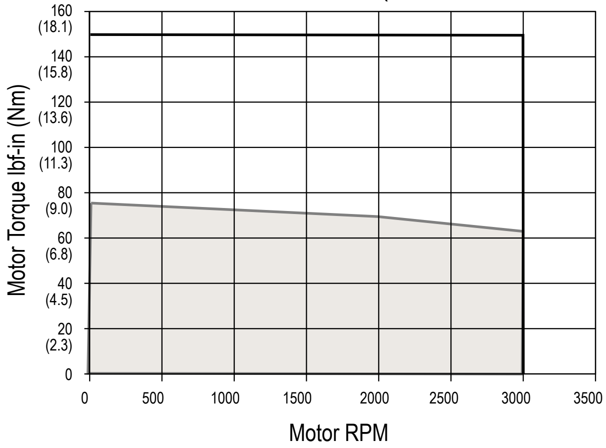
CON-TTCAN-M
M12 Field wireable connector

TDCESF1
Surge filter designed for use on Tritex 48 VDC rotary and linear actuators provides EFT/B and surge disturbance immunity to IEC/EN 61800-3:2004-08 Second Environment (industrial) levels. Electrical Fast Transient/Burst (EET/B) and surge disturbances are caused by a number of events including switching inductive loads, relay contact bounce, power system switching activity or faults, nearby lightning strikes, etc.

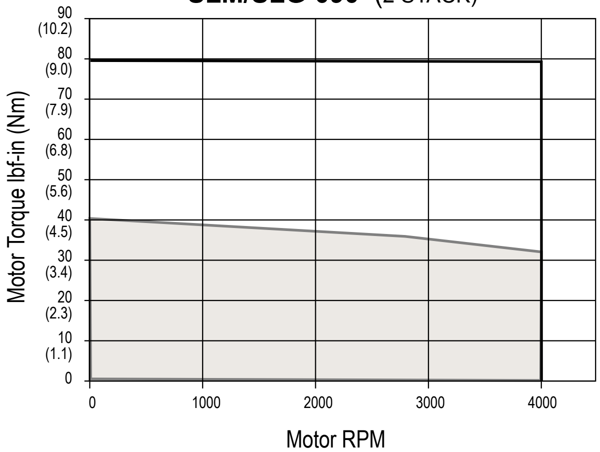
SLM/SLG-090 (1 STACK)



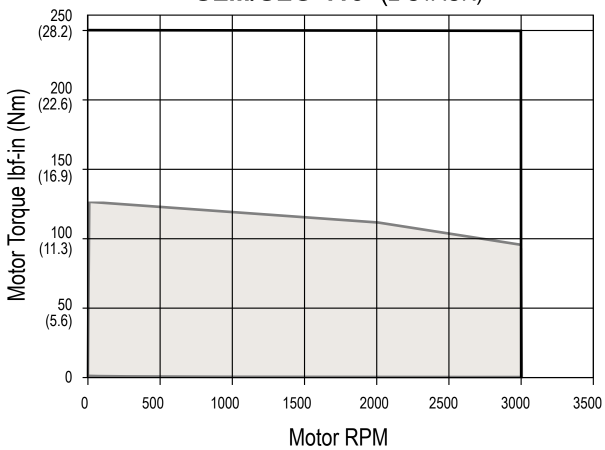
SLM/SLG-115 (1 STACK)



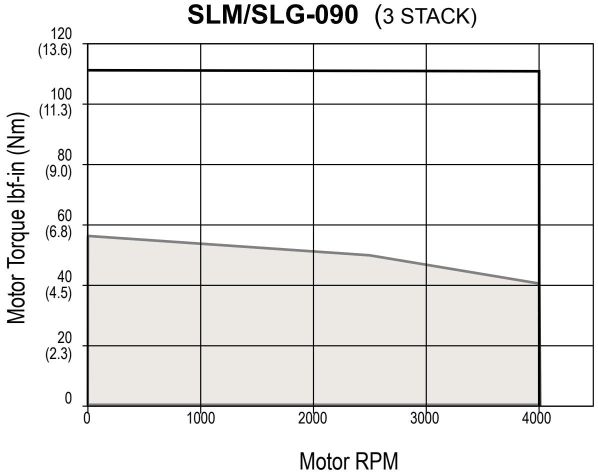
SLM/SLG-090 (2 STACK)



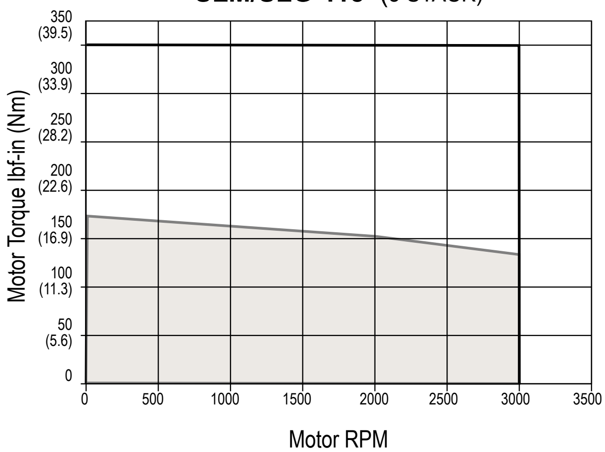
SLM/SLG-115 (2 STACK)



SLM/SLG-090 (3 STACK)



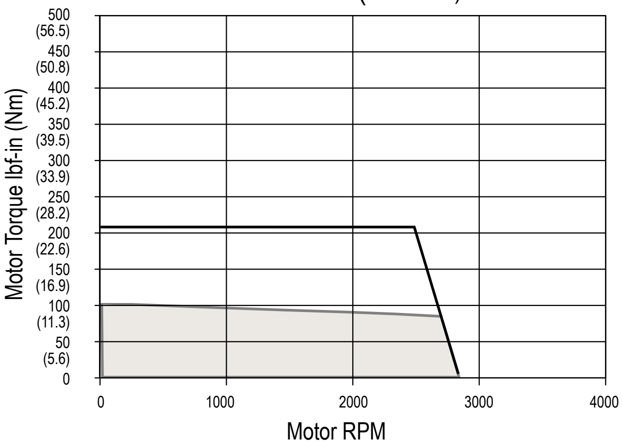
SLM/SLG-115 (3 STACK)



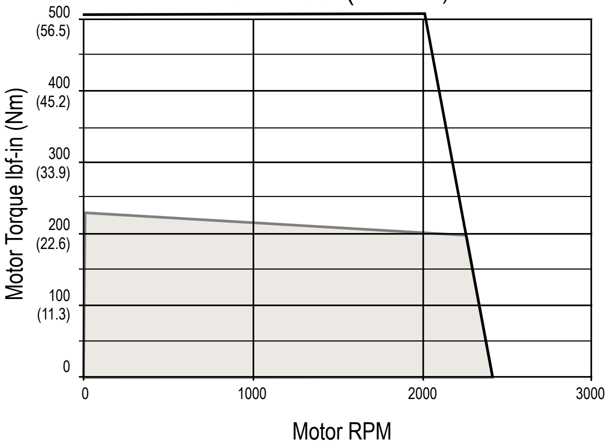
Test data derived using NEMA recommended aluminum heatsink 10" x 10" x 3/8" on SLM/SLG090 and 12" x 12" x 1/2" on SLM/SLG115 at 25°C ambient.
For gearmotors, divide speed by gear ratio; multiply torque by gear ratio and effciency. Efficencies: 1 Stage = 0.91, 2 Stage = 0.86

Peak Torque
Continuous Torque

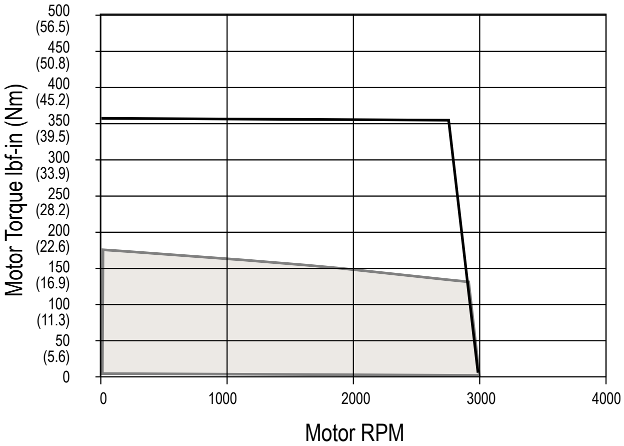
SLM142 (1 STACK)



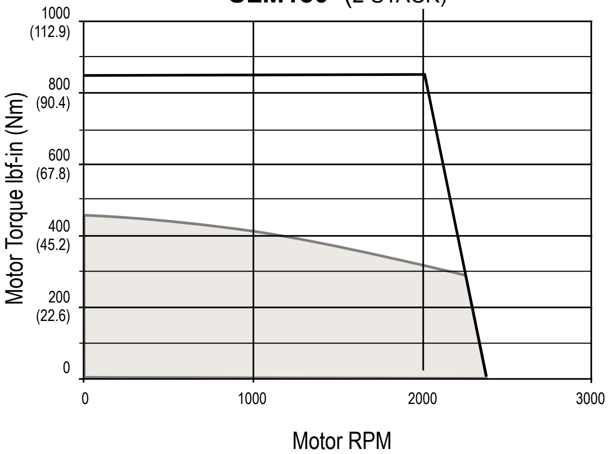
SLM180 (1 STACK)



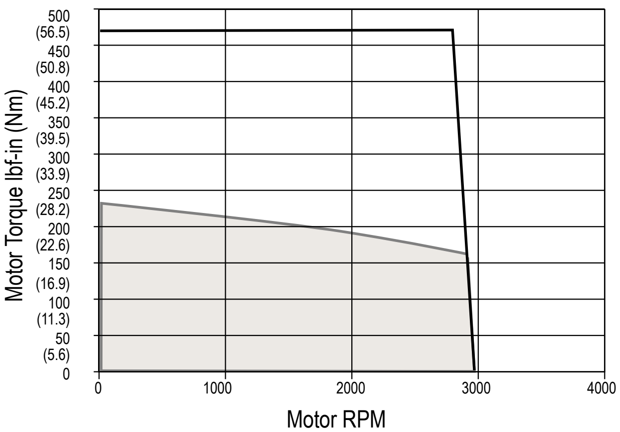
SLM142 (2 STACK)



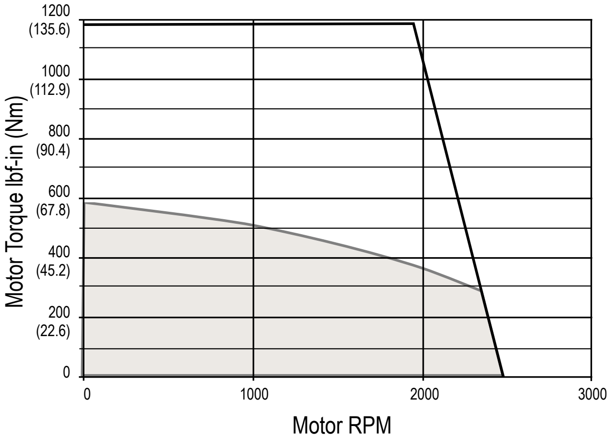
SLM180 (2 STACK)



SLM142 (3 STACK)



SLM180 (3 STACK)



Test data derived using NEMA recommended aluminum heatsink 12" x 12" x 1/2" on SLM142 at 25°C ambient.

For gearmotors, divide speed by gear ratio; multiply torque by gear ratio and efficiency. Efficiencies: 1 Stage = 0.91, 2 Stage = 0.86

Test data derived using NEMA recommended aluminum heatsink 16" x 16" x 1" on SLM180 at 25°C ambient

Peak Torque
Continuous Torque

SLM/G Series

Options

Motor Speed

All Exlar T-LAM motors and actuators carry a standard motor speed designator (see chart). This is representative of the standard base speed of the motor for the selected bus voltage.

If the model number is created and the location for the motor speed designator is left blank, this is the base speed to which the motor will be manufactured. The model number can also be created including this standard speed designator.

Exlar also provides the flexibility to manufacture all of its “T-LAM” products with special base speeds to match the your exact application requirements. This may be a higher than standard speed motor, or lower base speed than standard which will allow your to get the required torque at a speed optimized to your application and use the minimum amount of current from your amplifier.

The call-out for a special speed is configured in the model number by using a two digit code from 01-99. This code represents the number, in hundreds, of RPM that is the base speed for the particular motor.

For example, an SLG090-010-KCGS-AB1-138-40 motor that normally has a 4000 rpm standard winding can be changed to a 3300 rpm winding by changing the -40, to a -33. Similarily, it can be changed to a 5000 rpm winding by changing the -40 to a -50.

Changing this speed designator changes the ratings of the motor, these must be obtained from your local sales representative. Also, it is not possible to produce every possible speed from -01 to -99 for each motor at each voltage, so please contact your local sales representative for confirmation of the speed that is desired for the application.

Designator	Base Speed	Motor Series
-50	5000 rpm	SLM/SLG060
-40	4000 rpm	SLM/SLG075
-40	4000 rpm	SLM/SLG090
-30	3000 rpm	SLM/SLG115
-24	2400 rpm	SLM142, SLM180
01-99	Special Speed, consult your local sales representative	

Motor Stators

SLM/SLG motor options are described with a 3 digit code. The first digit calls out the stack length, the second digit signifies the rated bus voltage, and the third digit identifies the number of poles of the motor. Refer to the mechanical/electrical specifications for motor torque and actuator rated force.

8 Pole, Class 180 H

1 Stack		2 Stack		3 Stack	
118	115 Vrms	218	115 Vrms	318	115 Vrms
138	230 Vrms	238	230 Vrms	338	230 Vrms
158	400 Vrms	258	400 Vrms	358	400 Vrms
168	460 Vrms	268	460 Vrms	368	460 Vrms
1A8*	24 VDC	2A8*	24 VDC	3A8*	24 VDC
1B8*	48 VDC	2B8*	48 VDC	3B8*	48 VDC
1C8*	120 VDC	2C8*	120 VDC	3C8*	120 VDC

Refer to specification pages 95-100 for availability of 115V stators by configuration.

* Low voltage stators may be limited to less than catalog rated torque and/or speed.
Please contact your local sales representative when ordering this option.

Mechanical Options

HW = Manual Drive, Handwheel

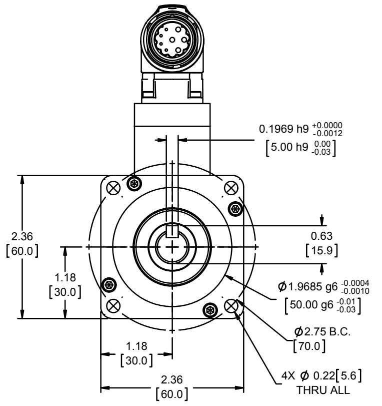
This option provides a manual drive handwheel on the side of the motor. The handwheel has an engage/disengage lever that is tied to an interrupt switch. Not available on SLM/G060. Also not available with holding brake unless application details have been discussed with your local sales representative.

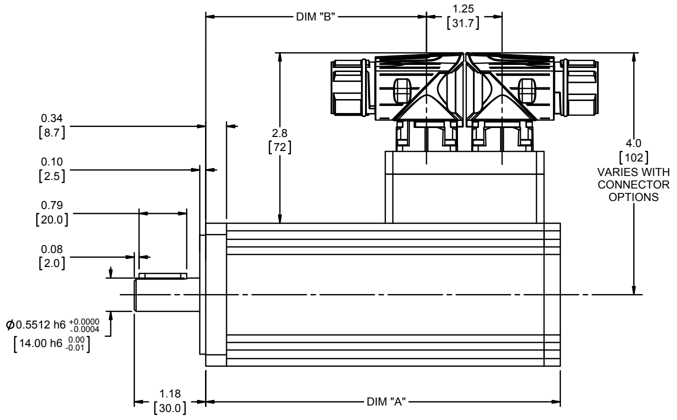
IP Ratings

Please see page 218 for full description of IP Ratings.

Dimensions

SLM060

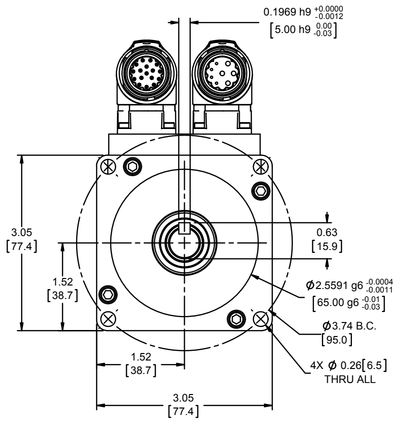


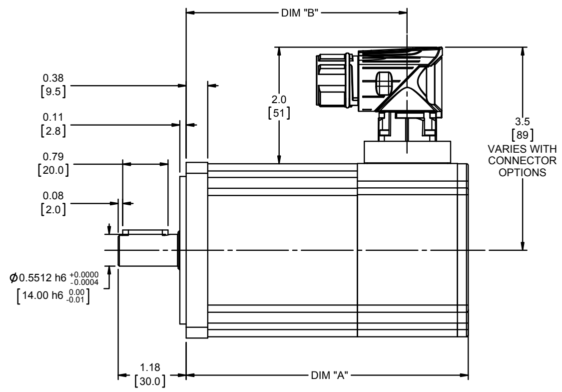


DIM	1 Stack Motor in (mm)	2 Stack Motor in (mm)	3 Stack Motor in (mm)
A	4.61 (117.1)	5.86 (148.9)	7.11 (180.6)
B	2.40 (61.1)	3.65 (92.8)	4.90 (124.6)

Add 1.02 inches (25.9 mm) to Dimensions A and B if ordering a brake.
Face plate edge is not intended for alignment of shaft (use pilot)

SLM075





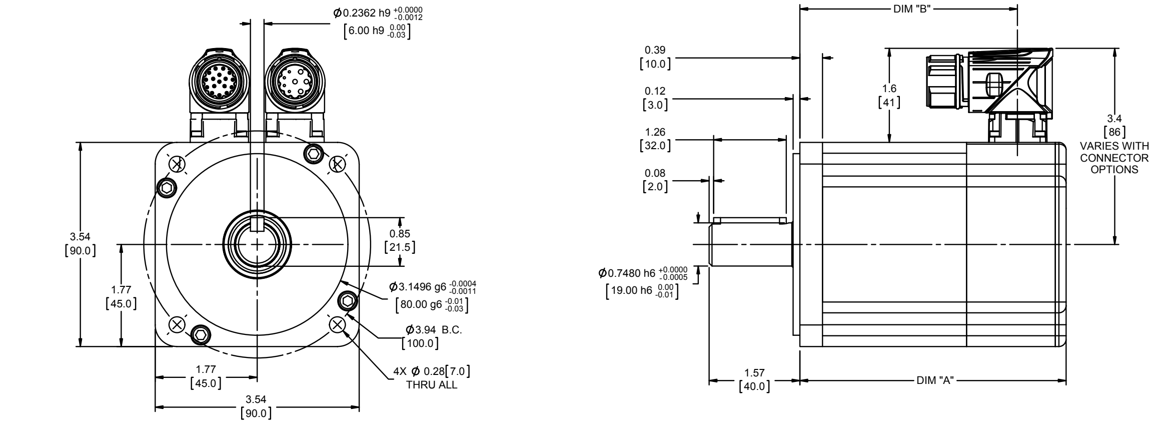
DIM	1 Stack Motor in (mm)	2 Stack Motor in (mm)	3 Stack Motor in (mm)
A	4.90 (124.5)	5.90 (149.9)	6.90 (175.3)
B	3.84 (97.6)	4.84 (123.0)	5.84 (148.4)

Add 1.28 inches (32.5 mm) to Dimensions A and B if ordering a brake.
Face plate edge is not intended for alignment of shaft (use pilot)
Electronics box extends past motor mount face.

Due to the size of many absolute encoders, the selection of such feedback results in a larger package size than is shown in drawings. Consult Exlar for details, or refer to the drawings provided after receipt of order.

Pre-sale drawings and models are representative and are subject to change. Certified drawings and models are available for a fee. Consult your local Exlar representative for details.

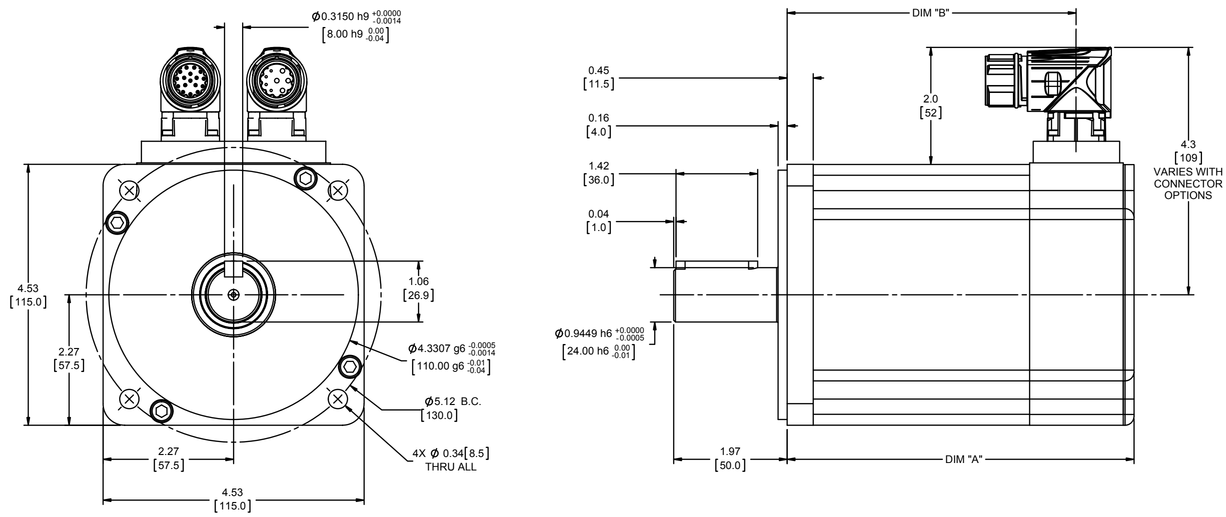
SLM090



DIM	1 Stack Motor in (mm)	2 Stack Motor in (mm)	3 Stack Motor in (mm)
A	4.65 (118.1)	5.65 (143.5)	6.65 (168.9)
B	3.81 (96.8)	4.76 (121.0)	5.81 (147.6)

Add 1.31 inches (33.3 mm) to Dimensions A and B if ordering a brake.
Face plate edge is not intended for alignment of shaft (use pilot)

SLM115

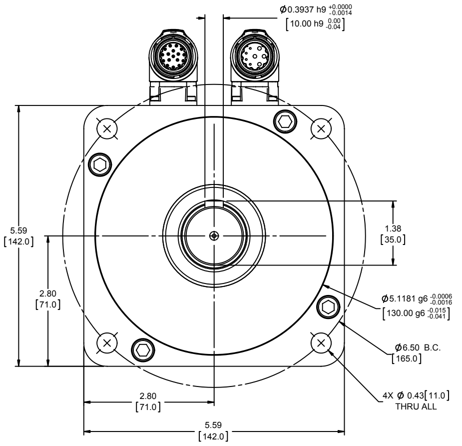


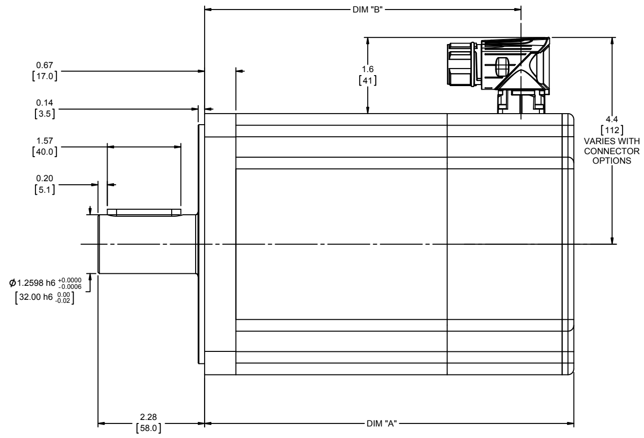
DIM	1 Stack Motor in (mm)	2 Stack Motor in (mm)	3 Stack Motor in (mm)
A	6.02 (152.9)	8.02 (203.7)	10.02 (254.5)
B	5.02 (127.5)	7.02 (178.3)	9.02 (229.1)

Add 1.73 inches (43.9 mm) to Dimensions A and B if ordering a brake.
Face plate edge is not intended for alignment of shaft (use pilot)

Due to the size of many absolute encoders, the selection of such feedback results in a larger package size than is shown in drawings. Consult Exlar for details, or refer to the drawings provided after receipt of order.

