

# Tritex II<sup>®</sup> AC Series Actuators



## 240V AC Linear and Rotary Actuator 90 mm and 115 mm Frame Sizes Installation and Service Manual

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 opinion), at the factory any product(s), or parts thereof, which prove to Seller's satisfaction to be defective as a result of defective materials, or workmanship and within the period of time, in accordance with the Seller's stated product warranty (see Terms and Conditions above), provided, however, that written notice of claimed defects shall have been given to Exlar within thirty (30) days from the date of any such defect is first discovered. The product(s) claimed to be defective must be returned to Exlar, transportation prepaid by Buyer, with written specification of the claimed defect. Evidence acceptable to Exlar must be furnished that the claimed defects were not caused by misuse, abuse, or neglect by anyone other than Exlar.

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

Electronic component damage due to improper connection to power sources or connection to a power source at an incorrect voltage is not covered by this warranty. Electronic component damage caused by operating beyond limits established by factory set parameters in Tritex II product 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> .....	<b>5</b>
Warnings and Cautions .....	5
Underwriters Laboratories Listed .....	8
UL Certificate of Compliance .....	11
CE Declaration of Conformity .....	12
CSA Certified Product .....	16
<b>GENERAL SPECIFICATIONS</b> .....	<b>20</b>
Tritex II Overview .....	20
Drive Specification for all Tritex 240 Volt Models .....	21
Specifications: Size 90 Linear Actuators .....	22
Specifications: Size 115 Linear Actuators .....	23
Specifications: Size 90 Motors and Gearmotors .....	24
Extended Temperature De-ratings .....	26
Linear Actuator Ordering Guide .....	27
<b>MECHANICAL INSTALLATION</b> .....	<b>29</b>
Mounting and Operating Considerations .....	29
Lubrication .....	29
General Operation .....	30
Mounting Configurations .....	30
T2M Series Linear Actuator Anti-rotation Option .....	30
T2M/X090 Actuator Mounting Dimensions .....	31
T2M/X115 Actuator Dimensions .....	32
R2M090 and R2G090 Motor/Gearmotor Dimensions .....	33
R2M115 and R2G115 Motor/Gearmotor Dimensions .....	34
Options and Rod End Attachment Dimensions .....	35
Outdoor and Wash Down Installations .....	37
<b>ELECTRICAL INSTALLATION</b> .....	<b>40</b>
Introduction .....	40
Tritex Configurations .....	41
Grounding .....	42
Shielding .....	43
NPT Connections .....	43
AC Input Power .....	44
Input Power Ratings .....	44
AC Supplies NOT Requiring Transformers .....	44
AC Supplies Requiring Transformers .....	47
Wire Size, Branch Circuit Protection and Overcurrent Protection .....	49
Power Terminal Wiring .....	50
Power Terminal Connections .....	51
Power Connector Wiring .....	52
Brake / Shunt Resistor Considerations .....	53
Control Logic Power Supply .....	55
Input / Output Connections .....	56
Terminal Board Connections for Digital and Standard Analog I/O .....	56

Terminal Board Connections for IA4 Option (4-20 mA Isolated Analog I/O).....	57
I/O Wiring for “I” option (M16 I/O connector).....	57
I/O Power Supply.....	59
4-20 mA I/O - IA4 Option Board.....	66
Communications.....	69
Standard Modbus RTU Communications.....	69
Important Considerations.....	71
PC Communications.....	72
CANopen.....	73
Ethernet Options, EIP or TCP or ProfiNET.....	74
AF Option - Absolute Feedback.....	75
<b>MAINTENANCE PROCEDURES FOR RE-GREASING.....</b>	<b>77</b>
Maintenance Procedure for Roller Screw Re-Greasing.....	77
Disassembly.....	77
Lubrication Maintenance.....	78
Grease Renewal.....	78
Reassembly.....	79
Maintenance Procedures for Complete Re-Greasing.....	80
Disassembly.....	80
Lubrication Maintenance.....	81
Grease Renewal.....	81
Reassembly.....	82
<b>ACCESSORIES.....</b>	<b>84</b>
Cables.....	84
<b>RETURNING A PRODUCT FOR REPAIR.....</b>	<b>87</b>

## SAFETY CONSIDERATIONS

### Warnings and Cautions

As with any electro-mechanical device, safety must be considered during the installation and operation of your Tritex II 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 are present. Damage to equipment and injury to personnel can result. Refer to the following warnings on supply isolation and stored energy discharge time for more information.

## 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 maintenance is performed except adjustments to the settings or parameters as specified in the manual.

## WARNING



**Risk of Electric Shock.  
Allow 3 minutes for Discharge Time.**

### **3-Minutes**

The actuator contains capacitors that remain charged to a potentially lethal voltage for up to 3 minutes after the supply has been removed. Do not touch power wiring or terminals until this discharge time has expired.

## WARNING



### **If connected by plug and socket**

A special hazard may exist where the actuator is incorporated into a system connected to the AC supply by a plug and socket. The pins of the plug are not generally isolated from the charge stored in the bus capacitor, so must be considered electrically “hot” until the discharge time has expired. It is the responsibility of the user to avoid any possibility of electric shock from the pins when they are accessible.

## WARNING



### **Grounding - High Leakage Current**

The drive must be grounded by a conductor sufficient to carry all possible fault 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 instructions for ground connections shown in this manual must be followed.

## CAUTION



### **Compatibility with Residual Current-operated Protection Device (RCD)**

This product can cause a DC current in the protective earthing conductor. Where a residual current –operated protective (RCD) or monitoring (RCM) device is used for protection in case of direct or indirect contact, only an RCD or RCM of Type B is allowed on the supply side of this product.

## WARNING



### **Hot Surface – Risk of Burn.**

Exposed surfaces of the actuator may exceed 70 degrees C under normal operation and can take a long time to cool, resulting in a risk of burns when touched.

## Underwriters Laboratories Listed



IND. CONT. EQ.  
UL File E325731

Certain models of Tritex II Linear and Rotary Actuators are marked “UL Listed” after passing a rigorous set of design and testing criteria developed by Underwriters Laboratories (UL508C). This label indicates that UL certifies this product to be safe when installed according to the installation instructions and used in accordance with the product specifications and the following conditions of acceptability:

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

- Drive input maximum continuous operating ratings:

Input Voltage (all models): 240 VAC, 1 $\Phi$ , 50/60 Hz		
Drive Model	Drive Description	Input Continuous Current (Arms)
R2M090- or R2G090-	90 mm rotary motor	6.3
R2M115- or R2G115-	115 mm rotary motor	8.3
T2M090- or T2X090-	90 mm linear actuator	6.3
T2M115- or T2X115-	115 mm linear actuator	8.3

- Above full load ratings are at a maximum surrounding air temperature of 25°C.
- This product is “Suitable For Use On A Circuit Capable of Delivering Not more Than 5,000 rms Symmetrical Amperes, 240 Volts maximum”, when protected by fuses or inverse-time circuit breaker only, sized 250% FLA maximum.
- Drives shall be protected by Class CC or Class RK1 fuses or drives shall be protected by non-semiconductor fuses or inverse-time circuit breakers only, sized a maximum of 250% of the drives FLA and 250 Volts maximum.
- “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”.



