

# Tritex II® DC Series Actuators



**Models TDM/TDX 060 & 075, RDM/RDG 060, 075 & 090**

## 48 VDC Linear and Rotary Actuator Installation and Service Manual



**EtherNet/IP™**  
conformance tested

Information furnished by Exlar Corporation is believed to be accurate and reliable. However, no responsibility is assumed by Exlar Corporation for its use. Exlar reserves the right to change the design and operation of the equipment described herein and any associated motion products that may appear in this document. Information in this document pertaining to equipment not furnished by Exlar should be confirmed by that equipment manufacturer. Exlar assumes no responsibility for changes to information by other manufacturers or errors in that information or the description of that information. Information in this document is subject to change without notice.

***This document does not contain any export controlled technical data.***

## 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 Exlar's database 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's 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 option), 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 herein 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, 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.**

# TABLE OF CONTENTS

<b>SAFETY CONSIDERATIONS</b>	4
CSA Certified Product	7
EU Declaration of Conformity for CE Mark	9
<b>TRITEX™ PRODUCT OVERVIEW</b>	13
System overview, shown with SIO / Ethernet Option Board	14
Tritex Configurations	14
60mm frame, top exiting connections, shown with 90 deg, M23 connectors	15
General Specifications	16
<b>INSTALLATION</b>	17
Mechanical Installation	17
<i>Lubrication</i>	17
<i>Mounting Configurations</i>	17
<i>Mounting and Operating Considerations</i>	17
Outdoor and Wash Down Installations	18
Manual Drive Operating Instructions	19
Electrical Installation	26
Introduction	26
Main Power Supply Selection	26
Unregulated AC/DC Power Supplies	27
Regulated AC/DC Power Supplies	27
Power from Battery Systems	29
Handling Regen Energy – Internal Shunt Resistor and Regulator	29
Handling Regen Energy – External Shunt Resistor and Regulator	30
Logic Power Supply	30
Shielding	33
NPT Connections	33
Grounding	34
Power Supply Connections	35
Tritex Input and Output Wiring	37
Input/Output Connections	38
CANopen	39
I/O Power Supply	40
Two Power Supply Configuration	40
Single Power Supply Configuration	40
Digital Inputs	41
Digital Outputs	42
Actuator Brake Option	43
Analog Input	44
Analog Output	45
Communications	45
PC Communications	46
IA4 Option board connections	48
AF Option, Absolute Feedback	51
Ethernet Options, EIP, TCP or ProfiNet	52
EMC Considerations	54

<b>TROUBLESHOOTING PROCEDURES</b> .....	55
<b>MAINTENANCE</b> .....	57
Procedures for Roller Screw Re-Greasing.....	57
<i>Lubrication Maintenance</i> .....	58
<i>Grease Renewal</i> .....	58
<i>Reassembly</i> .....	59
Procedures for Complete Re-Greasing.....	60
<i>Disassembly</i> .....	60
<i>Lubrication Maintenance</i> .....	61
<i>Grease Renewal</i> .....	61
<i>Reassembly</i> .....	62
<b>ACCESSORIES</b> .....	64
Cables.....	64
<i>TTIOC-xxx I/O Cable</i> .....	64
<i>TTIPC-xxx Power Cable</i> .....	65
<i>TTICO-xxx Communications Cable</i> .....	65
Communication Converters .....	67
Power Supply.....	67
<i>TTPS1048 Power Supply Introduction</i> .....	67
Shunt Regulator.....	69
<i>TTSR1 Shunt Regulator Option</i> .....	69
Power Distribution and Surge Filter .....	71
<i>TDCESF1 Power Distribution and Surge Filter Accessory</i> .....	71

## SAFETY CONSIDERATIONS

As with any electro-mechanical device, safety must be considered during the installation and operation of your Tritex Series actuator. Throughout this manual, you will see paragraphs marked with CAUTION and WARNING signs as shown below

### WARNING



“**Warning**” indicates the information following is essential to avoiding a safety hazard.

### CAUTION



“**Caution**” indicates the information following is necessary for avoiding a risk of damage to the product or other equipment.

### WARNING



#### General

Failure to follow safe installation guidelines can cause death or serious injury. The voltages used in the product

can cause severe electric shock and/or burns and could be lethal. Extreme care is necessary at all times when working with or adjacent to the product. The installation must comply with all relevant safety legislation in the country of use. The forces created by actuator could be lethal or cause severe injury if proper protection is not provided to keep personnel away from moving components.

## WARNING



### **System Design and safety for personnel**

The actuator is intended as a component for professional incorporation into complete equipment or a system. If installed incorrectly, the actuator may present a safety hazard.

The actuator uses high voltages and currents, carries a high level of stored electrical energy, and is used to control equipment which can cause injury. Close attention is required to the electrical installation and the system design to avoid hazards either in normal operation or in the event of equipment malfunction. System design, installation, commissioning, and maintenance must be carried out by personnel who have the necessary training and experience. They must read this safety information and this manual carefully.

**None of the functions or features of the Tritex actuator may be used to ensure safety of personnel, i.e. they must not be used for safety-related functions.** For example the actuators enable / disable, brake, stop/start and forward/reverse functions are not sufficient for use in safety-critical applications without additional independent channels of protection. Careful consideration must be given to the functions of the actuator which might result in a hazard, either through their intended behavior or through incorrect operation due to a fault. In any application where a malfunction of the actuator or its control system could lead to or allow damage, loss or injury, a risk analysis must be carried out, and where necessary, further measures taken to reduce the risk.- for example a failsafe brake in case of loss of actuator braking power.

## WARNING



### **Never attempt to connect or disconnect the actuator with power applied.**

Dangerous voltages may be present. Damage to equipment and injury to personnel can result. Many amplifiers have voltage present for a considerable time period after incoming power is removed. Take care to insure that the amplifier has discharged all power.

## WARNING



### Supply isolation

The AC supply or high voltage DC supply must be removed from the actuator using an approved isolation device or disconnect before any servicing work is performed, other than adjustments to the settings or parameters specified in the manual. The actuator contains capacitors which remain charged to a potentially lethal voltage after the supply has been removed.

## WARNING



### If connected by plug and socket

A special hazard may exist where the actuator is incorporated into a system which is connected to the AC supply by a plug and socket. When unplugged, the pins of the plug may be connected to the drive input, which is only separated from the charge stored in the bus capacitor. It is the responsibility of the user to avoid any possibility of electric shock from the pins, if they are accessible.

## WARNING



### Grounding - High Leakage Current

In the event of a fault, this equipment has high earth leakage current. You must comply with local safety regulations with respect to minimum size and special installation requirements on the protective earth conductor for high leakage current equipment. The ground connections shown in this manual must be followed.

## WARNING



### Fuses and Branch circuit protection

*“The Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes”*, or equivalent. Fuses or over-current protection must be provided at the input in accordance with the instructions in the manual.

## CAUTION



### CAUTION – Hot Surface – Risk of Burn.

## CSA Certified Product



The Tritex II DC Linear and Rotary Actuators are marked as shown after passing a rigorous set of design and testing criteria developed by CSA International (C22.2 No. 139).

This label indicates that CSA certifies this product to be safe when installed according to the installation guidelines and used with the scope of the product specifications.

### The conditions of acceptability required by CSA are:

- The drive voltage rating range and maximum current operating rating:

Voltage	Current (Adc)
12-24 Vdc	18.0A max.

- Maximum Rated Force: Up to 872 lbf (3,879N)
- Installation Requirements
  - Hazardous Location (Class I Division 2 Group A, B, C, D) installations – ½" rigid conduit with NPT connections must be used.
  - For NPT connections the power wires must be UL approved copper only wires, 12 AWG, 300 VAC minimum rating, and 105° C minimum rating..
  - For other non-hazardous installations:
    - Use the above connection method, or
    - Cable with connector assemblies, or
    - Cables with cable glands are permitted.
  - When an AC to DC power supply is used to supply main power then the power supply must be agency approved and provided with its own enclosure.
  - If a customer requires an additional +24 VDC power supply to provide power to the Digital I/O, 4-20 mA I/O, or the Analog Input then it must be a recognized or listed Class 2 Power Supply.
  - The full ratings are at 40C ambient temperature. Derate the input current linearly above the 40°C ambient temperature to 14.0Adc at maximum ambient temperature of 65°C.
  - These conditions of acceptability only apply to units with a CSA mark on the product label.

For additional information on cable installations or part numbers, contact Exlar.



# Certificate of Compliance

**Certificate:** 2332992 (109156\_0\_000)

**Master Contract:** 163694

**Project:** 70105665

**Date Issued:** 2017-03-17

**Issued to:** Exlar Corporation  
18400 West 77th St  
Chanhassen, Minnesota 55317  
USA

**Attention:** Larry Lunzer

*The products listed below are eligible to bear the CSA Mark shown  
with adjacent indicators 'C' and 'US' for Canada and US or with adjacent  
indicator 'US' for US only or without either indicator for Canada only.*



**Issued by:** Sorin Tat  
Sorin Tat

## PRODUCTS

CLASS - C322882 - VALVES-Actuators - For Hazardous Locations-Certified to U.S. Standards

CLASS - C322802 - VALVES-Actuators - For Hazardous Locations

- Tritex II T2X & T2M Series Linear Actuators and R2M & R2G Series Rotary Actuators, input rated 100-240Vac, 6.3A max (90mm versions) / 8.3A max (115mm versions), 50-60Hz,  $-40^{\circ}\text{C} \leq \text{Ta} \leq +65^{\circ}\text{C}$ .
- Tritex TDM & TDX Series Linear Actuators and RDM & RDG Series Rotary Actuators, input rated 12-24Vdc, 18.0A max.,  $-40^{\circ}\text{C} \leq \text{Ta} \leq -65^{\circ}\text{C}$ .  
Note: Derate input current linear above  $\text{Ta} = 40^{\circ}\text{C}$  to 14.0A max. at  $65^{\circ}\text{C}$ .

Conditions of Certifications - I/O terminals must be connected to Class 2 circuits when in use.

CLASS - C322882 - VALVES-Actuators - For Hazardous Locations-Certified to U.S. Standards

CLASS - C322802 - VALVES-Actuators - For Hazardous Locations

## **CSA Class I, Division 2, Group A, B, C and D**

- Tritex II T2X & T2M Series Linear Actuators and R2M & R2G Series Rotary Actuators, input rated 100-240Vac, 6.3A max (90mm versions) / 8.3A max (115mm versions), 50-60Hz, Temperature Code T3 ( $200^{\circ}\text{C}$ ),  $-40^{\circ}\text{C} \leq \text{Ta} \leq +65^{\circ}\text{C}$ .





**Certificate:** 2332992

**Master Contract:** 163694

**Project:** 70105665

**Date Issued:** 2017-03-17

- Tritex II TDM & TDX Series Linear Actuators and RDM & RDG Series Rotary Actuators, input rated 12-24Vdc, 18.0A max. Temperature Code T4 (135°C),  $-40^{\circ}\text{C} \leq T_a \leq 165^{\circ}\text{C}$ .  
Note: Derate input current linear above  $T_a = 40^{\circ}\text{C}$  to 14.0Ade max. at 65°C.

Conditions of Certifications

1. The actuators may include a holding brake. The thermal effects of the brake pad have not been evaluated and are to be considered by the authority having jurisdiction.
2. I/O terminals must be connected to Class 2 circuits when in use.

APPLICABLE REQUIREMENTS

CSA C22.2 No 0 - 10	- General Requirements - Canadian Electrical Code Part II
CSA C22.2 No 0.4 - 04	- Bonding of Electrical Equipment
CSA Standard C22.2 No. 139-2013	- Electrically Operated Valves
CSA C22.2 No 213 - M1987	- Non-Incendive Electrical Equipment for Use in Class I, Division 2 Hazardous Locations
UL Standard 429 - 7 <sup>th</sup> Edition	- Electrically Operated Valves
ISA 12.12.01; 2007	- Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations



### *Supplement to Certificate of Compliance*

**Certificate:** 2332992 (109156 0 000)

**Master Contract:** 163694

*The products listed, including the latest revision described below,  
are eligible to be marked in accordance with the referenced Certificate.*

#### **Product Certification History**

<b>Project</b>	<b>Date</b>	<b>Description</b>
70105665	2017-03-17	Update report 2332992 to CSA 139-13 and UL 427 7th Edition as per CSA Signal Sensing and Controls No.12
70045743	2015-11-18	Update report 2332992 to include editorial changes and drawing updates that do not affect Certification test parameters.
70019837	2015-03-27	CONTINUATION OF PROJECT 2785888 at a cost of 5000 USD using existing Purchase Order or Down Payment
70009820	2014-12-19	Update to 2332992 to include Tritex Linear and Rotary Actuators
2472487	2012-01-27	Update to 2332992 to include new lower voltage models including 12-24, 48 and special voltage ranges.
2332992	2011-03-23	Evaluation of Tritex II Actuators as Class I, Div 2, Grps ABCD

# EU Declaration of Conformity for CE Mark

## ***EU Declaration of Conformity***

*This declaration is issued under the sole responsibility of the manufacturer.*

*The undersigned, representing the  
Manufacturer  
Exlar Corporation  
18400 West 77<sup>th</sup> Street  
Chanhassen, MN 55317 USA*

*and the authorized representative  
established within the community  
Exlar GmbH  
Frankfurter Str.: 107  
65479 Raunheim, Germany*

*Declares, that the Exlar Brand Products:*

**TDM, TDX, RDM, RDG Powered Linear and Rotary Actuators**

*(Complete Model Listing Below)*

*Model identification:*

**TDM060, TDX060,**

**RDM060, RDG060,**

**TDM075, TDX075,**

**RDM075, RDG075,**

**RDM090, RDG090**

*The objects of the declaration described above is in conformity with the relevant  
Union harmonization legislation.*

*Per directives listed below:*

*EU EMC Directive 2004/108/EC (until April 19th, 2016)*

*EU EMC Directive 2014/30/EU (from April 20th, 2016)*


*Using the relevant section of the following EU standards and other normative documents:*

*EMC: EN 61800-3:2004+A1:2012 Adjustable Speed Electrical Power Drive  
Systems – Part 3: EMC Requirements and Specific Test Methods.*

*Year of CE Marking: 2012*

*Note: The above products operate at less than 75 VDC and thus  
are not subject to the requirements of the Low Voltage Directive.*

Signature:



Name:

John Wiegert

Position:

Director of Electrical Engineering

Date of Issue:

20-April-2016

Per EU directives implemented on April 20th, 2016 the following requirement for requirement must be followed by Importers and Distributors.

**The requirements for importers include:**

Importers shall indicate their name, registered trade name or registered trade mark and the postal address at which they can be contacted on the apparatus (unless that is not possible, in which case it should be included on the packaging or in an accompanying document).

Importers shall ensure that the product is accompanied by instructions and safety information in a language which can be easily understood by end-users, as determined by the Member State concerned.

Importer is to translate the EU declaration of conformity into the languages required by the member state(s), where the product is sold." Importers shall keep a copy of the EU declaration of conformity (for 10 years).

Importers shall provide a reasoned request from a competent national authority and provide it with all the information and documentation in paper or electronic form necessary to demonstrate the conformity of a product in a language which can be easily understood by that authority.

Importers shall ensure that, while apparatus is under their responsibility, its storage or transport conditions do not jeopardize its compliance with the safety objectives.

Importer shall corrective action necessary when they consider or have reason to believe that the product is not in conformity with its directive(s).

**The requirements for distributor include:**

Distributors shall indicate their name, registered trade name or registered trade mark and the postal address at which they can be contacted on the apparatus (unless that is not possible, in which case it should be included on the packaging or in an accompanying document).