SLM142

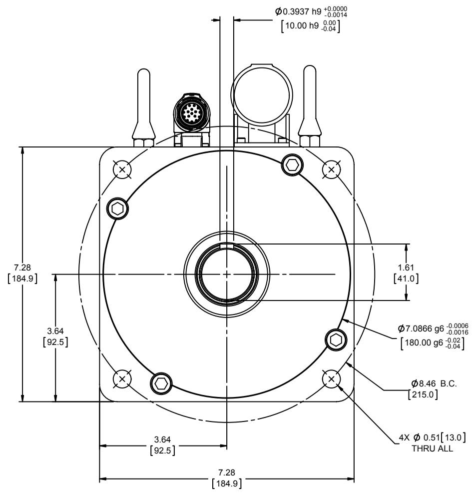


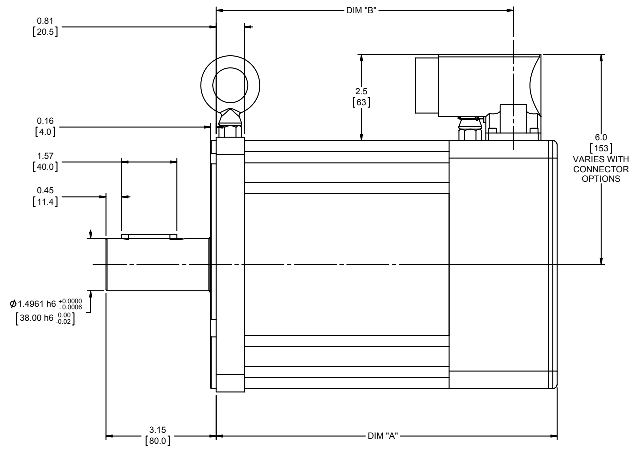


DIM	1 Stack Motor in (mm)	2 Stack Motor in (mm)	3 Stack Motor in (mm)
A	7.87 (199.9)	9.62 (244.3)	11.37 (288.8)
B	6.75 (171.3)	5.50 (139.6)	10.25 (260.2)

Add 1.66 inches (42.2 mm) to Dimensions A and B if ordering a brake.
Face plate edge is not intended for alignment of shaft (use pilot)

SLM180





DIM	1 Stack Motor in (mm)	2 Stack Motor in (mm)	3 Stack Motor in (mm)
A	9.74 (247.4)	12.24 (310.9)	14.74 (374.4)
B	8.49 (215.6)	10.99 (279.1)	13.49 (342.6)

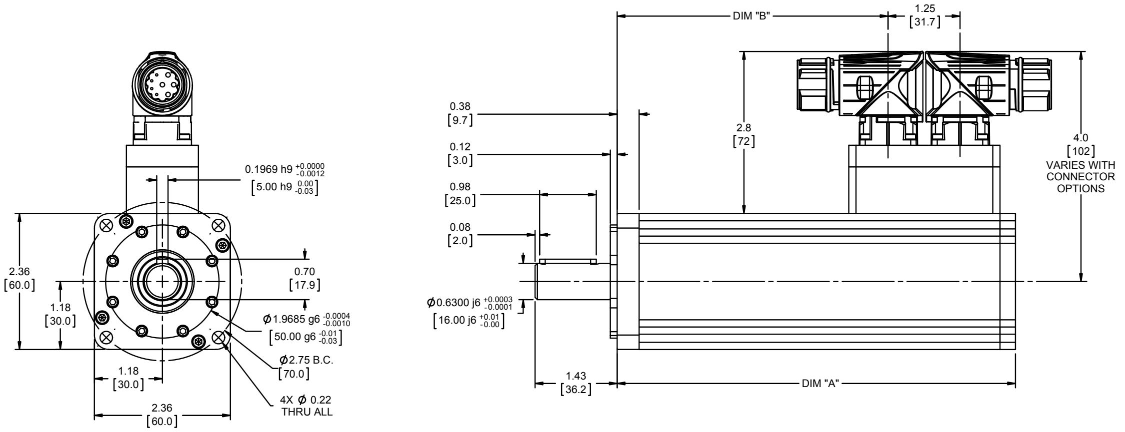
Add 1.90 inches (48.3 mm) to Dimensions A and B if ordering a brake.
Face plate edge is not intended for alignment of shaft (use pilot)

SLM/G Series

Due to the size of many absolute encoders, the selection of such feedback results in a larger package size than is shown in drawings. Consult Exlar for details, or refer to the drawings provided after receipt of order.

Pre-sale drawings and models are representative and are subject to change. Certified drawings and models are available for a fee. Consult your local Exlar representative for details.

SLG060

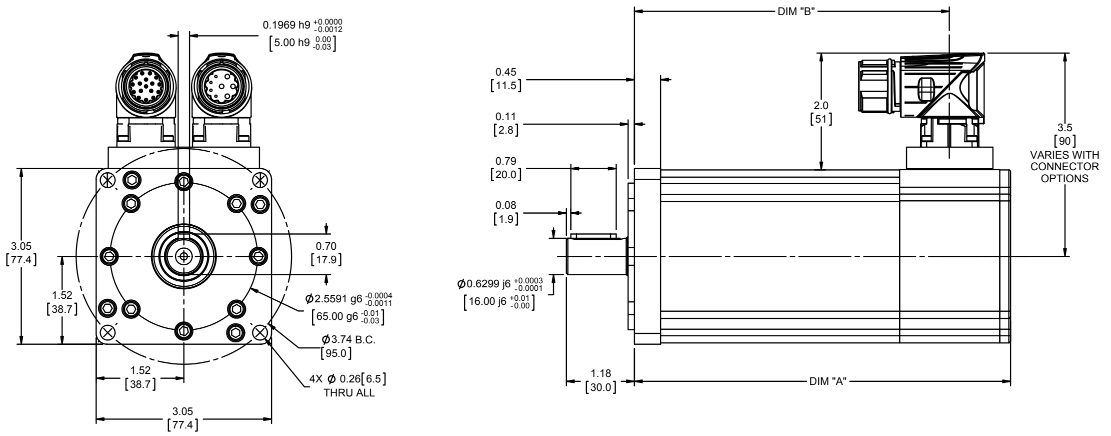


1 Stage Gearhead			
DIM	**1 Stack Motor in (mm)**	**2 Stack Motor in (mm)**	**3 Stack Motor in (mm)**
A	6.92 (175.6)	8.17 (207.4)	9.42 (239.1)
B	4.71 (119.6)	5.96 (151.4)	7.21 (183.1)

2 Stage Gearhead			
DIM	**1 Stack Motor in (mm)**	**2 Stack Motor in (mm)**	**3 Stack Motor in (mm)**
A	7.96 (202.2)	9.21 (233.9)	10.46 (265.7)
B	5.75 (146.2)	7.00 (177.9)	8.25 (209.7)

Add 1.02 inches (25.9 mm) to Dimensions A and B if ordering a brake.
Face plate edge is not intended for alignment of shaft (use pilot)

SLG075



1 Stage Gearhead			
DIM	**1 Stack Motor in (mm)**	**2 Stack Motor in (mm)**	**3 Stack Motor in (mm)**
A	6.53 (165.9)	7.53 (191.3)	8.53 (216.7)
B	5.47 (139.0)	6.47 (164.4)	7.47 (189.8)

Add 1.23 inches (31.2 mm) to Dimensions A and B if ordering a brake.
Face plate edge is not intended for alignment of shaft (use pilot)

Due to the size of many absolute encoders, the selection of such feedback results in a larger package size than is shown in drawings. Consult Exlar for details, or refer to the drawings provided after receipt of order.

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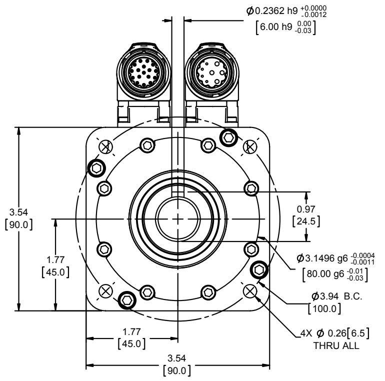
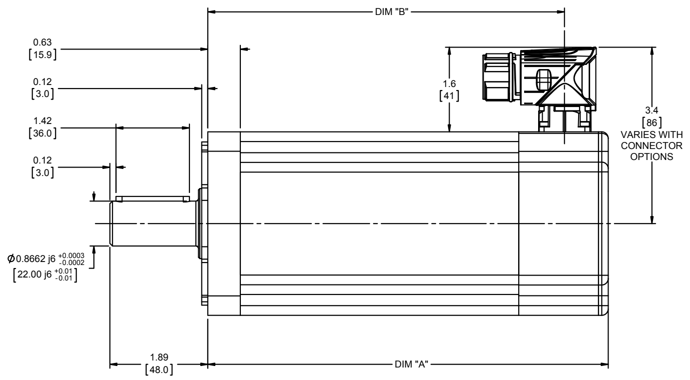
SLG090



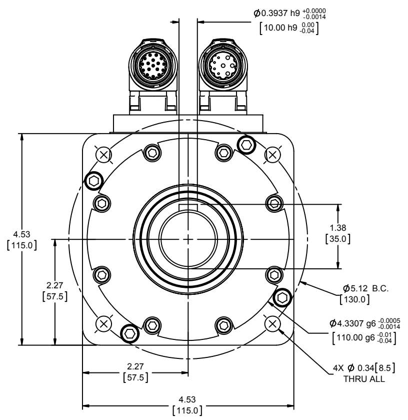


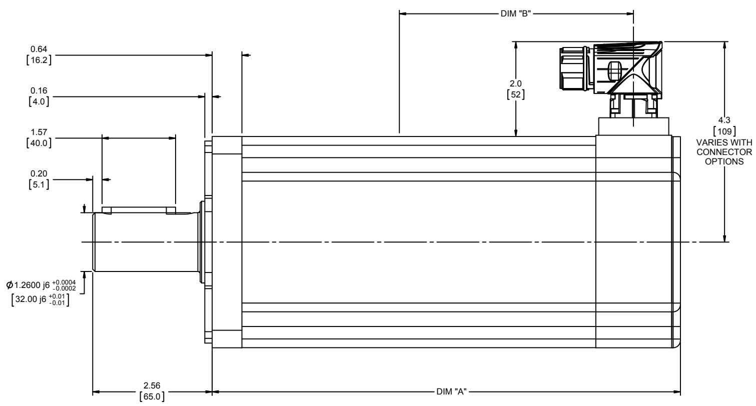
1 Stage Gearhead			
DIM	**1 Stack Motor in (mm)**	**2 Stack Motor in (mm)**	**3 Stack Motor in (mm)**
A	7.76 (197.1)	8.76 (222.5)	9.76 (247.9)
B	6.92 (175.8)	7.92 (201.2)	8.92 (226.6)

2 Stage Gearhead			
DIM	**1 Stack Motor in (mm)**	**2 Stack Motor in (mm)**	**3 Stack Motor in (mm)**
A	9.03 (229.2)	10.03 (254.6)	11.03 (280.0)
B	8.19 (207.9)	9.19 (233.3)	10.19 (258.7)

Add 1.31 inches (33.3 mm) to Dimensions A and B if ordering a brake.
Face plate edge is not intended for alignment of shaft (use pilot)

SLG115





1 Stage Gearhead			
DIM	**1 Stack Motor in (mm)**	**2 Stack Motor in (mm)**	**3 Stack Motor in (mm)**
A	10.03 (254.8)	12.03 (305.6)	14.03 (256.4)
B	9.03 (255.0)	11.03 (280.2)	13.03 (331.0)

2 Stage Gearhead			
DIM	**1 Stack Motor in (mm)**	**2 Stack Motor in (mm)**	**3 Stack Motor in (mm)**
A	11.64 (295.7)	13.64 (346.5)	15.64 (397.3)
B	10.64 (270.3)	12.64 (321.1)	14.64 (372.1)

Add 1.73 inches (43.9 mm) to Dimensions A and B if ordering a brake.
Face plate edge is not intended for alignment of shaft (use pilot)

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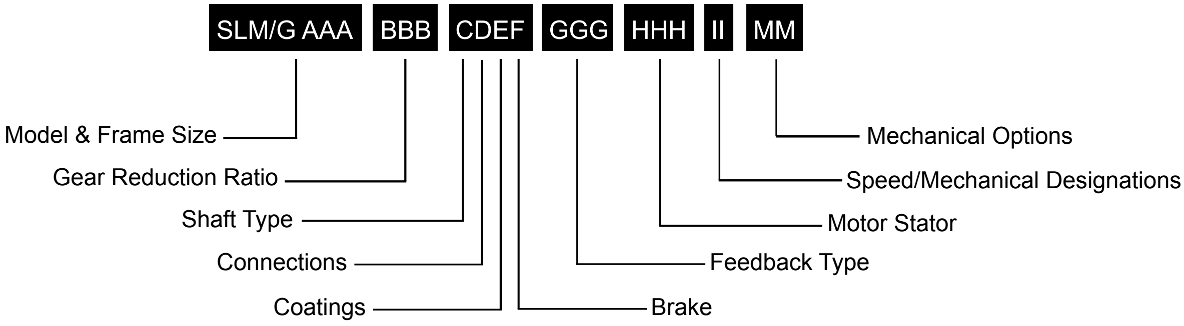
SLM/G Series



SLM/G = Model Series
SLG = SLG Series Servo Gear Motor
SLM = SLM Series Servo Motor
(No Gear Reduction)

AAA = Frame Size
060 = 60 mm
075 = 75 mm
090 = 90 mm
115 = 115 mm
142 = 142 mm, (SLM only)
180 = 180 mm, (SLM only)

BBB = Gear Reduction Ratio
Blank = SLM
Single reduction ratio
004 = 4:1
005 = 5:1
010 = 10:1
Double reduction ratio (N/A on 075 mm)
016 = 16:1
020 = 20:1
025 = 25:1
040 = 40:1
050 = 50:1
100 = 100:1

C = Shaft Type
K = Keyed
R = Smooth/round

D = Connections
I = Exlar standard M23 style
M = Manufacturer's connector [2]
J = Embedded leads with "I" plug 3 ft. standard

E = Coating Options
G = Anodized Aluminum (standard)
F = Smooth white epoxy [1]

F = Brake Options
B = Brake
S = Standard no brake

GGG = Feedback Type
See page 207 for detailed information.

(HHH = Motor Stator – All 8 Pole [3]

118 = 1 stack	115 Vrms	158 = 1 stack	400 Vrms
218 = 2 stack		258 = 2 stack	
318 = 3 stack		358 = 3 stack	
138 = 1 stack	230 Vrms	168 = 1 stack	460 Vrms
238 = 2 stack		268 = 2 stack	
338 = 3 stack		368 = 3 stack	

II = Optional Speed and Mechanical Designations
24 = 2400 rpm, SLM142 & 180
30 = 3000 rpm, SLM/G115
40 = 4000 rpm, SLM075, SLM/G090
50 = 5000 rpm, SLM/G060

MM = Mechanical Options [5]
HW = Manual drive, handwheel with Interlock switch [4]

NOTES:
1. These housing options would typically be accompanied by the choice of the electroless nickel connectors if a connectorized unit were selected. Please inquire with your local sales representative.
2. Available as described in Feedback Types.
3. See page 170 for explanation of voltage, speed, stack and optimized stator options.
4. Not available on SLM/G060
5. For extended temperature operation consult factory for model number.

For options or specials not listed above or for extended temperature operation, please contact Exlar

EL/ER SERIES

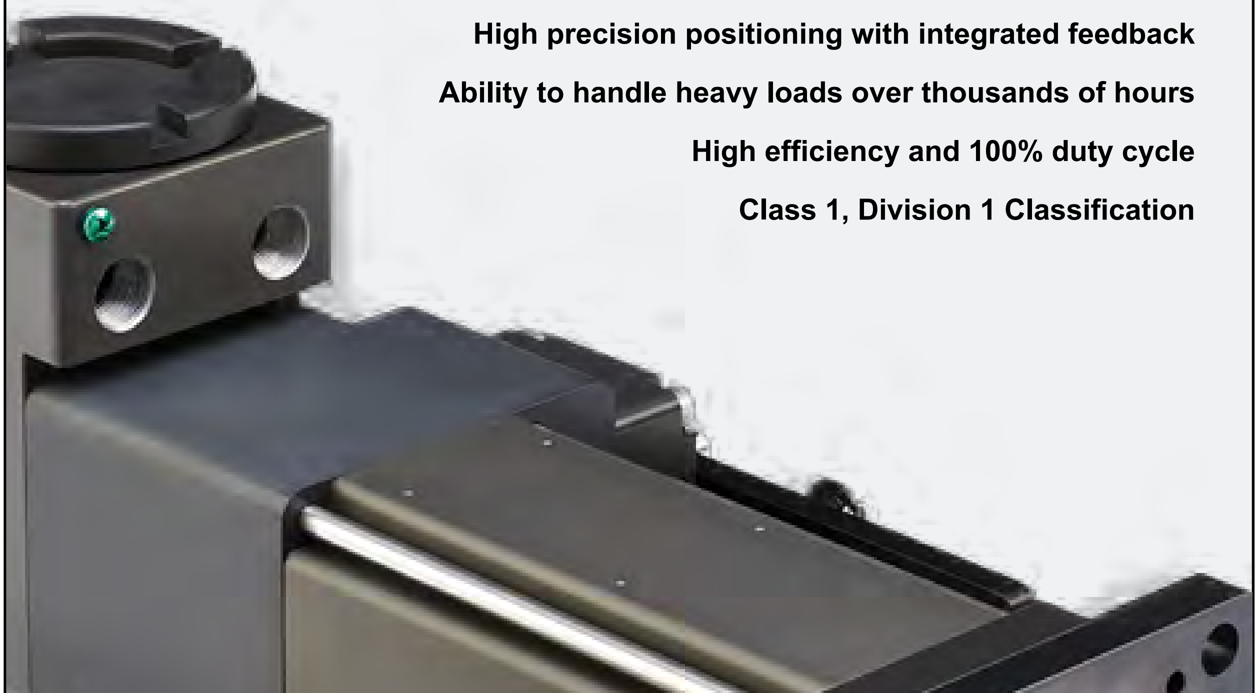
HAZARDOUS LOCATION ACTUATORS AND MOTORS

High precision positioning with integrated feedback

Ability to handle heavy loads over thousands of hours

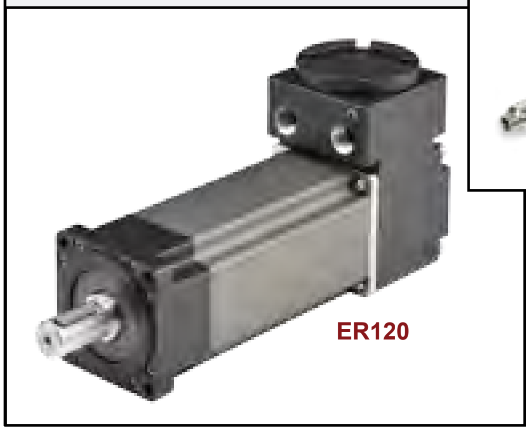
High efficiency and 100% duty cycle

Class 1, Division 1 Classification



EL120

EL100



ER120

Return to table of contents

EL120

ATEX Rated Explosion-Proof Linear Actuators

Perfect for valve control or other hazardous environment applications, the EL120 is a high performance electric actuator offered as a direct replacement for hydraulics. EL120 actuators feature longer life, linear speeds up to 37 inches per second, closed loop feedback, 90% efficiency and 100% duty cycle.

For gas turbines with variable guide vanes, EL120 actuators provide precise positioning and feedback for fine tuning injector airflow to effectively manage CO and NOx emissions. In Oil & Gas applications, the EL120 is well suited for position-based drilling choke valves.

0518

II 2G
Ex d IIB+H2 T4 Gb
SIRA 15ATEX1010X

C US
163694
Class I Division 1
Groups B, C, D, T4

Features
Forces up to 4000 lbs
Speeds up to 37.5 ips
Strokes up to 18 inches
8 pole brushless motors
Feedback configurations for nearly any servo amplifier
Several mounting configurations
Windings available from 24 VDC to 460 Vrms
CSA Class I, Div 1 Group B, C, D, and T4 hazardous environment rating
ATEX, Ex d II B +H2 T4 Gb IP66S, Type 4
IECEx CSA 14.0014
Completely sealed motor assures trouble-free operation

EL120 explosion-proof actuators meet ATEX requirements for use in potentially explosive atmospheres and are in conformity with the EU ATEX Directive 94/9/EC. Additionally, these actuators are rated for Class 1, Division 1, Groups B, C, D, and T4 hazardous environments.

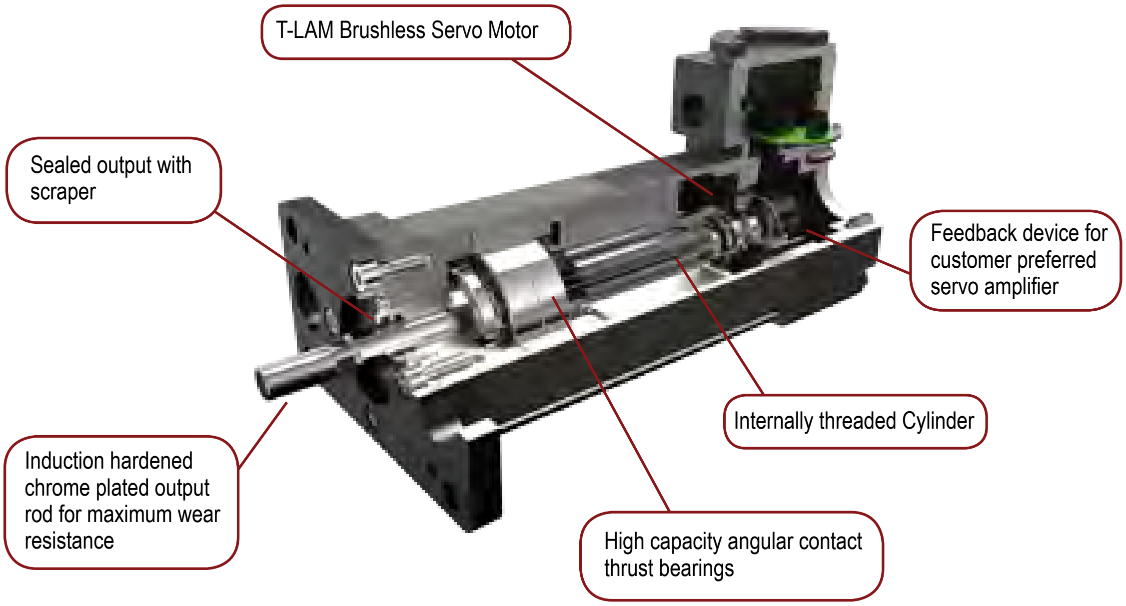
The EL Series integrates a highly efficient planetary roller screw mechanism with a high torque servomotor in a single self-contained package. This highly robust design is engineered to provide reliable and precise operation over thousands of hours, handling heavy loads—even under very arduous conditions.

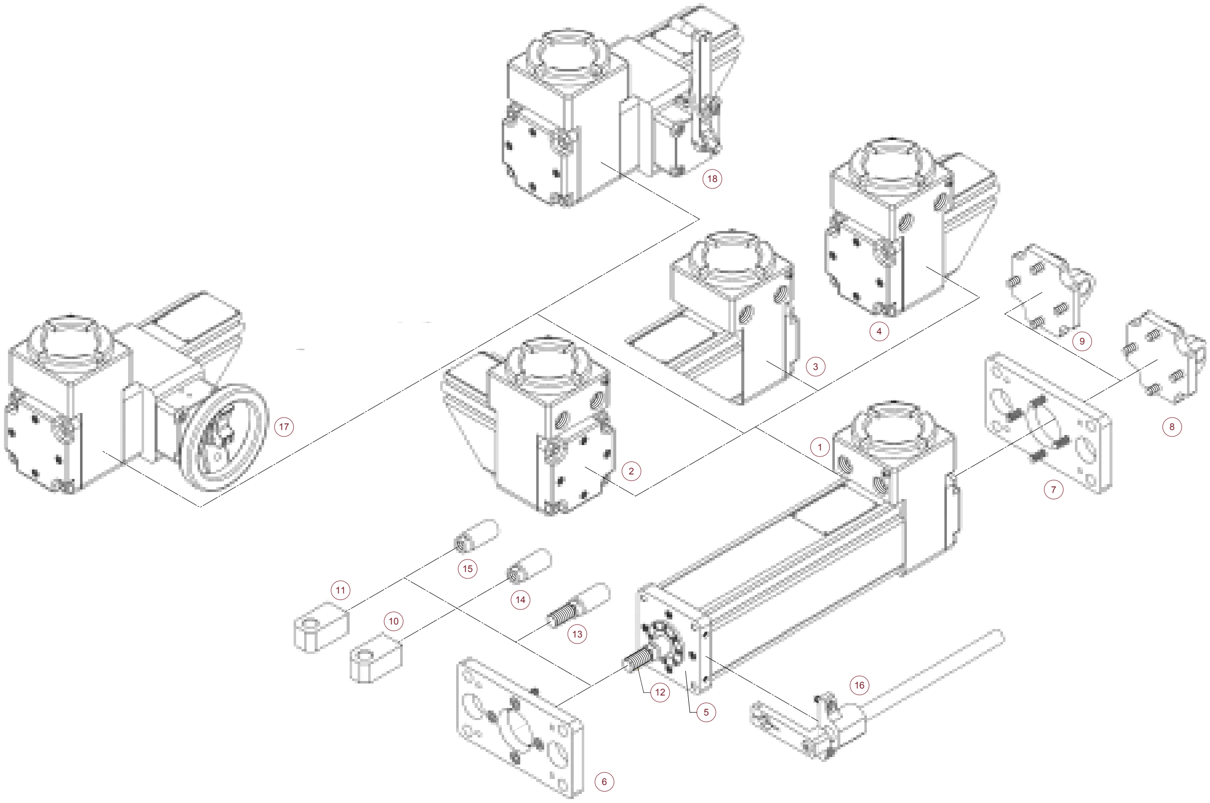
The EL120 Actuator is compatible with nearly any manufacturer's servo amplifier.