- If used, the +24 VDC Control Logic power supply and/or the I/O power supply must be a recognized or listed Class 2 Power Supply
- *A secondary circuit intended to be supplied from a Class 2 transformer or power source in the field shall be marked “Class 2” next to the voltage rating of the device.*
- *If used, optional input control power shall be 24 VDC, Class 2 supply or 24 VDC provided with a 4A fuse.*
- L1, L2, PE: *For input terminals maximum 14 AWG wire shall be used but not less than 125% of the maximum current for the input.*
- *Wires ends are to be solid for input terminal connections. When stranded wire is used tin the wires or a similar method should be used to prevent stray strands of wire.*
- *Do not strip wires more than 0.25 inch (6.3 mm) for input terminal leads.*
- *“Use copper conductors only” for all power wiring.*
- Use UL approved copper only wires, 300 Vac minimum rating, and 105° C minimum rating at input power and PE terminals.
- The Type 4 enclosure rating requires that the motor face plate is attached to a similarly rated panel enclosure.
- A ½ inch NPT connection with conduit is required to maintain Type 4 enclosure rating. Teflon tape or equivalent must be used to seal the NPT conduit to the housing.

## **Additional Information Related to UL**

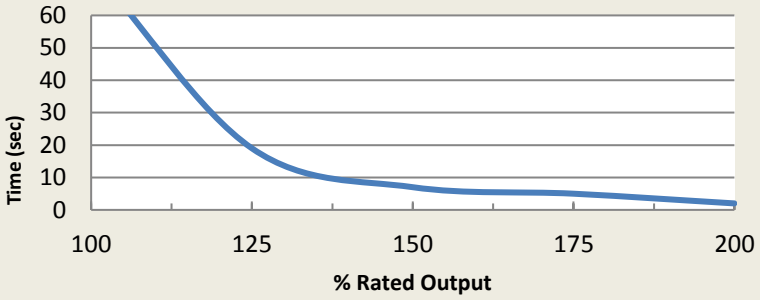
### **Motor Over temperature Sensing is not provided by the Drive**

Though Tritex II AC has a high temperature limit switch built into the motor, its overall function has not been approved by UL for motor over temperature protection and is therefore not used as the basis for motor overload protection.

### **Electronic Overload Protection**

Solid state overload protection is provided in each model at no more than 110% of rated output torque / force. This overload protection is based on maximum continuous current capacity. It will allow up to 200 % of rated output to be delivered for the amount of time determined by the following chart:

**Torque / Force Output vs. Time**



# UL Certificate of Compliance

## Certificate of Compliance

Certificate Number 20111220 – E325731  
Report Reference E325731 – 2010 December 01  
Issue Date 2011 December 20

Page 1 of 1



Issued to: **EXLAR CORP**  
18400 W 77TH ST  
CHANHASSEN, MN 55317 USA

*This is to certify that representative samples of*

### Power Conversion Equipment

Tritex II AC Power Linear Actuators, Model T2M or T2X followed by 090 or 115; followed by 01 through 24 or \*XX; followed by \*XX; followed by N; followed by \*X; followed by \*X; followed by HD, IE, AF, or \*XX; followed by 1, 2, 3, or \*X; followed by 1 or 3; followed by 6, 8, or \*X; followed by 01 through 99; followed by 230; may be followed by SIO, IA4, EIP, TCP, ABZ, PIO, CNO, XF, OR \*XXX; may be followed by \*XX; may be followed by 00000 through 99999. X Any Alphanumeric characters.


Tritex II AC Power Rotary Actuators, Model R2M or R2G followed by 090 or 115; followed by XXX; followed by \*X; followed by N; followed by \*X; followed by B or S; followed by HD, IE, AF, or \*XX; followed by 1, 2, 3 or \*X; followed by 1 or 3; followed by 6, 8, or \*X; followed by 01 through 99; followed by 230; may be followed by SIO, IA4, EIP, TCP, ABZ, PIO, CNO, XF, OR \*XXX; may be followed by (Multiple Options) \*XX; may be followed by 00000 though 99999. X Any Alphanumeric characters.

*Have been investigated by Underwriters Laboratories in accordance with the Standard(s) indicated on this Certificate.*

**Standard(s) for Safety:** ANSI/UL 508C, "Power Conversion Equipment."

**Additional Information:** See UL On-line Certification Directory at [WWW.UL.COM](http://WWW.UL.COM) for additional information.

Only those products bearing the UL Listing Mark should be considered as being covered by UL's Listing and Follow-Up Service.

The UL Listing Mark generally includes the following elements: the symbol UL in a circle:  with the word "LISTED"; a control number (may be alphanumeric) assigned by UL; and the product category name (product identifier) as indicated in the appropriate UL Directory.

Look for the UL Listing Mark on the product

**William R. Carney**  
Director, North American Certification Programs

Underwriters Laboratories Inc.  
Any information and documentation involving UL Mark services are provided on behalf of Underwriters Laboratories Inc. (UL) or any authorized licensee of UL.

For questions, please contact a local UL Customer Service Representative at <http://www.ul.com/global/eng/pages/corporate/contactus>

## CE Declaration of Conformity

The Tritex II Linear and Rotary Actuators are marked with the “Conformité Européenne Mark” (CE Mark) after passing a rigorous set of design and testing criteria. This label indicates the product meets applicable electrical safety, and electromagnetic immunity and emissions (EMC) standards when installed according to the installation instructions.

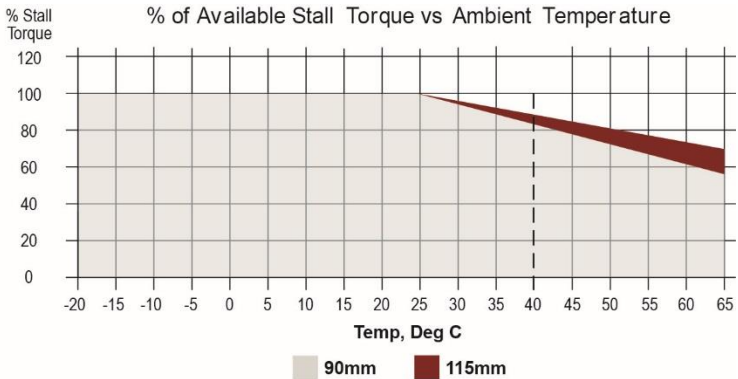
### The conditions of acceptability required for CE are:

- Drive input maximum continuous operating ratings:

<b>Input Voltage (all models): 240 VAC, 1 <math>\Phi</math>, 50/60 Hz</b>		
<b>Drive Model</b>	<b>Drive Description</b>	<b>Input Continuous Current (Arms)</b>
R2M090- or R2G090-	90mm rotary motor	6.3
R2M115- or R2G115-	115mm rotary motor	8.3
T2M090- or T2X090-	90mm linear actuator	6.3
T2M115- or T2X115-	115mm linear actuator	8.3

- L1, L2, PE: For input terminals maximum 14 AWG/ 2.5mm<sup>2</sup> wire shall be used but not less than 125% of the maximum current for the input.
- Wires ends are to be solid for input terminal connections. When stranded wire is used tin the wires or a similar method should be used to prevent stray strands of *wire*.
- Do not strip wires more than 0.25 inch (6.3 mm) for input terminal leads.
- Use 300VAC minimum rating, and 105° C minimum rating copper wires
- An externally connected ground wire must be used. Single rear screw connection, screw. Must be earthed (grounded) for safety, minimum wire size 2.5mm<sup>2</sup>. Adequate strain relief and mechanical protection must be provided for this wire. Note, this does not replace and is used in addition to the 2.5mm<sup>2</sup> grounding conductor that is connected to the input power terminals.
- If used, the +24 VDC Control Logic power supply and/or the I/O power supply must be a CE marked 24V supply and negative side must be connected to PE.
- This product is suitable for use on a circuit capable of delivering 5,000 rms symmetrical amperes, 240 volts maximum, when protected with by a Class RK1 or Class CC fuse or Inverse Time Circuit Breaker, rated at 15 A rms.

- The full load ratings are at a maximum surrounding air temperature of 25°C, see de-rating chart below for higher ambient temperatures.