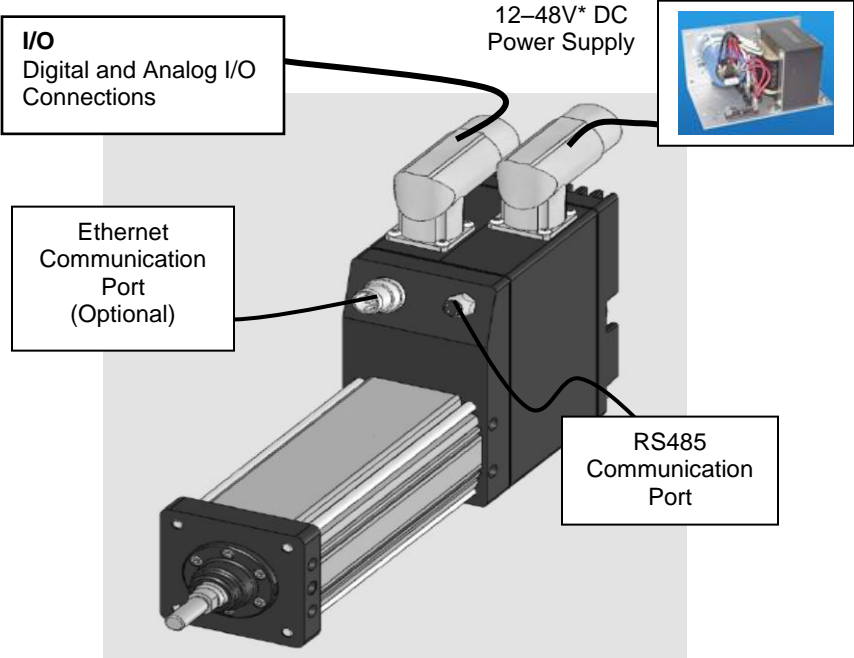
Distributor shall ensure that apparatus is accompanied by instructions and safety information in an appropriate language. Distributor shall translate the EU declaration of conformity into the languages required by the member state(s), where the product is sold." Distributors shall keep a copy of the EU declaration of conformity (for 10 years).

Distributor shall ensure that, while apparatus is under their responsibility, its storage or transport conditions do not jeopardize its compliance with the safety objectives.

Distributor shall corrective action necessary when they consider or have reason to believe that the product is not in conformity with its directive(s).

TRITEX™ PRODUCT OVERVIEW

The Exlar Tritex Series of electric actuators combines an integrated brushless servo motor, amplifier and motion controller.



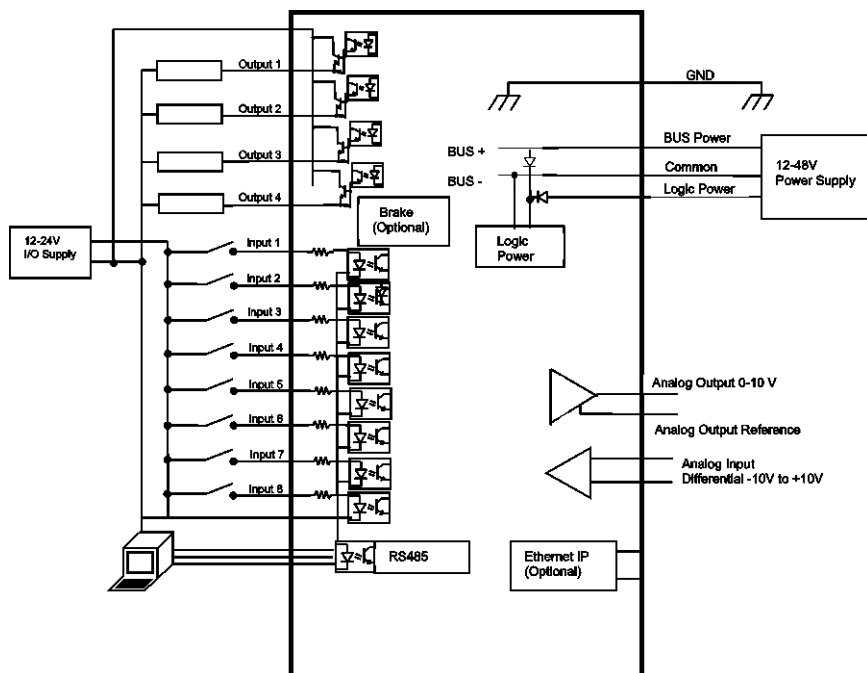
*Integrated actuator, servo motor, amplifier and motion control*

\*Note: 48V (Nominal) for full speed (except CSA certified installations). 24V and 12V (Nominal) will result in reduced speeds.

The Tritex actuators are available in linear and rotary versions with integrated amplifier and motion control.

Frame Size	Linear		Rotary Motor	Rotary Gearmotor
	Std. Capacity	High Capacity		
60 mm	TDM060	TDX060	RDM060	RDG060
75 mm	TDM075	TDX075	RDM075	RDG075
90 mm	NA	NA	RDM090	RDG090

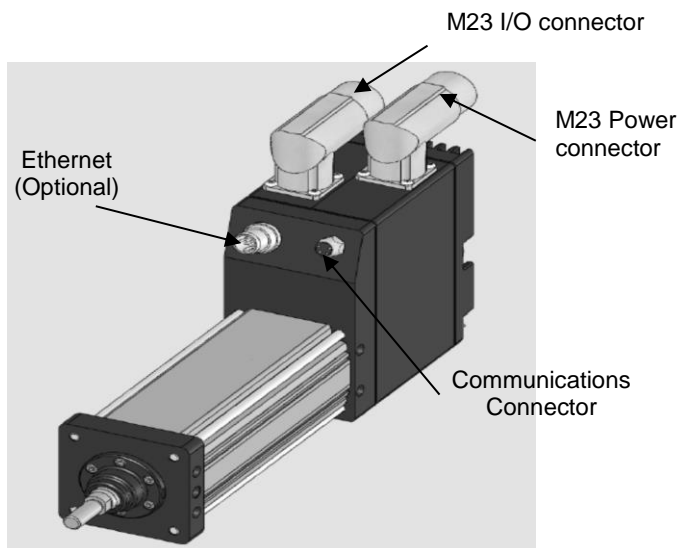
All of the required power components and motion processor are contained in the actuator housing.



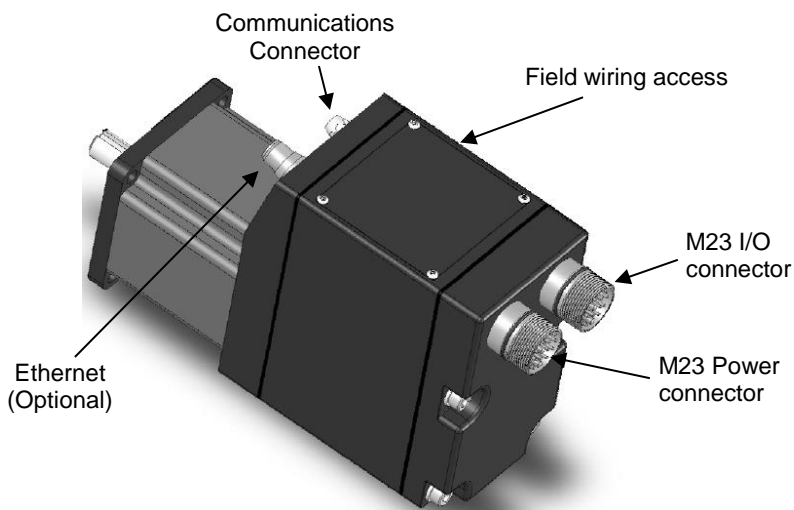
*System Overview, Shown with SIO / Ethernet Option Board*

## Tritex Configurations

The models TDM, TDX, RDM & RDG include the drive and motion controller integrated into the rear of the actuator. Various power and I/O connections are available. 60 mm frame sizes have top exiting 90 degree M23 connectors (shown below), or embedded leads connection options. 75mm and 90mm frame sizes have rear exiting connectors and a top access cover for field wiring. Connector option include straight M23 connectors (shown below), NPT or M20 threaded holes or embedded leads. Customized connection options are also available. See ordering section for model mask information.



*60 mm Frame, Top Exiting Connections, Shown with 90 Degree, M23 Connectors*



*75 & 90 mm Frame, Rear Exiting Connectors, Shown with M23 Connectors*

# General Specifications

Drive Specification for all Tritex II DC Models with embedded drives

Embedded Drive Specifications			
<b>Input Voltage, Bus and Logic</b>	12-24VDC nominal for CSA certified installation 12-48VDC nominal for general use Internal logic remains active with Bus or Logic power at 9V min		
<b>I/O Power Supply</b>	12-24V nominal, 30V max, 9V min Models with brakes require 24V +/- 10% for brake operation		
	<b>SIO &amp; Ethernet Options</b>	<b>IA4 Option</b>	<b>Details</b>
<b>Digital Inputs,</b>	8	4	Opto-isolated, 0-5V or 0-2mA OFF, 8-30V or >3mA ON, programmable functions
<b>Digital Outputs,</b>	4	3	Opto-isolated, 1V max ON state voltage drop, 100mA max continuous load, short circuit & overload protect, programmable functions
<b>Analog Input,</b>	+/-10V, differential input 13 bit resolution	Isolated 4-20 mA, with >14 bit resolution, ext power, 12V max drop @ 22mA	Programmable as position, velocity or torque command
<b>Analog Output,</b>	0-10V, 11 bit resolution	Isolated 4-20 mA 12 bit resolution, ext power, 8V lift- off @ 21mA	Programmable functions
<b>Serial Interface</b>	RS485, Modbus RTU protocol, max baud rate 38.4k, Isolated		
<b>Commutation</b>	Sinusoidal, 10kHz PWM		
<b>Resolution (Std. Feedback)</b>	0.001 revolution		
<b>Accuracy (Std. Feedback)</b>	+ / - 0.002 revolution		
<b>Output Current</b>	Continuous and peak output current is dependent on actuator		
<b>Environmental</b>	Ambient Temperature for rated output: 40°C Maximum Operating Temperature Range: 0°-65°C with power de-rating Humidity: 10-95% non-condensing Altitude: 3000 m above sea level maximum		



## INSTALLATION

### Mechanical Installation

#### Lubrication

The TDM / TDX Series actuators are shipped from the factory fully greased and ready for installation. Exlar recommends using Mobilith SHC 220, a high performance, extreme-pressure grease. The unique physical properties of the synthetic base oil provide outstanding protection against wear, rust, corrosion and high or low-temperature degradation. Mobilith SHC allows for very low starting and running torque values. Its operating range is -40° C to 177° C (-40° F to 350° F).

However, in installation below 0° C is stiffer using some of the motors available torque, for cold temperature operation contact Exlar Application Engineer for lubrication options. See Maintenance section for detail on disassembly for greasing.

#### Mounting Configurations

The standard configurations available are Rear Clevis, Side Mount, Side Trunnion and Front Flange (See Model Mark and ordering guide in Overview section). General drawings are shown in the product section guide.

#### Mounting and Operating Considerations

Every effort should be made to minimize misalignment. Any misalignment will decrease the life of the components within the actuator and also may create problems within the application associated with misalignment.



**Excessive side load on the output rod of the actuator will dramatically reduce the life of the actuator and should be avoided completely. Side load can be caused from misalignment or loading that is not in line with the actuator output rod.**

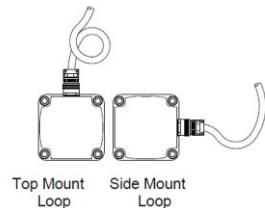


**Care should be taken not to exceed the physical travel limits of TDM Series Actuators. Doing so will cause the actuator to end-crash internally. End crashes can physically damage the roller screw and the internal components of the actuator.**

## Outdoor and Wash Down Installations.

Tritex ratings: The TDM/X, RDM/G actuators have been tested to IP 66. Tritex actuators are not intended for applications where the actuator could possibly be submerged.

1. Avoid rod/shaft up installations if possible; if not possible, make external provisions to keep rod/shaft exposure to water to a minimum. When new, the seals are effective to IP 66 or better. However over time, depending on the amount of side load, they can wear and eventually allow moisture to ingress. Contact Exlar application engineering for special options.
2. With the NPT connection option use thread sealant or Teflon tape on the connector/conduit threads.
3. If straight metric conduit connection is used verify the connector/fitting IP rating and verify the connector O-ring is in place.
4. If cord-grip type cable glands are used, the type with soft rubber glands are preferred (IP 68). The firmer rubber can cause the cable to compress over time, compromising the seal between the gland and the cable. Cable strain reliefs should also be considered to assure tension, bending radius or flexing of the cable over time does not compromise the seal. Careful consideration and testing is required when these glands are used in outdoor applications.
5. If the I connector option is used verify the connector plugs are properly sealed and have the desired IP rating. During installation be sure to screw the plug all the way on to the receptacle for proper sealing.
6. Position conduit fittings or loop cable / flexible conduit so water does not drain towards the conduit fitting.
7. When the wire termination cover is re-installed verify the gasket is in place and the surfaces of the gasket as well as the cover are free from debris so a good seal can be achieved. If the gasket is missing, replace it with PN 51530.
8. When re-installing the termination cover, tighten all 4 screws evenly to be sure the cover seats flat. Tighten the screws to assure the cover is securely held against the gasket. Caution, over tightening can strip the threads in the enclosure. If a screw is missing replace it with Exlar PN 01185. (4-40 x 1/4 Button Head Cap Screw, Stainless Steel)



## Manual Drive Operating Instructions

### WARNING



Isolate all sources of energy to prevent safety hazard due to unexpected motion. System design and operating procedures must ensure that the drive will have no unintended motion that can create a hazard to personnel when operating the drive manually. This includes electrical energy turning the motor as well as energy stored in a vertical load or spring.

There are two manual drive options available on the Tritex, Hand Wheel (HW) and Side Drive (SD)

The hand wheel option includes an internal switch that is closed when the hand-wheel drive is fully disengaged and opens when an attempt is made to engage the hand wheel drive. This switch is in series with the actuator overtemperature sensor to form a combined run permissive signal. When manual drive is engaged, an Actuator Overtemperature fault occurs. The fault action for this fault will disable the drive.

This function is not safety rated, so is not usually sufficient to ensure safety. Power to the drive must be isolated before manual operation.

The Side Drive does not include an interlock switch so power must be removed before use.

### CAUTION



Important information to avoid damage to the manual drive

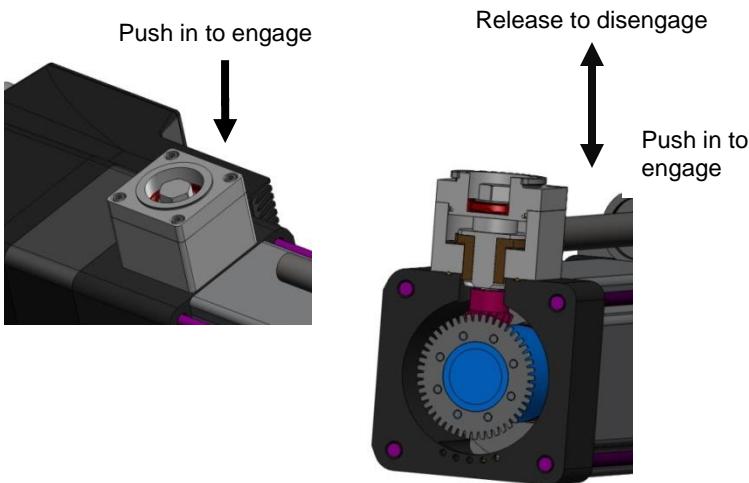
- If manually driving with a brake engaged or high force is necessary, please consult Exlar Application Engineering.
- If a power tool is used to operate the manual side drive the speed should be limited to 600 RPM
- An impact driver should never be used to operate the manual side drive.
- Determine end of stroke of actuator or system and do not apply force past it.
- Refer to **Table 1** for maximum torque specifications.

## Side Drive Instructions

- 1) Isolate all sources of energy from the drive
- 2) Press down on the hex until you feel you have bottomed out the manual drive. **Constant downward force is required to maintain engagement during operation.**
- 3) Give the hex a slight turn while observing if you are moving the rod or not. It is possible that during engagement the gear teeth have not completely engaged; this will prevent the gears from meshing. If the rod is not moving continue to press down while turning the manual drive slowly until it pushes farther down. When this happens, you have proper gear engagement.
- 4) After gear engagement is achieved, the manual drive can be operated. The maximum torque input for the manual drive should not exceed the values shown in Table 1.
- 5) When the manual drive movement is completed, cease the downward force and the manual drive will disengage.