Technical Characteristics	
Frame Sizes in (mm)	4.7 (120)
Screw Leads in (mm)	0.1 (2.54), 0.2 (5.08), 0.5 (12.7), 0.8 (20.3)
Standard Stroke Lengths in (mm)	4 (100), 6 (150), 8 (200), 10 (250), 12 (300), 18 (450)
Force Range	up to 4081 lbf-in (18 kN)
Maximum Speed	up to 37.5 in/sec (953 mm/s)

Operating Conditions and Usage		
Accuracy:		
Screw Lead Error	in/ft	0.001 (0.025)
Screw Lead Variations	in (mm)	0.0012 (0.030)
Screw Lead Backlash	in (mm)	0.004 maximum
Ambient Conditions:		
Ambient Temperature	°C	-29 to 93
Storage Temperature	°C	-54 to 93
IP Rating		IP66S
Rel. Humidity	%	5 to 100 at 60° C
Vibration		3.5 grms, 5 to 520 hz

Product Features





1- Two 0.75 in NPT Ports, Front Facing (as viewed from rod end) 2 - Two 0.75 in NPT Ports, Back Facing (as viewed from rod end)
3 - Two 0.75 in NPT Ports, Right Facing (as viewed from rod end) 4 - Two 0.75 in NPT Ports, Left Facing (as viewed from rod end)
5 - Threaded Front & Rear Face, Metric and Threaded Front & Rear Face, English 6 - Standard Front Flange 7 - Standard Rear Flange 8 - Metric Rear Clevis
9 - English Rear Clevis 10 - Metric Rear Eye 11 - English Rear Eye 12 - Male, US Standard Thread 13 - Male, Metric Thread 14 - Female, US Standard Thread
15 - Female, Metric Thread 16 - External anti-rotate assembly 17 - Handwheel Drive - Standard 18 - Crank Drive

EL120

Industries and Applications

Process Control

- Valve control
- Damper control
- Turbine control
- Choke valves
- Fuel control
- Plunger pumps

Automotive

- Paint booths
- Fuel control
- Engine test stands

Defense

- Weapons room

Material Handling

- Printing presses

The EL Series of explosion proof actuators is ideal for valve control, as well as many other applications in hazardous environments. These all-electric actuators easily outperform hydraulics and other competing technologies offering long life, high speeds, closed loop feedback, 90% efficiency and 100% duty cycle.

Notes

Mechanical Specifications

Motor Stacks		1 Stack				2 Stack				3 Stack		
Screw Lead Designator		**01**	**02**	**05**	**08**	**01**	**02**	**05**	**08**	**02**	**05**	**08**
Screw Lead	in	0.1	0.2	0.5	0.75	0.1	0.2	0.5	0.75	0.1	0.2	0.5
	mm	2.54	5.08	12.7	19.05	2.54	5.08	12.7	19.05	2.54	5.08	12.7
Continuous Force** *(Motor Limited)*	lbf	2,984	1,748	839	559	NA	2,865	1,375	917	4,081	1,959	1,306
	N	13,272	7,776	3,733	2,488	NA	12,744	6,117	4,078	18,152	8,713	5,809
Max Velocity	in/sec	5	10	25	37.5	5	10	25	37.5	5	10	25
	mm/sec	127	254	635	953	127	254	635	953	127	254	635
Friction Torque	in-lbf	2.7				3.0				3.5		
	N-m	0.31				0.34				0.40		
Friction Torque *(preloaded screw)*	in-lbf	7.2				7.5				8.0		
	N-m	0.82				0.85				0.91		
Back Drive Force [1]	lbf	380	150	60	50	380	150	60	50	150	60	50
	N	1700	670	270	220	1700	670	270	220	670	270	220
Min Stroke	in	4				NA	6			8		
	mm	100				NA	150			200		
Max Stroke	in	18			12	NA	18		12	18		12
	mm	450			300	NA	450		300	450		300
C_a (Dynamic Load Rating)	lbf	7900	8300	7030	6335	7900	8300	7030	6335	7900	8300	7030
	N	35,141	36,920	31,271	28,179	35,141	36,920	31,271	28,179	35,141	36,920	31,271
Inertia *(zero stroke)*	lb-in-s²	0.01132				0.01232				0.01332		
	Kg-m²	0.000012790				0.00001392				0.00001505		
Inertia *(per unit of stroke)*	lb-in-s²/in	0.0005640										
	Kg-m²/mm	0.0000006372										
Weight *(zero stroke)*	lb	8.0				11.3				14.6		
	Kg	3.63				5.13				6.62		
Weight Adder *(per unit of stroke)*	lb/in	2.0										
	Kg/mm	0.91										

* Please note that stroke mm are Nominal dimensions.
** Force ratings at 25°C.
*** Inertia +/-5%
[1] Back drive force is a nominal value only. Operating conditions can cause wide variations in back drive force. Exlar cannot assure that an actuator will or will not back drive.

DEFINITIONS:

Continuous Force: The linear force produced by the actuator at continuous motor torque.

Max Velocity: The linear velocity that the actuator will achieve at rated motor rpm.

Friction Torque (standard screw): Amount of torque required to move the actuator when not coupled to a load.

Friction Torque (preloaded screw): Amount of torque required to move the actuator when not coupled to a load.

Back Drive Force: Amount of axial force applied to the rod end of the actuator that will produce motion with no power applied to the actuator.

Min Stroke: Shortest available stroke length.

Max Stroke: Longest available stroke length.

C_a (Dynamic Load Rating): A design constant used when calculating the estimated travel life of the roller screw.

Inertia (zero stroke): Base inertia of an actuator with zero available stroke length.

Inertia Adder (per unit of stroke): Inertia per unit of stroke that must be added to the base (zero stroke) inertia to determine the total actuator inertia.

Weight (zero stroke): Base weight of an actuator with zero available stroke length.

Weight Adder (per unit of stroke): Weight adder per unit of stroke that must be added to the base (zero stroke) weight to determine the total actuator weight.

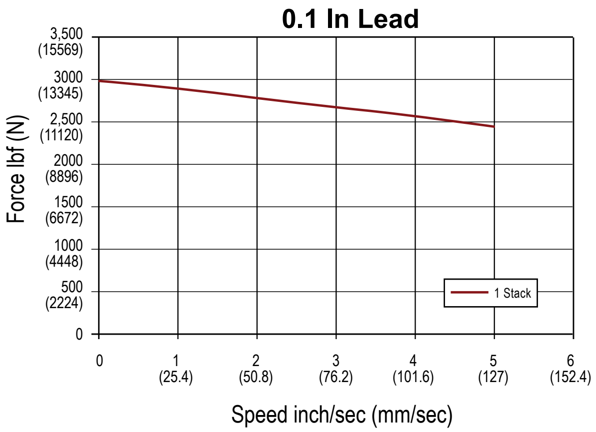
Electrical Specifications

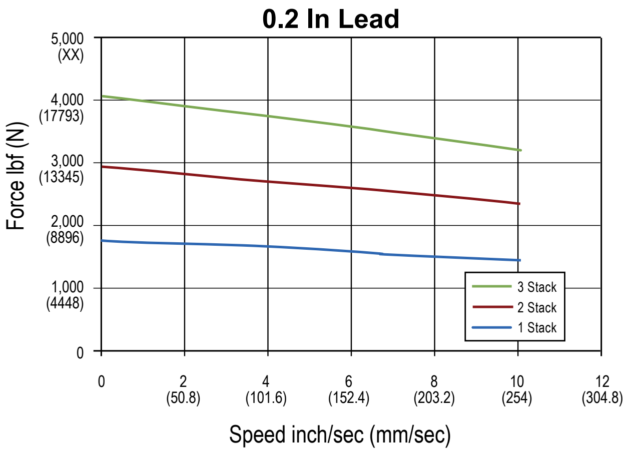
Motor Stator		118	138	158	168	238	258	268	338	358	368
RMS SINUSOIDAL COMMUTATION DATA											
Continuous Motor Torque	lbf-in	74.1	74.1	74.3	74.1	123.6	121.4	123.6	172.3	168.9	176.9
	N-m	8.37	8.37	8.39	8.37	13.96	13.72	13.96	19.46	19.09	19.98
Peak Motor Torque	lbf-in	148.20	148.20	148.60	148.10	247.20	242.80	247.20	344.50	337.80	353.70
	N-m	16.74	16.74	16.79	16.74	27.93	27.43	27.93	38.93	38.17	39.96
Torque Constant (Kt)	lbf-in	4.30	8.70	15.70	17.30	8.70	15.80	17.30	8.50	15.80	17.50
	N-m/A	0.49	1.00	1.80	2.00	1.00	1.80	2.00	1.00	1.80	2.00
Continuous Current Rating	A	19.10	9.50	5.30	4.80	15.90	8.60	8.00	22.70	11.90	11.30
Peak Current Rating	A	38.20	19.10	10.60	9.50	31.80	17.10	15.90	45.40	23.80	22.50
O-PEAK SINUSOIDAL COMMUTATION											
Continuous Motor Torque	lbf-in	74.1	74.1	74.3	74.1	123.6	121.4	123.6	172.3	168.9	176.9
	N-m	8.37	8.37	8.39	8.37	13.96	13.72	13.96	19.46	19.09	19.98
Peak Motor Torque	lbf-in	148.20	148.20	148.60	148.10	247.20	242.80	247.20	344.50	337.80	353.70
	N-m	16.74	16.74	16.79	16.74	27.93	27.43	27.93	38.93	38.17	39.96
Torque Constant (Kt)	lbf-in/A	3.10	6.10	11.10	12.30	6.10	11.20	12.30	6.00	11.20	12.40
	N-m/A	0.35	0.70	1.30	1.40	0.70	1.30	1.40	0.70	1.30	1.40
Continuous Current Rating	A	27.00	13.50	7.50	6.70	22.50	12.10	11.30	32.10	16.90	15.90
Peak Current Rating	A	54.00	27.00	15.00	13.50	45.00	24.20	22.50	64.20	33.70	31.90
MOTOR DATA											
Voltage Constant @ 25°C (Ke)	Vrms	29.6	59.2	106.9	118.5	59.2	108.2	118.5	58.0	108.2	119.8
	Krpm	41.9	83.8	151.2	167.6	83.8	153.0	167.6	82.0	153.0	169.4
Pole Configuration		8	8	8	8	8	8	8	8	8	8
Resistance (L-L)	Ohms	0.20	0.80	2.60	3.21	0.34	1.17	1.35	0.20	0.72	0.81
Inductance (L-L)	mH	3.30	11.90	42.40	48.30	5.90	21.10	25.30	3.70	11.60	17.10
Brake Inertia	lbf-in-sec^2	0.00146									
	kg-cm^2	1.66									
Brake Current @24 VDC +/- 10%	A	1.0									
Brake Holding Torque - Dry	lbf-in	177									
	Nm/A	20									
Brake Engage/Disengage Time	ms	13/50									
Mechanical Time Constant (tm)	ms	0.79	0.79	0.79	0.79	0.60	0.63	0.60	0.54	0.56	0.51
Electrical Time Constant (te)	ms	16.26	14.88	16.34	15.06	17.60	18.06	18.72	18.51	16.06	21.16
Friction Torque	lbf-in	1.43	1.43	1.43	1.43	1.81	1.81	1.81	2.32	2.32	2.32
	N-m	0.16	0.16	0.16	0.16	0.20	0.20	0.20	0.26	0.26	0.26
Bus Voltage	Vrms	115	230	400	460	230	400	460	230	400	460
Speed @ Bus Voltage	rpm	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000
Insulation Class		180(H)									
Ambient Temperature Rating		-29°C to 93°C									
Insulation System Voltage Rating		T4, 135°C Maximum Allowable Surface Temperature									

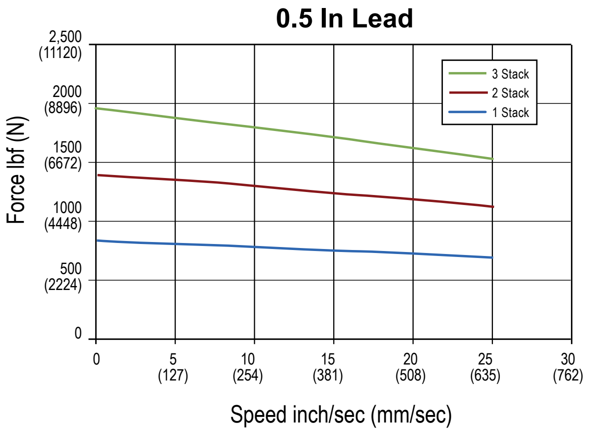
Test data derived using NEMA recommended aluminum heatsink 12" x 12" x 1/2" at 25°C ambient.

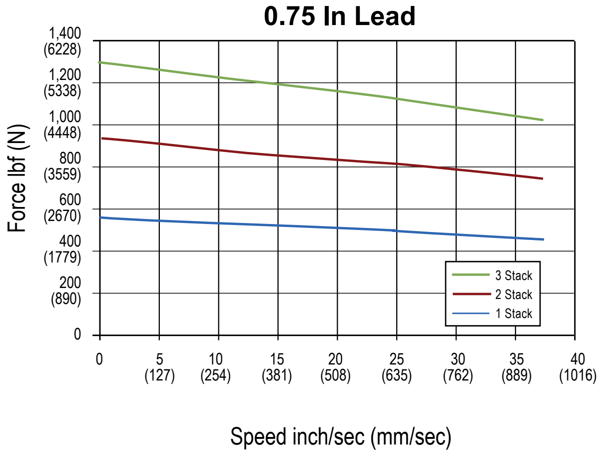
Speed vs. Force Curves

The speed vs. force curves (below) represent approximate continuous thrust ratings at the indicated linear speed. Different types of servo amplifiers offer varying motor torque and, thus, varying actuator thrust. These values are at constant velocity and do not account for motor torque required for acceleration.









Estimated Service Life

The L_{10} expected life of a roller screw linear actuator is expressed as the linear travel distance that 90% of properly maintained roller screws are expected to meet or exceed. For higher than 90% reliability, multiply the result by the following factors: 95% x 0.62; 96% x 0.53; 97% x 0.44; 98% x 0.33; 99% x 0.21. This is not a guarantee; these charts should be used for estimation purposes only.

The underlying formula that defines this value is:

Travel life in millions of inches, where:

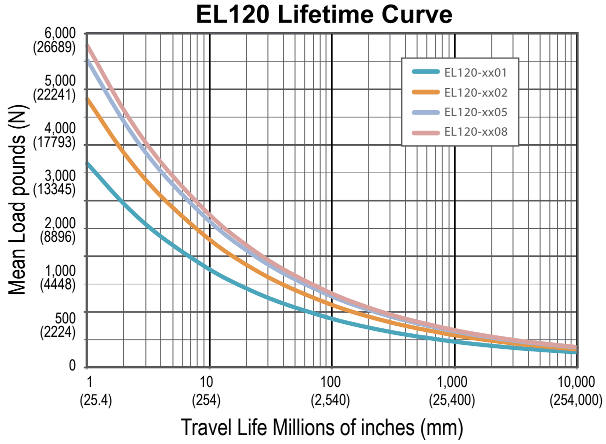
C_a = Dynamic load rating (lbf)

F_{cml} = Cubic mean applied load (lbf)

ℓ = Roller screws lead (inches)

$$L_{10} = \left(\frac{C_a}{F_{cml}}\right)^3 \times \ell$$

All curves represent properly lubricated and maintained actuators. Ratings may vary, depending on the application.

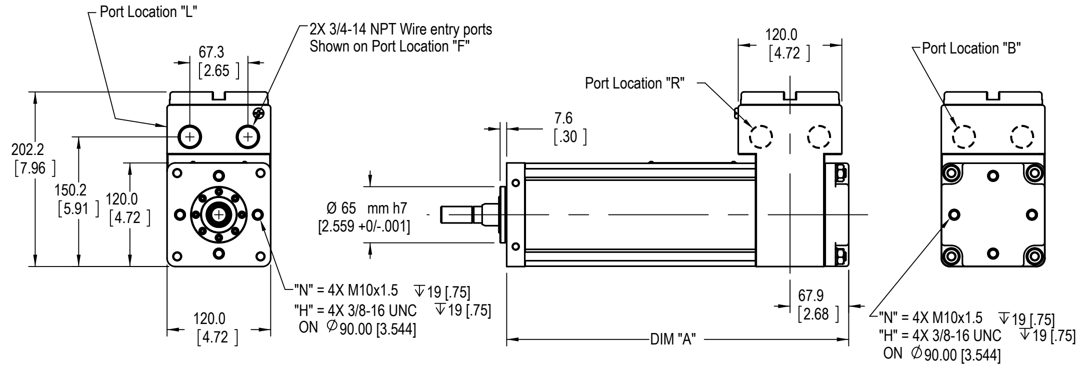


EL120

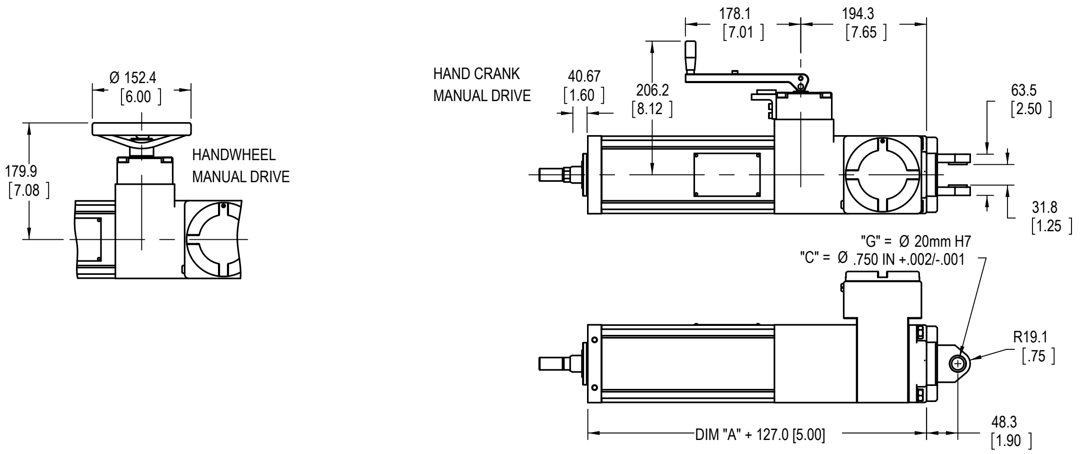
Dimensions

Base Actuator

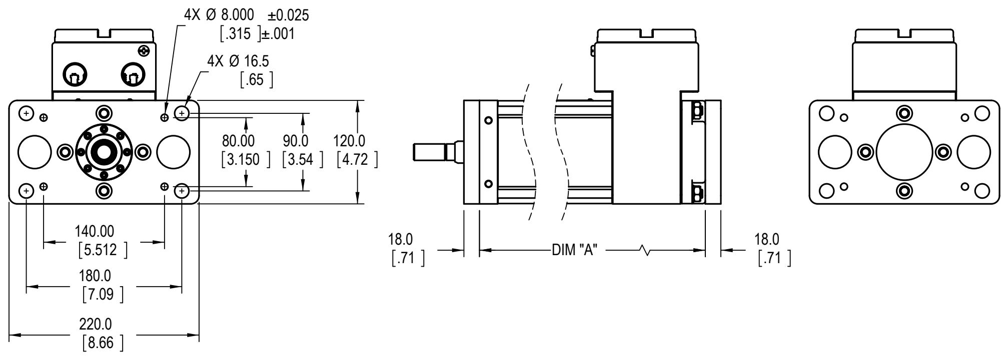
All dimensions shown in mm (inches)



Clevis Mount and Manual Drive Options



Front and Rear Flange Mount

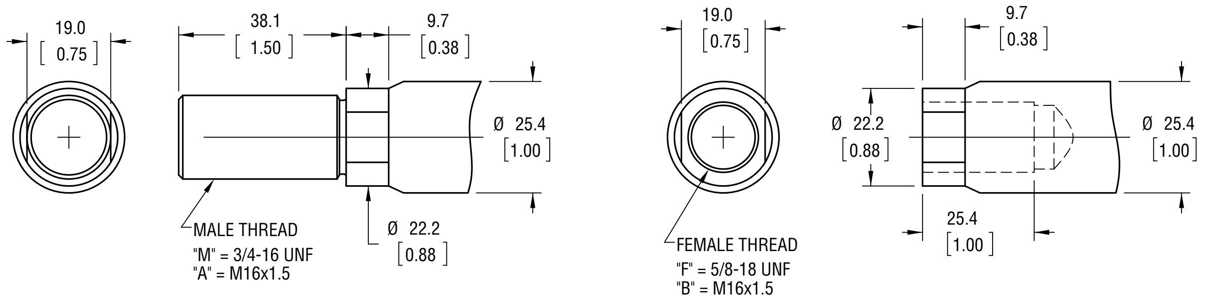


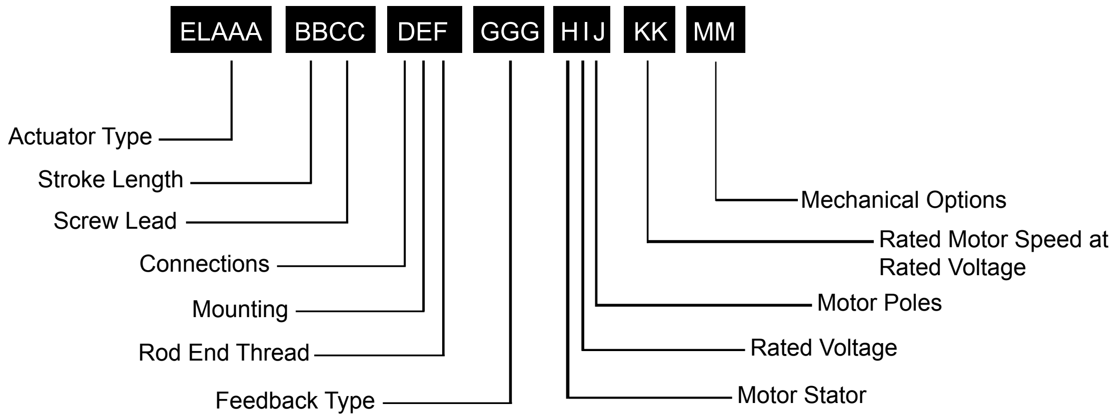
Dim	4" (102 mm) Stroke in (mm)	6" (152 mm) Stroke in (mm)	8" (203 mm) Stroke in (mm)	10" (254 mm) Stroke in (mm)	12" (305 mm) Stroke in (mm)	18" (457 mm) Stroke in (mm)
A	345 (13.6)	396 (15.6)	447 (17.6)	498 (19.6)	549 (21.6)	701 (27.6)

Note: Add 1.63 Inches (41.4 mm) to Dims “A” if ordering a brake without a manual drive.

Pre-sale drawings and models are representative and are subject to change. Certified drawings and models are available for a fee. Consult your local Exlar representative for details.