- All cables must be shielded, with the outer shield bonded to the case.
- When using cable glands use glands that connect the braided shield of the cable directly to enclosure.
- When using connectors ensure that the outer shield of the cable is in full contact with the connector housing. Connector housings must be conductive.
- Make ground connections as short as possible for low impedance.
- Keep cable runs as short as possible. Power and signal cables must be separated and far as possible and only crossing them at right angles as described in the Cable routing section of this manual.
- IP rating: Model T2M actuators are IP 54 rated unless they include the IP65 option, Models T2X, R2M, and R2G are IP65 rated.
- To maintain IP rating the RS485 cable or cap must be installed. All other cable connections must be connected or sealed.

# ***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:  
**T2M, T2X, R2M and R2G Powered Linear and Rotary Actuators***

*(Complete Model Listing Below)*

*Model identification:  
**T2M090, T2M115, T2X090, T2X115,  
R2M090, R2M115, R2G090, R2G115***

*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)*

*EU Low Voltage Directive 2006/95/EC (until April 19th, 2016)*

*EU Low Voltage Directive 2014/35/EU (from April 20th, 2016)*

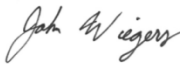
*Using the relevant section of the following EU standards and other normative documents:*

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

*Safety: IEC/EN: 61800-5-1:2007 Adjustable Speed Electrical Power Drive  
Systems – Part 5-1: Safety Requirements*

*Year of CE Marking: 2010*

Signature:



Name: John Wiegiers  
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).

## CSA Certified Product



The Tritex II 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:

- Drive input maximum continuous operating ratings:

<b>Input Voltage (all models): 240 VAC, 1 <math>\Phi</math>, 50/60 Hz</b>		
<b>Drive Model</b>	<b>Drive Description</b>	<b>Input Continuous Current (Arms)</b>
R2M090- or R2G090-	90 mm rotary motor	6.3
R2M115- or R2G115-	115 mm rotary motor	8.3
T2M090- or T2X090-	90 mm linear actuator	6.3
T2M115- or T2X115-	115 mm linear actuator	8.3

- Maximum Rated Force: Up to 3325 lbf (14kN)
- Installation Requirements
  - Hazardous Location (Class I Division 2 Group A, B, C, D) installations – ½” rigid conduit with NPT connections and use UL approved copper only wires, 14 AWG, 300 Vac minimum rating, and 105° C minimum rating shall be used.
  - For other non-hazardous locations:
    - Use the above connection method, or
    - Cable with connector assemblies, or
    - Cables with cable glands are permitted.

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

- If a customer requires an additional +24 VDC power supply to provide power then it must be a recognized or listed Class 2 Power Supply.
- Branch circuit protection must be provided. Reference the manual’s electrical installation section for fuse and circuit breaker options. Note: branch circuit protection must be located outside of the hazardous location environment.



- The full load ratings are at 25°C ambient temperature. See de-rating chart on page 13 for higher ambient temperatures.
- These conditions of acceptability only apply to units with a CSA mark on the product label.



# 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 I1DM & 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  $\text{Ta} = 40\text{C}$  to 14.0Adc max. at 65C.

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°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),  $-40^{\circ}\text{C} \leq T_a \leq +65^{\circ}\text{C}$ .  
Note: Derate input current linear above  $T_a = 40\text{C}$  to 14.0A 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.*

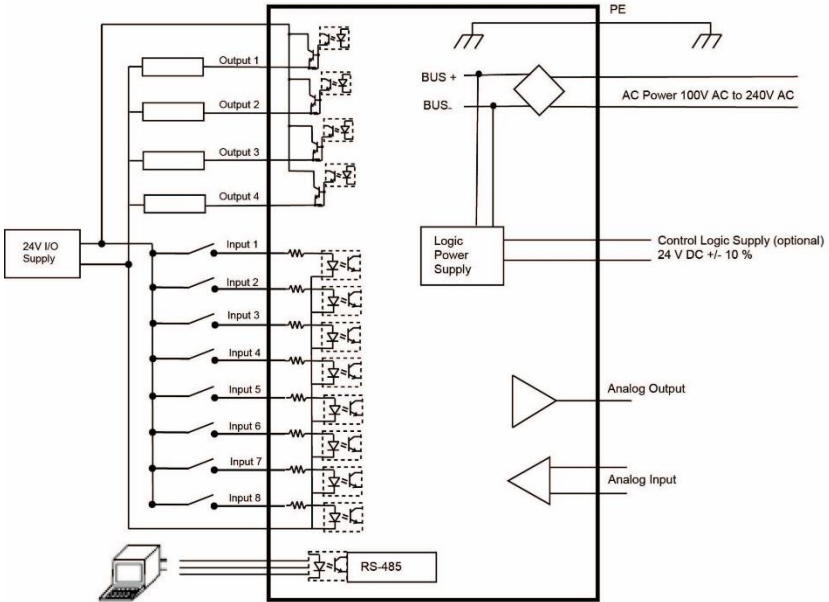
### Product Certification History

Project	Date	Description
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

# GENERAL SPECIFICATIONS

## Tritex II Overview

Tritex II is Exlar's advanced family of integrated drives. This manual applies to 90mm and 115mm frame sizes with 240VAC input power. All of the required power components and motion processor are contained in the actuator housing.



*Tritex II Basic Block Diagram*

## Drive Specification for all Tritex 240 Volt Models

Drive Specifications	
<b>Input Voltage, Bus and Logic</b>	100 to 240 Volts ac nominal +/-10%
<b>Control Logic supply (Optional)</b>	24 V dc +/- 10% - Class 2 or isolating source protected by 4A maximum fuse 0.5 A dc max load
<b>I/O Power Supply</b>	24 V dc +/- 10% - Class 2 or isolating source protected by a 4A maximum fuse
<b>Enclosure Rating</b>	UL Type 4 and IP:66
<b>Digital Inputs</b>	8 – opto isolated, 12 to 30 V dc for ON state, 0 to 1V dc for OFF state, common return at “I/O Power Supply” “common” terminal Programmable functions
<b>Digital Outputs</b>	4 – opto isolated 100 mA continuous, short circuit protected, powered from “I/O Power Supply” with 1V maximum drop from supply voltage, programmable functions
<b>Analog Input</b>	0-10 Volts or +/- 10 Volts differential input, 12 bit resolution, programmable as position, velocity or torque command
<b>Analog Output</b>	0-10 Volts at up to 20 mA, 12 bit resolution, programmable function
<b>Serial Interface</b>	Optically isolated RS-485, Modbus RTU protocol, 38.4kbaud max
<b>Commutation</b>	Sinusoidal, 10kHz PWM
<b>Position Resolution</b>	0.001 revolution (with analog hall feedback)
<b>Accuracy</b>	+ / - 0.002 revolution (with analog hall feedback)
<b>Environmental</b>	Ambient Temperature, charts below show ratings for 25° C Maximum Operating temperature range -20° to 65° C See de-rating chart for temperatures above 25° C. For operation below -20°C contact Exlar Applications Engineering.

### Actuator Selections

(This manual applies to 90mm and 115mm frame sizes only)

Tritex actuators are available in linear, rotary, and rotary with integrated planetary gearing in both 90 mm and 115 mm frame sizes. All include embedded drive and motion controller.