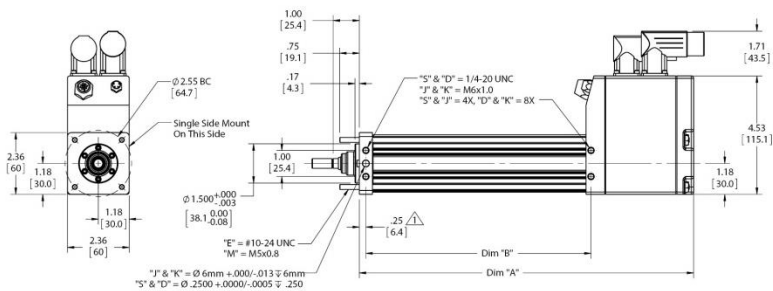
**Table 1 - Maximum operating conditions**

Model	Maximum Torque in-lbs / (Nm)
T2M/X 090	30 / (3.4)
T2M/X 115	40 / (5.6)

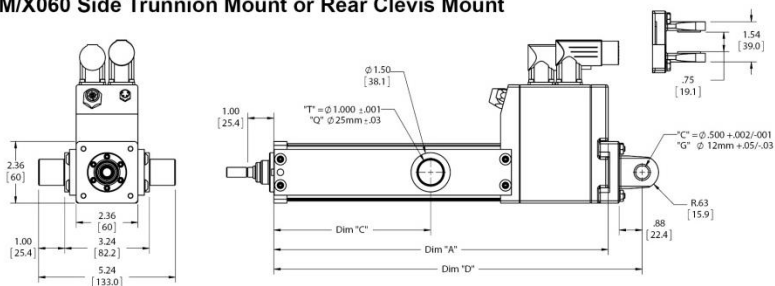


## Dimensions

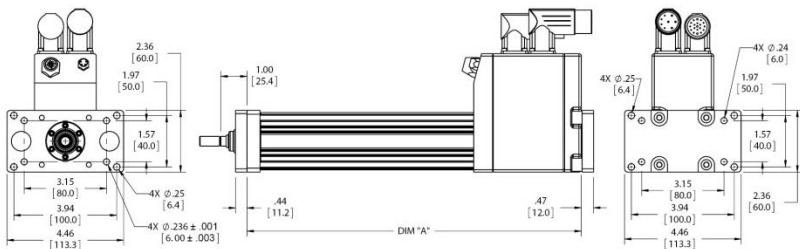
### TDM/X060 Double Side Mount or Extended Tie Rod Mount



### TDM/X060 Side Trunnion Mount or Rear Clevis Mount



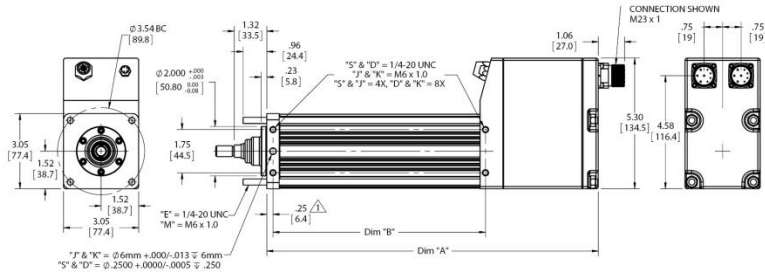
### TDM/X060 Front, Rear, or Front and Rear Flange Mount



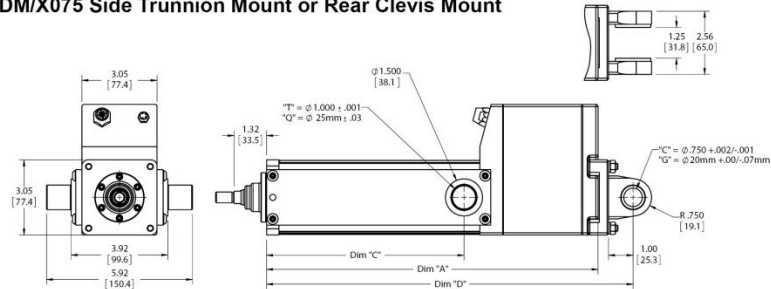
DIM	3 inch (75 mm) stroke in (mm)	6 inch (150 mm) stroke in (mm)	10 inch (250 mm) stroke in (mm)	12 inch (300 mm) stroke in (mm)
A	9.79 (248.7)	12.79 (324.9)	16.79 (426.5)	18.79 (477.3)
B	5.62 (142.8)	8.62 (218.9)	12.62 (320.6)	14.62 (371.4)
C	3.00 (76.2)	6.00 (152.4)	10.00 (254.0)	12.00 (304.8)
D	11.10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

Note: 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  main rod.

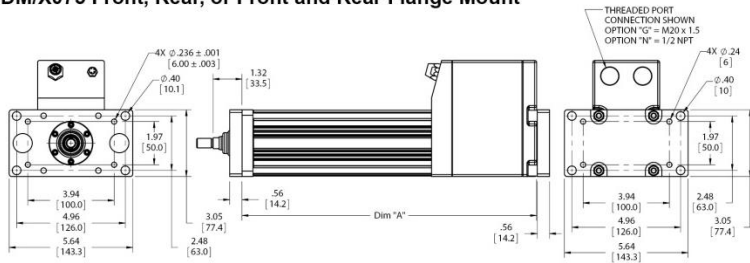
TDM/X075 Double Side Mount or Extended Tie Rod Mount



TDM/X075 Side Trunnion Mount or Rear Clevis Mount



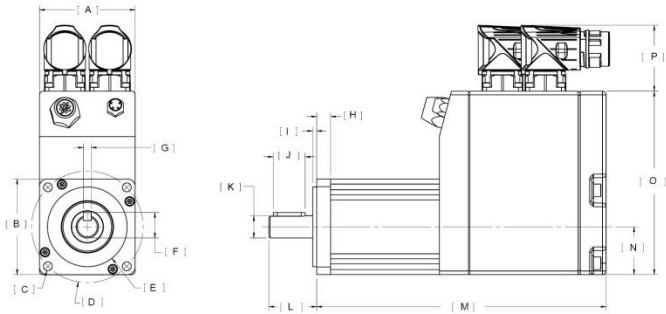
TDM/X075 Front, Rear, or Front and Rear Flange Mount



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)

Note: 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  $\Delta$  main rod.

**RDM/G060 Base Actuator**



		RDM060	RDG060			RDM060	RDG060
A	in	2.36	2.36	I	in	.10	.12
	mm	60	60		mm	2.5	3.0
B	in	2.36	2.36	J	in	.79	.98
	mm	60	60		mm	20.0	25.0
C	in	4X Ø .22	4X Ø .22	K	in	Ø .5512 / .5507	Ø .6302 / .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	.63	.70	N	in	1.18	1.18
	mm	15.9	17.9		mm	30.0	30.0
G	in	Ø .1969 / .1957	Ø .1969 / .1957	O	in	4.53	4.53
	mm	5 h9	5 h9		mm	115.1	115.1
H	in	.34	.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)

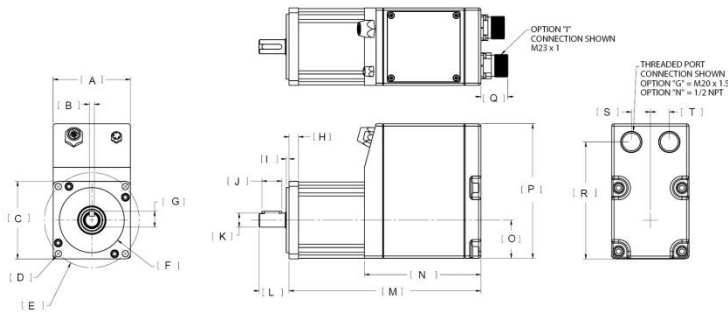
	With Brake Option		
DIM	1 Stack Stator	2 Stack Stator	3 Stack Stator
M	7.856 (199.5)	9.106 (231.3)	10.356 (263.0)

**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)

RDM/G075 Base Actuator



		RDM075	RDG075			RDM075	RDG075
A	in	3.05	3.05	K	in	Ø .5512 / .5508	Ø .6302 / .6298
	mm	77.4	77.4		mm	14 h6	16 j6
B	in	Ø .1969 / .1957	Ø .1969 / .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 .26 ON BC	4X Ø .26 ON BC	N	in	4.59	
	mm	6.5	6.5		mm	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	.63		Q	in	1.06	1.06
	mm	15.9			mm	27.0	27.0
H	in	.38	.45	R	in	4.61	4.61
	mm	9.5	11.5		mm	117.0	117.0
I	in	.11	.11	S	in	.75	.75
	mm	2.8	2.8		mm	19.1	19.1
J	in	.79	.79	T	in	.75	.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)

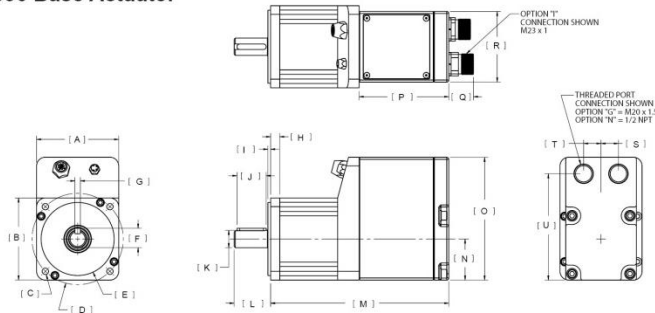
RDG075

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)



RDM/G090 Base Actuator



RDM90				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 .28	4X Ø .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	.85	.96	Q	in	1.06	1.06
	mm	21.5	24.3		mm	27.0	27.0
G	in	Ø .2362 / .2350	Ø .2362 / .2350	R	in	3.05	3.05
	mm	6 h9	6 h9		mm	77.4	77.4
H	in	.39	.63	S	in	.75	.75
	mm	10.0	15.9		mm	19.1	19.1
I	in	.12	.12	T	in	.75	.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 .7480 / .7475	Ø .8665 / .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

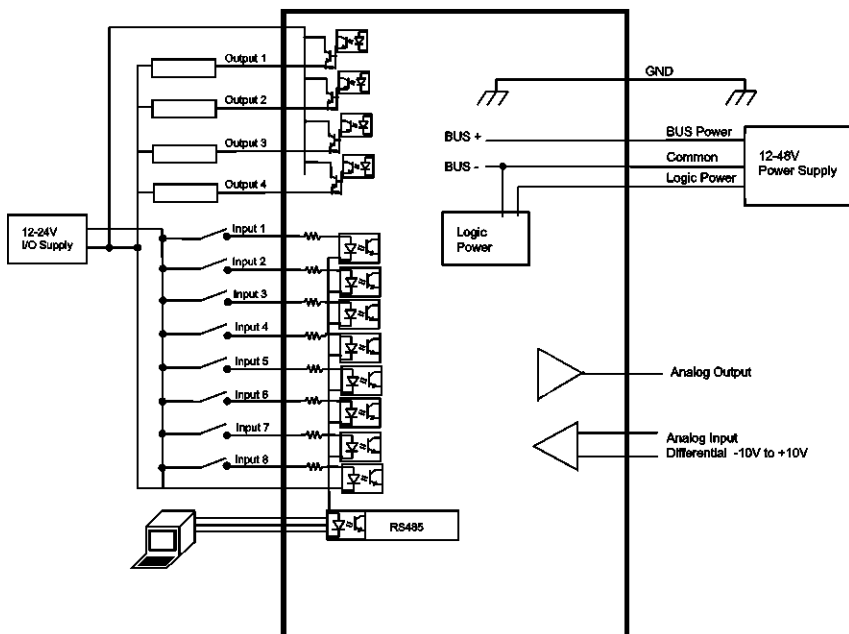
Without Brake Option			
DIM	1 Stack Stator 1 Stage Gearhead	2 Stack Stator 1 Stage Gearhead	3 Stack Stator 1 Stage Gearhead
M	10.80 (274.3)	11.80 (299.7)	12.80 (325.1)
DIM	1 Stack Stator 2 Stage Gearhead	2 Stack Stator 2 Stage Gearhead	3 Stack Stator 2 Stage Gearhead
M	12.06 (306.3)	13.06 (331.7)	14.06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

## Electrical Installation

### Introduction

All of the required power components and motion processor are contained in the actuator or drive housing.



### Main Power Supply Selection

The Tritex actuator requires DC power from a power supply or batteries. The actuator will operate on voltages from 12-48V DC nominal. The continuous operating range is 10-53V DC. If the bus voltage rises above 85 V DC a High Bus Fault will occur and the drive will disable. The voltage threshold may be set lower through a user parameter where appropriate to protect a power supply from overvoltage during regen. The power supply output current rating depends on the maximum actuator power required for the installation.

A 48V supply will allow the motor to deliver maximum rated speed, (specifications in Overview section) a 24V supply will allow the motor to deliver  $\frac{1}{2}$  the maximum rated speed, and a 12V Supply will allow the motor to deliver  $\frac{1}{4}$  the maximum rated speed.

Power supply selection and connection is complicated by three factors associated with variable speed servo drives: high peak loads, power regeneration (regen) and switching frequency ripple current. Peak loads and regen will depend on the application. Ripple current can adversely affect some power supplies.

Note: This section does not pertain to an I/O or Holding Brake Power Supply. The I/O supplies have different limits and it is often inappropriate to use the same supply for all. See section on I/O Supply.

Power supply sizing for motion is based mainly on maximum mechanical power delivered to the load, which is force times velocity for linear or torque times angular velocity for rotary. The power supply has to provide this power which is rated voltage times maximum current plus about 20% to cover losses.

Either regulated or unregulated power supplies can be used for the bus and logic power. Different considerations pertain to each type, and each has advantages and disadvantages.

Exlar offers a 48V unregulated supply rated at 10 amps continuous output, TTPS1048 (see Accessories section). It can deliver about 450W continuous output power. Due to its higher output voltage at light load, it may be necessary to connect to a higher voltage tap, such as the 132V tap for 120V operation. This supply requires an external fuse in the AC input.

## **Unregulated AC/DC Power Supplies**

Tritex II DC operates well from a transformer isolated, unregulated DC power supply. This type of supply should be sized and connected such that the maximum output voltage under high-line and light-load conditions does not exceed the drive maximum voltage rating, 48V + 10%. For instance, when using the TTPS1048 power supply, if the line voltage ever rises above 120V AC, the supply should be connected for 132V AC operation to lower the output voltage by 9%.

Unregulated supplies have the advantage of being able to supply peak currents without overloading and will not trip on high voltage. Unregulated supplies have larger capacitance at the output, especially when compared to regulated switching supplies, providing greater energy recovery and storage during regen and tolerating high ripple current. See section on regen for more information on handling energy from regeneration. They have the disadvantage of output voltage droop as the current rises.

Unregulated supplies are usually rated only by continuous output current. For a very short time, not exceeding 1 second, they can typically output up to 200% of continuous current. Voltage droop may be significant above continuous voltage rating, which can reduce maximum speed. One sizing technique is to calculate the required average power over the worst 5 second interval in a machine cycle, add 20% and use that to determine continuous rated output power for an unregulated supply.

## **Regulated AC/DC Power Supplies**

Most AC/DC power supplies available today are regulated switching power supplies. They are generally not designed to directly power

brushless DC (BLDC) drives, but can do so with special consideration for the load that BLDC drives present to the supply and the overload characteristics of the power supply. These supplies provide very good output voltage regulation as well as high efficiency and smaller size and weight compared with unregulated linear supplies.

Due to overcurrent protection, regulated supplies must generally be rated for the peak power required by the drive. Because the supplies limit output current, fuses between power supply and drive may not be able to interrupt fault current to the drive. The power supply must have output current foldback and / or output cycling on overload. Foldback is where the output current limit is reduced more or less proportionally with the output voltage. Output cycling removes all output power on overload and waits a few seconds before attempting to restore power, limiting average power during faults. Fuses can still be very useful in isolating a fault when a large power supply is used to power several loads. Where conditions of use by an approval agency require fuse protection, the fuses must be installed even if they would not immediately clear a fault.

## CAUTION



**During deceleration of the load the energy generated from the motor and the load will increase the bus voltage and could possibly damage the output of a regulated power supply. If a regulated power supply is used for bus power, a blocking diode should be installed to protect the power supply. See Power Supply Wiring Diagrams section below**

Regenerative energy due to deceleration, spring action, or gravity on the mechanical load will increase bus voltage and attempt to drive energy backward into a power supply. Regulated supplies may trip on overvoltage or recover slowly after being out of regulation causing a dip in output voltage at the end of a regen event. It may be necessary to use a blocking diode to allow the bus voltage at the drive to rise above normal supply voltage without any reverse current. Exlar offers a Power Distribution and Surge Filter assembly that include a blocking diode, TDCSF1 (see Accessories section). See the section below on Handling Regen Energy

Another aspect of BLDC drive loads is that it tends to take pulses of current at twice internal switching frequency creating high ripple current. Some regulated supplies may not be able to tolerate high ripple current, depending on the final filter capacitors. The Power Distribution and Surge Filter assembly includes a small inductor that reduces ripple current. The blocking diode (if used) also reduces ripple current. Power wiring or power cables more than 30 ft (10 m) long provide enough impedance to reduce ripple current as well. Contact Exlar applications support for additional information.