Rod End Options





EL = Model Series
EL = Explosion proof linear actuator

AAA = Frame Size
120 = 120 mm

BB = Stroke Length
04 = 4 in
06 = 6 in
08 = 8 in
10 = 10 in
12 = 12 in
18 = 18 in

CC = Screw Lead (linear travel per screw revolution)
01 = 0.1 in/rev (2.54 mm/rev)
02 = 0.2 in/rev (5.08 mm/rev)
05 = 0.5 in/rev (12.7 mm/rev)
08 = 0.8 in/rev (20.3 mm/rev)

D = Connections
F = Two 0.75 in NPT Ports, Front Facing (as viewed from rod end)
B = Two 0.75 in NPT Ports, Back Facing (as viewed from rod end)
R = Two 0.75 in NPT Ports, Right Facing (as viewed from rod end)
L= Two 0.75 in NPT Ports, Left Facing (as viewed from rod end)

E = Mounting
F = Standard Front Flange
R = Standard Rear Flange
G = Metric Rear Clevis
C = English Rear Clevis
J = Metric Rear Eye
K = English Rear Eye

F = Rod End Thread
M = Male, US Standard Thread
A = Male, Metric Thread
F = Female, US Standard Thread
B = Female, Metric Thread

GGG = Feedback Type
See page 207 for detailed information

H = Motor Stator
1 = 1 stack motor
2 = 2 stack motor
3 = 3 stack motor

I = Rated Voltage
1 = 115 Volt RMS
3 = 230 Volt RMS
5 = 400 Volt RMS
6 = 460 Volt RMS

J = Motor Poles
8 = 8 pole motor

KK = Rated Motor Speed at Rated Voltage
01 - 45 Two digit number x 100 = rated RPM

MM = Mechanical Option [3]
PF = Preloaded follower[1]
AR = External anti-rotate assembly
RB = Rear brake
HW = Manual drive, handwheel with interlock switch
CD = Crank drive with interlock switch

NOTES:
1. The dynamic load rating of zero backlash, preloaded screws is 63% of the dynamic load rating of the standard non-preloaded screws. The calculated travel life of a preloaded screw will be 25% of the same size and lead of a non-preloaded screw.
2. Not compatible with Kinetix 300 Drives.
3. For extended temperature operation consult factory for model number.

For options or specials not listed above or for extended temperature operation, please contact Exlar

EL120

Return to table of contents

EL100

Explosion-Proof Linear Actuators

This electromechanical system provides process engineers with a clean, fast, simple, and cost effective replacement for hydraulic actuation and a longer life alternative to pneumatic actuation. The roller screw technology manufactured by Exlar offer 15 times the travel life of rival ball screws and can carry higher loads. The compact design allows users to effectively replace hydraulic or air cylinders with an electromechanical actuator, while meeting all required capabilities of the application. Servo electric actuation reduces emissions, lowers energy consumption (80% system energy efficiency), and increases position control and accuracy—all leading to reduced cost.

The EL100 explosion-proof linear actuator offers a Class 1, Division 1, Groups B, C, D, and T3 rating. Additionally, it meets ATEX essential requirements and are in conformance with the EU ATEX Directive 94/9/EC.

The EL Series linear actuators are compatible with nearly any manufacturer's resolver-based amplifier.

** "Class I" means that flammable gases or vapors may be present in the air in quantities sufficient to produce explosive or ignitable mixtures. "Division 1" means that hazardous concentrations in the air may exist continuously, intermittently, or periodically under normal operating conditions. "Group B" allows for atmospheres containing hydrogen, gases, or vapors of equivalent hazard, such as manufactured gas. "Group C" allows for atmospheres containing ethyl-ether vapors, ethylene or cyclo propane. "Group D" allows for atmospheres containing gasoline, hexane, naphtha, benzene, butane, alcohol, acetone, benzol, lacquer solvent vapors or natural gas. EL Series actuators are not rated for operation in atmospheres containing acetylene. Temperature classification defines the maximum surface temperature the product will reach at full load. T3 = 200° C, T3A =180° C, T4 = 135° C.*

CE 0518

II 2 G
Ex d IIB+H2 T3 Gb
IECEx SIR 13.0139X

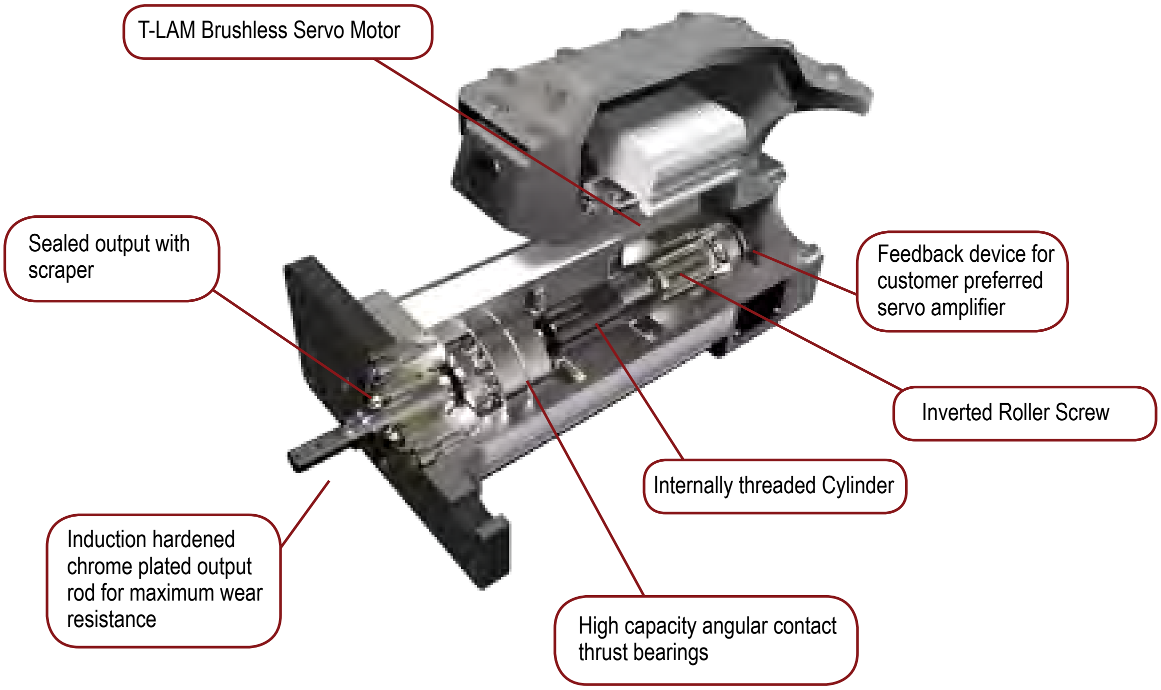
C US
163694
Class I Division 1
Groups B, C, D, T3C

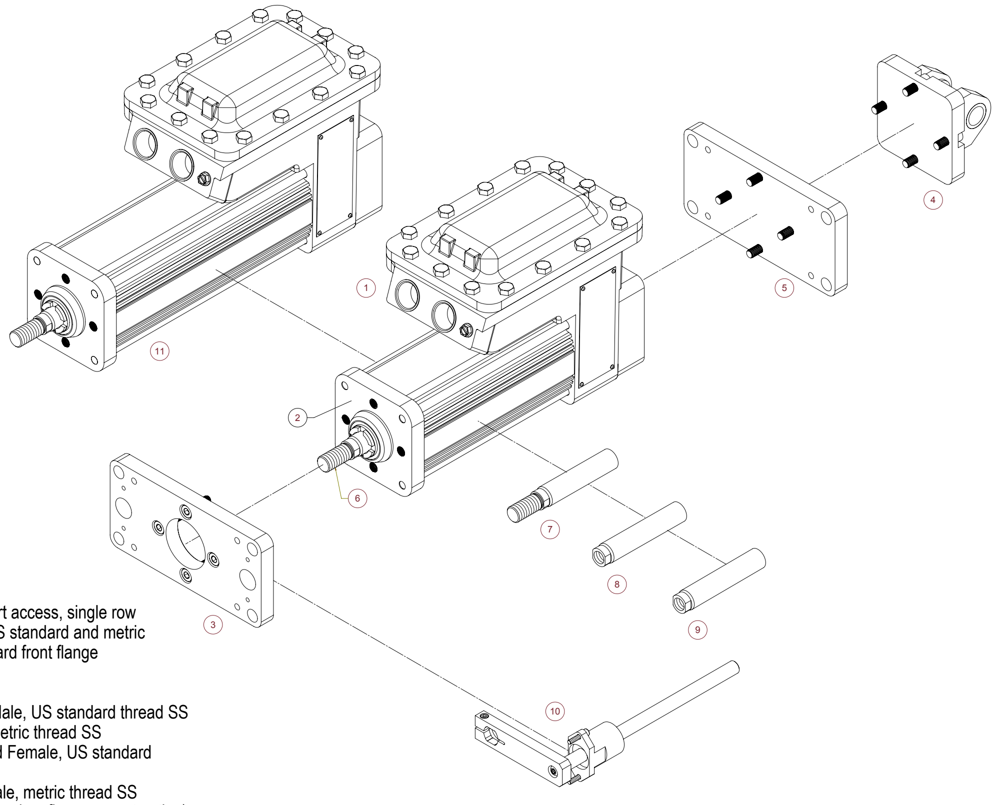
Technical Characteristics	
Frame Sizes in (mm)	4 (100)
Screw Leads in (mm)	0.1 (2.54), 0.2 (5.08), 0.5 (12.7)
Standard Stroke Lengths in (mm)	5.9 (150)
Force Range	up to 4081 lbf-in (18 kN)
Maximum Speed	up to 37.5 in/sec (953 mm/s)

Features
T-LAM technology yielding 35% increase in continuous motor torque over traditional windings
Forces up to 2000 lbs
Speeds up to 25 ips
Resolver feedback
Strokes up to 6 inches
8 pole motors
Rod end options
Several mounting configurations
Potted NPT connectors
Windings available from 24 VDC to 460 VAC rms
Class 180H insulation, IP66S Standard

Operating Conditions and Usage		
Accuracy:		
Screw Lead Error	in/ft	0.001 (0.025)
Screw Lead Variation	in (mm)	0.0012 (0.030)
Screw Lead Backlash	in (mm)	0.004 maximum
Ambient Conditions:		
Ambient Temperature	°C	-29 to 93
Storage Temperature	°C	-54 to 93
IP Rating		IP66S
Shock		10g
Vibration		5 grms, 5 to 2000 hz

Product Features





1 - Terminal strips with 3/4" NPT port access, single row
2 - Threaded front and rear face, US standard and metric
3 - Front and rear flange and standard front flange
4 - Standard rear clevis
5 - Front and rear flange
6 - Male, US standard thread and Male, US standard thread SS
7 - Male, metric thread and Male, metric thread SS
8 - Female, US standard thread and Female, US standard thread SS
9 - Female, metric thread and Female, metric thread SS
10 - External anti-rotate assembly (requires flange mount option)
11 - Rear brake

Industries and Applications

Process Control
- Turbine fuel flow
- Chemical process plants
- Fuel distribution systems
- Shipbound fuel management
- Valve control
- Damper control
- Fuel Skids
- Silos

Defense
- Weapons room

Material Handling
- Printing presses

Automotive
- Engine test stands
- Paint booths

The EL100 actuator is another simple, clean, and cost effective replacement for hydraulics meeting Class 1, Division 1, Group B, C, D, and T3 as well as ATEX requirements.

Mechanical Specifications

Motor Stacks		2 Stacks		
Screw Lead Designator		**01**	**02**	**05**
Screw Lead	in	0.1	0.2	0.5
	mm	2.54	5.08	12.7
Continuous Force *(Motor Limited)*	lbf	2011	1005	402
	N	8943	4472	1789
Max Velocity	in/sec	6.66	13.33	33.33
	mm/sec	169.33	338.58	846.58
Friction Torque *(standard screw)*	in-lbf	1.7		
	N-m	0.19		
Friction Torque *(preloaded screw)*	in-lbf	3.5		
	N-m	0.39		
Back Drive Force	lbf	180	80	40
	N	800	360	180
Min Stroke	in	3		
	mm	75		
Max Stroke	in	18		
	mm	450		
C_a (Dynamic Load Rating)	lbf	5516	5800	4900
	N	24,536	25,798	21,795
Inertia	lb-in-s^2	0.002829		
	Kg-m^2	0.000003196		
Weight	lb	7.65		
	Kg	3.47		

*Please note that stroke mm are nominal dimensions. Specifications subject to change without notice.
**Inertia +/– 5%

See definitions on page 190.

Electrical Specifications

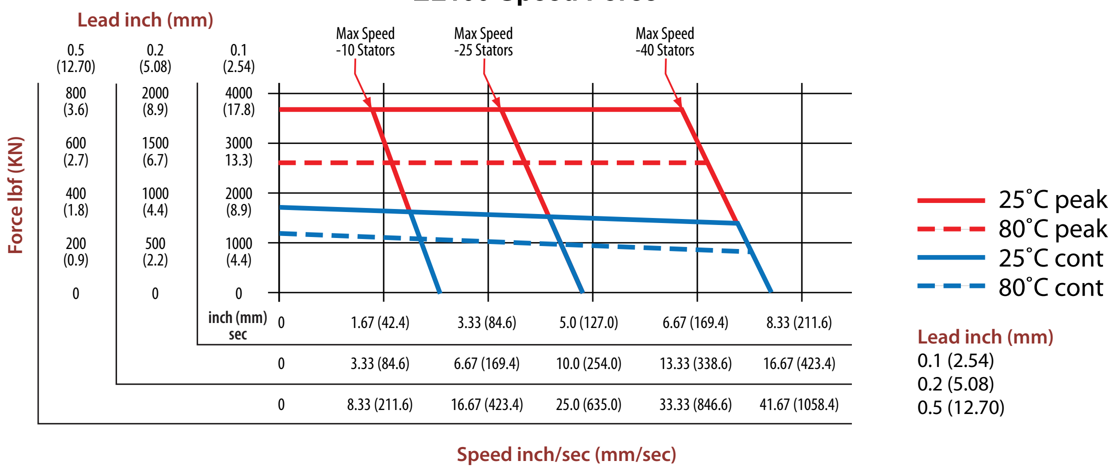
Motor Stator		2A8-10	2B8-25	2C8-40	218-40	238-40	258-40	268-40
RMS SINUSOIDAL COMMUTATION DATA								
Continuous Motor Torque (25°/80°C)	lbf-in	35.2/24.3	35.9/24.8	36.5/25.2	39.6/27.3	40.0/27.6	39.5/27.3	39.9/27.6
	N-m	3.98/2.75	4.06/2.80	4.12/2.85	4.47/3.09	4.52/3.12	4.46/3.08	4.51/3.11
Torque Constant	lbf-in	1.7	1.7	2.6	3.2	6.6	11.6	13.2
	N-m/A	0.19	0.19	0.30	0.37	0.75	1.31	1.50
Continuous Current Rating (25°/80°C)	A	23.1/15.9	23.6/16.3	15.6/10.7	13.6/9.4	6.8/4.7	3.8/2.6	3.4/2.3
Peak Current Rating (25°/80°C)	A	46.2/31.9	47.1/32.5	31.1/21.5	27.3/18.8	13.5/9.3	7.6/5.3	6.7/4.7
O-PEAK SMUSOIDAL COMMUTATION DATA								
Continuous Motor Torque (25°/80°C)	lbf-in	35.2/24.3	35.9/24.8	36.5/25.2	39.6/27.3	40.0/27.6	39.5/27.3	39.9/27.6
	N-m	3.98/2.75	4.06/2.80	4.12/2.85	4.47/3.09	4.52/3.12	(4.46/3.08)	(4.51/3.11)
Torque Constant	lbf-in/A	1.2	1.2	1.9	2.3	4.7	8.2	9.4
	N-m/A	0.14	0.14	0.21	0.26	0.53	0.92	1.06
Continuous Current Rating (25°/80°C)	A	32.7/22.6	33.3/23.0	22.0/15.2	19.3/13.3	9.5/6.6	5.4/3.7	4.8/3.3
Peak Current Rating (25°/80°C)	A	65.4/45.1	66.7/46.0	44.0/30.4	38.6/26.6	19.1/13.2	10.8/7.5	9.5/6.6
MOTOR STATOR DATA								
Voltage Constant @ 25˚C (Ke)	Vrms/Krpm	11.6	11.6	17.9	22.1	45.2	78.9	90.4
	Vpk/Krpm	16.5	16.5	25.3	31.3	64.0	111.6	127.9
Pole Configuration		8	8	8	8	8	8	8
Resistance (L-L)	Ohms	0.10	0.1	0.2	0.30	1.2	3.8	4.86
Inductance (L-L)	mH	0.75	0.8	1.9	2.93	12.2	37.2	48.9
Brake Inertia	lbf-in-sec^2	0.00047						
	kg-cm^2	0.53						
Brake Current @24 VDC +/- 10%	A	0.5						
Brake Holding Torque - Dry	lbf-in	70						
	Nm/A	8						
Brake Engage/Disengage Time	ms	25/50						
Mechanical Time Constant (tm)	ms	1.4	1.3	1.3	1.1	1.1	1.1	1.1
Electrical Time Constant (te)	ms	7.2	7.9	8.2	9.9	10.1	9.9	10.1
Frictional Torque	lbf-in	2.22	2.22	2.22	2.22	2.22	2.22	2.22
	N-m	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Bus Voltage	Vrms	24 VDC	48 VDC	120 VDC	115 VAC	230 VAC	400 VAC	460 VAC
Speed @ Bus Voltage	rpm	1,000	2,500	4,000	4,000	4,000	4,000	4,000
Insulation Class		180 (H)						
Ambient Temperature Rating		-29° C to 93° C						
CSA/ATEX Temperature Class		T3, 200˚ C Maximum Allowable Surface Temperature						

For amplifiers using peak sinusoidal ratings, multiply RMS sinusoidal Kt by 0.707, and peak current by 1.414.
Test data derived using NEMA recommended aluminum heatsink 12” x 12” x 1/2” at 25° / 80°C ambient.

Specifications subject to change without notice.

Performance Curves

The below speed vs. force curves represent approximate continuous thrust ratings at indicated linear speed. Different types of servo amplifiers offer varying motor torque and, thus, varying actuator thrust. These values are at constant velocity and do not account for motor torque required for acceleration.



DEFINITIONS:

Continuous Force: The linear force produced by the actuator at continuous motor torque.

Max Velocity: The linear velocity that the actuator will achieve at rated motor rpm.

Friction Torque (standard screw): Amount of torque required to move the actuator when not coupled to a load.

Friction Torque (preloaded screw): Amount of torque required to move the actuator when not coupled to a load.

Back Drive Force: Amount of axial force applied to the rod end of the actuator that will produce motion with no power applied to the actuator.

Min Stroke: Shortest available stroke length.

Max Stroke: Longest available stroke length.

C_a (Dynamic Load Rating): A design constant used when calculating the estimated travel life of the roller screw.

Inertia (zero stroke): Base inertia of an actuator with zero available stroke length.

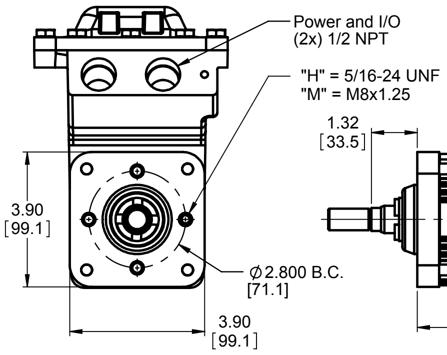
Inertia Adder (per unit of stroke): Inertia per unit of stroke that must be added to the base (zero stroke) inertia to determine the total actuator inertia.

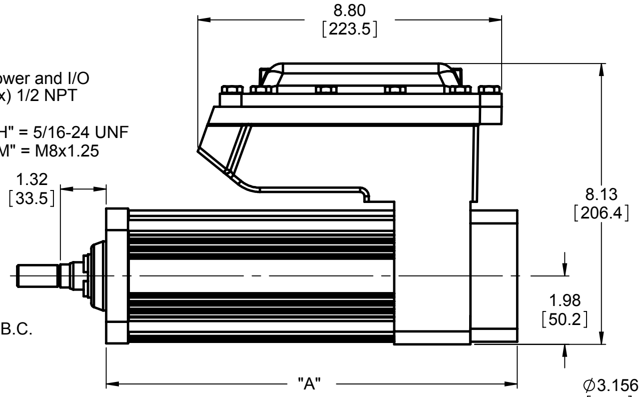
Weight (zero stroke): Base weight of an actuator with zero available stroke length.

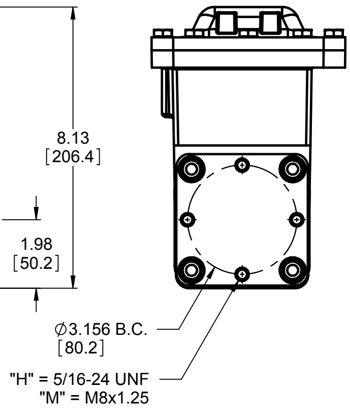
Weight Adder (per unit of stroke): Weight adder per unit of stroke that must be added to the base (zero stroke) weight to determine the total actuator weight.

Dimensions

Base Actuator

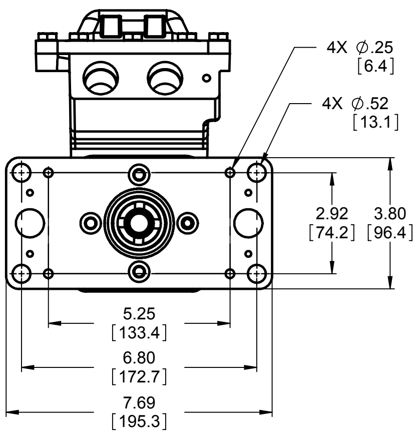


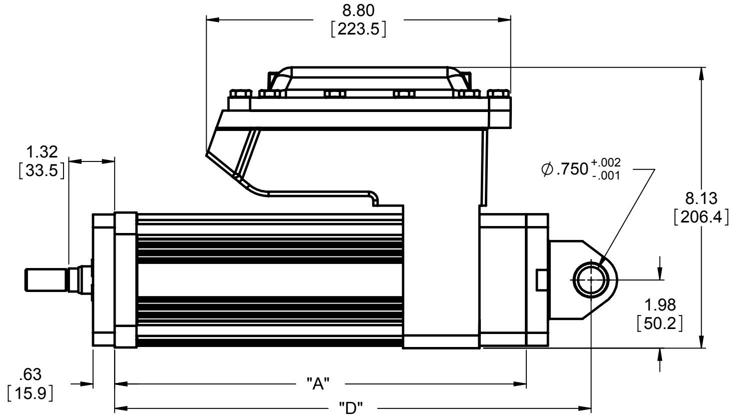


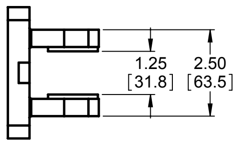


Dim	No Brake	Brake
A	11.9 (302.3)	14.2 (360.8)

Front Flange or Clevis Mount

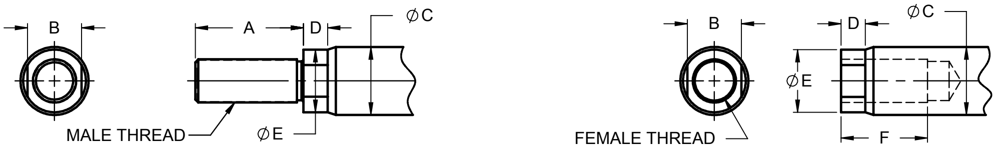






Dim	No Brake	Brake
A	11.9 (302.3)	14.2 (360.8)
D	13.77 (349.9)	16.7 (408.2)