Frame Size	Linear		Rotary Motor	Rotary Gearmotor
	Std. Capacity	High Capacity		
90 mm	T2M-090	T2X-090	R2M-090	R2G-090
115 mm	T2M-115	T2X-115	R2M-115	R2G-115

### Specifications: Size 90 Linear Actuators T2M/X090

		Stator	1 Stack	2 Stack	3 Stack
Lead		RPM @ 240 VAC	4000	4000	3000
0.1	Continuous Force	lbf (N)	1,130 (5062)	1,488 (6619)	NA
	Peak Force	lbf (N)	2,260 (10053)	2,700 (12010)***	NA
	Max Speed	in/sec (mm/sec)	6.67 (169)	6.67 (169)	NA
	T2X - C <sub>a</sub> (Dynamic Load Rating)	lbf (N)	5516 (24536)		NA
	T2M - C <sub>a</sub> (Dynamic Load Rating)	lbf (N)	3310 (14724)		NA
0.2	Continuous Force	lbf (N)	640 (2847)	843 (3750)	1,113 (4951)
	Peak Force	lbf (N)	1,281 (5698)	1,687 (7504)	2,225 (9897)
	Max Speed	in/sec (mm/sec)	13.33 (338)	13.33 (338)	10.00 (254)
	T2X - C <sub>a</sub> (Dynamic Load Rating)	lbf (N)	5800 (25798)		
	T2M - C <sub>a</sub> (Dynamic Load Rating)	lbf (N)	3570 (15880)		
0.5	Continuous Force	lbf (N)	271 (1205)	357 (1588)	471 (2095)
	Peak Force	lbf (N)	542 (2410)	714 (3176)	942 (4190)
	Max Speed	in/sec (mm/sec)	33.33 (846)	33.33 (846)	25.00 (635)
	T2X - C <sub>a</sub> (Dynamic Load Rating)	lbf (N)	4900 (21795)		
	T2M - C <sub>a</sub> (Dynamic Load Rating)	lbf (N)	3016 (13416)		
Drive Current @ Continuous Force	Amps	5.7	7.5	7.5	
Available Stroke Lengths	in (mm)	3 (75), 6 (150), 10 (254), 12 (300), 18 (450)			
Inertia (zero stroke)	lb-in-s <sup>2</sup> / Kg-m <sup>2</sup>	0.002655 (0.000003000)	0.002829 (0.000003196)	0.003003 (0.0000033963)	
Inertia Adder (per inch of stroke)	lb-in-s <sup>2</sup> /in/ Kg-m <sup>2</sup> /in	0.0001424 (0.0000001609)			
Approximate Weight	lb (kg)	14 (6.35) for 3 inch stroke, 1 stack. Add 1 (0.5) per inch of stroke. Add 3 (1.4) per motor stack. Add 3 (1.4) for brake.			
Operating Temperature Range*		-20 to 65° C (-40° C available, consult Exlar)			
Continuous AC Input Current**	Amps	6.3	6.3	6.3	

Ratings based on 25° C conditions.

\*\* Continuous input current rating is defined by UL and CSA.

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

# Specifications: Size 115 Linear Actuators

## T2M/X115

		Stator	1 Stack	2 Stack	3 Stack
Lead		RPM @ 240 VAC	3000	2000	1500
0.1	Continuous Force	lbf (N)	2,060 (9,163)	3,224 (14,341)	NA
	Peak Force	lbf (N)	4,120 (18,327)	5,400 (24,020)	NA
	Max Speed	in/sec (mm/sec)	5.00 (127)	3.33 (84)	NA
	T2X - C <sub>a</sub> (Dynamic Load Rating)	lbf (N)	7900 (35141)		NA
	T2M - C <sub>a</sub> (Dynamic Load Rating)	lbf (N)	4736 (21067)		NA
0.2	Continuous Force	lbf (N)	1,177 (5,235)	1,843 (8,198)	2,380 (10,586)
	Peak Force	lbf (N)	2,354 (10,471)	3,685 (16,392)	4,760 (21,174)
	Max Speed	in/sec (mm/sec)	10.00 (254)	6.67 (169)	5.00 (127)
	T2X - C <sub>a</sub> (Dynamic Load Rating)	lbf (N)	8300 (36920)		
	T2M - C <sub>a</sub> (Dynamic Load Rating)	lbf (N)	4890 (21751)		
0.5	Continuous Force	lbf (N)	530 (2,358)	829 (3,688)	1,071 (4,764)
	Peak Force	lbf (N)	1,059 (4711)	1,658 (7,375)	2,142 (9,528)
	Max Speed	in/sec (mm/sec)	25.00 (635)	16.67 (423)	12.50 (317)
	T2X - C <sub>a</sub> (Dynamic Load Rating)	lbf (N)	7030 (31271)		
	T2M - C <sub>a</sub> (Dynamic Load Rating)	lbf (N)	4218 (18763)		
0.75	Continuous Force	lbf (N)	353 (1,570)	553 (2,460)	714 (3,176)
	Peak Force	lbf (N)	706 (3,140)	1,106 (4,920)	1,428 (6,352)
	Max Speed	in/sec (mm/sec)	37.5 (953)	25 (635)	17.75 (450)
	T2X - C <sub>a</sub> (Dynamic Load Rating)	lbf (N)	6335 (28179)		
	T2M - C <sub>a</sub> (Dynamic Load Rating)	lbf (N)	3328 (14804)		
Drive Current @ Continuous Force		Amps	8.5	8.5	8.5
Available Stroke Lengths		in (mm)	4 (102), 6 (150), 10 (254), 12 (300), 18 (450)		
Inertia (zero stroke)		lb-in-s <sup>2</sup> / Kg-m <sup>2</sup>	0.01132 (0.000012790)	0.01232 (0.00001392)	0.01332 (0.00001505)
Inertia Adder (per inch of stroke)		lb-in-s <sup>2</sup> /in/ Kg-m <sup>2</sup> /in	0.0005640 (0.000006372)		
Approximate Weight		lb (kg)	34 (15.5) for 6 inch stroke, 1 stack. Add 2 (1) per inch of stroke. Add 8 (4) per motor stack. Add 4 (2) for brake.		
Operating Temperature Range*			-20 to 65° C (-40° C available, consult Exlar)		
Continuous AC Input Current**		Amps	8.3	8.3	8.3

\*Ratings based on 25° C conditions.

\*\* Continuous input current rating is defined by UL and CSA.

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

# Specifications: Size 90 Motors and Gearmotors

## R2M090

### Rotary Motor Torque and Speed Ratings

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

\*Ratings based on 25° C ambient conditions.

For output torque of R2G gearmotors, multiply by ratio and efficiency.

\*\*Continuous input current rating is defined by UL and CSA.

Please note maximum allowable output torques shown below.

### Inertia

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

\*Add armature inertia to gearing inertia for total inertia.

### Radial Load and Bearing Life

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

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

### Gearmotor Mechanical Ratings

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

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

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

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

### Gearing Reflected Inertia

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

### Backlash and Efficiency

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

### Motor and Gearmotor Weights

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

3 (1.4)



# Specifications: Size 115 Motors and Gearmotors

## R2M115

### Rotary Motor Torque and Speed Ratings

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

\*Ratings based on 25° C ambient conditions.

†Continuous input current rating is defined by UL and CSA.