## Power from Battery Systems

Tritex II DC is designed to be powered directly from 12V and 24V lead-acid batteries in vehicles. Regen energy and ripple current are not generally of concern with battery applications of this type. Battery systems generally will be able to supply peak power to the actuator. The average power may be a consideration in sizing the charging circuits for the battery system. Other battery powered applications are possible, but would require additional engineering considerations.

The product has not been tested for immunity to “load dump” conditions. An external voltage clamp designed specifically for load dump protection may be necessary on 24V systems.

## Handling Regen Energy – Internal Shunt Resistor and Regulator

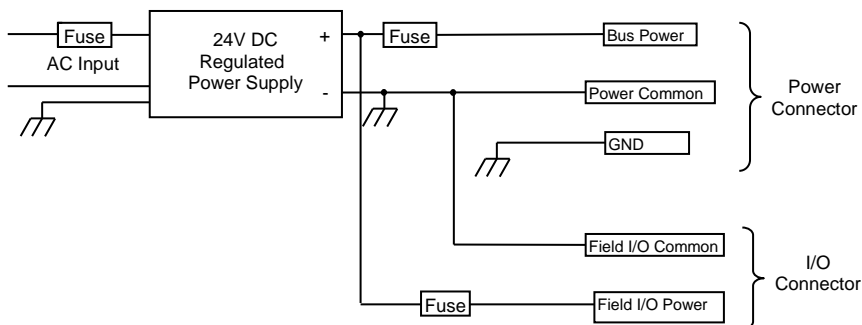
Tritex II DC has a built in controller and small internal shunt resistor that can handle up to 10 joules of energy at a time as long as average power does not exceed 8W. Though not high capacity, it is adequate to handle the inertia for many linear and geared applications and for some low-inertia rotary applications. It is usually inadequate to handle energy from a vertical load or spring return. The controller will turn off the shunt upon reaching either energy or power limits. If there is more regen energy, the bus voltage will rise, resulting in a high bus fault.

Note: A poorly tuned system may have some oscillation that results in the bus voltage pumping up and down enough to turn on the shunt. This reduces the available capacity for handling expected energy from deceleration. Likewise, if an overly aggressive move profile results in significant following error, there can be velocity overshoot followed by deceleration that causes unnecessary regen energy to reach the internal shunt resistor.

As shipped from the factory the internal regulator is set to a value to protect the Tritex from an overvoltage fault condition (85 V). This parameter will not require adjustment as long as the power supply can be back-driven to 85 V like most unregulated 48 V supplies, or can handle all the regen energy like most battery applications, or is isolated with a blocking diode. For other applications, the built in regulator can be adjusted to restrict bus voltage to a level that will protect the power supply from regen energy. Set the User Overvoltage Fault Limit Parameter found in Expert software on the System Set-up page / Limits tab to a value that the power supply can tolerate. The Tritex shunt regulator will operate at 90% of the User Overvoltage Fault Limit value. The drive will trip with a High Bus Voltage fault at the User Overvoltage Fault Limit value or at 85 V, whichever is lower. The default setting of 0 is a special case that means the factory parameter values of 85 V for trip and 76.5 V for shunt operation will be used.

In the example below a single 24 volt supply is used to power bus, logic and Field I/O, the logic power is derived internally from the bus power, the 24 volt regulated supply will keep the I/O voltage under the

30 volt limit. Notice there is no external diode, isolating the power supply from the Bus voltage. For this example, set the User Overvoltage Fault Limit to 33 V. The Tritex shunt regulator will attempt to limit the Bus Voltage to 30 volts (90% of 33 V) to protect the power supply from overvoltage faults & shutdowns and the I/O from overvoltage. If the regen energy is too large, the shunt regulator will turn off to protect itself and a high bus voltage fault will occur at 33 V, disabling the drive and protecting the power supply and I/O circuits.



Unregulated supplies often have very large capacitors that can store regen energy if allowed to be back driven. This characteristic can be used in conjunction with the internal shunt resistor and regulator. The shunt operating point is set to the working voltage of the capacitors. Regen energy is stored in the capacitor until its voltage rises to the shunt operating point. Then the internal shunt accepts up to 10 J of additional energy.

### Handling Regen Energy – External Shunt Resistor and Regulator

For applications lowering vertical loads or decelerating a large inertia or working to hold back some force, regen energy will exceed the ability of the internal shunt resistor and power supply to dissipate or store it. The TTSR1 Shunt Regulator can handle at least two hundred joules of energy at up to 95 Watt average power. It has a fixed operating voltage of 77V, so the power supply must be able to be back driven to more than this voltage or a blocking diode is required. The TDCSF1Power Distribution and Surge Filter accessory may be used to simplify wiring when an external shunt regulator is used with single or multiple Tritex II DC.

### Logic Power Supply

A logic power supply can be used to maintain the control and position information with bus power removed. This power supply is optional and requires about 2 watts of power. It is wired to the Logic Power terminal (+) and Power Common terminal (-). If it is not connected the logic power will come the bus power. Note that the main power and logic power

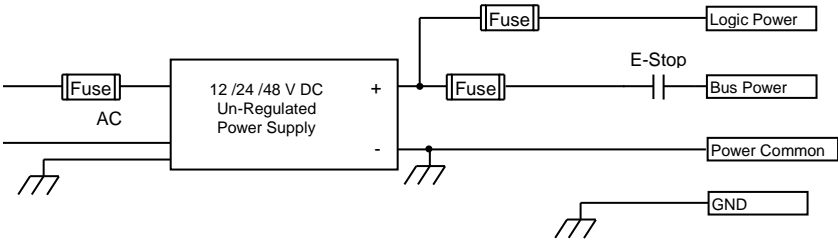
share a return path. Logic Power can be the same wide range as the main power supply, 12 V, 24 V, or 48 V nominal, and can handle the regen voltages that appear on the main supply. A single supply may be used for both with a relay contact in series with the main supply positive connection to remove bus power.

## Power Supply Wiring Diagrams

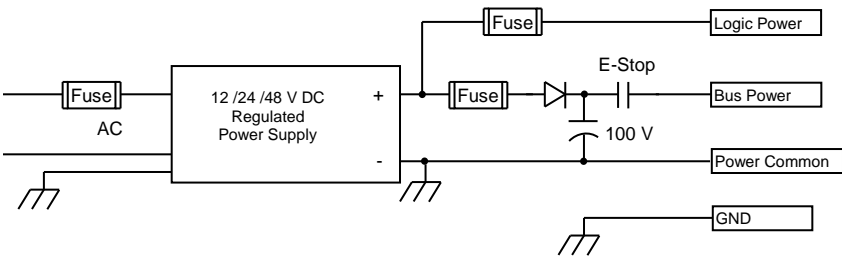
### WARNING



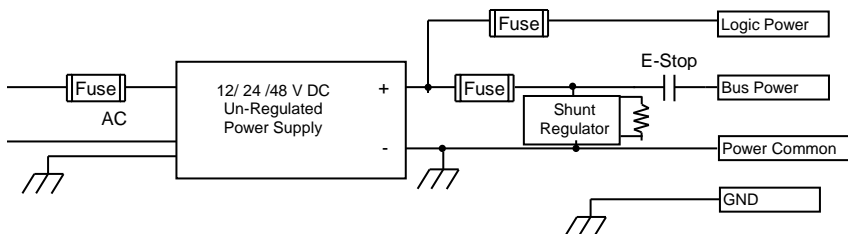
**All installations should provide a method of removing bus power during an emergency stop condition. The actuator enable function should not be relied on for this function when equipment or personnel safety is required. Disconnect only the + bus power; do not disconnect the – bus power.**



*Un-Regulated Power Supply for Logic and Bus Power*



*Regulated Power Supply for Logic and Bus Power, with Diode Isolation and Optional Extra Capacitance*



*Un-Regulated Power Supply for Logic and Bus power, with a Shunt Regulator Such as Exlar TTSR1*

## CAUTION



**Reversing polarity of the Bus Power (+) and Power Common (-) will cause a short circuit, which must be protected by the input fuse. See fusing below**

**If a fuse is not installed the drive could be permanently damaged.**

## Power Supply Wiring and Fusing

	Fuse	Wire
Bus Power	20 amp 125 V dc. Bussmann type ABC or similar.	12 gauge (4 mm <sup>2</sup> )
Logic Power	2 amp 125 V dc. Bussmann type ABC or similar.	18 gauge (1,5 mm <sup>2</sup> )

Twelve gauge wire is recommended for bus power to reduce voltage drop across the wire during peak power demands. If the application does not require high peak or continuous power, the wire gauge can be reduced, with a corresponding reduction in fuse rating.

## WARNING

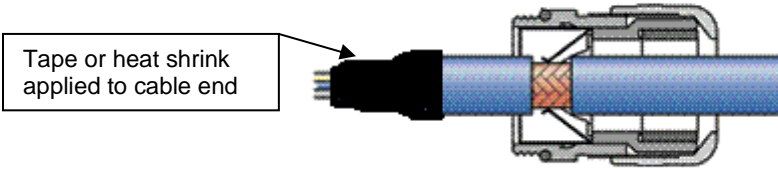


**If the wire gauge for bus power is reduced the fuse Amp rating must also be reduced in accordance with wire size, type and local regulations.**



## Shielding

For best EMC practices the power and I/O cable shields should be connected to the enclosure at the entry / exit point. This is most easily accomplished with EMC type cable glands.



## CAUTION



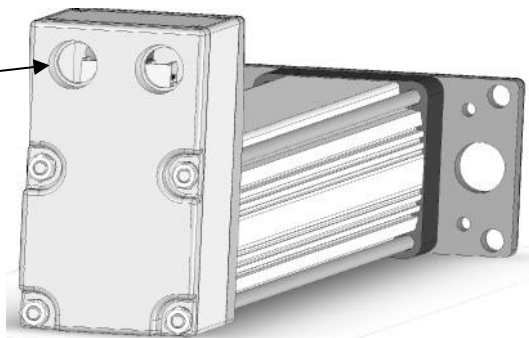
**Always apply tape or heat shrink to the end of the shield to prevent strands of the braided shield from breaking off and shorting internal electronics**

When the “I” connector option and Exlar cables are used this function is included in the cable / connector construction at the actuator end.

## NPT Connections

When the connector option “N” is selected (not available on TDM/X060 or RDM/G060 models) the Power and I/O wiring access holes are machined for ½ inch NPT fittings. Teflon tape or the equivalent must be used to seal the NPT thread connections. .

NPT Fittings with  
Teflon tape for  
thread sealing

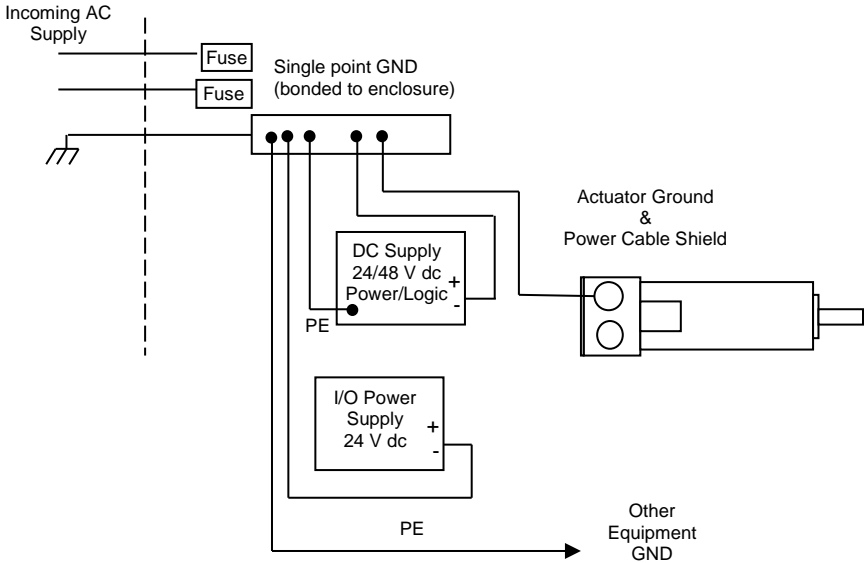


# Grounding

## WARNING



The actuator and all power supply PE and negative connections must be properly grounded using a single point grounding method.



*Grounding Diagram*

Power Supply Connections

Power Connector Pin-Out, M23 Connectors, “I” Connector Option

Signal	Pin for “I” Connector Option	Wire Color	
		TTIPC	“B” Option
Bus Power (+) 12-48 V dc	1	Blue	Red
Logic Power (+) 12-48 V dc	3	White	Blue
Power Common (-)	4	Black	Black
PE (GND)	2	Green	Green
N/C	A	Orange	N/A
N/C	B	Red	N/A
Remote Absolute Position Battery (+)*	C	White/Black	Light Blue
Remote Absolute Position Battery (-)*	D	Red/Black	Light Blue/White

\* Only with AF option on 60 mm

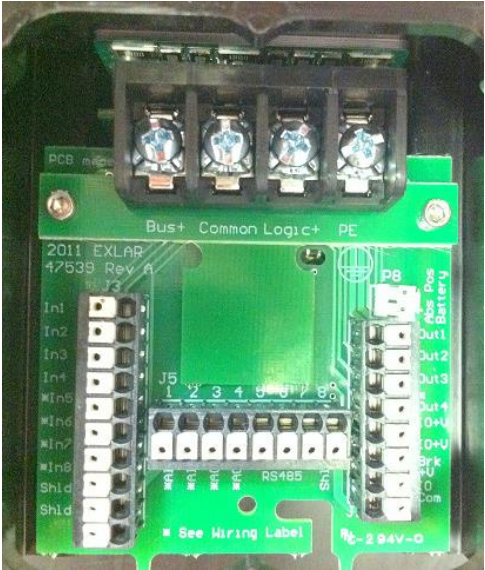
Front View “I” Connector Option

Insulation inserts : E-Type , Front view



Power Connections on Terminal board 75 mm and 90 mm

Signal	Terminal Label for “N” or “G”	Minimum Wire AWG.
Bus Power (+) 12-48 V dc	Bus +	12
Power Common (-)	COMMON	12
Logic Power (+) 12-48 V dc	LOGIC +	18
PE (GND)	PE	12



## Tritex Input and Output Wiring

### Input / Output Connections with M23 connectors 19 Pin I/O Connector for I Connector Options.

FUNCTION	Pin for "I" Connector Option	Wire Color Code TTIOC Cable and "B" Connector Option
INPUT1	1	White/Yellow
INPUT2	2	White/Red
INPUT3	3	White/Green
INPUT4	4	White/Black
*INPUT5	5	Red/Black
*INPUT6	7	Red/Green
*INPUT7	8	Red/Yellow
*INPUT8	9	Beige
Field I/O Power (+24V)	6	Red
Field I/O Common	19	Black
*ANALOG IN+	10	Green
*ANALOG IN-	11	White
*ANALOG OUT +	13	Blue
*ANALOG OUT reference	14	Orange
OUTPUT4	15	White/Brown
OUTPUT3	16	White/Orange
OUTPUT2	17	White/Blue
OUTPUT1	18	Light Red
Shields	12	Drains

\* For the IA4 option Inputs 5, 6, 7 & 8 and Output 4 are removed. The analog voltage input and output are replaced with 4-20 mA input and output. For the CANopen option Inputs 5, 6, 7 & 8 are used for CAN communications and Output 4 is removed. The analog voltage input and output are also removed.

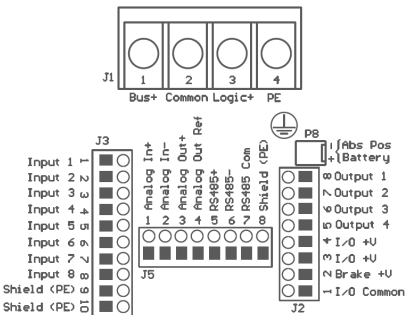
# Input / Output Connections

## Terminal board connections for 75 mm and 90 mm only

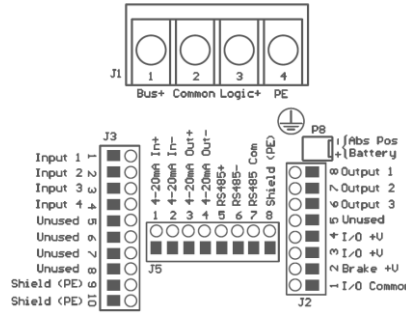
J3 Terminal #	Function	J2 Terminal #	Function	J5 Terminal #	Function
1	INPUT 1	1	Field I/O Com.	1	*Analog IN+
2	INPUT 2	2	Brake Power +	2	*Analog IN-
3	INPUT 3	3	Brake Power +	3	*Analog OUT
4	INPUT 4	4	Field I/O Power	4	*Analog REF
5	*INPUT 5	5	*Out 4	5	RS485+
6	*INPUT 6	6	Out 3	6	RS485-
7	*INPUT 7	7	Out 2	7	RS485 COM
8	*INPUT 8	8	Out 1	8	PE
9	PE	Pin header P8 used for Absolute Position Battery connector.			
10	PE				

\* For the IA4 option Inputs 5, 6, 7 & 8 and Output 4 are removed. The analog voltage input and output are replaced with 4-20 mA input and output. For the CANopen option Inputs 5, 6, 7 & 8 are used for CAN communications and Output 4 is removed. The analog voltage input and output are also removed.