Rod End Options

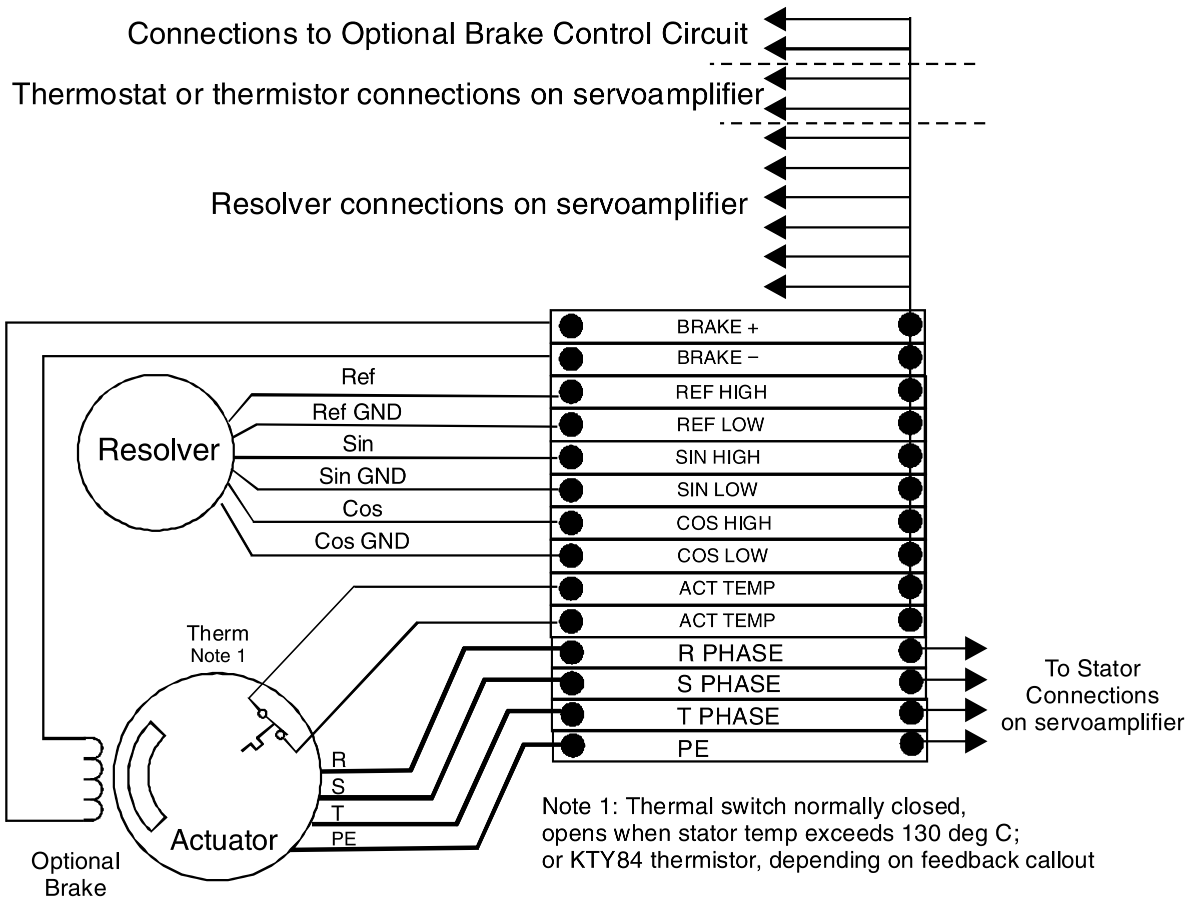


	A	B	ØC	D	ØE	F	Male "M" Inch	Male "A" Metric	Female "F" Inch	Female "B" Metric
EL100 in (mm)	1.250 (31.8)	0.625 (17.0)	0.787 (20.0)	0.281 (7.1)	0.725 (18.4)	1.000 (25.4)	1/2 - 20 UNF – 2A	M16 x 1.5 6g	1/2 - 20 UNF – 2B	M16 x 1.5 6h

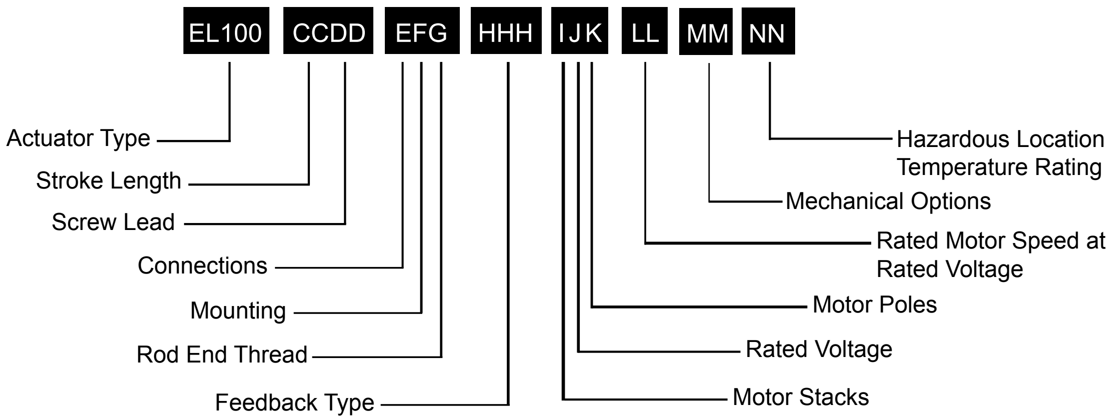
Pre-sale drawings and models are representative and are subject to change. Certified drawings and models are available for a fee. Consult your local Exlar representative for details.

EL100

Terminal Box Wiring



Pre-sale drawings and models are representative and are subject to change. Certified drawings and models are available for a fee. Consult your local Exlar representative for details.



EL100 = Model Series

CC = Stroke Length
06 = 5.9 inch (150 mm)

DD = Roller Screw Lead (Linear Travel per Screw Revolution)
01 = 0.1 in/rev (2.54 mm/rev)
02 = 0.2 in/rev (5.08 mm/rev)
05 = 0.5 in/rev (12.7 mm/rev)

E = Connections
S = Terminal strips with 3/4" NPT port access, single row

F = Mounting
H = Threaded front and rear face, US standard thread
N = Threaded front and rear face, metric thread
B = Front and rear flange
F = Standard front flange
C = Standard rear clevis
R = Rear flange

G = Rod End
M = Male, US standard thread
A = Male, metric thread
F = Female, US standard thread
B = Female, metric thread
W = Male, US standard thread SS
R = Male, metric thread SS
V = Female, US standard thread SS
L = Female, metric thread SS

HHH = Controller Feedback Option
XX1 = Custom Feedback. Resolver only. Consult Exlar
AB6 = Allen-Bradley/Rockwell - standard resolver
AM3 = Advanced Motion Control - standard resolver
AP1 = API Controls - standard resolver
BD2 = Baldor - standard resolver
BM2 = Baumueller - standard resolver
BR1 = B&R Automation
CT5 = Control Techniques - standard resolver
CO2 = Copely Controls - standard resolver
DT2 = Delta Tau Data Systems - standard resolver
EL1 = Elmo Motion Control - standard resolver
EX4 = Exlar - standard resolver
IF1 = Infranor - standard resolver
IN6 = Indramat/Bosch-Rexroth - standard resolver
JT1 = Jetter Technologies - standard resolver
KM5 = Kollmorgen/Danaher - standard resolver
LZ5 = Lenze/AC Tech - standard resolver
MD1 = Modicon - standard resolver
MG1 = Moog - standard resolver
MN4 = Momentum – Standard Resolver
MX1 = Metronix - standard resolver
OR1 = Ormec - standard resolver
PC7 = Parker - standard resolver - European only
PC0 = Parker - standard resolver - US only
PS3 = Pacific Scientific - standard resolver
SM2 = Siemens - standard resolver
SW1 = SEW/Eurodrive - standard resolver
WD1 = Whedco/Fanuc - standard resolver

I = Motor Stacks
2 = 2 stack motor

J = Rated Voltage
A = 24 VDC
B = 48 VDC
C = 120 VDC
1 = 115 Volt RMS
3 = 230 Volt RMS
5 = 400 Volt RMS
6 = 460 Volt RMS

K = Motor Poles
8 = 8 Pole Motor

LL = Rated Motor Speed at Rated Voltage
01 - 99 = Two digit number x 100 = rated RPM

MM = Mechanical Options [2]
PF = Pre-loaded roller screw follower[1]
AR = External anti-rotate assembly (requires flange mount option)
RB = Rear brake

NN = Haz Loc Temp Rating
T3 = 200˚ C max allowable surface temperature

NOTES:
1. The dynamic load rating of zero backlash, preloaded screws is 63% of the dynamic load rating of the standard non-preloaded screws. The calculated travel life of a preloaded screw will be 25% of the calculated travel life of the same size and lead of a non-preloaded screw.
2. For extended temperature operation consult factory for model number.

For options or specials not listed above or for extended temperature operation, please contact Exlar

Return to table of contents

ER120 Series

Explosion-Proof Rotary Motor and Gearmotor

For hazardous duty environments with constant exposure to flammable gasses or vapors* Exlar's ER Series rotary explosion-proof motors and gearmotors provide an excellent solution. Exlar's motors utilizing T-LAM technology, an innovative segmented winding, have been designed for efficiency, power and durability and provide a very high torque-to-size ratio when compared to other suppliers' motors.

The gearmotor comprises a brushless permanent magnet motor optimized for use with an integral planetary gear set. Through the uniform load sharing of several gears acting in concert, planetary gear heads are a very compact, reliable solution providing high torque, low backlash and low maintenance.

The ER Series motors are compatible with nearly any manufacturers' resolver-based amplifier.

The ER Series actuators are ideal for operating quarter turn or multi turn valves or shaft driven dampers in hazardous environments. These actuators are directly coupled shaft-to-shaft, eliminating ungainly mechanisms needed by the linear motion of pneumatics. Our compact T-LAM servo motors outperform any standard motor, providing excellent continuous modulating service.

** ER Series motors are rated for Class I, Division 1, Groups B, C and D. "Class I" means that flammable gasses or vapors may be present in the air in quantities sufficient to produce explosive or ignitable mixtures. "Division 1" means that hazardous concentrations in the air may exist continuously, intermittently, or periodically under normal operating conditions. "Group B" allows for atmospheres containing hydrogen, or gasses (or vapors) of equivalent hazard, such as manufactured gas. "Group C" allows for atmospheres containing ethyl-ether vapors, ethylene or cyclo propane. "Group D" allows for atmospheres containing gasoline, hexane, naphtha, benzene, butane, alcohol, acetone, benzol, lacquer solvent vapors or natural gas. ER Series motors are not rated for operation in atmospheres containing acetylene.*

Technical Characteristics	
Frame Sizes	4.72 in (120 mm)
Torque Range	up to 4696 lbf-in (530 Nm)
Maximum Speed	3000 rpm

0518

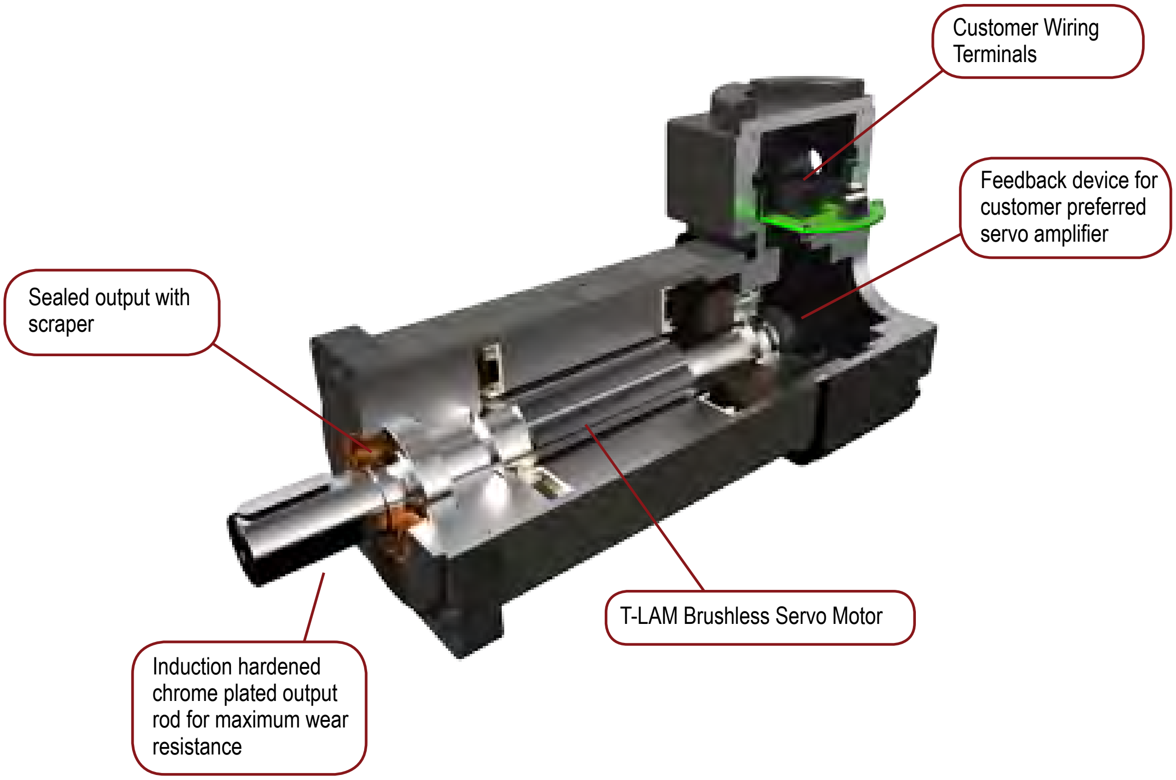
II 2G
Ex d IIB+H2 T4 Gb
SIRA 15ATEX1010X

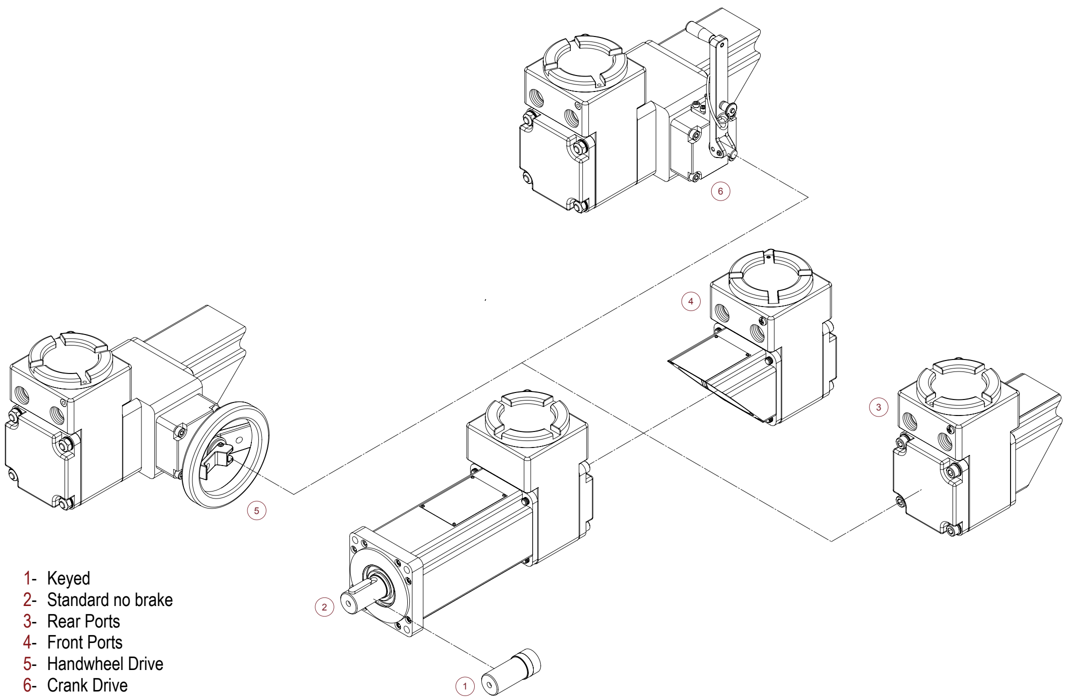
163694
Class I Division 1
Groups B, C, D, T4

Operating Conditions and Usage		
Ambient Conditions:		
Ambient Operating Temperature	°C °F	-29 to 93 -20 to 199
Storage Temperature	°C	-54 to 93
IP Rating		IP65S

Features
T-LAM technology yielding 35% increase in continuous motor torque over traditional windings
Resolver feedback
8 pole motors
Rod end options
1, 2, or 3 stack motor availability compatible with nearly any resolver based servo amplifier
Several mounting configurations
Potted NPT leads
Windings from 24 VDC to 460 VAC rms
Class 180H insulation system

Product Features





1- Keyed
2- Standard no brake
3- Rear Ports
4- Front Ports
5- Handwheel Drive
6- Crank Drive

Industries and Applications

Process Control
- Valve control
- Damper control
- Turbine control
- Choke valves
- Fuel control
- Plunger pumps

Automotive
- Paint booths
- Fuel control
- Engine test stands

Defense
- Weapons room

Material Handling
- Printing presses

In hazardous duty environments where exposure to flammable gasses or vapors may be ever present, ER Series explosion proof motors and gear motors stand up to the challenge making them perfect for paint booths and printing presses.

With life counts in the hundreds of millions of cycles, response times in milliseconds and accuracy of 0.10%, Exlar offers superior electric control valve actuation replacing other traditional electric, pneumatic, and hydraulic actuators.

Electrical and Mechanical Specifications

Motor Stator		1A8	1B8	118	138	158	168	2A8	2B8	238	258	268	338	358	368
RMS SINUSOIDAL COMMUTATION DATA															
Continuous Motor Torque	lbf-in	71.8	71.8	74.1	74.1	74.3	74.1	120.5	120.5	123.6	121.4	123.8	172.3	168.9	176.9
	N-m	8.11	8.11	8.37	8.37	8.39	8.37	13.61	13.61	13.96	13.72	13.96	19.46	19.09	19.98
Peak Motor Torque	lbf-in	143.6	143.6	148.2	148.2	148.6	148.2	241.0	241.0	247.2	242.8	247.2	344.5	337.8	353.7
	N-m	16.22	16.22	16.74	16.74	16.79	16.74	27.23	27.23	27.93	27.43	27.93	38.93	38.17	39.96
Torque Constant (Kt) (+/- 10% @ 25°C)	lbf-in/A	5.3	5.3	4.3	8.7	15.7	17.3	5.3	5.3	8.7	15.8	17.3	8.5	15.8	17.5
	N-m/A	0.60	0.60	0.49	1.00	1.80	2.00	0.60	0.60	1.00	1.80	2.00	1.00	1.80	2.00
Continuous Current Rating	A	15.2	15.2	19.1	9.5	5.3	4.8	25.5	25.5	15.9	8.6	8.0	22.7	11.9	11.3
Peak Current Rating	A	30.4	30.4	38.2	19.1	10.6	9.5	51.0	51.0	31.8	17.1	15.9	45.4	23.8	22.5
O-PEAK SINUSOIDAL COMMUTATION															
Continuous Motor Torque	lbf-in	71.8	71.8	74.1	74.1	74.3	74.1	120.5	120.5	123.6	121.4	123.6	74.1	74.1	74.1
	N-m	8.11	8.11	8.37	8.37	8.39	8.37	13.61	13.61	13.96	13.72	13.96	8.37	8.37	8.37
Peak Motor Torque	lbf-in	143.6	143.6	148.2	148.2	148.6	148.2	241.0	241.0	247.2	242.8	247.2	344.5	337.8	353.7
	N-m	16.22	16.22	16.74	16.74	16.79	16.74	27.23	27.23	27.93	27.43	27.93	38.93	38.17	39.96
Torque Constant (Kt) (+/- 10% @ 25°C)	lbf-in/A	3.7	3.7	3.1	6.1	11.1	12.3	3.7	3.7	6.1	11.2	12.3	6.0	11.2	12.4
	N-m/A	0.42	0.42	0.35	0.70	1.25	1.39	0.42	0.42	0.70	1.27	1.39	0.68	1.27	1.40
Continuous Current Rating	A	21.5	21.5	27.0	13.5	7.5	6.7	36.1	36.1	22.5	12.1	11.3	32.1	16.9	15.9
Peak Current Rating	A	43.0	43.0	54.0	27.0	15.0	13.5	72.1	72.1	45.0	24.2	22.5	64.2	33.7	31.9
MOTOR DATA															
Voltage Constant (Ke) (+/- 10% @ 25°C)	Vrms/Krpm	36.1	36.1	29.6	59.2	106.9	118.5	36.1	36.1	59.2	108.2	118.5	58.0	108.2	119.8
	Vpk/Krpm	51.0	51.0	41.9	83.8	151.2	167.6	51.0	51.0	83.8	153.0	167.6	82.0	153.0	169.4
Pole Configuration		8													
Resistance (L-L) (+/- 5% @ 25°C)	Ohms	0.31	0.31	0.20	0.80	2.60	3.21	0.13	0.13	0.34	1.17	1.35	0.20	0.72	0.81
Inductance (L-L) (+/- 15%)	mH	4.8	4.8	3.3	13.0	42.4	52.1	2.3	2.3	6.3	21.1	25.3	4.0	13.1	17.1
Armature Inertia (+/- 5%)	lbf-in-sec²	0.00538						0.00818					0.01097		
	Kg-cm²	6.082						9.242					12.400		
Brake Inertia	lbf-in-sec²	0.00030													
	Kg-cm²	0.339													
Brake Current @ 24VDC (+/- 10%)	A	1.0													
Brake Holding Torque - Dry	lbf-in	177													
	(N-m)	20													
Brake Engage/ Disengage Time	ms	13/50													
Mechanical Time Constant ™	ms	0.94	0.94	0.91	0.91	0.9	0.91	0.58	0.58	0.57	0.59	0.57	0.47	0.47	0.45
Electrical Time Constant (te)	ms	15.73	15.73	16.26	16.26	16.34	16.25	18.41	18.41	18.72	18.06	18.72	20.08	20.19	21.16
Friction Torque	lbf-in	1.39	1.39	1.39	1.39	1.39	1.39	1.75	1.75	1.75	1.75	1.75	2.25	2.25	2.25
	N-m	0.157	0.157	0.157	0.157	0.157	0.157	0.197	0.197	0.197	0.197	0.197	0.254	0.254	0.254
Bus Voltage	Vrms	24 VDC	48 VDC	115	230	400	460	24 VDC	48 VDC	230	400	460	230	400	460
Speed @ Bus Voltage	rpm	300	750	3000				300	750	3000			3000		
Insulation Class		180 (H)													
Ambient Temperature Rating		-29°C to 93°C													
Insulation System Voltage Rating		T4, 135°C Maximum Allowable Surface Temperature													

Test data derived using NEMA recommended aluminum heatsink 12" x 12" x 1/2" at 25°C ambient

Gearmotor Data

	1 Stack Motor			2 Stack Motor		3 Stack Motor
SLG Armature Inertia* lbf-in-sec^2 (Kg-cm^2)	0.00538 (6.085)			0.00820 (9.274)		0.01102 (12.464)
GEARING REFLECTED INERTIA	SINGLE REDUCTION			DOUBLE REDUCTION		
	Gear Stages	lbf-in-sec^2	(Kg-cm^2)	Gear Stages	lbf-in-sec^2	(Kg-cm^2)
	4:1	0.000851	(0.961)	16:1	0.000510	(0.576)
	5:1	0.000557	(0.629)	20:1, 25:1	0.000344	(0.389)
	10:1	0.000145	(0.164)	40:1, 50:1, 100:1	0.000092	(0.104)
Backlash at 1% rated torque:	10 Arc minutes (Efficiency: Single reduction 91%)			13 Arc minutes (Efficiency: Double Reduction: 86%)		

* Add armature inertia to gearing inertia for total ER geared system inertia

Gearmotor General Performance Specifications

Two torque ratings for the ER Series Gearmotors are given in the table below. The left hand columns give the maximum (peak) allowable output torque for the indicated ratios of each size ER Series Gearmotor. This IS NOT the rated output torque of the motor multiplied by the ratio of the reducer.

It is possible to select a configuration of the motor selection and gear ratio such that the rated motor torque, multiplied by the gear ratio exceeds these ratings. It is the responsibility of the user to ensure that the settings of the system, including the amplifier, do not allow these values to be exceeded.

The right hand columns give the output torque at the indicated speed which will result in 10,000 hour (L10). The setup of the system, including the amplifier, will determine the actual output torque and speed.

Output Torque Ratings – Mechanical

ER120 Ratio	Maximum Allowable Output Torque lbf-in (Nm)	Output Torque @ Speed for 10,000 Hour Life – lbf-in (Nm)		
		1000 RPM	2000 RPM	3000 RPM
4:1	4696 (530.4)	1392 (157.3)	1132 (127.9)	1000 (112.9)
5:1	4066 (459.4)	1445 (163.3)	1175 (132.8)	1040 (117.5)
10:1	2545 (287.5)	1660 (187.6)	1350 (152.6)	1200 (135.6)
16:1	4696 (530.4)	2112 (238.6)	1714 (193.0)	1518 (171.0)
20:1	4696 (530.4)	2240 (253.1)	1840 (207.9)	1620 (183.0)
25:1	4066 (459.4)	2350 (265.5)	1900 (214.7)	1675 (189.2)
40:1	4696 (530.4)	2800 (316.4)	2240 (253.1)	2000 (225.9)
50:1	4066 (459.4)	2900 (327.7)	2350 (265.5)	2100 (237.3)
100:1	2545 (287.5)	2500 (282.5)	2500 (282.5)	2400 (271.2)

Radial Load and Bearing Life

RPM	ER120 lbf (N)	RPM	ER120 (Gear) lbf (N)
50	579 (2576)	50	1223 (5440)
100	460 (2046)	100	971 (4318)
250	339 (1508)	250	715 (3181)
500	269 (1197)	500	568 (2525)
1000	214 (952)	1000	451 (2004)
3000	148 (658)	3000	218 (970)

Side load ratings shown below are for 10,000 hour bearing life at 25 mm from motor face at given rpm.

Visit www.exlar.com for full details on radial load and bearing life.