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

### Inertia

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

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

### Radial Load and Bearing Life

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

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

### Gearmotor Mechanical Ratings

Model	Ratio	Maximum Allowable Output Torque-Set by User lbf-in (Nm)	Output Torque at Motor Speed for 10,000 Hour Life		
			1000 RPM lbf-in (Nm)	2000 RPM lbf-in (Nm)	3000 RPM lbf-in (Nm)
R2G115-004	4:1	4696 (530.4)	1392 (157.3)	1132 (127.9)	1000 (112.9)
R2G115-005	5:1	4066 (459.4)	1455 (163.3)	1175 (132.8)	1040 (117.5)
R2G115-010	10:1	2545 (287.5)	1660 (187.6)	1350 (152.6)	1200 (135.6)
R2G115-016	16:1	4696 (530.4)	2112 (238.6)	1714 (193.0)	1518 (171.0)
R2G115-020	20:1	4696 (530.4)	1840 (209.1)	1840 (207.9)	1620 (183.0)
R2G115-025	25:1	4066 (459.4)	2350 (265.5)	1900 (214.7)	1675 (189.2)
R2G115-040	40:1	4696 (530.4)	2800 (316.4)	2240 (253.1)	2000 (225.9)
R2G115-050	50:1	4066 (459.4)	2900 (327.7)	2350 (265.5)	2100 (237.3)
R2G115-100	100:1	2545 (287.5)	2500 (282.5)	2500 (282.5)	2400 (271.2)

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

### Gearing Reflected Inertia

Single Reduction			Double Reduction		
Gear Stages	lbf-in-sec <sup>2</sup>	(kg-cm <sup>2</sup> )	Gear Stages	lbf-in-sec <sup>2</sup>	(kg-cm <sup>2</sup> )
4:1	0.000635	(0.717)	16:1	0.000513	(0.580)
5:1	0.000428	(0.484)	20:1, 25:1	0.000350	(0.396)
10:1	0.000111	(0.125)	40:1, 50:1, 100:1	0.0000911	(0.103)

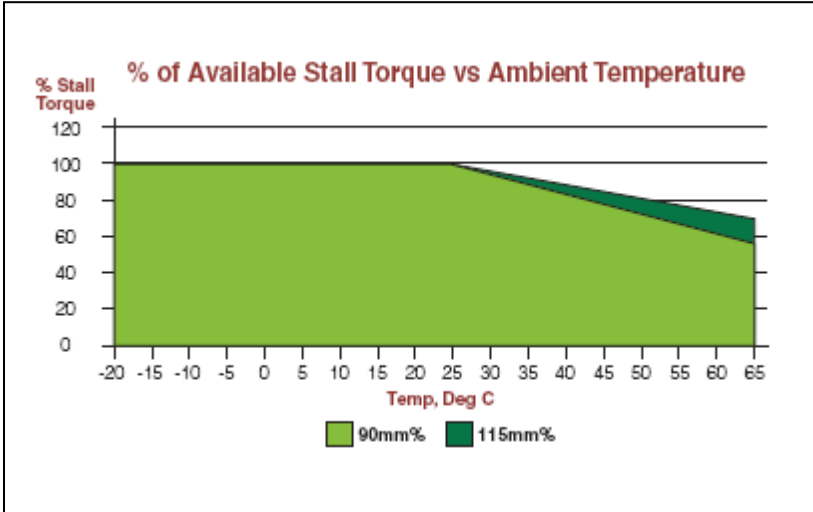
### Backlash and Efficiency

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

### Motor and RTG115 Gearmotor Weights

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

## Extended Temperature De-ratings



***Use this chart to determine continuous (rms) rated torque values at elevated temperatures. Peak torque ratings are not affected.***

## Linear Actuator Ordering Guide

### T2M/X = Actuator Type

T2M = Tritex II Linear Actuator, standard mechanical capacity

T2X = Tritex II Linear Actuator, high mechanical capacity

### BBB = Actuator Frame Size

075 = 75 mm

090 = 90 mm

115 = 115 mm

### CC = Stroke Length

03 = 3 inch (76 mm) (N/A T2M/X115)

04 = 4 inch (102 mm) (T2M/X115 only)

06 = 6 inch (150 mm)

10 = 10 inch (254 mm)

12 = 12 inch (305 mm)

18 = 18 inch (457 mm)

### DD = Screw Lead (linear travel per screw revolution)

01 = 0.1 inch (2.54 mm)

02 = 0.2 inch (5.08 mm)

05 = 0.5 inch (12.7 mm)

08 = 0.75 inch (19.05 mm) (T2M/X115 only) <sup>5</sup>

### E = Connections

G = Standard Straight Threaded Port with Internal terminals, M20 x 1.5

N = NPT Threaded Port via Adapter with Internal Terminals, 1/2" NPT

I = Intercontec Style - Exlar std, M16/M23 Style Connector

J = Embedded leads with "I" plug 3' standard

### F = Mounting

C = Rear Clevis

D = Double Side Mount

E = Extended Tie Rod

F = Front Flange

G = Metric Rear Clevis

K = Metric Double Side Mount

M = Metric Extended Tie Rod

Q = Metric Side Trunnion

R = Rear Flange

T = Side Trunnion

### G = Rod End

A = Male Metric Thread <sup>1</sup>

B = Female Metric Thread <sup>1</sup>

F = Female US Standard Thread <sup>1</sup>

M = Male US Standard Thread <sup>1</sup>

### HH = Feedback Type

HD = Analog Hall Device

IE = Incremental Encoder, 8192 count resolution

AF = Absolute Feedback

### III-II = Motor Stator, All 8 Pole

T2M/X075 Stator Specifications

138-40 = 1 Stack, 230 VAC, 4000 rpm

238-30 = 2 Stack, 230 VAC, 3000 rpm

338-20 = 3 Stack, 230 VAC, 2000 rpm

T2M/X090 Stator Specifications

138-40 = 1 Stack, 230 VAC, 4000 rpm

238-40 = 2 Stack, 230 VAC, 4000 rpm

238-30 = 2 Stack, 230 VAC, 3000 rpm <sup>9</sup>

T2M/X115 Stator Specifications

138-30 = 1 Stack, 230 VAC, 3000 rpm

238-20 = 2 Stack, 230 VAC, 2000 rpm <sup>11</sup>

238-15 = 2 Stack, 230 VAC, 1500 rpm <sup>9, 11</sup>  
(N/A with 0.1" lead)

### JJJ = Voltage

230 = 115-230 VAC, single phase

### KKK = Option Board

SIO = Standard I/O Interconnect

IA4 = 4-20 mA Analog I/O

COP = CANOpen w/M12 connector

CON = CANOpen, without M12 <sup>10</sup>

EIP = SIO plus Ethernet/IP w/M12 connector

EIN = SIO plus Ethernet/IP without M12 connector <sup>10</sup>

PIO = SIO plus Profinet IO w/M12 connector

PIN = SIO plus Profinet IO without M12 connector <sup>10</sup>

TCP = SIO plus Modbus TCP w/M12 connector

TCN = SIO plus Modbus TCP w/o M12 connector <sup>10</sup>

### MM = Mechanical Options <sup>6</sup>

AR = External Anti-rotate

L1/2/3 = External Limit Switches <sup>7</sup>

RB = Rear Brake

PB = Protective Bellows (N/A with extended tie rod mounting option)

SR = Splined Main Rod <sup>8, 2</sup>

P5 = IP65 Sealing Option (T2M only)

### NOTES:

1. Chrome-plated carbon steel. Threads not chrome-plated.
2. Consult Exlar when ordering splined stainless steel main rod.
3. The dynamic load rating of zero backlash, preloaded screws is 63% of the dynamic load rating of the std non-preloaded screws. The calculated travel life of a preloaded screw will be 25% of the calculated travel life of the same size and lead of a non-preloaded screw.

4. This housing option may indicate the need for special material main rods or mounting.
5. 0.75 lead not available above 12 inch stroke.
6. For extended temperature operation consult factory for model number.
7. Limit switch option requires AR option.
8. This option is not sealed and is not suitable for any environment in which contaminants come in contact with actuator and may enter the actuator.
9. N/A with 0.1 inch lead
10. Requires customer supplied Ethernet cable through I/O port for Class 1 Division 2 compliance only.
11. Not available with 4 inch stroke.