Field Wiring Terminations  
For Standard I/O



Field Wiring Terminations  
For 4-20mA I/O Option



SIO and Ethernet Option

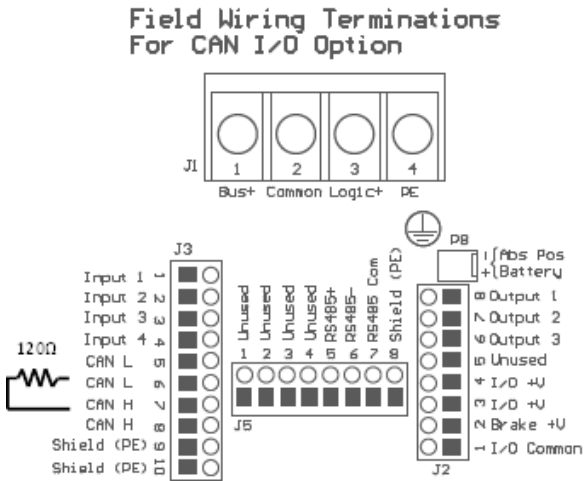
4-20 mA Option

CANopen

The CANopen circuit is optically isolated from the drive main power.

There are two methods of connecting to the Tritex with the CANopen option. If the connector option (COP) is chosen, the only option available for 60mm actuators, a five pin connector (Turck FS 57-.1) will be presented to the user for connection or “T-ing” off of.

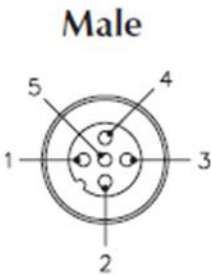
For the 75mm and 90mm models, there is also the option (CON) of user wiring in which individual wires can be passed through the cable gland or NPT port and inserted into connectors. A 120 Ω resistor is installed from the factory, in J3 pins 6 & 7, as a termination resistor and can be removed for daisy chaining or changed to another value if desired.



**CAUTION**  
See Installation Manual

*CANopen CON Option*

Signal	Pin	Color
CAN H	4	White
CAN L	5	Blue
Shield	1	Gray

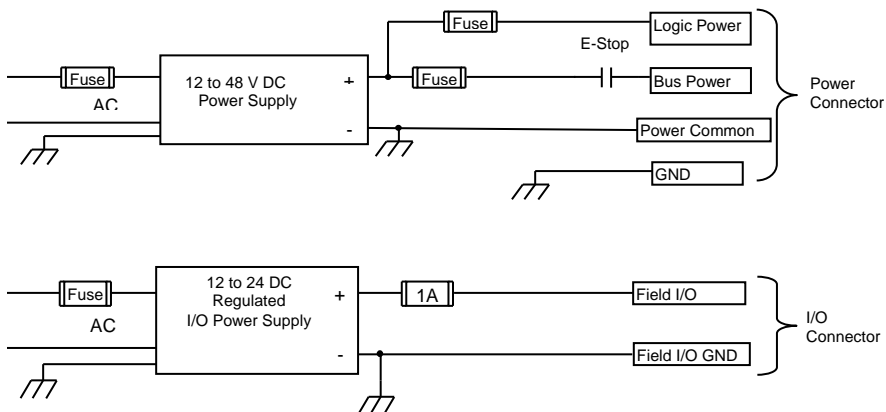


*CANopen COP Option*

## I/O Power Supply

The digital inputs and outputs are optically isolated from the other power supplies. If it is desired to maintain this isolation, a separate power supply must be used with an output within the range of 10 V to 30 V dc.

## Two Power Supply Configuration



*Two Power Supply Configuration, Maintaining I/O Isolation*

## Single Power Supply Configuration

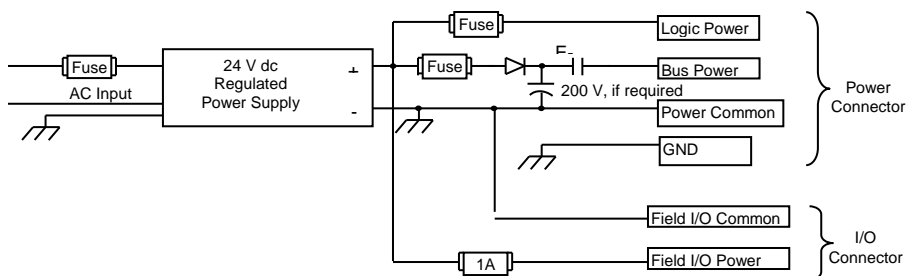
For applications not requiring I/O isolation a single power supply can be used; however, the supply must be a regulated to 30 V or less.

### CAUTION



**The single power supply configuration cannot be used when bus power supply is greater than 30 V. When a single power supply configuration is used for bus power and I/O power a blocking diode must be added to prevent the I/O voltage from rising above 30 V due to regen energy.**

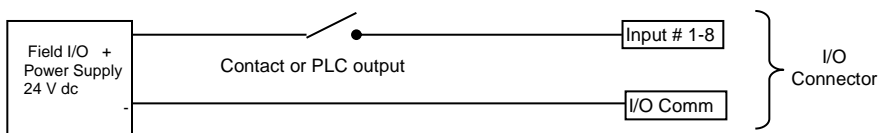




*Single Power Supply Configuration*

## Digital Inputs

Tritex digital inputs are optically isolated from drive main power, but have a common negative side. SIO and Ethernet options have 8 inputs; the IA4 option has 4 inputs. They require a positive voltage to turn on, so are compatible with sourcing outputs only. Each input can be assigned to any of the internal input functions (see software section).



*Input Wiring (External)*

## Digital Input Specifications

Description	Specification
Input Voltage Range	0 - 30 V dc
On state voltage range	8 – 30 V dc
Off state voltage range	0 – 5 V dc
On state current 10V (min) 24V (nominal) 30V (maximum)	3.3 mA 5.0 mA 5.7 mA
Nominal Impedance (24V)	4.8 kΩ
Off state current (max)	2.0 mA
Update rate	1 ms (typical)

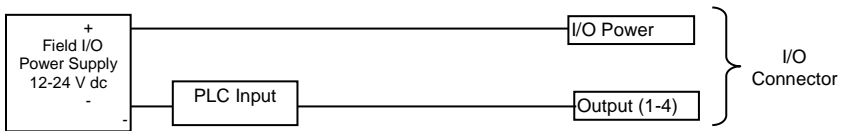
## Digital Outputs

The Tritex digital outputs are optically isolated from drive main power, but have a common positive side. SIO and Ethernet options have four outputs; the IA4 option has three outputs. These outputs are sourcing only, they provide a positive voltage when on. The outputs have short circuit and thermal protection, and protection against inductive kick at turn-off. Each output can be assigned to any of the internal output functions (see software manual).

### CAUTION



**Each output is rated to continuously drive a 100 mA load and is short protected at 500 mA with automatic reset after the short fault is removed.**



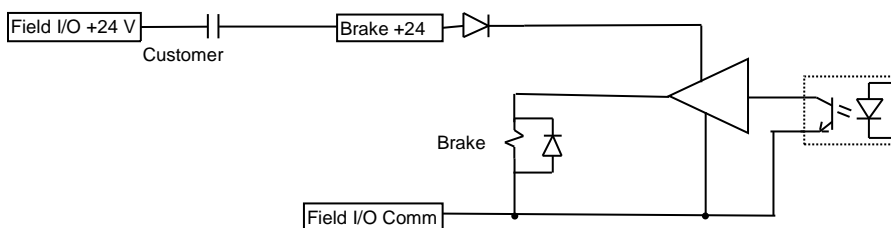
*External Wiring of Outputs for Connection to PLC or Any Load*

## Digital Output Specifications

Description	Specification
Operating voltage range	0 to 30 V dc
On state maximum continuous current	100 mA
On state voltage drop (@ 50mA)	.5 V typical
Short circuit protection (auto reset)	.5 A
Update rate	1 ms

## Actuator Brake Option

The actuators may be ordered with a brake option. This brake is intended as a “parking brake” and is not intended for use as “stopping brake”. The brake engages when the brake voltage is removed. Brake voltage is 24 V +/- 10%. Since the Brake and I/O power supplies are interconnected, use of a brake places additional voltage and power constraints on the I/O supply. The negative side of the brake is connected to the Field I/O common. The brake +24 V can be connected directly to Field I/O +24 V or through customer interlocks. When Brake +24 V is applied the brake follows the Tritex Enable function with time delays added. Starting from a disabled status, with brake engaged, when the drive enables the brake will release after a time of 0.3 sec. This allows time for the motor current to become active and hold the load before releasing the brake. Starting from the enabled state, with the brake released, when the drive is disabled for any reason the drive will immediately apply full current, bringing the motor to an abrupt stop and engage the brake, then after a .3 sec delay the drive will be disabled. Brake Release Active status can be assigned to an output, the brake can be manually released, overriding the drives control of the brake, by assigning the Brake override Input function to an Input. See I/O Assignment section of the Software. In some cases it may be required to release the brake without DC motor power applied, in this case +24 V must be supplied to brake +24 V as well as the logic +24 V power supply for the brake override input to function.



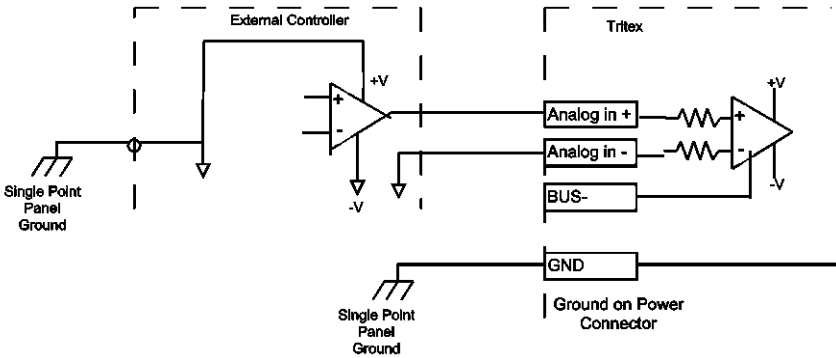
*Brake Connections*

## Analog Input

An analog input is provided for use as a position, velocity or current command.

Differential input range is -10 V to +10 V. Input range on Analog IN+ is -15 V to +15 V with respect to I/O Common. Input range of Analog IN- is -15 V to +12 V with respect to I/O Common. Due to voltage drop in the wiring to BUS-, the analog signal must be wired differentially with a return wire to the analog signal source.

(See software section for configuration of the analog input and analog positioning parameters.)



*Analog input wiring from voltage or current control external controller*

Note: Analog input reference from an external controller must be referenced to single point ground to prevent damage to the analog input circuit.

## Analog Input Specifications

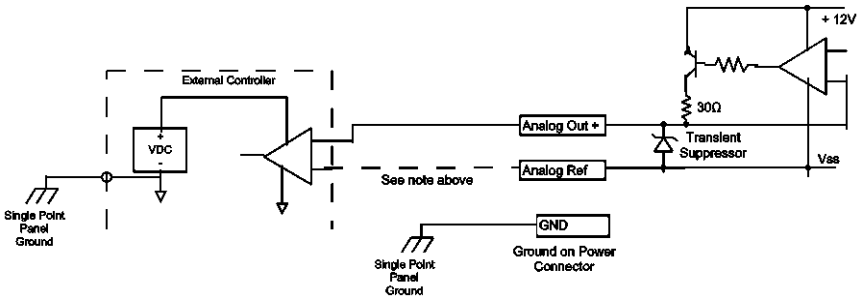
Description	Specification
Voltage Input Range	-10 V to +10 V
Input impedance	100 k $\Omega$
Input resolution	13 bits over full -10 V to +10 V range
Update rate	0.5 ms

## Analog Output

A 0-10 V analog output is provided. The function of this output is programmable. It can be used for position, velocity or current monitoring.

The intent of this output is to provide a “monitor” type value not a “control” value, meaning the performance is not intended for the user to close a high speed position loop around this signal.

The Analog Reference terminal should only be connected when used with an isolated or differential input. **DO NOT CONNECT TO A GROUNDED POINT EXTERNALLY!**



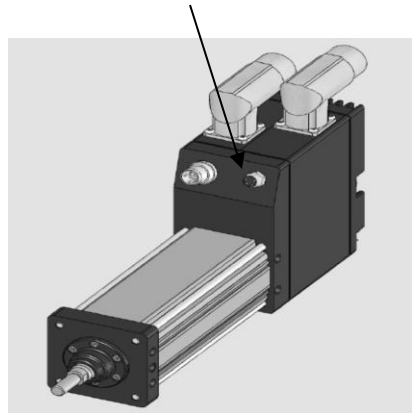
## Analog Current Output Specifications

Description	Specification
Current Output Range	0 - 10 V
Load Range	20 kΩ min
Output resolution	11 bits

## Communications

Serial communication to the actuator is provided through the 8 mm communication connector on the front of the actuator and also via terminal connection on J5 under the access cover on 75 mm and 90 mm models. The serial interface is two wire opto-isolated RS485 network. The actuator supports the Modbus RTU protocol for access to all drive parameters (see Modbus Parameter Reference). The Default baud rate is 19.2k. The default Modbus address is 1.

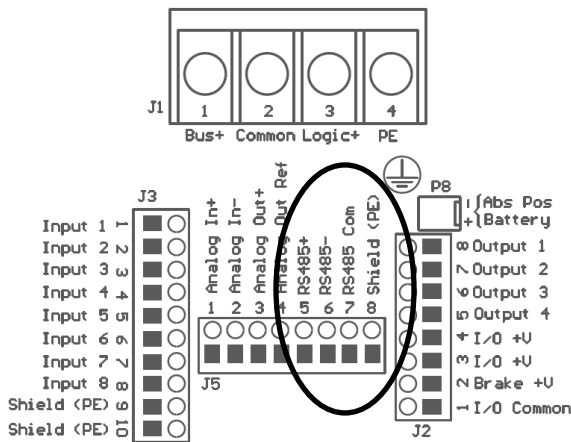
8mm communications connector



8mm communications connector  
Front view



Field Wiring Terminations  
For Standard I/O

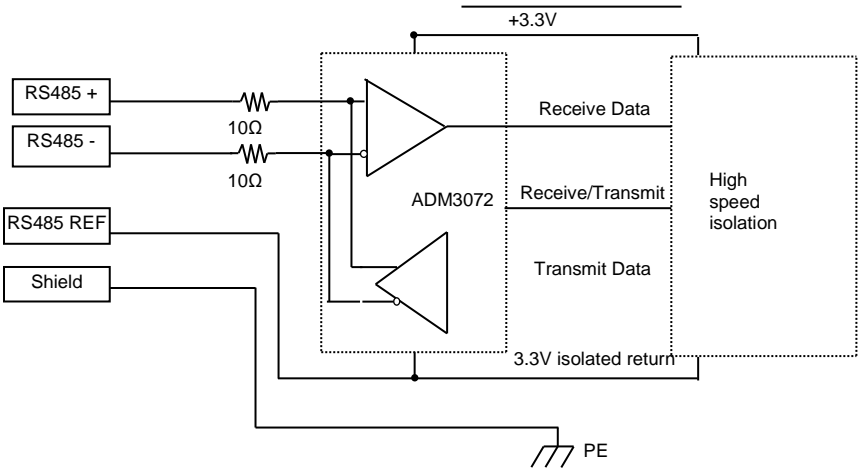


Optional RS 485 Field Wiring for 75 mm and 90 mm

Function	8 mm Pin Number	Wire Color for TTCOM	J5 Terminal #
485+	1	Brown	5
485-	3	Blue	6
485 COM	4	Black	7
Shield	2	Drain	8

# PC Communications

When using the Expert software for set-up and diagnostics an RS485 converter will be required to interface between one of the PC communication ports and the RS485. This can be either a USB to 485 converter, such as the Exlar CBL-T2USB485-M8 or any other standard 485 converter. See Accessories section.