Motor and Gearmotor Weight

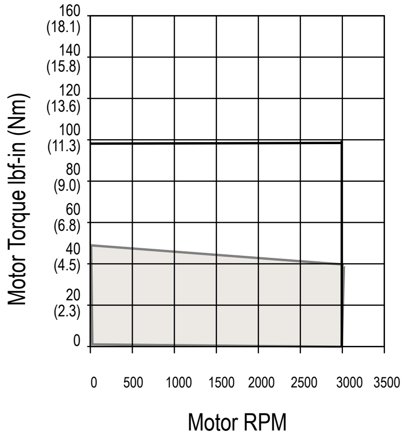
	Motor	Gearmotor	
ER120	Motor Weight lb (kg)	1 Stage lb (kg)	2 Stage lb (kg)
1 Stack	29.9 (13.56)	37.7 (17.10)	43.2 (19.60)
2 Stack	37.4 (16.96)	45.2 (20.50)	50.7 (23.00)
3 Stack	44.8 (20.32)	52.7 (23.90)	58.3 (26.45)

* For brake option add 0.9 lb (0.408 kg) mass.

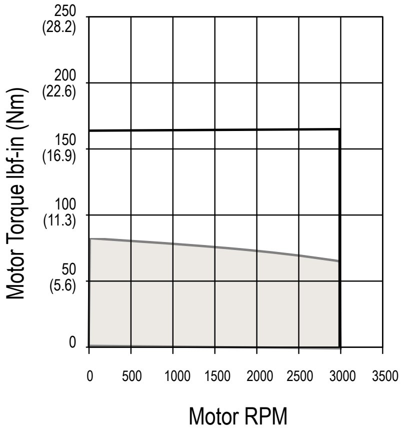
Speed/Torque Curves

Peak Torque
Continuous Torque
Torque Rated at 80˚C

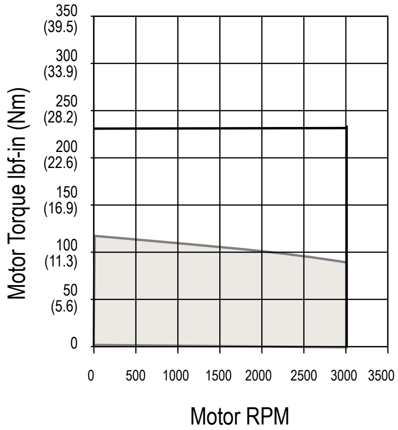
1 Stack Motors



2 Stack Motors



3 Stack Motors



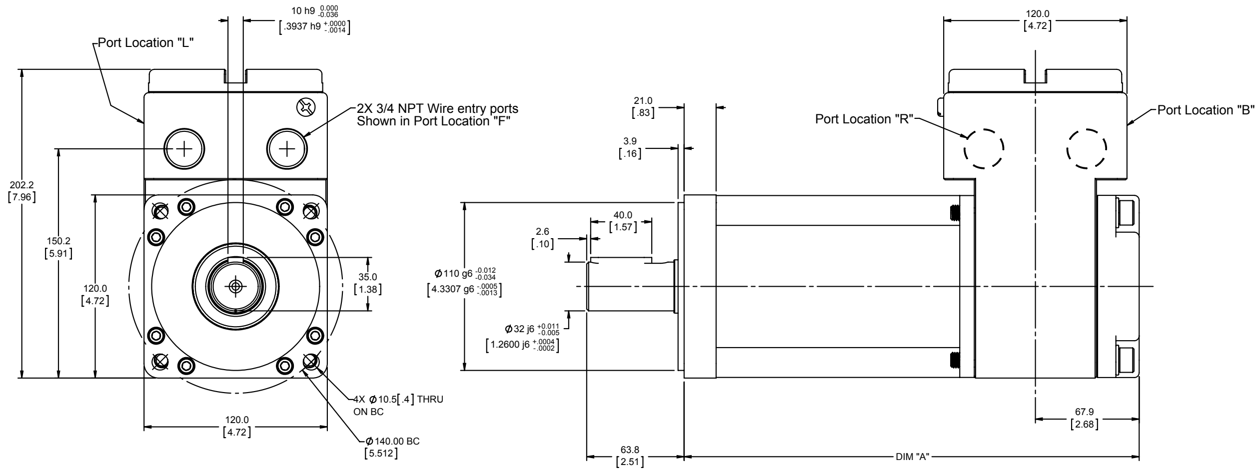
For gearmotors, divide speed by gear ratio; multiply torque by gear ratio and effciency. Efficencies: 1 Stage = 0.91, 2 Stage = 0.86
Test data derived using NEMA recommended aluminum heatsink 12” x 12” x 1/2” at 25°C ambient.

Notes

ER120

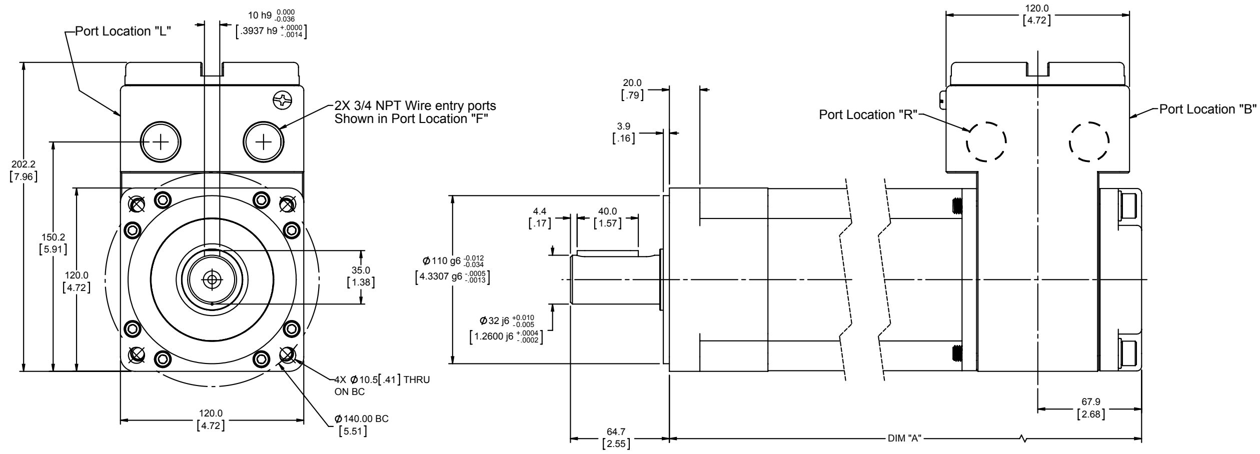
Dimensions

Base Actuator



Gear Reduction		Dimension "A"
Stages	**Stacks**	**Length mm (in)**
0	1	297.9 (11.73)
	2	348.7 (13.73)
	3	399.5 (15.73)

ER120 with Gear Reduction Option



Gear Reduction		Dimension "A"
Stages	**Stacks**	**Length mm (in)**
1	1	389.8 (15.35)
	2	440.7 (17.35)
	3	491.5 (19.35)

Gear Reduction		Dimension "A"
Stages	**Stacks**	**Length mm (in)**
2	1	429.9 (16.93)
	2	480.8 (18.93)
	3	531.6 (20.93)

Pre-sale drawings and models are representative and are subject to change. Certified drawings and models are available for a fee. Consult your local Exlar representative for details.

ER AAA | BBB | C D F | GGG | HHH | II | MM

- Motor Type & Frame Size
- Gear Reduction Ratio
- Shaft Type
- Connections
- Brake
- Feedback Type
- Mechanical Options
- Speed Designations
- Motor Stator

ER = Model Series
ER = Explosion proof rotary actuator

AAA = Frame Size
120 = 120 mm

BBB = Gear Reduction Ratio
Single reduction ratio
004 = 4:1
005 = 5:1
010 = 10:1
Double reduction ratio (N/A on 075 mm)
016 = 16:1
020 = 20:1
025 = 25:1
040 = 40:1
050 = 50:1
100 = 100:1

C = Shaft Type
K = Keyed
R = Smooth/round

D = Connections
F = Two 0.75 in NPT Ports, Front Facing (as viewed from rod end)
B = Two 0.75 in NPT Ports, Back Facing (as viewed from rod end)
R = Two 0.75 in NPT Ports, Right Facing (as viewed from rod end)
L = Two 0.75 in NPT Ports, Left Facing (as viewed from rod end)

F = Brake Options
S = Standard no brake
B = Brake

GGG = Feedback Type
See page 207 for detailed information

HHH = Motor Stator, All 8 Pole

118=1 Stack	115 Vrms	158 = 1 Stack	400 Vrms
138 = 1 Stack	230 Vrms	258 = 2 Stack	
238 = 2 Stack		358 = 3 Stack	
338 = 3 Stack		168 = 1 Stack	460 Vrms
		268 = 2 Stack	
		368 = 3 Stack	

II = Speed Designations
30 = 3000 rpm

MM = Mechanical Options [1]
HW = Manual drive, handwheel with Interlock switch
CD = Crank drive with interlock switch

NOTES:
1. For extended temperature operation consult factory for model number.

Contact your local sales representative regarding all special actuator components.

For options or specials not listed above or for extended temperature operation, please contact Exlar

Return to table of contents

Feedback Cable Configuration - e.g. CBL-ENCOD-SMI-015

CBL – AAAAA – BCD – EEE

Cable
CBL = Cable

Cable Style
S = Standard Cabl -40c to 100c
F = High Flex Cable -5c to 70c*

Connection Option
I = Exlar Standard M23 European Style
A = MS Style Anodized
D = MS Style Electroless Nickel*

Length ft (M)
015 (4.6) Standard
025 (7.6) Standard
050 (15.2) Standard
075 (22.9) Standard
100 (30.5) Standard
1-999 - Custom

Cable Model
ENCOD = Incremental Encoder
ABSOL = Absolute Encoder
RESOL = Resolver

Connection Mounting
M = Molded Straight
R = Strain Relief Straight
T = 90 Degree MS Style Only*

Power Cable Configuration - e.g. CBL-PWRB1-SMI-015

CBL – AAAAA – BCD – EEE

Cable
CBL = Cable

Cable Style
S = Standard Cabl -40c to 100c
F = High Flex Cable -5c to 70c*

Connection Option
I = Exlar Standard M23 Size 1**
A = MS Style Anodized
D = MS Style Electroless Nickel*

Length ft (M)
015 (4.6) Standard
025 (7.6) Standard
050 (15.2) Standard
075 (22.9) Standard
100 (30.5) Standard
1-999 - Custom

Cable Model***
PWRB1 = 20,30,060,075,090 Frames Power/Brake
PWRB2 = 40,50,115,142 Frames Power/Brake
PWRB3 = 60, 180 Frame Power/Brake

Connection Mounting
M = Molded Straight
R = Strain Relief Straight
T = 90 Degree MS Style Only*

Accessory Cable Configuration - e.g. CBL-ASSY1-SMI-015

CBL – AAAAA – BCD – EEE

Cable
CBL = Cable

Cable Style
S = Standard Cabl -40c to 100c
F = High Flex Cable -5c to 70c*

Connection Option
I = Exlar Standard M23 European Style
A = MS Style Anodized
D = MS Style Electroless Nickel*

Length ft (M)
015 (4.6) Standard
025 (7.6) Standard
050 (15.2) Standard
075 (22.9) Standard
100 (30.5) Standard
1-999 - Custom

Cable Model
ASSY1 = EB Accessory Brake/XT
Load Cell/HW Handwheel Interlock

Connection Mounting
M = Molded Straight
R = Strain Relief Straight
T = 90 Degree MS Style Only*

All Exlar cables rated IP65 when mated to actuator.

* Non-standard options – require longer lead times.
** PWRB3 uses M40 size 1.5.
*** Special stator winding may require a special power cable.

Manufacturers Feedback Cable Selection Guide

Amplifier/Drive Selected	Feedback Selected	Manufacturers Part Number
Allen-Bradley/Rockwell: All Drives	RA1/RA2/RA3/RA4 AB8/AB9/ABB	2090-CFBM7DF-CDAxyy
AMKASYN: All Drives	AK1/AK2	DS Series Absolute Encoder Cable
Beckhoff: All Drives	BE1	ZK4000-26yy-2zzz
B&R Automation: All Drives	BR1 BR2	8CRxxx.12-1 8CExxx.12-1
Emerson/Control Techniques: Unidrive SP/Epsilon EP Unidrive M	CT1/CT3 CT2/EM2/EM5 CT4/CT7 CT5 CT5	SSBCABXXXX UFCSXXX SIBAAAXXXX SRBBBBXXXX SRBBABXXXX
En/Epsilon/MDS	CT4/CT7 EM2/EM5	SIBAEAXXXX CFCSXXX
Elau: All Drives	EU1/EU4	SH Series Absolute Encoder Cable
G&L Motion Control/Danaher Motion: MMC Smart Drive/ Digital MMC Control	 GL1 GL2 GL3 GL4	 ENC-H&F ENC-L&M ENC-NSM ENDAT-AKM
Indramat/Bosch-Rexroth: DKC Series/DIAX IndraDrive	 IN1 IN5 IN6 IN7	 IKS4001 IKS4001 IKS4374 RKG4200
Jetter Technologies: JetMove 2xx JetMove 6xx	 JT1 JT1	 JH/JL Series Resolver Cable Nr. 23 JH/JL Series Resolver Cable Nr. 423
Kollmorgen/Danaher: All Drives	KM4 KM5 KM6	AKM Series Sine Encoder Based (Absolute) Encoder with Duel Intercontec Connectors use B,C, or G Connector Options AKM Series Resolver Based with Duel Intercontec Connectors use B,C, or G Connector Options AKM Series Encoder Based with Intercontec Connectors use B,C, or G Connector Options
Lenze/AC Tech: All Drives	LZ1 LZ5 LZ6	MCS Series Absolute Encoder Cable MCS Series Resolver Cable MCS Series Incremental Encoder Cable
Mitsubishi: MR-J3	MT1	MR-J3ENSCBLxxM-H
Momentum: All Drives	MN1 MN2 MN3 MN4	SC-AE1-xxx SC-AE2-xxx SC-IE1-xxx SC-RS1-xxx
Ormec: All Drives	OR2	Consult Exlar
Parker Compumotor: All Drives	PC6 PC7 PC8 PC9/ PCØ	SMH Series Incremental Encoder Cable SMH Series Resolver Cable COMPAX3 F-2C1-xx or Aries F-1A1-xx F-2B1-xx
Pacific Scientific: All Drives	PS3	CEF-RO-XXX-900X
Stober Drives: FDS/MDS 5000	SB3	Stober Absolute Encoder Cable
Siemens: 611U/Masterdrives/SMC20	SM2 SM3/SM4 SM5	6FX5002-2CF02-.... 6FX5002-2EQ10-.... 6FX5002-2CA31-....
SEW/Eurodrive: All Drives	SW1 SW3	CMP Series Resolver Cable CMP Series Absolute Encoder Cable
Yaskawa: Sigma II Series	YS2/YS3	JZSP-CMP02-XX(B)

Manufacturers Power/Brake Cables

Models:		GSM/GSX20, GSM/GSX30, SLM/SLG060, SLM/SLG090		
Amplifier/Drive Selected	Feedback Selected	Power only 4 wire	Power + Brake/Therm	Brake Cable
Allen-Bradley/Rockwell: All Drives	RA1/RA2/RA3/RA4 AB8/AB9/ABB	2090-CPWM7DF-16Axyy	2090-CPBM7DF-16Axyy	N/A
AMKASYN: All Drives	AK1/AK2	N/A	DS Series Power Cable Size 1	N/A
Beckhoff: All Drives	BE1	N/A	ZK4000-2xx1-2xxxx	N/A
B&R Automation: All Drives	BR1/BR2	N/A	8CMxxx.12-1	N/A
Emerson/Control Techniques: All Drives	CT1/CT3/CT4/CT5/CT7 CT2/EM2/EM5	PSBxA CMDS	PBBxA N/A	N/A CBMS
Elau: All Drives	EU1/EU4	N/A	E-MO-111	N/A
G&L Motion Control/ Danaher Motion: MMC Smart Drive/ Digital MMC Control	GL1 GL2 GL3 GL4	PWR-H&F…16AA N/A PWR-NSM…16AA N/A	N/A PWR-L&M…16-64 N/A PWR-AKM…16-64	Exlar CBL-ASSY1-xxA-xxx N/A Exlar CBL-ASSY1-xxA-xxx N/A
Indramat/Bosch-Rexroth: DKC Series/DIAX IndraDrive	IN1/IN5/IN6 IN7	N/A N/A	MKD/MHD Power Cable Size 1 MSK Power Cable Size 1	N/A N/A
Jetter Technologies: All Drives	JT1	N/A	JH/JL Power Cable Size 1 #24.1	N/A
Kollmorgen/Danaher: All Drives	KM4/KM5/KM6	N/A	AKM Connector with B,C, or G Options	N/A
Lenze/AC Tech: All Drives	LZ1/LZ5/LZ6	N/A	MCS Power Cable Size 1	N/A
Mitsubishi: MR-J3	MT1	MR-J3P2-xM	N/A	MR-J3BRKS1-xM
Momentum: All Drives	MN1/MN2/MN3/MN4	PCBL1.5-MNT-xxx	PCBL1.5-MNB-xxx	N/A
Ormec: All Drives	OR2		Consult Exlar	
Parker Compumotor: All Drives	PC6/PC7 PC8/PC9/PC0	N/A N/A	SMH Power Cable Size 1 P-3B1-xx	N/A N/A
Pacific Scientific: All Drives	PS3	N/A	PMA Power Cable Size 1	N/A
Stober Drives: FDS/MDS 5000	SB3	N/A	Stober Power Cable Size 1	N/A
Siemens: All Drives with flying leads	SM2/SM3/SM4/SM5		6FX5002-5DA01-....	N/A
SEW/Eurodrive: All Drives	SW1/SW3	N/A	CMP Power Cable Size 1	N/A
Yaskawa: Sigma II Series	YS2 YS3	N/A B1E-xxA	N/A B1BE-xxA	N/A N/A

	GSM/GSX40, GSX50, SLM/SLG115, SLM142			GSX60 & SLM180		
	Power only 4 wire	Power + Brake/Therm	Brake Cable	Power only 4 wire	Power + Brake/Therm	Brake Cable
	2090-CPWM7DF-14Axyy	2090-CPBM7DF-14Axyy	N/A	2090-CPWM7DF-10Axyy	2090-CPBM7DF-10Axyy	N/A
	N/A	DS Series Power Cable Size 1	N/A	N/A	DS Series Power Cable Size 1.5	N/A
	N/A	ZK4000-2xx1-2xxxx	N/A	N/A	Exlar CBL-PWRB3-xxl-xxx	N/A
	N/A	8CMxxx.12-3	N/A	N/A	8CMxxx.12-5	N/A
	PSBxA CMMS	PBBxA N/A	N/A CBMS	PSBxB CMLS	PBBxB N/A	N/A CBMS
	N/A	E-MO-112	N/A	N/A	E-MO-114	N/A
	PWR-H&F…14-AA N/A N/A N/A	N/A PWR-L&M…14-6H N/A PWR-AKM…14-6H	Exlar CBL-ASSY1-xxA-xxx N/A N/A N/A	PWR-H&F…10-AA N/A N/A N/A	N/A PWR-L&M…12-6H N/A PWR-AKM…12-6H	Exlar CBL-ASSY1-xxA-xxx N/A N/A N/A
	N/A N/A	MKD/MHD Power Cable Size 1 MSK Power Cable Size 1	N/A N/A	N/A N/A	MKD/MHD Power Cable Size 1.5 MSK Power Cable Size 1.5	N/A N/A
	N/A	JH/JL Power Cable Size 1 #24.1	N/A	N/A	Exlar CBL-PWRB3-xxl-xxx	N/A
	N/A	AKM Connector with B,C, or G Options	N/A	N/A	Under 24 AMP use CP-508-ENBN-XXX Over 24 AMP Contact Kollmorgen Vendor	N/A
	N/A	MCS Power Cable Size 1	N/A	N/A	MCS Power Cable Size 1.5	N/A
	MR-J3P6-xM	N/A	MR-J3BRKS1-xM	MR-J3P7-xM	N/A	MR-J3BRKS1-xM
	PCBL2.5-MNT-xxx	PCBL2.5-MNB-xxx	N/A	PCBL4.0-MNT-xxx	PCBL4.0-MNB-xxx	N/A
		Consult Exlar			Consult Exlar	
	N/A N/A	SMH Power Cable Size 1 P-4B1-xx	N/A N/A	N/A N/A	SMH Power Cable Size 1.5 P-6B2-xx	N/A N/A
	N/A	PMA Power Cable Size 1	N/A	N/A	Exlar CBL-PWRB3-xxl-xxx	N/A
	N/A	Stober Power Cable Size 1	N/A	N/A	Stober Power Cable Size 1.5	N/A
		6FX5002-5DA11-....	N/A		6FX5002-5DA61-....	N/A
	N/A	CMP Power Cable Size 1	N/A	N/A	CM Power Cable Size 1.5	N/A
	B1E-xxA N/A	B1BE-xxA N/A	N/A N/A	B2E-xxA N/A	B2BE-xxA N/A	N/A N/A

(Please note: Euro style connectors are size 1.5 M40 connectors. If the manufacturer does not offer a size 1.5 M40 power cable, an Exlar Power Cable must be purchased.

Return to table of contents

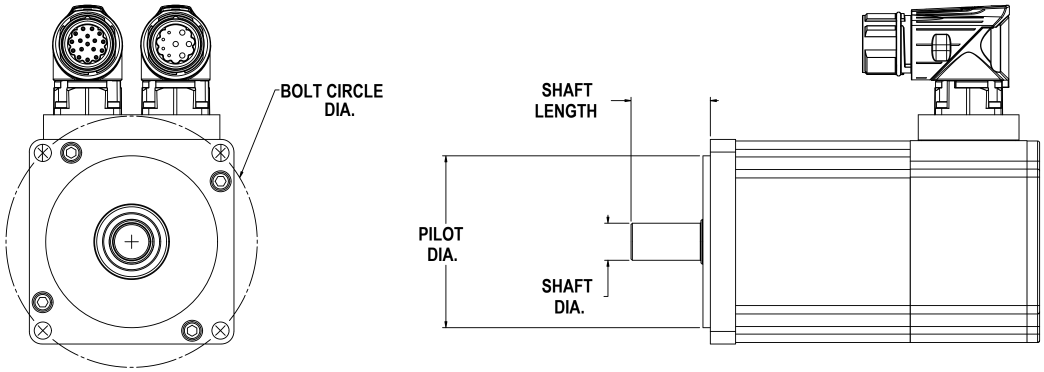
Motor Mount Codes for the FT and K Series

Bolt Circle Diameter (mm)	Pilot Diameter (mm)	Shaft Diameter (mm)	Shaft Length (mm)	Key Width (mm)	Motor Mount Code
63	40	9	20	3	IEA
63	40	9	24	3	IEB
63	40	11	23	4	IEC
63	40	14	30	5	IED
70	50	11	30	4	JGC
70	50	12	30	NA	JGB
70	50	14	30	5	JGA
70	50	16	30	5	EGB
75	60	11	23	4	IHA
75	60	14	30	5	IHB
90	70	11	30	4	JKE
90	70	14	30	5	JKD
90	70	16	35	NA	JKC
90	70	16	40	5	JKG
90	60	19	40	6	JKF
90	70	19	40	6	JKA
95	65	14	30	5	ELA
95	50	14	30	5	ELC
95	65	16	30	5	ELB
100	80	10	32	3	IMD
100	80	14	30	5	IMA
100	80	14	40	5	JMC
100	80	16	40	5	IMB
100	80	16	40	5	JMA
100	80	19	40	6	IMC
100	80	19	55	6	JMD
100	80	22	48	6	EMB
115	95	19	40	6	INA
115	95	19	55	6	JNC
115	95	22	45	8	JND
115	95	22	70	NA	JNB
115	95	24	45	8	JNA
115	95	24	50	8	INB
130	95	19	40	6	IPC
130	110	19	40	6	IPA
130	110	24	50	8	IPB
130	95	24	50	8	IPD
130	110	32	65	10	EPB
145	110	19	55	5	JQG
145	110	22	55	6	JQF

Bolt Circle Diameter (mm)	Pilot Diameter (mm)	Shaft Diameter (mm)	Shaft Length (mm)	Key Width (mm)	Motor Mount Code
145	110	22	70	8	JQE
145	110	22	55	8	JQH
145	110	24	55	8	JQD
145	110	24	65	8	JQC
145	110	28	55	8	JQB
145	110	28	63	8	JQA
165	130	24	50	8	IRA
165	95	24	50	8	IRG
165	110	24	50	8	IRF
165	130	28	60	8	IRB
165	130	32	50	10	IRD
165	130	32	58	10	IRC
165	130	32	80	10	IRE
190	155	32	60	10	I2A
200	114.3	22	55	6	JSE
200	114.3	28	55	8	JSF
200	114.3	35	70	10	JSB
200	114.3	35	80	10	JSA
200	114.3	42	113	10	JSD
215	180	24	50	10	ITA
215	180	28	60	10	ITB
215	180	32	58	10	ITC
215	130	32	60	10	ITE
215	180	32	80	10	ITD
215	180	38	80	10	ITF
215	180	42	82	12	ITG
235	200	35	70	10	JUC
235	200	42	85	12	JUB
235	200	42	116	12	JUD
235	200	55	116	NA	JUA
265	230	38	80	10	IVA
265	230	38	110	10	IVB
265	230	42	110	12	IVC
265	230	55	110	16	JVA
265	230	60	140	18	JVC
265	230	65	140	18	JVB
300	250	48	82	14	IWB
300	250	48	112	14	IWA
300	250	60	140	18	JWA

*Consult factory if dimension is not shown.