## Rotary Motor and Gearmotor Ordering Guide

### R2M/G = Motor Type

R2M = Tritex II AC Rotary Motor

R2G = Tritex II AC Rotary Gearmotor

### AAA = Frame Size

075 = 75 mm

090 = 90 mm

115 = 115 mm

### BBB = Gear Ratio

Blank = R2M

Single Reduction Ratios

004 = 4:1

005 = 5:1

010 = 10:1

Double Reduction Ratios (N/A on 75 mm)

016 = 16:1    020 = 20:1

025 = 25:1    040 = 40:1

050 = 50:1    100 = 100:1

### C = Shaft Type

K = Keyed

R = Smooth/Round

### D = Connections

G = Standard Straight Threaded Port with Internal Terminals, M20 x 1.5

N = NPT Threaded Port with Internal Terminals, 1/2" NPT

I = Intercontec style - Exlar Standard, M16/M23 Style Connector

J = Embedded leads with "I" plug 3' standard

### E = Coating Options

G = Exlar Standard

### F = Brake Option

S = No Brake, Standard

B = Electric Brake, 24 VDC

### GG = Feedback Type

HD = Analog Hall Device

IE = Incremental Encoder, 8192 Count Resolution

AF = Absolute Feedback

### HHH-HH = Motor Stators

*R2M/G075 Stator Specifications*

138-40 = 1 Stack, 230 VAC, 4000 rpm

238-30 = 2 Stack, 230 VAC, 3000 rpm

338-20 = 3 Stack, 230 VAC, 2000 rpm

*R2M/G090 Stator Specifications*

238-40 = 2 Stack, 230 VAC, 4000 rpm

238-30 = 2 Stack, 230 VAC, 3000 rpm

338-20 = 3 Stack, 230 VAC, 2000 rpm

*R2M/G115 Stator Specifications*

138-30 = 1 Stack, 230 VAC, 3000 rpm

238-20 = 2 Stack, 230 VAC, 2000 rpm

238-15 = 2 Stack, 230 VAC, 1500 rpm

### III = Voltage

230 = 115-230 VAC, Single Phase

### JJJ = Option Board

SIO = Standard I/O Interconnect

IA4 = 4-20 mA Analog I/O

COP = CANOpen w/M12 connector

CON = CANOpen, without M12 connector <sup>1</sup>

EIP = SIO plus Ethernet/IP w/M12 connector

EIN = SIO plus Ethernet/IP without M12 connector <sup>1</sup>

PIO = SIO plus Profinet IO w/M12 connector

PIN = SIO plus Profinet IO without M12 connector <sup>1</sup>

TCP = SIO plus Modbus TCP w/M12 connector

TCN = SIO plus Modbus TCP w/o M12 connector <sup>1</sup>

### NOTES:

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

## MECHANICAL INSTALLATION

### Mounting and Operating Considerations

Every effort should be made to minimize misalignment of the output shaft in all actuators (linear and rotary) and especially misalignment that results in side loading on linear actuators. Any misalignment will decrease the life of the components within the actuator or create problems with external components or adversely affect performance.



**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.**

Stroke length and centering must be carefully considered to avoid hitting physical travel limits in linear actuators, including over travel in fast motion profiles. Homing to end of travel may be done at very slow speed and limited force, but homing manually or to a limit switch, or maintaining continuous Logic Power or using the absolute position feedback option to avoid frequent homing should be considered.



**Do not exceed the physical travel limits of T2M Series Actuators. Doing so will result in an internal end-crash that will physically damage the roller screw and the internal components of the actuator.**

### Lubrication

The T2M and T2X Series linear 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).

Note: If the actuator with which you are working has a preloaded follower (PF option), do not remove the nut or screw. Contact Exlar and arrange to have maintenance and/or re-lubrication performed on the actuator by an authorized Exlar repair facility.

## General Operation

The Tritex Series of actuators and motors function in the same manner as a brushless servomotor. The servo amplifier is used to rotate the motor at controlled speed and torque, and for controlled numbers of revolutions and move times. This rotary motion is translated into linear motion by the internal planetary roller screw mechanism of the T2M / T2X Series linear actuator.

The rotary motion of the motor and the linear motion of the actuator correspond to the following relationships:

$$\text{Linear Distance Traveled (in)} = (\text{Motor Revolutions}) * (\text{Roller Screw Lead})$$

$$\text{Linear Speed (in/sec)} = ((\text{Motor RPM}) / 60) * (\text{Roller Screw Lead})$$

$$\text{Linear Force (lbf)} = ((\text{Motor Torque (in-lbf)}) * (2\pi) * (\text{efficiency})) / (\text{Roller Screw Lead (in)})$$

All of the above relationships require proper anti-rotation of the T2M Series actuator rod.

## Mounting Configurations

The standard configurations available are Rear Clevis, Side Mount, Side Trunion and Front Flange (See Model Mask and ordering guide in the General Specifications section). Mounting dimensional drawings in the following pages:

### T2M Series Linear Actuator Anti-rotation Option

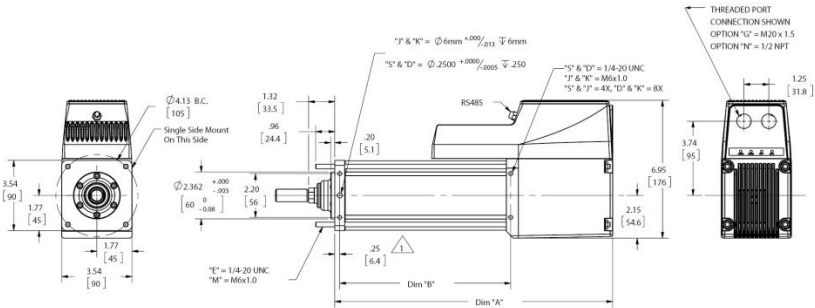
The unique design of the T2M Series linear actuators allows the extending rod to rotate. This simplifies the setup of the actuator by allowing the user to rotate the rod and thread it in and out of the actuator for mechanical attachment or system testing.

This feature also requires that the rod be kept from rotating when used in its dedicated application to insure proper linear motion. In most applications, such as those where the load is coupled to linear bearings or some other support device, the load cannot rotate, providing anti-rotation for the extending rod of the actuator.

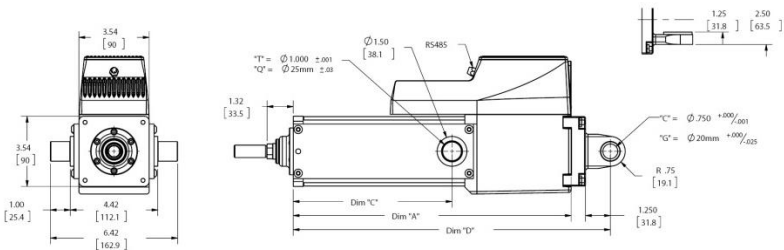
For applications in which the load is free to rotate, Exlar offers the anti-rotation systems shown in drawings following the mounting dimension drawings. The drawings show the rod and bushing on only one side of the actuator. For long stroke actuators, the rod and bushing are require on both sides of the actuator.