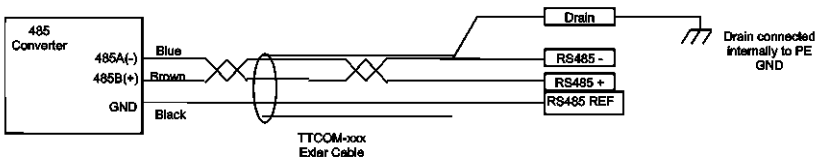


*Internal RS485 Circuit*

## CAUTION

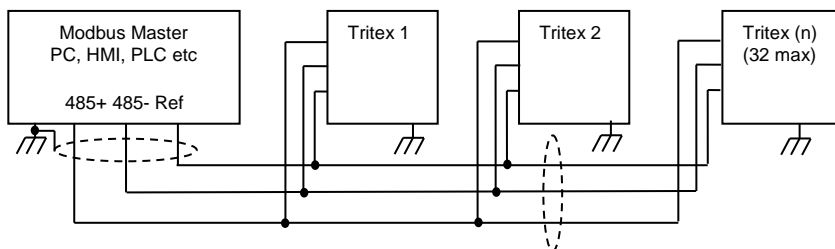


**It is important that the RS485 REF is connected to the circuit common of the converter RS485 output. Failure to connect could cause damage to the drive, the converter or the PC port.**



*Typical RS485 connection to external converter*

## Connecting multiple Tritex actuators to a Modbus Master Host



### **Important considerations:**

- Always use 3 conductors, RS485 +, RS485 – and Reference.
- A twisted pair for 485+ and 485- is preferred.
- RS485 is a “multi-drop” network as opposed to a “star”, therefore keep the drop (stub) to each actuator as short as possible. When using the 8 mm connector use a T connector, such as the Exlar PN TT458SP.
- A termination resistor is not usually required.

## **IA4 Option board connections**

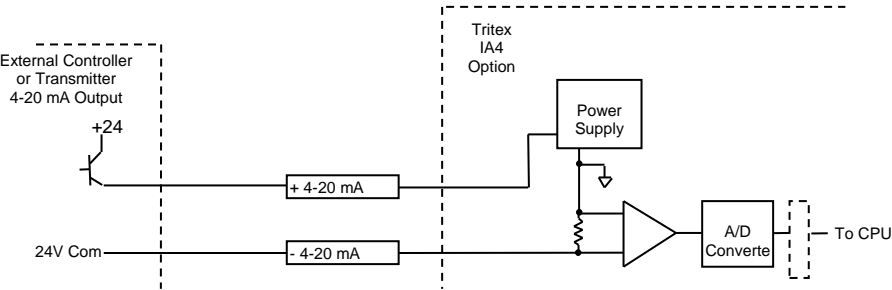
### *4-20 mA Isolated I/O, IA4 Option*

The IA4 option board replaces the standard I/O board and provides one 4-20 mA isolated analog input and one 4-20 mA isolated analog output; these I/O circuits are isolated from each other as well as all other actuator I/O, grounds and commons. The IA4 option also includes four isolated digital inputs and three isolated digital outputs; this is a reduction from the eight inputs and four outputs available on the standard I/O board.

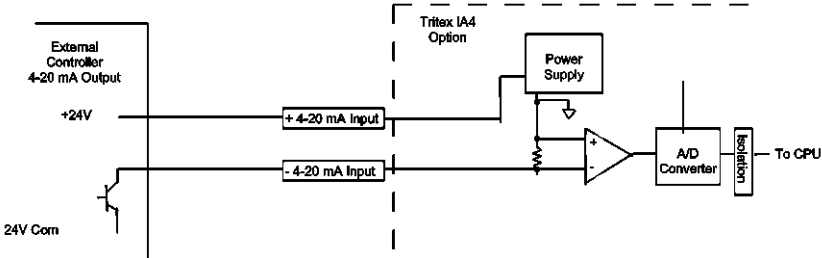
The 4-20 mA input is a two wire circuit. A small amount of power from 4-20 mA signal is used to generate the internal power supplies needed for the isolation of the input section. This allows the input to float with the Transmitter or loop power supply without inference from the other Actuator grounds or commons. The power supply starts up when the input reaches 3mA. When the 4-20 mA loop is unpowered, the software reads an off-scale high value that should be configured to indicate a “Loss of Signal” condition.



4-20 mA input connection



Connection to High Side Controller



Connection to Low Side Controller

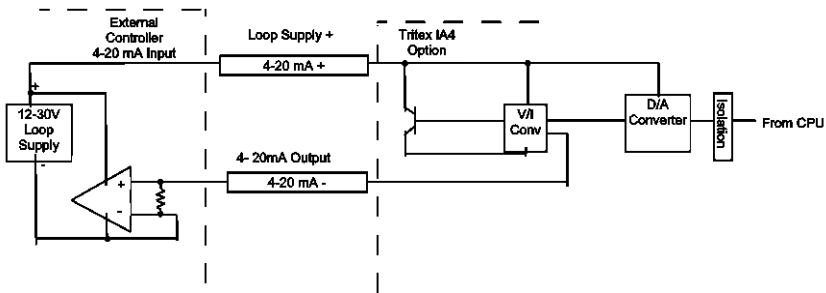
4-20 mA Input Specification:

Description	Specification
Input Range	2 mA to 22 mA (Loss of Signal condition <2.0 mA)
Voltage drop at 20mA	11V typ
Input Resolution	>14 bits over 4-20 mA range
Update Rate	0.5 ms

4-20 mA Output

The 4-20 mA output is a two wire circuit; it requires an external loop supply of 12 to 30V DC to generate the isolated supply voltages needed. The Tritex circuit requires 8V to operate; therefore the max impedance the output can drive is dependent on the loop supply voltage. If the drive is powered down, the output goes to an off-scale low output approximately 2mA.

Loop Supply Voltage	Maximum Impedance @ 20 mA	Minimum Impedance @ 20 mA
12 V	200 Ω	200 Ω
15 V	350 Ω	200 Ω
24 V	800 Ω	200 Ω
30 V	1100 Ω	200 Ω



4-20mA Output Connection

4-20 mA Output Specifications:

Description	Specification
Output Current Range	3 – 21 mA
Load Range	200 to 1100 Ω (see table above)
Output resolution	12 bits
Update rate	0.5 ms

## AF Option, Absolute Feedback

The Tritex absolute feedback consists of a combination of the standard hall feedback and a low power battery-backed multi-turn counter. The counter will track the motor's position, as long as the battery voltage is present.

### *Battery life information:*

An improved design effective January 2016 extended battery life to typically five years. Prior to that expected battery life was two to three years depending on how much of the time main power was off. In all cases, movement of the motor with power off will cause extra battery power consumption and shorten battery life. For applications that produce frequent or continuous motor movement with power off, a logic power supply should be used. See Logic Power Supply section of this manual.



60 mm Remote Battery Assembly

### *Battery Location:*

For 75 mm and 90 mm actuators the battery is located under the removable wiring access cover. For 60 mm actuators and motors the option includes a remote mount battery assembly P/N 48224 which must be mounted externally, typically near the power supply. The battery connections to the actuator are made through the power connector and cable. See power connections section for details on battery connection.

### *Low battery voltage:*

When the battery voltage gets below 3 V, a low battery condition will be set. This condition is typically set to generate a warning on the Fault Enable tab of the System Setup page. The warning status can then be assigned to one of the outputs. The battery voltage can be displayed on the Diagnostic page while on-line with the actuator. When battery voltage gets too low to maintain the count value the Homed Status will be lost on the subsequent power up, requiring the actuator to be re-homed. A low or dead battery does not keep the system from running it just means a Home is required.

### *Replacing the battery:*

For 75 mm and 90 mm actuators with a removable wiring access cover, remove the cover, pull the battery out of the clip, and unplug the harness from the two pin connector. The replacement battery kit is Exlar P/N 54108. The T2BAT1 kit (Exlar P/N 42712) for Tritex AC actuators will work, but outer sleeve on battery must be removed to fit well in clip. For 60 mm actuators there is no removable cover. The battery is mounted remotely and wired through the power connector. The

replacement battery only is Exlar P/N 50748. Observe battery polarity when installing replacement battery in clips.

### **Important Note for units built before 2016:**

If the battery is removed with both Motor and Logic power also removed, do **not** reconnect the battery and leave all power **off** for **4 minutes**. Once all power is removed from the battery backed logic it must be allowed enough time to completely bleed down before restarting. Once power is re-applied the home position must be re-established. For the 60 mm actuator, the Motor, Logic, and battery connections are all made through the power connector. This means any time the power connector is removed from the actuator it should not be reinstalled for 4 minutes.

### **WARNING**



Replacement battery assembly for 75 mm and 90 mm actuators is Exlar PN 54108 or 42712. Replacement battery for use on remote battery assembly is Exlar P/N 50748. Replacement with any other battery will violate UL and CSA certification.

#### *Travel limitations.*

The counter has a range of +/- 4096 motor revolutions; therefore the actuator must operate within this range and if the actuator is moved beyond this limit a home position must be re-established.

*Speed limitations: When power is off and the counter is under battery backup, the maximum rpm the counter can track is 2100 rpm.*

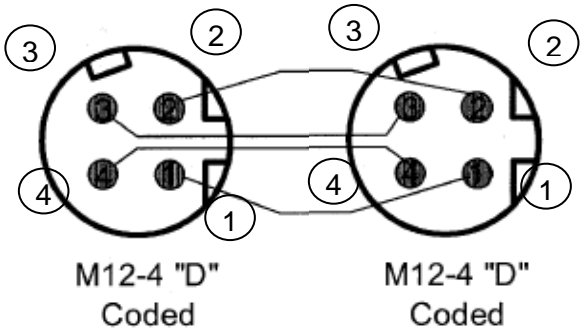
### **Ethernet Options, EIP, TCP or ProfiNet**

The Ethernet Option provides an Ethernet rated M12 connector for connection to the Network at the rear of the actuator.

An IP 67 4-pole M12 D coded connector is used, this type of connector must only be used with two pair cables. When the Ethernet connection is made via an Ethernet switch or hub, a straight through cable set must be used. If there is a single node connection direct from the Ethernet PC/PLC to the Tritex then a crossover cable may be required. Some PC Ethernet cards have capability to detect a crossover connection. See Expert Software section for setup of Tritex Ethernet parameters.

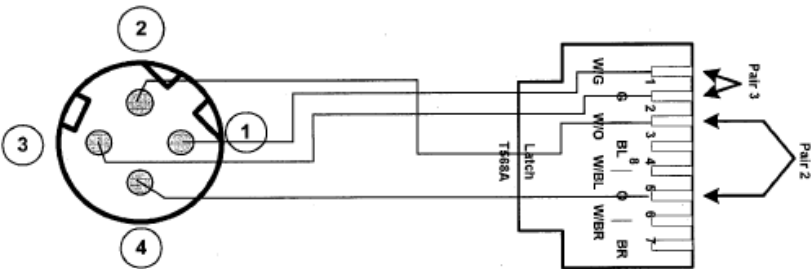
Cord sets

Pin	Signal Name	
1	Transmit + (TX+)	Pair
3	Transmit - (TX-)	
2	Receive + (RX+)	Pair
4	Receive - (RX-)	



M12 D Coded Straight through Cord Set

8-Way Modular	M12	Signal	
1	1	TX+	Pair
2	3	TX-	
3	2	RX+	Pair
6	4	RX-	



Conversion from M12 D Coded to 8-way Modular Straight through Cord Set

## Shielded or Unshielded Cables

The Tritex can be used with either shielded or un-shielded Ethernet cables. **If a shielded cable is used it is important that the shield is not connected at the Tritex M12 end of the cable. Off the shelf shielded Ethernet cables with M12 connectors usually connect the shield through the M12 connector coupling nut, be sure the shield is not connected to the Tritex end of the coupling nut.** The Tritex M12 connector is in direct contact with the enclosure which is connected directly to PE. Typically the shield should be connected to PE at the switch or hub end only. Connecting the shield at both ends can cause ground loop noise on the shield which can degrade communication performance.

For more details on the installation of an Industrial Ethernet network download the EtherNet/IP Media Planning and Installation Manual, found in the EtherNet/IP library at [www.ODVA.org](http://www.ODVA.org)

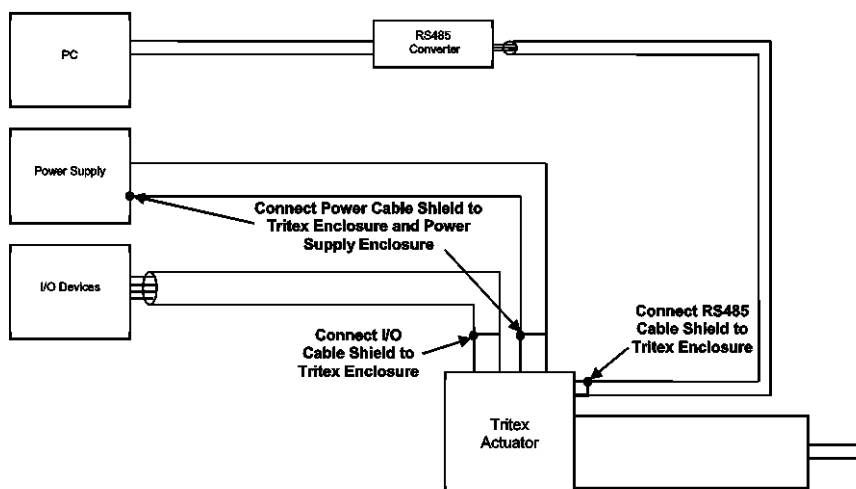
## EMC Considerations

Tritex actuators are designed not to create or be affected by electromagnetic interference in most applications. Under extreme conditions there may be unwanted electromagnetic interaction between the Tritex actuator and other equipment. It is the responsibility of the installer to ensure that the complete system meets all relevant EMC (electromagnetic compatibility) emission and immunity requirements.

Tritex Embedded drives are designed to be IEC/EN 61800-3:2004-08 compliant when using shielded cables. Some installations may require an external filter. See section on TDCESF1 accessory.

General EMC guidelines that should be followed when installing and designing a system include:

- House all components in conductive enclosures
- Connect components using shielded cables grounded to the component enclosures (see figure on next page)
- Ground components using the single point grounding scheme described in the *Grounding* section of this manual
- When necessary, remove paint from mating surfaces that may prevent a good ground connection from being made
- Make ground connections as short as possible and use flat braided cable when available to create low impedance ground connections
- Keep cable runs as short as possible and power and signal cables as far apart as possible, only crossing them at right angles, as described in the *Cable Routing* section of this manual



*Cable Shield Grounding Example*

## TROUBLESHOOTING PROCEDURES

This section provides you with guidelines and hints on troubleshooting various problems that may be encountered during installation and operation of your Tritex Series actuator.

Symptom / Trouble	Possible Cause / Troubleshooting Procedure
No response from actuator.	<ol style="list-style-type: none"> <li>1. Check drive for faults that may indicate problem via I/O or Expert software.</li> <li>2. Check to insure that drive is powered and enabled.</li> <li>3. Check for proper wiring.</li> </ol>
Actuator seems to be enabled (receiving current) but is not operating or is operating erratically.	<ol style="list-style-type: none"> <li>1. Drive may be improperly tuned. Check all gain settings.</li> <li>2. Check for load irregularities or excess compliance.</li> </ol>
Actuator cannot move load.	<ol style="list-style-type: none"> <li>1. Load is too large for the capacity of the actuator or too much friction is present.</li> <li>2. Excessive side load.</li> <li>3. Misalignment of output rod to load.</li> <li>4. Current limit in drive is set too low</li> <li>5. Power supply has too low of current capacity</li> </ol>

Actuator housing moves or vibrates when shaft is in motion.	<ol style="list-style-type: none"> <li>1. Check actuator mounting. Insure that the actuator is securely mounted.</li> <li>2. Drive is improperly tuned (wrong gain settings).</li> </ol>
Output rod rotates during motion and thus does not provide proper linear motion.	<ol style="list-style-type: none"> <li>1. Install Exlar anti-rotation assembly or incorporate anti-rotation into the application.</li> </ol>
Actuator is overheating.	<ol style="list-style-type: none"> <li>1. Insufficient cooling for application requirements. Contact Exlar engineering.</li> <li>2. Ambient temperature is too high.</li> <li>3. Actuator is being operated outside of continuous ratings.</li> <li>4. Amplifier is poorly tuned causing excessive unnecessary current to be applied to motor. Check Gain settings.</li> <li>5. Over Voltage limit set too low causing internal shunt control to remain active.</li> </ol>

## Returning Product for Repair

### STANDARD EVALUATION AND REPAIR LEADTIME:

- Leadtime is dependent upon production capacity and level of demand. Please contact the factory for current leadtime.