Motor Mount Drawing



Feedback Types for GSX, GSM, SLG, SLM, EL, and ER

(Also specify the Amplifier/Drive Model being used when ordering)
- Standard Incremental Encoder – 2048 line (8192 cts) per rev. index pulse, Hall commutation, 5VDC
- Standard Resolver – Size 15, 1024 line (2048 cts) per rev. two pole resolver
- Motor files for use with select Emerson/CT, Rockwell /AB and Danaher/Kollmorgen Drives are available at www.exlar.com

Allen-Bradley/Rockwell: (Note: AB8, AB9 and ABB callouts are available only on spare/replacement actuators that have been previously ordered. For all new configurations using a Rockwell drive, please select from the options below. Consult Exlar for integration questions)[3]

Note: RA1, RA2, RA3, and RA4 callouts not available for SLM motors.

RA1 = Hiperface Stegmann SKM36 multi-turn absolute encoder. MPL Type V feedback (128 sin/cos) and Type 7 SpeedTec connectors and wiring when using the “M” connector option. 20 and 30 frame sizes only. (Formerly ABB)[1]
RA2 = Hiperface Stegmann SRM50 multi-turn absolute encoder. MPL Type M feedback (1024 sin/cos) and Type 7 SpeedTec connectors and wiring when using the “M” connector option. 40, 50 and 60 frame sizes only. (Formerly AB9)[1]
RA3 = Standard incremental encoder. MPL Type M feedback (2048 line) and Type 7 SpeedTec connector and wiring when using the “M” connector option. (Formerly AB8)
RA4 = Standard Resolver. MPL Type R feedback (4 pole) and Type 7 SpeedTec connectors and wiring when using the “M” connector option. (Formerly AB6)

Advanced Motion Control:
AM1 = Standard Incremental Encoder
AM2 = Encoder 1000 line, w/commutation, 5 VDC
AM3 = Standard Resolver
AM5 = Encoder 5000 line, w/commutation, 5 VDC

Baldor:
BD2 = Std Resolver – BSM motor wiring w/M23 connectors for ‘M’ option
BD3 = Std Incremental Encoder – BSM motor wiring w/M23 connectors for ‘M’ option

Beckhoff:
BE2 = EnDat Heidenhain EQN1125 multi-turn absolute encoder – AM5XX motor wiring w/M23 euro connectors for ‘M’ option

B&R Automation:
BR1 = Standard Resolver
BR2 = EnDat Heidenhain EQN1125/1325 multi-turn absolute encoder – 8LS/8LM motor wiring w/M23 euro connectors for ‘M’ option

Copley Controls:
CO1 = Standard Incremental Encoder
CO2 = Standard Resolver

Control Techniques/Emerson:
CT1 = Hiperface Stegmann SRM050 multi-turn absolute encoder – 40-50-60 Frame Size. FM/UM/EZ motor wiring w/M23 euro connectors for ‘M’ option
CT3 = Hiperface Stegmann SKM036 multi-turn absolute encoder – 20-30 Frame Size. FM/UM/EZ motor wiring w/M23 euro connectors for ‘M’ option
CT4 = Standard Incremental Encoder – FM/UM/EZ motor wiring w/M23 euro connectors for ‘M’ option
CT5 = Std Resolver – FM/UM/EZ motor wiring w/M23 euro connectors for ‘M’ option
CT7 = Encoder 5000 line, with commutation, 5 VDC – FM/UM/EZ motor wiring w/M23 euro connectors for ‘M’ option
CT9 = Unidrive SP with EnDat Heidenhain EQN1125 multi-turn absolute encoder w/M23 connectors

Elmo Motion Control:
EL1 = Standard Resolver
EL2 = Standard Incremental Encoder
EL3 = EnDat Heidenhain EQN1125 multi-turn absolute encoder

Emerson/Control Techniques:
EM2 = Std Incremental Encoder – NT motor wiring w/MS connectors for ‘M’ option
EM5 = Encoder 5000 line, with commutation, 5 VDC – NT motor wiring w/MS connectors for ‘M’ option

Continued on next page

Elau:

EU1 = Hiperface Stegmann SRM050 multi-turn absolute encoder – 40-50-60 Frame Size. SH motor wiring w/MS connectors for ‘M’ option

EU4 = Hiperface Stegmann SKM036 multi-turn absolute encoder – 20-30 Frame Size. SH motor wiring w/MS connectors for ‘M’ option.

Exlar:

EX4 = Standard Resolver

EX5 = Standard Resolver with KTY84 thermistor

EX6 = EnDat Heidenhain EQN1125 multi-turn absolute encoder

EX7 = Incremental encoder, 5000 line with commutation, 5Vdc

EX8 = Hiperface Stegmann SRM50 multi-turn absolute encoder

Indramat/Bosch-Rexroth:

IN6 = Std Resolver – MKD/MHD motor wiring w/M23 euro connectors for ‘M’ option

IN7 = Hiperface Stegmann SKM036 multi-turn absolute encoder – MSK motor wiring w/M23 euro connectors for ‘M’ option – plug & play option

IN8 = Indradrive EnDat Heidenhain EQN1125 multi-turn absolute w/M23 connectors

Kollmorgen/Danaher:

KM4 = EnDat Heidenhain EQN1325 multi-turn absolute encoder (Sine Encoder)– AKM motor wiring w/M23 Intercontec euro connectors for ‘M’ option

KM5 = Standard Resolver – AKM motor wiring w/M23 Intercontec euro connectors for ‘M’ option

KM6 = Standard Incremental Encoder – AKM motor wiring w/ M23 Intercontec euro connectors for ‘M’ option

Lenze/AC Tech:

LZ1 = Hiperface Stegmann SRM050 multi-turn absolute encoder – MCS motor wiring w/M23 euro connectors for ‘M’ option

LZ5 = Standard Resolver – MCS motor wiring w/ M23 euro connectors for ‘M’ option

LZ6 = Standard Incremental Encoder – MCS motor wiring w/ M23 euro connectors for ‘M’ option

Mitsubishi[2]:

MT2 = DSL Stegmann MR-J4 compatible

Parker Compumotor:

PC6 = Std Incremental Encoder – SMH motor wiring w/M23 connectors for ‘M’ option – European only

PC7 = Std Resolver – SMH motor wiring w/M23 connectors for ‘M’ option – European only

PC8 = Standard Incremental Encoder – MPP series motor wiring w/PS connectors for ‘M’ option – US Only

PC9 = Hiperface Stegmann SRM050 multi-turn absolute encoder – MPP motor wiring w/PS connectors for ‘M’ option – US Only

PC0 = Standard Resolver – MPP motor wiring w/PS connectors for ‘M’ option – US Only

Stober Drives:

SB3 = EnDat Heidenhain EQN1125 multi-turn absolute encoder – ED/EK motor wiring w/M23 euro connectors for ‘M’ option

SB4 = Standard Resolver ED/EK motor wiring W/23 connector for “M” option

Siemens:

SM2 = Standard Resolver – 1FK7 motor wiring w/M23 connectors for ‘M’ option

SM3 = EnDat Heidenhain EQN1325 multi-turn absolute encoder – 40-50-60 Frame Size. 1FK7 motor wiring w/M23 euro connectors for ‘M’ option

SM4 = EnDat Heidenhain EQN1125 multi-turn absolute encoder – 20-30 Frame Size. 1FK7 motor wiring w/M23 euro connectors for ‘M’ option

SM9 = Siemens Heidenhain EQN1325 4096 (12 bits) multi-turn absolute w/M23 connectors

SEW/Eurodrive:

SW1 = Standard Resolver – CM motor wiring w/ M23 euro connectors for ‘M’ option

SW2 = Standard Incremental Encoder

SW3 = Hiperface Stegmann SRM050 multi-turn absolute encoder – CM motor wiring w/ M23 euro connectors for ‘M’ option

Yaskawa:

YS5 = Yaskawa Sigma V absolute encoder

NOTES:

1. Not compatible with Kinetix 300 Drives.
2. N/A with holding brake unless application details are discussed with your local sales representative.
3. All rotary motors to be used with Kinetix or Sercos based systems will require prior approval from Rockwell Automation.

Sizing and Selection of Exlar Linear and Rotary Actuators

Move Profiles

The first step in analyzing a motion control application and selecting an actuator is to determine the required move profile. This move profile is based on the distance to be traveled and the amount of time available in which to make that move. The calculations below can help you determine your move profile.

Each motion device will have a maximum speed that it can achieve for each specific load capacity. This maximum speed will determine which type of motion profile can be used to complete the move. Two common types of move profiles are trapezoidal and triangular. If the average velocity of the profile, is less than half the maximum velocity of the actuator, then triangular profiles can be used. Triangular Profiles result in the lowest possible acceleration and deceleration. Otherwise a trapezoidal profile can be used. The trapezoidal profile below with 3 equal divisions will result in 25% lower maximum speed and 12.5% higher acceleration and deceleration. This is commonly called a 1/3 trapezoidal profile.

The following pages give the required formulas that allow you to select the proper Exlar linear or rotary actuator for your application. The first calculation explanation is for determining the required thrust in a linear application.

The second provides the necessary equations for determining the torque required from a linear or rotary application. For rotary applications this includes the use of reductions through belts or gears, and for linear applications, through screws.

Pages are included to allow you to enter your data and easily perform the required calculations. You can also describe your application graphically and fax it to Exlar for sizing. Reference tables for common unit conversions and motion system constants are included at the end of the section.

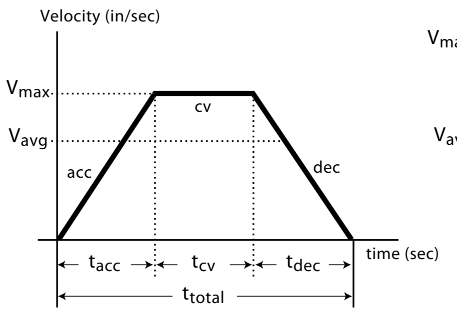
Linear Move Profile Calculations

Vmax = max.velocity-in/sec (m/sec)
Vavg = avg. velocity-in/sec (m/sec)
tacc = acceleration time (sec)
tdec = deceleration time (sec)
tcv = constant velocity (sec)
ttotal = total move time (sec)
acc = accel-in/sec^2 (m/sec^2)
dec = decel-in/sec^2 (m/sec^2)
cv = constant vel.-in/sec (m/sec)
D = total move distance-in (m) or revolutions (rotary)

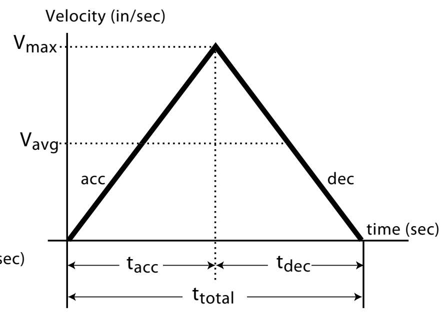
Standard Equations

Vavg = **D** / ttotal
If tacc = **t**dec **Then: V**max = (**t**total/(**t**total-tacc)(**V**avg)
and
D = Area under profile curve
D = (1⁄2(**t**acc+**t**dec)+**t**cv)(**V**max)

Trapezoidal Move Profile



Triangular Move Profile



Trapezoidal Equations

If tacc = **t**cv = **t**dec **Then:**
Vmax = 1.5 (**V**avg)
D = (2⁄3) (**t**total) (**V**max)
$acc = dec = \frac{V_{max}}{t_{acc}}$

Triangular Equations

If tacc = **t**total/2 **Then:**
Vmax = 2.0 (**V**avg)
D = (1⁄2) (**t**total) (**V**max)
$acc = dec = \frac{V_{max}}{t_{acc}}$

Terms and (units)

THRUST = Total linear force-lbf (N)
Ø = Angle of inclination (deg)
Ffriction = Force from friction-lbf (N)
tacc = Acceleration time (sec)
Facc = Acceleration force-lbf (N)
v = Change in velocity-in/sec (m/s)
Fgravity = Force due to gravity-lbf (N)
μ = Coefficient of sliding friction
Fapplied = Applied forces-lbf (N)
(refer to table on page 136 for different materials)
WL = Weight of Load-lbf (N)
g = 386.4: Acceleration of gravity - in/sec^2 (9.8 m/sec^2)

Thrust Calculation Equations

THRUST = **F**friction + [**F**acceleration] + **F**gravity + **F**applied

THRUST = **W**Lμcosø + [(**W**L /386.4) (**v**/tacc)] + **W**Lsinø + **F**applied

Sample Calculations: Calculate the thrust required to accelerate a 200 pound mass to 8 inches per second in an acceleration time of 0.2 seconds. Calculate this thrust at inclination angles(ø) of 0˚, 90˚ and 30˚. Assume that there is a 25 pound spring force that is applied against the acceleration.

WL = 200 lbm, v = 8.0 in/sec., **t**a = 0.2 sec., **F**app. = 25 lbf, μ = 0.15

ø = 0˚

THRUST = **W**Lμcosø + [(**W**L /386.4) (**v**/tacc)] + **W**Lsinø + **F**applied
= (200)(0.15)(1) + [(200/386.4)(8.0/0.2)] + (200)(0) + 25

= 30 lbs + 20.73 lbs + 0 lbs + 25 lbs = **75.73 lbs force**

ø = 90˚

THRUST = **W**Lμcosø + [(**W**L /386.4) (**v**/tacc)] + **W**Lsinø + **F**applied
= (200)(0.15)(0) + [(200/386.4)(8.0/0.2)] + (200)(1) + 25

= 0 lbs + 20.73 lbs + 200 lbs + 25 lbs = **245.73 lbs force**

ø = 30˚

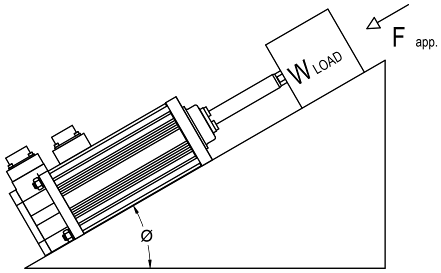
THRUST = **W**Lμcosø + [(**W**L /386.4) (**v**/tacc)] + **W**Lsinø + **F**applied
= (200)(0.15)(0.866) + [(200/386.4)(8.0/0.2)] + (200)(0.5) + 25

= 26 lbs + 20.73 lbs + 100 + 25 = **171.73 lbs force**

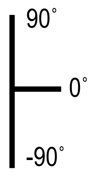
Thrust Calculations

Definition of thrust:

The thrust necessary to perform a specific move profile is equal to the sum of four components of force. These are the force due to acceleration of the mass, gravity, friction and applied forces such as cutting and pressing forces and overcoming spring forces.



Angle of Inclination



Note: at ø = 0˚
cosø = 1; sinø = 0
at ø = 90˚
cosø = 0; sinø = 1

It is necessary to calculate the required thrust for an application during each portion of the move profile, and determine the worst case criteria. The linear actuator should then be selected based on those values. The calculations at the right show calculations during acceleration which is often the most demanding segment of a profile.

Motor Torque Calculations

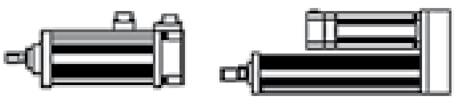
When selecting an actuator system it is necessary to determine the required motor torque to perform the given application. These calculations can then be compared to the torque ratings of the given amplifier and motor combination that will be used to control the actuator's velocity and position.

When the system uses a separate motor and screw, like the FT actuator, the ratings for that motor and amplifier are consulted. In the case of the GSX Series actuators with their integral brushless motors, the required torque divided by the torque constant of the motor (Kt) must be less than the current rating of the GSX or SLM motor.

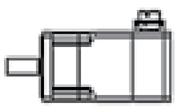
Inertia values and torque ratings can be found in the GSX, FT, and SLM/SLG Series product specifications.

For the GSX Series the screw and motor inertia are combined.

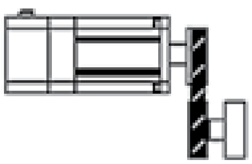
Motor with screw (GSX, GSM, FT, & EL)



Motor & motor with reducer (SLM/SLG & ER)



Motor with belt and pulley



Terms and (units)

λ	=	Required motor torque, lbf-in (N-m)
λa	=	Required motor acceleration torque, lbf-in (N-m)
F	=	Applied force load, non inertial, lbf (kN)
S	=	Screw lead, in (mm)
R	=	Belt or reducer ratio
TL	=	Torque at driven load lbf-in (N-m)
vL	=	Linear velocity of load in/sec (m/sec)
ωL	=	Angular velocity of load rad/sec
ωm	=	Angular velocity of motor rad/sec
η	=	Screw or ratio efficiency
g	=	Gravitational constant, 386.4 in/s^2 (9.75 m/s^2)
α	=	Angular acceleration of motor, rad/s^2
m	=	Mass of the applied load, lb (N)
JL	=	Reflected Inertia due to load, lbf-in-s^2 (N-m-s^2)
Jr	=	Reflected Inertia due to ratio, lbf-in-s^2 (N-m-s^2)
Js	=	Reflected Inertia due to external screw, lbf-in-s^2 (N-m-s^2)
Jm	=	Motor armature inertia, lbf-in-s^2 (N-m-s^2)
L	=	Length of screw, in (m)
ρ	=	Density of screw material, lb/in^3 (kg/m^3)
r	=	Radius of screw, in (m)
π	=	pi (3.14159)
C	=	Dynamic load rating, lbf (N)

Velocity Equations

Screw drive: $\mathbf{V}_L = \omega m * S / 2\pi$ in/sec (m/sec)

Belt or gear drive: $\omega m = \omega_L * R$ rad/sec

Torque Equations

Torque Under Load

Screw drive (GS, FT or separate screw): $\lambda = \dfrac{S \cdot F}{2 \cdot \pi \cdot \eta}$ lbf-in (N-**m**)

Belt and Pulley drive: $\lambda = \mathbf{T}_L / R\,\eta$ lbf-in (N-**m**)

Gear or gear reducer drive: $\lambda = \mathbf{T}_L / R\,\eta$ lbf - in (N-**m**)

Torque Under Acceleration

$\lambda a = (\mathbf{J}_m + \mathbf{J}_R + (\mathbf{J}_s + \mathbf{J}_L)/R^2)\alpha$ lbf-in

α = angular acceleration = ((RPM / 60) x 2π) / $\mathbf{t}_{acc}$, rad/sec^2.

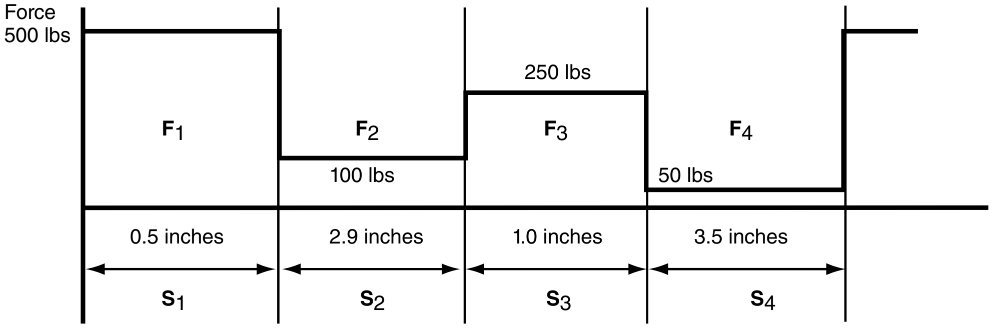
$\mathbf{J}_S = \dfrac{\pi \cdot \mathbf{L} \cdot \rho \times r^4}{2 \cdot g}$ lb - in - s^2 (N - **m** - s^2)

Total Torque per move segment

$\lambda T = \lambda a + \lambda$ lbf-in (N-m)

Mean Load Calculations

For accurate lifetime calculations of a roller screw in a linear application, the cubic mean load should be used. Following is a graph showing the values for force and distance as well as the calculation for cubic mean load. Forces are shown for example purposes. Negative forces are shown as positive for calculation.



S = Distance traveled during each move segment

Cubic Mean Load Equation

$$F_{cml} = \sqrt[3]{\frac{F_1^3 S_1 + F_2^3 S_2 + F_3^3 S_3 + F_4^3 S_4}{S_1 + S_2 + S_3 + S_4}}$$

Value from example numbers is 217 lbs.

Lifetime Calculations

The expected $\mathbf{L_{10}}$ life of a roller screw is expressed as the linear travel distance that 90% of the screws are expected to meet or exceed before experiencing metal fatigue. The mathematical formula that defines this value is below. The life is in millions of inches (mm). This standard $\mathbf{L_{10}}$ life calculation is what is expected of 90% of roller screws manufactured and is not a guarantee. Travel life estimate is based on a properly maintained screw that is free of contaminants and properly lubricated. Higher than 90% requires de-rating according to the following factors:

95% x 0.62	96% x 0.53
97% x 0.44	98% x 0.33
99% x 0.21	

Single (non-preloaded) nut:

$$L_{10} = \left(\frac{C_a}{F_{cml}}\right)^3 \times \ell$$

If your application requires high force over a stroke length shorter than the length of the nut, please contact Exlar for derated life calculations. You may also download the article “Calculating Life Expectency” at www.exlar.com.

Note: The dynamic load rating of zero backlash, preloaded screws is 63% of the dynamic load rating of the standard non-preloaded screws. The calculated travel life of a preloaded screw will be 25% of the calculated travel life of the same size and lead of a non-preloaded screw for the same application.

Total Thrust Calculations

Terms and (units)

THRUST = Total linear force-lbf (N)

$F_{friction}$ = Force from friction-lbf (N)

F_{acc} = Acceleration force-lbf (N)

$F_{gravity}$ = Force due to gravity-lbf (N)

$F_{applied}$ = Applied forces-lbf (N)

386.4 = Acceleration of gravity - in/sec^2 (9.8 m/sec^2)

Variables

Ø	= Angle of inclination - deg...................... =	_______
t_{acc}	= Acceleration time - sec......................... =	_______
v	= Change in velocity - in/sec (m/s)........... =	_______
μ	= Coefficient of sliding friction .... =	_______
W_L	= Weight of Load-lbm (kg)........................ =	_______
$F_{applied}$	= Applied forces-lbf (N) .... =	_______

Thrust Calculation Equations

THRUST = [$F_{friction}$] + [$F_{acceleration}$] + $F_{gravity}$ + $F_{applied}$

THRUST = [W_L x μ x cosø] + [(W_L /386.4) x (**v** / t_{acc})] + $W_L$sinø + $F_{applied}$

THRUST = [( )x( )x( )] + [(/386.4) x (/)] + [( ) ( )] + ( )

THRUST = [ ] + [( ) x ( )] + [ ] + ( )

= ________________ lbf.

Calculate the thrust for each segment of the move profile. Use those values in calculations below.
Use the units from the above definitions.

Cubic Mean Load Calculations

$$\sqrt[3]{\frac{F_1^3 S_1 + F_2^3 S^2 + F_3^3 S_3 + F_4^3 S_4}{S_1 + S_2 + S_3 + S_4}}$$

F_1= __________	S_1= __________	$F_1^3 S_1$ = __________
F_2= __________	S_2= __________	$F_2^3 S_2$ = __________
F_3= __________	S_3= __________	$F_3^3 S_3$ = __________
F_4= __________	S_4= __________	$F_4^3 S_4$ = __________

Move Profiles may have more or less than four components. Adjust your calculations accordingly.