# T2M/X090 Actuator Mounting Dimensions

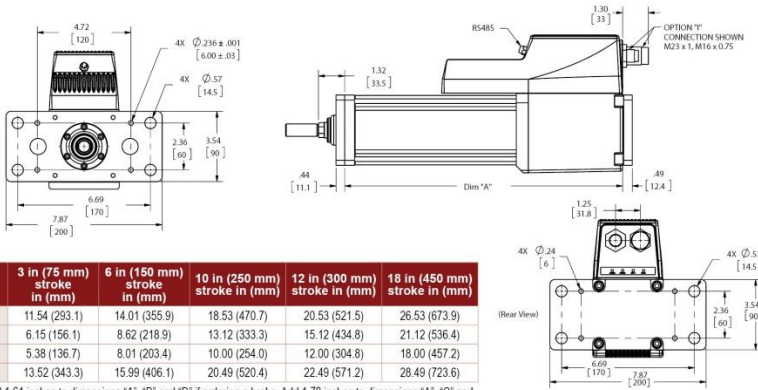
## T2M/X090 Double Side Mount or Extended Tie Rod Mount



## T2M/X090 Side Trunnion Mount or Rear Clevis Mount



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

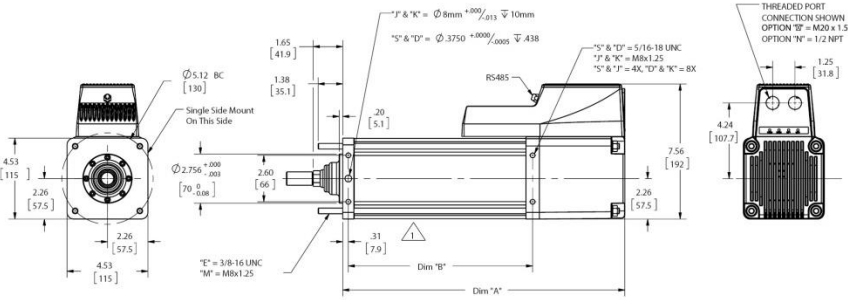


DIM	3 in (75 mm) stroke in (mm)	6 in (150 mm) stroke in (mm)	10 in (250 mm) stroke in (mm)	12 in (300 mm) stroke in (mm)	18 in (450 mm) stroke in (mm)
A	11.54 (293.1)	14.01 (355.9)	18.53 (470.7)	20.53 (521.5)	26.53 (673.9)
B	6.15 (156.1)	8.62 (218.9)	13.12 (333.3)	15.12 (434.8)	21.12 (536.4)
C	5.38 (136.7)	8.01 (203.4)	10.00 (254.0)	12.00 (304.8)	18.00 (457.2)
D	13.52 (343.3)	15.99 (406.1)	20.49 (520.4)	22.49 (571.2)	28.49 (723.6)

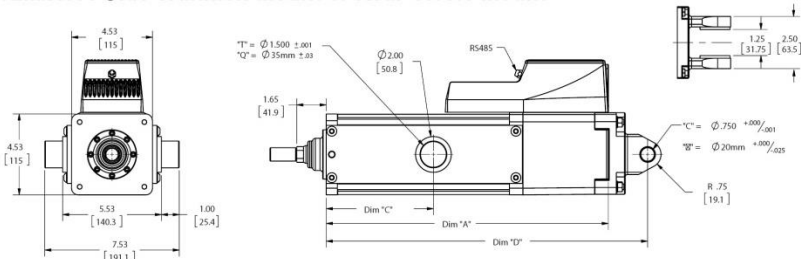
Note: Add 1.61 inches to dimensions "A", "B" and "D" if ordering a brake. Add 1.78 inches to dimensions "A", "C" and "D" and dimension if ordering a splined  $\Delta$  main rod.

# T2M/X115 Actuator Dimensions

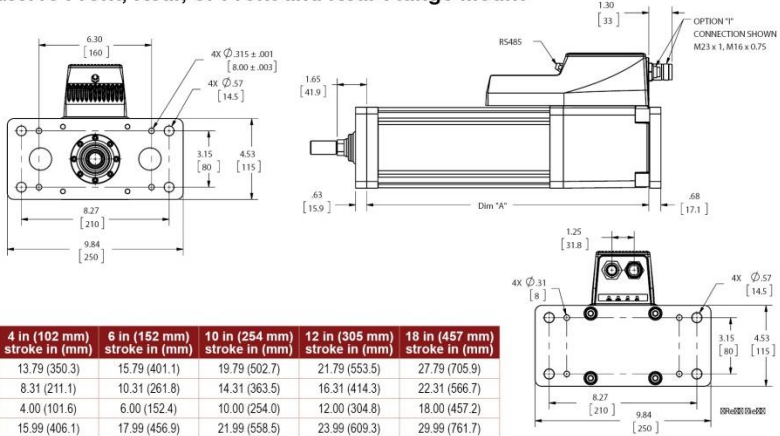
## T2M/X115 Double Side Mount or Extended Tie Rod Mount



## T2M/X115 Side Trunnion Mount or Rear Clevis Mount



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



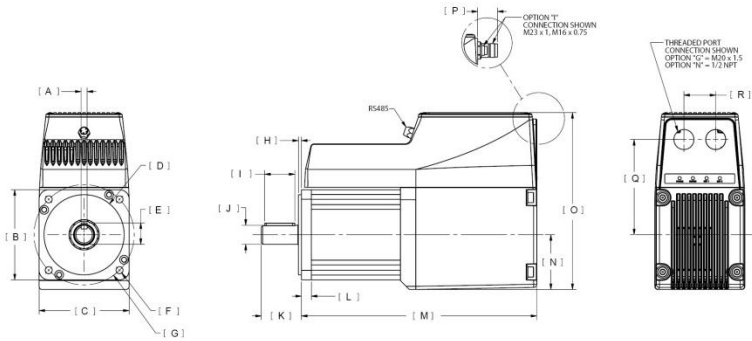
DIM	4 in (102 mm) stroke in (mm)	6 in (152 mm) stroke in (mm)	10 in (254 mm) stroke in (mm)	12 in (305 mm) stroke in (mm)	18 in (457 mm) stroke in (mm)
A	13.79 (350.3)	15.79 (401.1)	19.79 (502.7)	21.79 (553.5)	27.79 (705.9)
B	8.31 (211.1)	10.31 (261.8)	14.31 (363.5)	16.31 (414.3)	22.31 (566.7)
C	4.00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

Note: Add 2.33 inches to dimensions "A", "B" and "D" if ordering a brake. Add 1.77 inches to dimensions "A", "C" and "D" and dimension if ordering a spined  $\Delta$  main rod.



# R2M090 and R2G090 Motor/Gearmotor Dimensions

## R2M/G090 Base Actuator



		R2M090	R2G090			R2M090	R2G090
A	in	.2360 / .2348	.2362 / .2350	J	in	Ø .7480 / .7475	Ø .8665 / .8659
	mm	6 h9	6 h9		mm	19 h6	22 j6
B	in	3.54	3.54	K	in	1.57	1.89
	mm	90	90		mm	40	48
C	in	3.54		L	in	.39	.63
	mm	90			mm	10	16
D	in	Ø 3.1492 / 3.1485	Ø 3.1492 / 3.1485	M	in	See Below	See Below
	mm	80 g6	80 g6		mm	See Below	See Below
E	in	.85	.96	N	in	2.15	2.15
	mm	21.5	24.5		mm	55	55
F	in	4X Ø .28 ON BC	4X Ø .257 ON BC	O	in	6.95	6.95
	mm	7	6.5		mm	177	177
G	in	Ø 3.94 BC	Ø 3.94 BC	P	in	1.30	1.30
	mm	100	100		mm	33	33
H	in	.12	.118	Q	in	3.74	3.74
	mm	3	3		mm	95	95
I	in	1.38	1.417	R	in	1.25	1.25
	mm	35	36		mm	32	32