### EXPEDITED EVALUATION LEADTIME:

- An additional charge per unit can be quoted to expedite an evaluation.
- Ability to expedite is dependent upon production capacity and level of demand. Please contact the factory for current expedited evaluation lead time.

### PROCEDURE:

- Please discuss the return with Exlar Technical Support prior to requesting an RGA number to see if it is possible to resolve the issue prior to return.
- If it is determined that an RGA number is required, please do so by completing an online RGA request form located at <http://exlar.com/return-authorization-request/>
  - International Repairs: Closely follow instructions provided by the Exlar Returned Goods Administrator. Failure to comply with issued instructions may result in delays for repair and return.
- Exlar requires a purchase order at the time of RGA; \$750 on warranty returns (refunded if warranty status is confirmed by the factory), or for the desired service package charge per unit on all non-warranty units.



## MAINTENANCE

### *Procedures for Roller Screw Re-Greasing*

#### CAUTION



**If your actuator has a preloaded roller screw, do not remove it from the cylinder. Preloaded screws require special tooling and procedures for proper disassembly and reassembly. Contact Exlar to arrange for maintenance of a preloaded screw actuator.**

#### Disassembly

Refer to the exploded view on the following page.

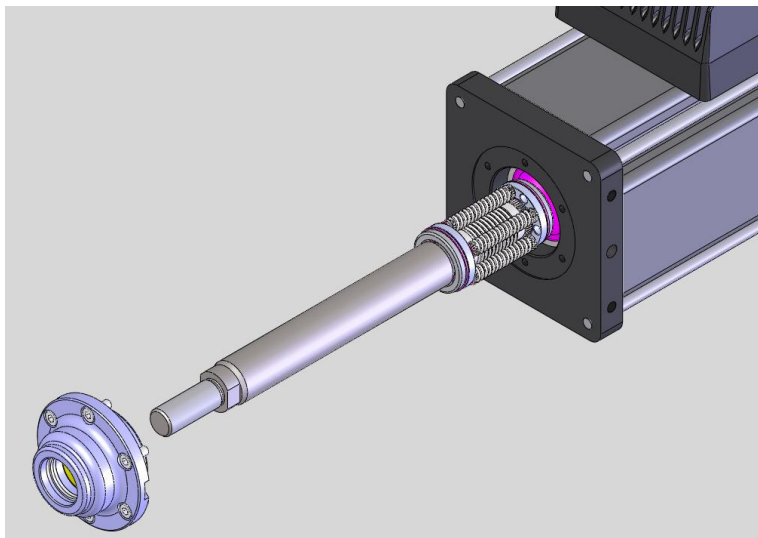
- 1.) Remove the actuator assembly from the machine by disconnecting the cables, main rod coupling and actuator mounting bolts or fasteners.
- 2.) If your unit does not have an external anti rotate assembly, skip this step. Loosen the two machine screws that clamp the anti-rotate cross member to the actuator output rod. Slide the anti-rotate mechanism forward and off the actuator.

#### CAUTION



**The end cap houses the Tritex drive and control. Extreme care should be taken when removing the tie rod nuts or tie rods so as not to twist or pull on the drive section of the actuator. Do not disconnect the wiring between the drive and the actuator.**

- 3.) Remove the screws holding the seal gland to the face plate. With the screws removed, pull the seal gland off. Pry spots are located on each side of the gland to aid in removal.
- 4.) When the seal gland is removed, the open end of the roller screw internally threaded cylinder (ITC) is visible. The roller screw can be removed by turning it counter clockwise and threading it out of the cylinder. It may be necessary to keep the roller screw cylinder from turning to remove the screw.



## Lubrication Maintenance

Exlar recommends using Mobilith SHC 220, a high performance, extreme-pressure grease. Grease lubricated units will require periodic inspection and renewal of the roller screw grease. The table below shows the recommended grease renewal period.

RMS rotational speed (RPM)	Recommended Grease Renewal Period (hours)	
	CASE TEMP 65°C (149°F)	CASE TEMP 80°C (176°F)
250	10,000	5,000
500	8,500	4,250
1000	6,000	3,000
1500+	3,500	1,750

## Grease Renewal

The angular contact thrust bearings located in the front of the actuator, the roller screw cylinder, and the roller screw assembly are the components that require grease. They require a coating of grease. They do not need to be packed with grease. Excess grease requires more torque from the motor when returned to operation, and does not improve the lubrication of the unit.

- 1.) Use a brush to work approximately 0.5 in<sup>3</sup> of grease for every 3 inches of stroke length into the roller screw cylinder. Be sure to cover all of the threaded areas of the cylinder.
- 2.) Use a brush to work grease in to the roller screw assembly. Be sure to cover all the threaded surfaces of the screw assembly. This can be accomplished by applying grease to a few places on the roller screw assembly and rotating the components repeatedly in both directions to work the grease into the assembly.

## Reassembly

- 1.) Rethread the roller screw into the internally threaded cylinder (ITC). It is a multiple start screw, and this is not always easy. **DO NOT FORCE THE ROLLER SCREW INTO THE CYLINDER.** It is best to have the actuator vertical with the open end of the roller screw cylinder facing up. Position the roller screw above the cylinder so that it is aligned axially with the ITC. Slowly turn the roller screw 1/4 to 1/2 a turn counterclockwise with it in contact with the ITC. This will help to align the threads on the roller screw with the threads in the ITC. Rotate the roller screw clockwise and it should begin to thread into the cylinder. If it does not turn freely, remove it and begin again. When threading the screw into the cylinder, it will roll freely into the actuator. When it reaches the portion of the cylinder that contains the motor magnets, the roller screw will be more difficult to turn because of the magnetic field of the magnets. **THIS IS NORMAL.** Continue to thread the roller screw into the cylinder. When it reaches the bottom, it will become difficult to turn and the motor and bearings will begin to rotate with it. The roller screw is now fully inserted into the cylinder.
- 2.) Place a small amount of seal lubricant on the inside surface of the seal/bushing assembly.
- 3.) Carefully slide the bushing/seal assembly over the actuator rod end. The seal is a tight fit on the rod end. Take care not to damage the seal on the threads of the extending rod. Standard TDM /TDX Series rods have a chamfer to provide a lead in for replacement of the seal and bushing. The mounting screws should have a low or medium strength thread locker added, such as Loctite 222MS. The mounting screws torque values are as follows:

**Tritex 60 & 75:** 10 in-lbs (0.83 lbf-ft, 1.13 N-m)

- 4.) If your actuator has an external anti-rotate mechanism, slide the rod or rods of the anti-rotate mechanism through the front flange and into the guide bushing or bushings mounted to the rear of the flange. Position the extending rod so that the wrench flats are parallel to the long side of the flange. Slide the cross member assembly of the anti-rotate mechanism over the end of the rod and onto the wrench flats. Tighten the two screws that clamp the assembly to the actuator rod.

## ***Procedures for Complete Re-Greasing***

### **Disassembly**

Refer to the exploded view on the following page.

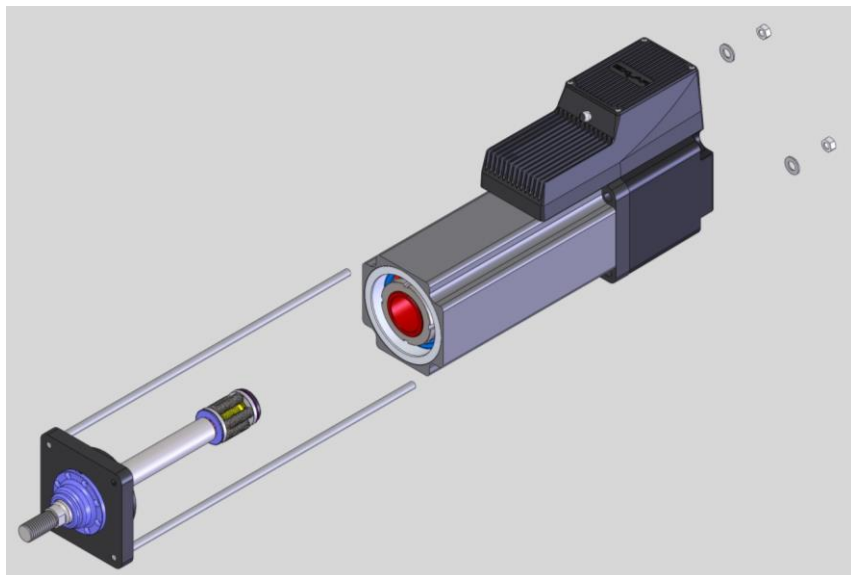
- 1.) Remove the actuator assembly from the machine by disconnecting the cables, main rod coupling and actuator mounting bolts or fasteners.
- 2.) If your unit does not have an external anti rotate assembly, skip this step. Loosen the two machine screws that clamp the anti-rotate cross member to the actuator output rod. Slide the anti-rotate mechanism forward and off the actuator.
- 3.) Remove the rear tie rod nuts from the back of the actuator.

### **CAUTION**



**The end cap houses the Tritex drive and control. Extreme care should be taken when removing the tie rod nuts or tie rods so as not to twist or pull on the drive section of the actuator. Do not disconnect the wiring between the drive and the actuator. Do not pinch wires when housing is reassembled.**

- 4.) If your actuator does not have a front flange, skip this step. Slide the front flange forward and off the actuator. The tie rods will remain attached to the front flange.
- 5.) When the face plate is removed, the thrust bearing and the open end of the roller screw internally threaded cylinder (ITC) are visible. The roller screw can be removed by turning it counter clockwise and threading it out of the cylinder. It may be necessary to keep the roller screw cylinder from turning to remove the screw.



## Lubrication Maintenance

Exlar recommends using Mobilith SHC 220, a high performance, extreme-pressure grease.

Grease lubricated units will require periodic inspection and renewal of the bearing and roller screw grease. The table below shows the recommended grease renewal period.

RMS rotational speed (RPM)	Recommended Grease Renewal Period (hours)	
	CASE TEMP 65°C (149°F)	CASE TEMP 80°C (176°F)
250	10,000	5,000
500	8,500	4,250
1000	6,000	3,000
1500+	3,500	1,750

## Grease Renewal

The angular contact thrust bearings located in the front of the actuator, the roller screw cylinder, and the roller screw assembly are the components that require grease. They require a coating of grease. They do not need to be packed with grease. Excess grease requires more torque from the motor when returned to operation, and does not improve the lubrication of the unit.

- 1.) Use a brush to work approximately 0.5 in<sup>3</sup> of grease for every 3 inches of stroke length into the roller screw cylinder. Be sure to cover all of the threaded areas of the cylinder.
- 2.) Use a brush to work grease in to the roller screw assembly. Be sure to cover all the threaded surfaces of the screw assembly. This can be accomplished by applying grease to a few places on the roller screw assembly and rotating the components repeatedly in both directions to work the grease into the assembly.
- 3.) Force grease into the front of the thrust bearing assembly. Make a concerted effort to insure that the grease is well worked in. Grease must reach the bearing just behind the bearing that is visible as well. Use the following amounts of grease for each size roller screw and bearing:  
**Tritex 60:** 0.5 in<sup>3</sup>  
**Tritex 75 & 90:** 0.75 in<sup>3</sup>  
**Tritex 115:** 1.0 in<sup>3</sup>

## Reassembly

- 1.) Rethread the roller screw into the internally threaded cylinder (ITC). It is a multiple start screw, and this is not always easy. **DO NOT FORCE THE ROLLER SCREW INTO THE CYLINDER.** It is best to have the actuator vertical with the open end of the roller screw cylinder facing up. Position the roller screw above the cylinder so that it is aligned axially with the ITC. Slowly turn the roller screw 1/4 to 1/2 a turn counterclockwise with it in contact with the ITC. This will help to align the threads on the roller screw with the threads in the ITC. Rotate the roller screw clockwise and it should begin to thread into the cylinder. If it does not turn freely, remove it and begin again. When threading the screw into the cylinder, it will roll freely into the actuator. When it reaches the portion of the cylinder that contains the motor magnets, the roller screw will be more difficult to turn because of the magnetic field of the magnets. **THIS IS NORMAL.** Continue to thread the roller screw into the cylinder. When it reaches the bottom, it will become difficult to turn and the motor and bearings will begin to rotate with it. The roller screw is now fully inserted into the cylinder.
- 2.) Place a small amount of seal lubricant on the inside surface of the seal/bushing assembly.

- 3.) Carefully slide the face plate and bushing/seal assembly over the actuator rod end, while guiding the tie rods through the holes in the rear end cap of the actuator. The seal is a tight fit on the rod end. Take care not to damage the seal on the threads of the extending rod. Standard Tritex rods have a chamfer to provide a lead in for replacement of the seal and bushing. Be sure that the faceplate seats completely and squarely on the front of the actuator. The inner surface of the faceplate provides the pre-loading for the bearings, and it is important that it is properly seated.

### **Units with a Front Flange**

Replace the faceplate as described above. Remount front flange by sliding tie rods through the holes in the faceplate and through the holes in the rear end cap. Pilot the flange on the pilot diameter located on the front of the faceplate.

- 4.) Replace the rear tie rod washers and nuts and tighten to the proper torque. Tighten the nuts simultaneously by partially tightening each in an opposing corner pattern until each is torqued to the rated value as follows.

**Tritex 60:** 30 lbf-in (2.5 lbf-ft, 3.39 N-m)

**Tritex 75 & 90:** 90 lbf-in (7.5 lbf-ft, 10.16 N-m)

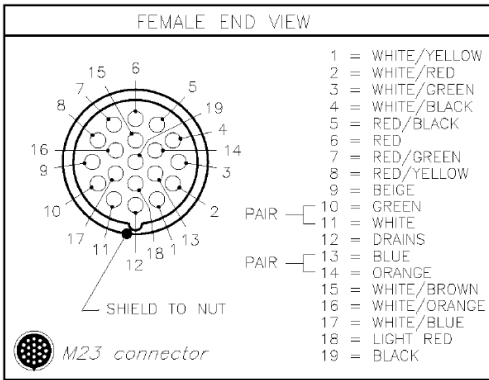
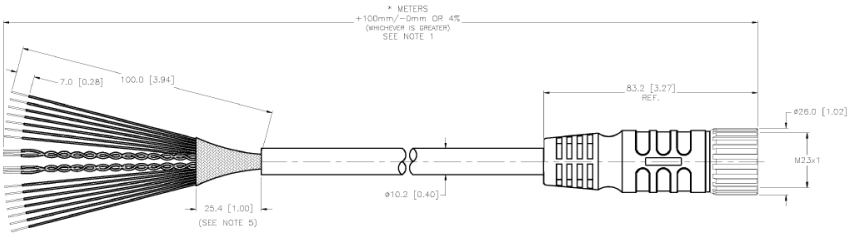
**Tritex 115:** 240 lbf-in (20 lbf-ft, 27.12 N-m)

- 5.) If your actuator has an external anti-rotate mechanism, slide the rod or rods of the anti-rotate mechanism through the front flange and into the guide bushing or bushings mounted to the rear of the flange. Position the extending rod so that the wrench flats are parallel to the long side of the flange. Slide the cross member assembly of the anti-rotate mechanism over the end of the rod and onto the wrench flats. Tighten the two screws that clamp the assembly to the actuator rod.