Torque Calculations

Terms and (units)

λ = Torque, lb-in (N-m) = ----------------------

F = Applied Load, non inertial, lbf (N) = ----------------------

S = Screw lead, in (m) = ----------------------

η = Screw or ratio efficiency (~85% for roller screws) = ----------------------

g = Gravitational constant, 386 in/s2 (9.8 m/s2) = ----------------------

α = Acceleration of motor, rad/s2 = ----------------------

R = Belt or reducer ratio = ----------------------

$\mathbf{T}_L$ = Torque at driven load, lbf-in (N-m) = ----------------------

$\mathbf{V}_L$ = Linear velocity of load, in/sec (m/sec) = ----------------------

ω_L = Angular velocity of load, rad/sec = ----------------------

ω_m = Angular velocity of motor, rad/sec = ----------------------

m = Mass of the applied load, lbm (kg) = ----------------------

$\mathbf{J}_R$ = Reflected Inertia due to ratio, lb-in-s2 (N-m-s2) = ----------------------

$\mathbf{J}_S$ = Reflected Inertia due to screw, lb-in-s2 (N-m-s2) = ----------------------

$\mathbf{J}_L$ = Reflected Inertia due to load, lb-in-s2(N-m-s2) = ----------------------

$\mathbf{J}_M$ = Motor armature inertia, lb-in-s2 (N-m-s2) = ----------------------

π = pi = 3.14159

$\mathbf{K}_t$ = Motor Torque constant, lb-in/amp (N-m/amp) = ----------------------

* For the GS Series J_S and J_M are one value from the GS Specifications.

Torque Equations

Torque From Calculated Thrust.

$\lambda = \frac{SF}{2 \cdot \pi \cdot \eta}$ lb - in (N - m) = (   ) x (   )/2π (0.85) = (   ) x (   )/5.34 = ----------------------------

Torque Due To Load, Rotary.

Belt and pulley drive: $\lambda = T_L / R\, \eta$ lbf-in (N-m)

Gear or gear reducer drive: $\lambda = T_L / R\eta$ lbf-in (N-m)

Torque During Acceleration due to screw, motor, load and reduction, linear or rotary.

$I = (\mathbf{J}_m + (\mathbf{J}_S + \mathbf{J}_L) / \mathbf{R}^2)\, \alpha$ lb-in (N-**m**) = [(   ) + (+   ) / (   )] (   ) = ------------------------

Total Torque = Torque from calculated Thrust + Torque due to motor, screw and load

(   ) + (   ) + (   ) = ________________

Motor Current = $\lambda / \mathbf{K}_t$ = (   ) / (   ) = ____________________

Exlar Application Worksheet

FAX to:
Exlar Actuation Solutions
(952) 368-4877
Attn: Applications Engineering

Date: ______________________ Company Name: ____

Address: ____

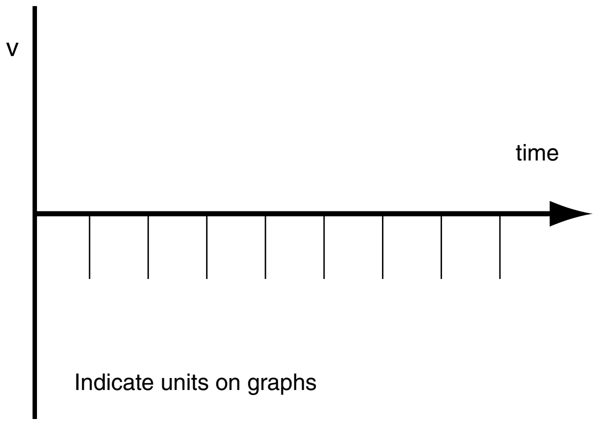
City: ____________________________________ State: ________________ Zip Code: ________

Phone: ___________________________________ Fax: ____________________________

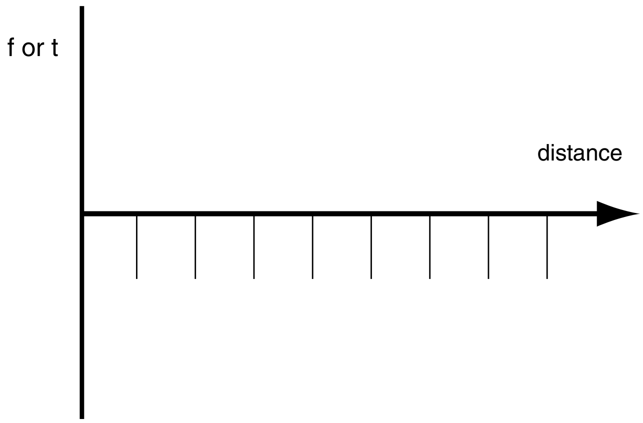
Contact: __________________________________ Title: ____________________________

Sketch/Describe Application

Velocity vs. Time



Force or Torque vs. Distance



Exlar Application Worksheet

Date: ____________________ Contact: ___________________________ Company: __________________________

Stroke & Speed Requirements

Maximum Stroke Needed .... __________________ inches (mm), revs

Index Stroke Length .... __________________ inches (mm), revs

Index Time .... __________________ sec

Max Speed Requirements .... __________________ in/sec (mm/sec), revs/sec

Min Speed Requirements .... __________________ in/sec (mm/sec), revs/sec

Required Positional Accuracy .... __________________ inches (mm), arc min

Load & Life Requirements

Gravitational Load .... _________________ lb (N)

External Applied Load .... _________________ lbf (N)

Inertial Load .... _________________ lbf (N)

Friction Load .... _________________ lbf (N)

Rotary Inertial Load .... _________________ lbf-in-sec^2 (Kg-m^2)

or rotary mass, radius of gyr. .... lb (kg) ________________ in (mm)

Side Load (rot. or lin. actuator) .... ________________ lb (N)

Force Direction _____ Extend _____ Retract _____ Both

Actuator Orientation _____ Vertical Up _____ Vertical Down _____ Horizontal

_____ Fixed Angle _____ Degrees from Horizontal

_____ Changing Angle _____ to _____

Cycling Rate .... ___________________ Cycles/min/hr/day

Operating Hours per Day .... ___________________ Hours

Life Requirement .... ___________________ Cycles/hr/inches/mm

---

Configuration

Mounting: _____ Side _____ Flange _____ Ext Tie Rod _____ Clevis _____ Trunnion

Rod End: _____ Male _____ Female _____ Sph Rod Eye _____ Rod Eye _____ Clevis

Rod Rotation Limiting: _____ Appl Inherent _____ External Required

Holding Brake Required: _____ Yes _____ No

Cable Length: _________ ft (m)

Rotary Inertia To obtain a conversion from A to B, multiply by the value in the table.

B	$Kg\text{-}m^2$	$Kg\text{-}cm^2$	$g\text{-}cm^2$	$kgf\text{-}m\text{-}s^2$	$kgf\text{-}cm\text{-}s^2$	$gf\text{-}cm\text{-}s^2$	$oz\text{-}in^2$	$ozf\text{-}in\text{-}s^2$	$lb\text{-}in^2$	$lbf\text{-}in\text{-}s^2$	$lb\text{-}ft^2$	$lbf\text{-}ft\text{-}s^2$
A												
$Kg\text{-}m^2$	1	10^{4}	10^{7}	0.10192	10.1972	$1.01972x10^{4}$	$5.46745x10^{4}$	$1.41612x10^{2}$	$3.41716x10^{3}$	8.850732	23.73025	0.73756
$Kg\text{-}cm^2$	10^{-4}	1	10^{3}	$1.01972x10^{5}$	$1.01972x10^{3}$	1.01972	5.46745	$1.41612x10^{-2}$	0.341716	$8.85073x10^{-4}$	$2.37303x10^{-3}$	$7.37561x10^{-5}$
$g\text{-}cm^2$	10^{-7}	10^{-3}	1	$1.01972x10^{-8}$	$1.01972x10^{-6}$	$1.01972x10^{-3}$	$5.46745x10^{-3}$	$1.41612x10^{-5}$	$3.41716x10^{-4}$	$8.85073x10^{-7}$	$2.37303x10^{-6}$	$7.37561x10^{-8}$
$kgf\text{-}m\text{-}s^2$	9.80665	$9.80665x10^{4}$	$9.80665x10^{7}$	1	10^{2}	10^{5}	$5.36174x10^{5}$	$1.388674x10^{3}$	$3.35109x10^{4}$	86.79606	$2.32714x10^{2}$	7.23300
$kgf\text{-}cm\text{-}s^2$	$9.80665x10^{-2}$	$9.80665x10^{2}$	$9.80665x10^{5}$	10^{-2}	1	10^{5}	$5.36174 x10^{3}$	13.8874	$3.35109x10^{-2}$	0.86796	2.32714	$7.23300x10^{-2}$
$gf\text{-}cm\text{-}s^2$	9.80665x10-5	0.980665	$9.80665x10^{2}$	10^{-5}	10^{-3}	1	5.36174	$1.38874 x10^{-2}$	0.335109	$8.67961x10^{-4}$	$2.32714x10^{-3}$	$7.23300x10^{-5}$
$oz\text{-}in^2$	$1.82901x10^{-5}$	0.182901	$1.82901x10^{2}$	$1.86505x10^{-6}$	$1.86505x10^{-4}$	0.186506	1	$2.59008 x10^{-3}$	$6.25 x10^{-2}$	$1.61880x10^{-4}$	$4.34028x10^{-4}$	$1.34900x10^{-3}$
$oz\text{-}in\text{-}s^2$	$7.06154x10^{-3}$	70.6154	$7.06154x10^{4}$	$7.20077x10^{4}$	$7.20077x10^{-2}$	72.0077	$3.86089x10^{2}$	1	24.13045	$6.25 x10^{-2}$	0.167573	$5.20833x10^{-4}$
$lb\text{-}in^2$	$2.92641x10^{-4}$	2.92641	$2.92641x10^{3}$	$2.98411x10^{5}$	$2.98411x10^{3}$	2.98411	16	$4.14414 x10^{2}$	1	$2.59008x10^{-3}$	$6.94444x10^{-3}$	$2.15840x10^{-4}$
$lbf\text{-}in\text{-}s^2$	0.112985	$1.129x10^{3}$	$1.12985x10^{6}$	$1.15213x10^{2}$	1.15213	$1.51213 x10^{3}$	$6.1774 x10^{3}$	16	$3.86088x10^{2}$	1	2681175	$8.3333x10^{-2}$
$lbf\text{-}ft^2$	$4.21403x10^{-2}$	$4.21403x10^{2}$	$4.21403x10^{5}$	$4.29711x10^{3}$	0.429711	4.297114	$2.304 x10^{3}$	5.96755	144	0.372971	1	$3.10809x10^{-2}$
$lbf\text{-}ft\text{-}s^2$	1.35583	$1.35582x10^{4}$	$1.35582x10^{7}$	0.138255	13.82551	$1.38255x10^{4}$	$7.41289x10^{4}$	192	$4.63306x10^{3}$	12	32.17400	1

Torque To obtain a conversion from A to B, multiply A by the value in the table.

B	N-m	N-cm	dyn-cm	Kg-m	Kg-cm	g-cm	oz-in	ft-lb	in-lb
A									
N-m	1	10^{-2}	10^{7}	0.109716	10.19716	$1.019716 x10^{4}$	141.6199	0.737562	8.85074
N-cm	102	1	10^{5}	$1.019716 x10^{3}$	0.1019716	$1.019716 x10^{2}$	1.41612	$7.37562 x10^{-3}$	$8.85074 x10^{-2}$
dyn-cm	10-7	10^{-5}	1	$1.019716 x10^{-8}$	$1.019716 x10^{-6}$	$1.019716 x10^{-3}$	$1.41612 x10^{-5}$	$7.2562 x10^{-8}$	$8.85074 x10^{-7}$
Kg-m	9.80665	$980665x10^{2}$	$9.80665 x10^{7}$	1	10^{2}	10^{5}	$1.38874 x10^{3}$	7.23301	86.79624
Kg-cm	9.80665x10-2	9.80665	$9.80665 x10^{5}$	10^{-2}	1	10^{3}	13.8874	$7.23301 x10^{-2}$	0.86792
g-cm	9.80665x10-5	$9.80665x10^{-3}$	$9.80665 x10^{2}$	10^{-5}	10^{-3}	1	$1.38874 x10^{-2}$	$7.23301 x10^{-5}$	$8.679624 x10^{-4}$
oz-in	7.06155x10-3	0.706155	$7.06155 x10^{4}$	$7.20077 x10^{-4}$	$7.20077 x10^{-2}$	72,077	1	$5.20833 x10^{-3}$	$6.250 x10^{-2}$
ft-lb	1.35582	$1.35582x10^{2}$	$1.35582 x10^{7}$	0.1382548	13.82548	$1.382548 x10^{4}$	192	1	12
in-lb	0.113	11.2985	$1.12985 x10^{6}$	$1.15212 x10^{-2}$	1.15212	$1.15212 x10^{3}$	16	$8.33333 x10^{-2}$	1

Common Material Densities

Material	oz/in^3	gm/cm^3
Aluminum (cast or hard drawn)	1.54	2.66
Brass (cast or rolled)	4.80	8.30
Bronze (cast)	4.72	8.17
Copper (cast or hard drawn)	5.15	8.91
Plastic	0.64	1.11
Steel (hot or cold rolled)	4.48	7.75
Wood (hard)	0.46	0.80
Wood (soft)	0.28	0.58

Coefficients of Sliding Friction

Materials in contact	μ
Steel on Steel (dry)	0.58
Steel on Steel (lubricated)	0.15
Aluminum on Steel	0.45
Copper on Steel	0.36
Brass on Steel	0.44
Plastic on Steel	0.20
Linear Bearings	0.001

Standard Ratings for Exlar Actuators

The standard IP rating for Exlar Actuators is IP54S or IP65S. Ingress protection is divided into two categories: solids and liquids.

For example, in IP65S the three digits following “IP” represent different forms of environmental influence:

- The first digit represents protection against ingress of solid objects.
- The second digit represents protection against ingress of liquids.
- The suffix digit represents the state of motion during operation.

Digit 1 - Ingress of Solid Objects

The IP rating system provides for 6 levels of protection against solids.

1	Protected against solid objects over 50 mm e.g. hands, large tools.
2	Protected against solid objects over 12.5 mm e.g. hands, large tools.
3	Protected against solid objects over 2.5 mm e.g. large gauge wire, small tools.
4	Protected against solid objects over 1.0 mm e.g. small gauge wire.
5	Limited protection against dust ingress.
6	Totally protected against dust ingress.

Digit 2 - Ingress of Liquids

The IP rating system provides for 9 levels of protection against liquids.

1	Protected against vertically falling drops of water or condensation.
2	Protected against falling drops of water, if the case is positioned up to 15 degrees from vertical.
3	Protected against sprays of water from any direction, even if the case is positioned up to 60 degrees from vertical.
4	Protected against splash water from any direction.
5	Protected against low pressure water jets from any direction. Limited ingress permitted.
6	Protected against high pressure water jets from any direction. Limited ingress permitted.
7	Protected against short periods (30 minutes or less) of immersion in water of 1m or less.
8	Protected against long durations of immersion in water.
9	Protected against high-pressure, high-temperature wash-downs.

Suffix

S	Device standing still during operation	**M**	Device moving during operation

Notes

Return to table of contents

1. OFFER AND ACCEPTANCE: These terms and conditions constitute Seller's offer to Buyer and acceptance by Buyer and any resulting sale is expressly limited to and conditioned upon Seller's terms and conditions as set forth below. If Buyer objects to any of Seller's terms and conditions, such objections must be expressly stated and brought to the attention of Seller in a written document which is separate from any purchase order or other printed form of Buyer. Such objections, or the incorporation of any additional or different terms or conditions by Buyer into a resulting order shall constitute non-acceptance of these Terms and Conditions, releasing Seller from any obligation or liability hereunder and a proposal for different terms and conditions which shall be objected to by Seller unless expressly accepted in writing by an authorized representative of Seller. Acknowledgment copy, if any, shall not constitute acceptance by Seller of any additional or different terms or conditions, nor shall Seller's commencement of effort, in itself, be construed as acceptance of an order containing additional or different terms and conditions.

2. PRICES: Published prices and discount schedules are subject to change without notice. They are prepared for the purpose of furnishing general information and are not quotations or offers to sell on the part of the company.

3. TRADE TERMS: Shipment terms are FCA, shipping point (Exlar, Chanhassen, MN). FCA (Free Carrier) per Incoterms 2010 means the Seller delivers the goods, cleared for export into the custody of the first carrier named by the buyer at the named place, above. This term is suitable for all modes of transport, including carriage by air, rail, road, and containerized/multi-modal transport. Title of the merchandise transfers from Exlar Corporation to the Buyer when it is received from Exlar by the carrier. Where allowable, Exlar will arrange the transportation via the carrier specified by the Buyer. The Buyer is responsible for all costs associated with the shipment.

4. PAYMENT TERMS: Subject to approval of Buyer's credit, the full net amount of each invoice is due and payable in cash within thirty (30) days of shipment. No payment discounts are offered, and minor inadvertent administrative errors contained in an invoice are subject to correction and shall not constitute reason for untimely payment. If, in the judgment of the Seller, the financial credit of Buyer at any time does not justify continuance of production or shipment of any product(s) on the payment terms herein specified, Seller may require full or partial payment prior to completion of production or shipment, or may terminate any order, or any part thereof, then outstanding. Custom products and blanket orders are subject to payment terms: 30% due at time of order, 70% due net 30 days from shipment.

5. MINIMUM BILLING: Minimum billing will be $50.00.

6. DELAYS: Exlar shall not be liable for any defaults, damages or delays in fulfilling any order caused by conditions beyond Seller's control, including but not limited to acts of God, strike, lockout, boycott, or other labor troubles, war, riot, flood, government regulations, or delays from Seller's subcontractors or suppliers in furnishing materials or supplies due to one or more of the foregoing clauses.

7. CANCELLATIONS: All cancelled orders for standard products are subject to order cancellation charges. The minimum cancellation charge will be 20% of the order total. Standard products, if unused may be returned in accordance with the current return policy. All returns are subject to prior approval by Exlar, and return charges may apply. No return credit for any product will be issued or authorized prior to evaluation of the product by Exlar. Custom product is not returnable. Orders for custom product are not cancelable.

8. QUANTITY PRICING AND BLANKET ORDER PRICING TERMS: Blanket order quantity pricing requires a complete delivery schedule for the volume being ordered, with all units scheduled to deliver within a 15 month period from the placement of the purchase order to the final scheduled shipment. Any requests to change the delivery schedule of a blanket order must be received in writing 60 days prior to the requested change. Failure to take delivery of the entire ordered volume will result in back charges equal to the difference in quantity price between the volume ordered and the volume received times the number of units received. A cancellation charge in accordance with the cancellation policy (item 7) will apply to any reduction in delivered volume from the original ordered quantity.

For orders receiving quantity discounts, but not as scheduled blanket orders, the same quantity pricing rules apply. Failure to take delivery of the entire quantity ordered will result in back charges equal to the difference in quantity price between the volume ordered and the volume received times the number of units received. Cancellation charges in accordance with the cancellation policy (item 7) will apply to any reduction in delivered volume from the original ordered quantity. For either blanket orders or quantity orders, in addition to any applicable cancellation charges, the customer is responsible for the value of any additional inventory allocated specifically to their order. Charges for this inventory will be invoiced in addition to cancellation charges, along with any back charges for quantity variance.

9. DESTINATION CONTROL STATEMENT: Exlar products, technology or software are exported from the United States in accordance with the Export Administration Regulations (EAR) or International Traffic in Arms Regulations (ITAR) as applicable. Diversion, transfer, transshipment or disposal contrary to U.S. law is prohibited.

10. EXPORT CONTROL AND SHIPMENT REGULATIONS: Purchaser agrees at all times to comply with all United States laws and regulations as well as International Trade Laws, as they may exist from time to time, regarding export licenses or the control or regulation of exportation or re-exportation of products or technical data sold or supplied to Distributor. Seller may terminate or suspend this order, without remedy, should the Purchaser become an entity identified on any US export denial listing. Products ordered may require authorization and/or validated export license from a U.S. government agency. Seller may terminate or suspend this order, without remedy, should a government agency approval be denied.

11. GOVERNING LAW AND VENUE: This order shall be governed by, and construed in accordance with the laws of the State of Minnesota, U.S.A. All disputes shall be resolved by a court of competent jurisdiction in the trial courts of Carver County, in the State of Minnesota.

12. ATTORNEY FEES: Reasonable attorney's fees and other expenses of litigation must be awarded to the prevailing party in an action in which a remedy is sought under this order.

13. NON-WAIVER: The failure by the Seller to require performance of any provision shall not affect the Seller's right to require performance at any time thereafter, nor shall a waiver of any breach or default of this Order constitute a waiver of any subsequent breach or default or a waiver of the provision itself.

14. MERGER AND INTEGRATION: These Terms and Conditions contain the entire agreement of the parties with respect to the subject matter of this order, and supersede all prior negotiations, agreements and understandings with respect thereto. Purchase orders may only be amended by a written document duly executed by buyer and seller.

15. INDEMNITY: Buyer agrees to indemnify, defend and hold harmless Exlar from any claims, loss or damages arising out of or related to Seller's compliance with Buyer's designs, specifications or instructions in the furnishing of products to Buyer, whether based on infringement of patents, copyrights, trademark or other right of others, breach of warranty, negligence, or strict liability or other tort.

WARRANTY AND LIMITATION OF LIABILITY: Products are warranted for two years from date of manufacture as determined by the serial number on the product label. Labels are generated and applied to the product at the time of shipment. The first and second digits are the year and the third and fourth digits represent the manufacturing week. Product repairs are warranted for 90 days from the date of the repair. The date of repair is recorded within the Exlar database and tracked by individual product serial number.

Exlar Corporation warrants its product(s) to the original purchaser and in the case of original equipment manufacturers, to their original customer to be free from defects in material and workmanship and to be made only in accordance with Exlar standard published catalog specifications for the product(s) as published at the time of purchase. Warranty or performance to any other specifications is not covered by this warranty unless otherwise agreed to in writing by Exlar and documented as part of any and all contracts, including but not limited to purchase orders, sales orders, order confirmations, purchase contracts and purchase agreements. In no event shall Exlar be liable or have any responsibility under such warranty if the product(s) has been improperly stored, installed, used or maintained, or if Buyer has permitted any unauthorized modifications, adjustments and/or repairs to such product(s). Seller's obligation hereunder is limited solely to repairing or replacing (at its opinion), at the factory any product(s), or parts thereof, which prove to Seller's satisfaction to be defective as a result of defective materials, or workmanship and within the period of time, in accordance with the Seller's stated product warranty (see Terms and Conditions above), provided, however, that written notice of claimed defects shall have been given to Exlar within thirty (30) days from the date of any such defect is first discovered. The product(s) claimed to be defective must be returned to Exlar, transportation prepaid by Buyer, with written specification of the claimed defect. Evidence acceptable to Exlar must be furnished that the claimed defects were not caused by misuse, abuse, or neglect by anyone other than Exlar.

Components such as seals, wipers, bearings, brakes, bushings, gears, splines, and roller screw parts are considered wear parts and must be inspected and serviced on a regular basis. Any damage caused by failure to properly lubricate Exlar products and/or to replace wear parts at appropriate times, is not covered by this warranty. Any damage due to excessive loading is not covered by this warranty.

The use of products or components under load such that they reach the end of their expected life is a normal characteristic of the application of mechanical products. Reaching the end of a product's expected life does not indicate any defect in material or workmanship and is not covered by this warranty.

Costs for shipment of units returned to the factory for warranty repairs are the responsibility of the owner of the product. Exlar will return ship all warranty repairs or replacements via UPS Ground at no cost to the customer.

For international customers, Exlar will return ship warranty repairs or replacements via UPS Expedited Service and cover the associated shipping costs. Any VAT or local country taxes are the responsibility of the owner of the product.

The foregoing warranty is in lieu of all other warranties (except as Title), whether expressed or implied, including without limitation, any warranty of merchantability, or of fitness for any particular purpose, other than as expressly set forth and to the extent specified herein, and is in lieu of all other obligations or liabilities on the part of Exlar.

Seller's maximum liability with respect to these terms and conditions and any resulting sale, arising from any cause whatsoever, including without limitation, breach of contract or negligence, shall not exceed the price specified of the product(s) giving rise to the claim, and in no event shall Exlar be liable under this warranty otherwise for special, incidental or consequential damages, whether similar or dissimilar, of any nature arising or resulting from the purchase, installation, removal, repair, operation, use or breakdown of the product(s) or any other cause whatsoever, including negligence.

The foregoing warranty shall also apply to products or parts which have been repaired or replaced pursuant to such warranty, and within the period of time, in accordance with Seller's stated warranty.

NO PERSON INCLUDING ANY AGENT OR REPRESENTATIVE OF EXLAR CORPORATION IS AUTHORIZED TO MAKE ANY REPRESENTATION OR WARRANTY ON BEHALF OF EXLAR CONCERNING ANY PRODUCTS MANUFACTURED BY EXLAR, EXCEPT TO REFER PURCHASERS TO THIS WARRANTY.

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