# ACCESSORIES

## Cables

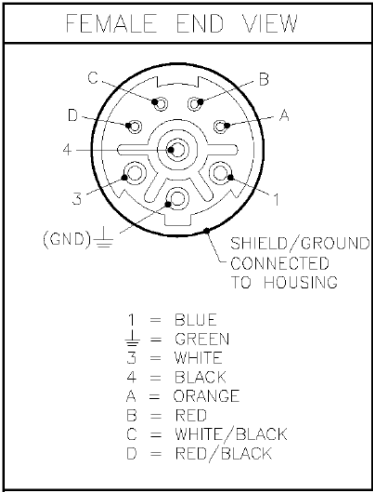
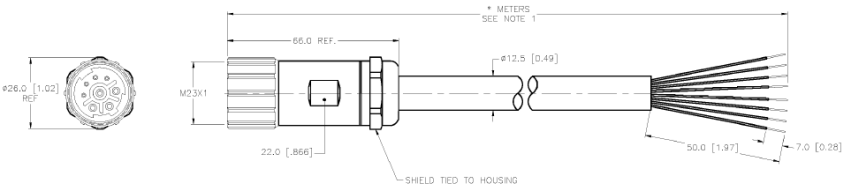
### CBL-TTIOC-SMI-xxx I/O Cable



SPECIFICATIONS	
CONTACT CARRIER MATERIAL/COLOR	NYLON or PBT/GRAY
MOLDED HEAD MATERIAL/COLOR	THERMOPLASTIC PUR/BLACK
CONTACT MATERIAL/PLATING	BRASS/GOLD
COUPLING NUT MATERIAL/PLATING	BRASS/NICKEL
RATED CURRENT [A]	3.0 A
RATED VOLTAGE [V]	150 V
OUTER JACKET MATERIAL/COLOR	PVC/BLACK
CONDUCTOR INSULATION MATERIAL	PVC
NUMBER OF CONDUCTORS [AWG]	18x22 AWG/2x22 AWG DRAIN
SHIELD/BRAID	ALUMINUM FOIL SHIELD/T-C BRAID
TEMPERATURE RANGE	-40°C to +105°C (-40°F to +221°F)
PROTECTION CLASS	IEC IP67

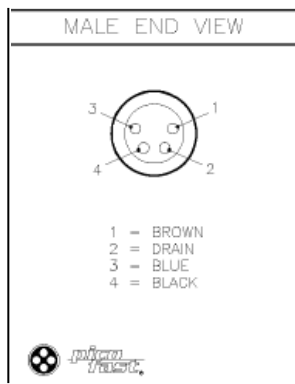
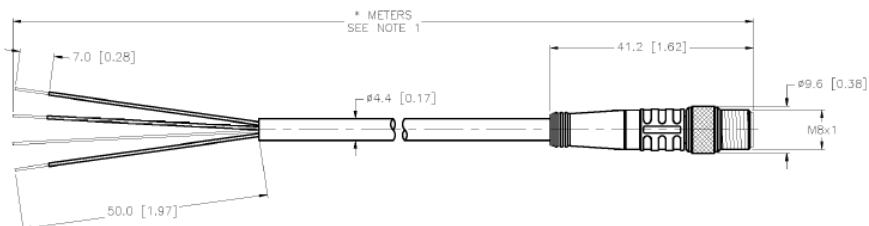


CBL-TTIPC-SMI-xxx Power Cable



SPECIFICATIONS	
CONTACT CARRIER MATERIAL	NYLON
CONTACT MATERIAL/PLATING	BRASS/GOLD
HOUSING MATERIAL/PLATING	BRASS/NICKEL
RATED CURRENT [A]	24 A (1-4), 8 A (A-D)
RATED VOLTAGE [V]	600 V
CONDUCTOR INSULATION MATERIAL	PVC
OUTER JACKET MATERIAL/COLOR	PVC/YELLOW
NUMBER OF CONDUCTORS [AWG]	4x12 AWG, 4x18 AWG
DRAIN/SHIELD	18 AWG/FOIL AND TINNED-COPPER BRAID
TEMPERATURE RANGE	-40°C to +105°C (-40°F to +221°F)
PROTECTION CLASS	IEC IP67

## CBL-TTCOM-xxx Communications Cable



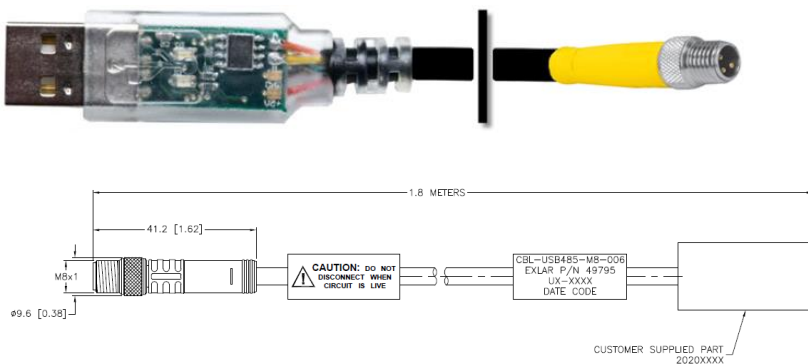
### SPECIFICATIONS

CONTACT CARRIER MATERIAL/COLOR	NYLON OR PUR/BLACK
MOLDED HEAD MATERIAL/COLOR	THERMOPLASTIC PUR/YELLOW
CONTACT MATERIAL/PLATING	BRASS/GOLD
COUPLING NUT MATERIAL/PLATING	BRASS/NICKEL
RATED CURRENT [A]	2.0 A
RATED VOLTAGE [V]	125 VAC/VDC
OUTER JACKET MATERIAL/COLOR	PUR/BLACK
CONDUCTOR INSULATION MATERIAL	PVC
NUMBER OF CONDUCTORS [AWG]	3x24 AWG
DRAIN/SHIELD	26 AWG DRAIN/FOIL
TEMPERATURE RANGE	-40°C to +105°C (-40°F to +221°F)
PROTECTION CLASS	MEETS NEMA 1,3,4,6P AND IEC IP67

## Communication Converters

When connecting the Tritex RS485 port to PC, a communication converter will typically be required. Exlar offers a USB to RS485 converter with an M8 connector ready to connect to the Tritex port. Model # CBL-T2USB485-M8-xxx. This converter is not isolated and is not recommended for permanent installation.

**Caution:** If another master is on the network such as PLC or HMI, this converter must be removed from the RS485 end. Leaving it connected with the USB end unconnected will load down the RS485 network and not allow it to function.



## Power Supply

### TTPS1048 Power Supply Introduction

The TTPS1048 is an unregulated power supply with 48 VDC nominal output @ 10 amps. Transformer taps allow connection to 108/120/132/216/240/264 VAC nominal input.

### Standard Features

- Bobbin Wound Transformer
- Computer Grade Capacitors – 100V rating is sufficient for regen, handles high ripple
- Floating Output – Allows grounding at any appropriate point in circuit
- Full Rated to 55 degrees Celsius
- Open Frame Construction – Must be installed in a separate enclosure
- Secondary Fuse Protection
- 50 amp, 200 volt full bridge rectifier

## Specifications

AC Input: 108/120/132/216/240/264 VAC @ 47-63 Hz

Output Ripple: 3% RMS at full rated load

Efficiency @ Full Load 80% typical

UL Recognized for USA and Canada File Number E133338

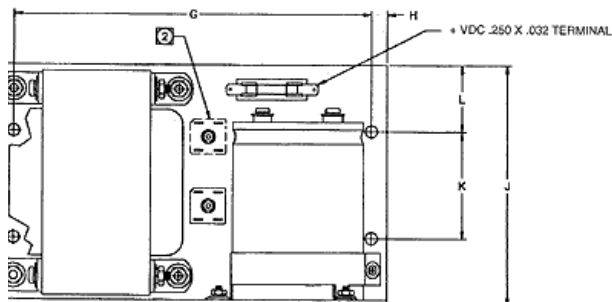
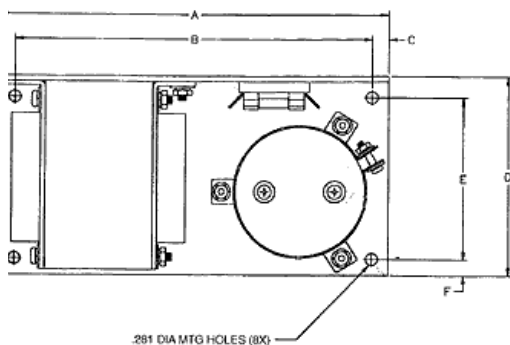
TUV Rheinland licensed. Certificate no. R 9675002

Complies with the requirements of standard EN 60590 and low voltage directive 72/23/EEC

## TTPS1048 Power Supply Output Voltage

Typical DC Output Voltage @ Nominal Input Voltage				
Model	No Load Voltage	Half Load Voltage	Full Load Voltage	Full Load Amps
TTPS1048	56.6	52.8	48.8	10

## TTPS1048 Dimensions



	INCH	mm
A	9.00	228.6
B	8.25	209.55
C	.37	9.40
D	4.62	117.35
E	3.750	95.25
F	.38	9.65
G	8.240	209.30
H	.35	8.89
J	5.62	142.75
K	2.500	63.50
L	1.56	39.62

## ***Shunt Regulator***

### **TTSR1 Shunt Regulator Option**

Transient over voltage problems are quickly solved using shunt regulators that clamp regeneration voltage to safe levels. These simple devices can increase system reliability by stabilizing voltage fluctuations and eliminate over-voltage shutdowns.

The purpose of a shunt regulator is to 'burn off' excess regeneration energy that is produced when a drive brings a large load to a stop. Mechanical braking systems use friction to stop a load and convert kinetic energy into heat. Servo drives on the other hand are very efficient power converters - typically over 98%! They convert electrical energy from the motor to the power supply just as efficiently as when they convert energy from the power supply to the motor. During a rapid deceleration or the deceleration of a large load, enough excess energy can be transferred to shut down the drive or damage the power supply.

A shunt regulator 'clamps' the power supply voltage to a set level and prevents unexpected shutdown or damage. It monitors the power supply voltage and if the voltage exceeds the set limit the shunt regulator 'bleeds off' the extra voltage through a power resistor. The shunt regulator is only active when the voltage exceeds the set level; otherwise, no current passes through the power resistor. The shunt regulator automatically turns the power resistor on and off as necessary to regulate the voltage, sometimes up to several hundred Hertz.

### **Description**

The TTSR1 shunt regulator is designed to work with four quadrant regenerative servo amplifiers. During braking most of the stored mechanical energy is fed back into the power supply, which charges the output capacitor to a higher voltage. If the charge reaches the amplifier's over-voltage shutdown point, motor control and braking will cease. To ensure smooth braking of large inertial loads with use of a shunt regulator is recommended. If the Tritex indicates an overvoltage fault there is a need for a shunt regulator. This regulator is designed to operate with power supplies that can > 75 volts without damage or shutdown, typically and unregulated supply.

### **Operation**

When the DC bus reaches the shunt voltage of ~ 77V the voltage comparator unit turns on the electronic switch, which connects the R1 power resistor across the DC bus. This power resistor dissipates the energy from the DC bus. After the bus voltage is reduced to less than the shunt voltage setting the resistor is disconnected from the bus. A small hysteresis loop allows time between switching. If the voltage goes above 85V the Tritex will trip on a High Bus Voltage fault and disable the drive. See Faults section.

# Specifications

Fuse: 3A motor delay rated @ 250 VAC

Filter Capacitance: 1200  $\mu$ F

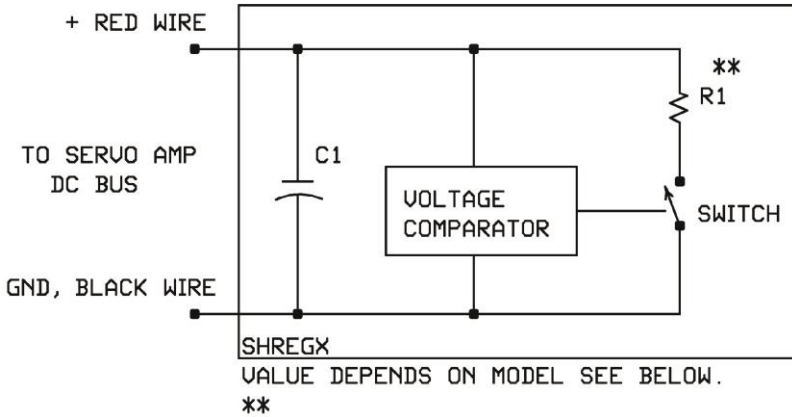
Dissipation Capabilities: 95W

Resistance: 5 Ohms

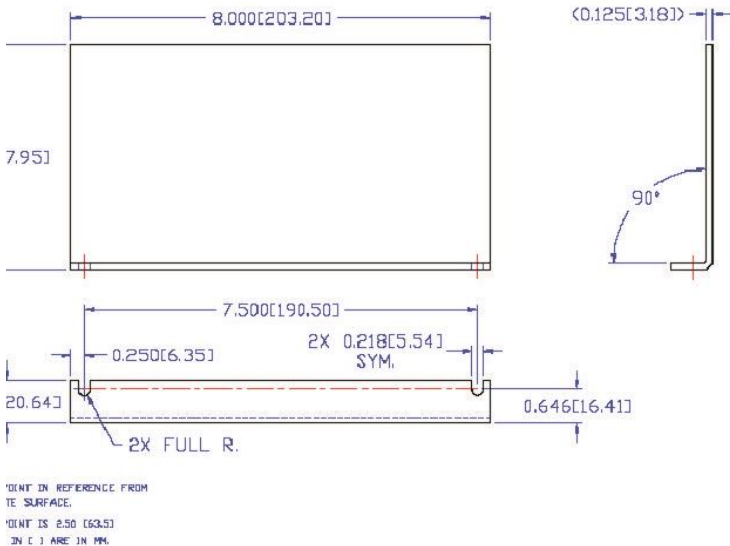
Size: 8.00 x 4.25 x 2.63 inches (203.2 x 108.0 x 66.7 mm)

Weight: 0.8 lbs (0,36 kg)

## Wiring Detail



## TTSR1 Dimensions



## ***Power Distribution and Surge Filter***

### **TDCESF1 Power Distribution and Surge Filter Accessory**

This accessory was designed to eliminate surge transients across + and – lines on a DC power source in order to pass EMC testing as a stand-alone device. It will seldom if ever be needed for that purpose because the Tritex II DC device will be connected to a power source that does not pass this type of transient. The only time this could occur is if the DC source is far away such as in an adjacent building and the negative side is connected to ground locally and at its source. In general, it will not be needed to construct a system that will pass all transient immunity tests for EMC compliance at the system level.

Its main use is for power conditioning and distribution, especially where multiple Tritex II DC units have a common power supply and / or shunt regulator. Features are as follows:

- Dual input power connections for daisy-chain connection of main power and logic power to multiple drives.
- Additional ground “PE” distribution with dual terminals on supply side
- Blocking diode with removable bypass link
- Inductor and additional bus capacitance to reduce ripple current at power supply
- Main power fuse
- Side by side terminals for all four drive power cable conductors
- Shunt blocking diode with removable bypass link
- Dual terminals for daisy-chain connection of shunt to multiple drives.
- Quick connect main power terminals capable of handling 10 AWG (4 mm<sup>2</sup>) wire
- Din rail or flat panel mounting.

### **Configuration**

J1 (six power terminals) and J2 (two signal terminals) on the “left” side connect to the power source. All have dual terminals for daisy-chain connection of multiple devices. They are +Pwr, -Pwr, PE at J1 and Logic Pwr+ at J2. Maximum current at +Pwr is 30A with current limit or fuse protection at the source. Logic Pwr should be fused at 2A at its source, which may be from the same power supply or a separate one.

J3 (six power terminals) on the “right” side connect to the Tritex II DC as BusPwr (+),

PwrCom (-), Logic Pwr (+) and PE. The other two terminals are for daisy-chain connection to the positive side of a shunt regulator. The negative side of the shunt regulator connects to the open PwrCom (-) terminal on the “left” side.

The red wire labeled “Power Link” from J5 to J6 connects Pwr+ to BusPwr through fuse F1. If a blocking diode is required to prevent regen power from flowing back to the power supply, the Power Link can be clipped out at J5 and J6, which then allows the internal blocking diode to operate. Re-installing a link is possible, but obviously much more difficult.

The blue wire labeled “Shunt Link” from J7 to J8 bypasses a steering diode to the shunt regulator. If the shunt regulator serves multiple drives, the Shunt Link should be clipped out at J7 and J8 on each Power Distribution and Surge Filter device connected to the shunt regulator. If there is only one drive connected to the shunt regulator the Shunt Link should be left in place to get full benefit from the capacitance at the TTSR1shunt regulator.

The device comes with mounting feet for top hat or G style DIN rails and panel mounting ears. When mounting to a panel, the DIN rail feet can be clipped or cut off without dis-assembling the device.

## Specifications

Fuse: 20A Bussmann type ABC or equivalent with recommended 12 AWG cable to drive

Inductance for ripple current reduction: 15  $\mu$ H

Maximum Current for daisy-chain distribution: 30A

Size: 4.25 wide x 4.5 long (along rail) x 3 deep (with rail feet) inches (110 x 108 x 75 mm)

Weight: 0.4 lbs (0,2 kg)

## Simplified Schematic