## R2M090

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

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

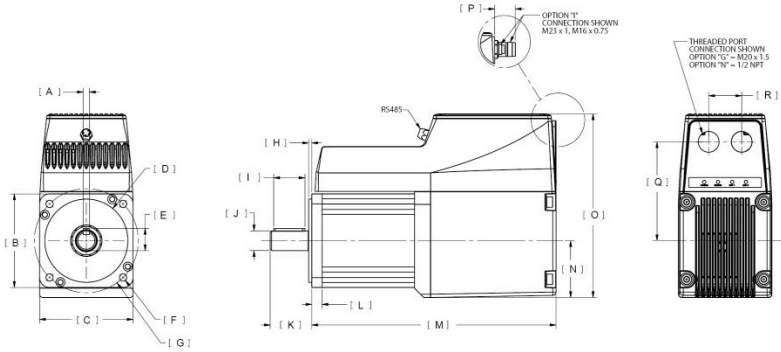
## R2G090

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

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

# R2M115 and R2G115 Motor/Gearmotor Dimensions

## R2M/G115 Base Actuator



		R2M115		R2G115				R2M115		R2G115	
A	in	.3150 / .3135	.3937 / .3923	J	in	Ø .9449 / .9444	Ø 1.2603 / 1.2596	K	in	1.97	2.55
	mm	8 h9	10 h9		mm	24 h6	32 j6		mm	50	65
B	in	4.53	4.530	L	in	.45	.64	M	in	See Below	See Below
	mm	115	115		mm	12	16		mm	See Below	See Below
C	in	4.53	M	in	See Below	See Below	N	in	2.27	2.27	
	mm	115		mm	See Below	See Below		mm	58	58	
D	in	Ø 4.3302 / 4.3294	Ø 4.3302 / 4.3294	O	in	7.56	7.56	P	in	1.30	1.30
	mm	110 g6	110 g6		mm	192	192		mm	33	33
E	in	1.06	1.380	Q	in	4.23	4.23	R	in	1.25	1.25
	mm	27	35		mm	108	108		mm	32	32
F	in	4 X Ø .34 ON BC	4 X Ø .34 ON BC								
	mm	8.5	8.5								
G	in	Ø 5.12 BC	Ø 5.12 BC								
	mm	130	130								
H	in	.16	.16								
	mm	4	4								
I	in	1.41	1.58								
	mm	35.9	40								

### R2M115

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

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

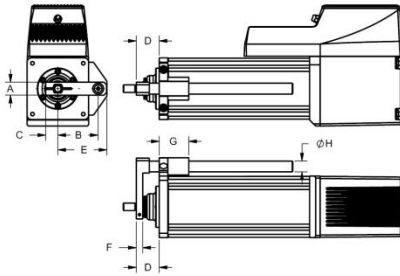
### R2G115

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

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

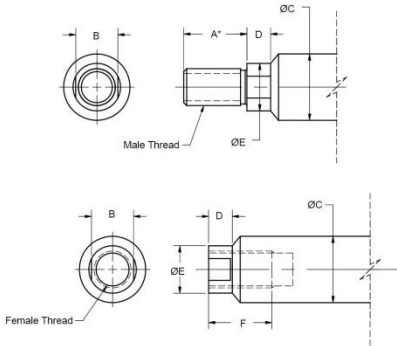
# Options and Rod End Attachment Dimensions

## Anti-Rotate Option



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

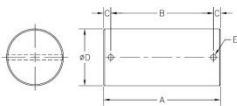
## Actuator Rod End Option



DIM in (mm)	T2M/X075	T2M/X090	T2M/X115
A*	0.750 (19.1)	1.250 (31.8)	1.500 (38.1)
B	0.500 (12.7)	0.625 (17.0)	0.750 (19.1)
ØC	0.625 (15.9)	0.787 (20.0)	1.000 (25.4)
D	0.281 (7.1)	0.281 (7.1)	0.381 (9.7)
ØE	0.562 (14.3)	0.725 (18.4)	0.875 (22.2)
F	0.750 (19.1)	1.000 (25.4)	1.000 (25.4)
Male-Inch "M", "W"	7/16-20 UNF-2A	1/2-20 UNF-2A	3/4-16 UNF-2A
Male-Metric "A", "R"	M12 x 1.75 6g	M16 x 1.5 6g	M16 x 1.5 6g
Female-Inch "F", "V"	7/16-20 UNF-2B	1/2-20 UNF-2B	5/8-18 UNF-2B
Female-Metric "B", "L"	M10 x 1.5 6h	M16 x 1.5 6h	M16 x 1.5 6h

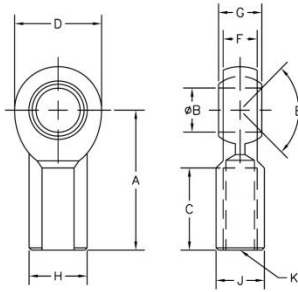
\*When male, metric (Dimension "A") = 1.58 in (40 mm)

## Clevis Pin



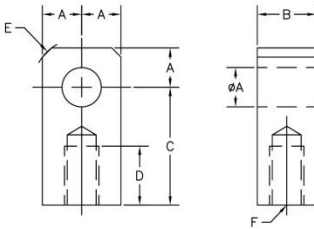
DIM	T2M/X075/T2M/X090	T2M/X075/T2M/X090	T2M/X115
in (mm)	CP050 Rod Eye, Rod Clevis	CP075 Rear Clevis	CP075 Rod Eye, Rod Clevis, Spherical Eye, Rear Clevis
A	2.28 (57.9)	3.09 (78.5)	3.09 (78.5)
B	1.94 (49.28)	2.72 (69.1)	2.72 (69.1)
C	0.17 (4.32)	0.19 (4.82)	1.19 (4.82)
ØD	0.50 -0.001/-0.002 (112.7 mm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

## Spherical Rod Eye



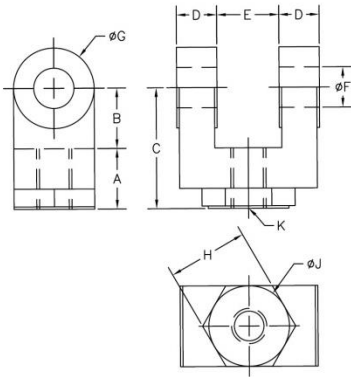
DIM in (mm)	T2M/X075	T2M/X090	T2M/X115
	SRM044	SRM050	SRM075
A	1.81 (46.0)	2.125 (54.0)	2.88 (73.2)
$\phi B$	0.438 (11.13)	0.500 (12.7)	0.75 (19.1)
C	1.06 (26.9)	1.156 (29.4)	1.72 (43.7)
D	1.13 (28.7)	1.312 (33.3)	1.75 (44.5)
E	14 Deg	6 Deg	14 Deg
F	0.44 (11.1)	0.500 (12.7)	0.69 (17.5)
G	0.56 (14.2)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

## Rod Eye



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

## Rod Clevis

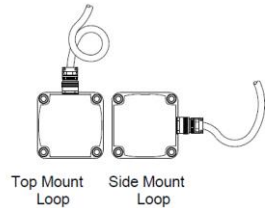


DIM in (mm)	T2M/X075	T2M/X090	T2M/X115
	RC050	RCI050	RC075
A	0.750 (19.05)	0.750 (19.05)	1.125 (28.58)
B	0.750 (19.05)	0.750 (19.05)	1.25 (31.75)
C	1.500 (38.1)	1.500 (38.1)	2.375 (60.3)
D	0.500 (12.7)	0.500 (12.7)	0.625 (15.88)
E	0.765 (19.43)	0.765 (19.43)	1.265 (32.12)
$\phi F$	0.500 (12.7)	0.500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

## Outdoor and Wash Down Installations

Tritex ratings: The T2M 090/ 115 with the P5 option and the T2X 90/115, R2M/G 090/115 have been tested to IP 65. The electronic enclosure as tested by UL as a Type 4 enclosure rating if NPT connection ports are used. 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 65 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. If possible, position conduit fittings or loop cable / flexible conduit so water does not drain towards the conduit fitting. When the wire termination cover is re-installed, verify the O-ring gasket is in place and the surfaces of the O-ring as well as the cover are free from debris so a good seal can be achieved. If the O-ring is missing replace it with PN – 46896
7. 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 O-ring/gasket. Caution, over tightening can strip the threads in the enclosure. If any screws are missing replace them with Exlar PN 64746 (M3x0.5 x 8mm stainless)



## 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 manually 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**

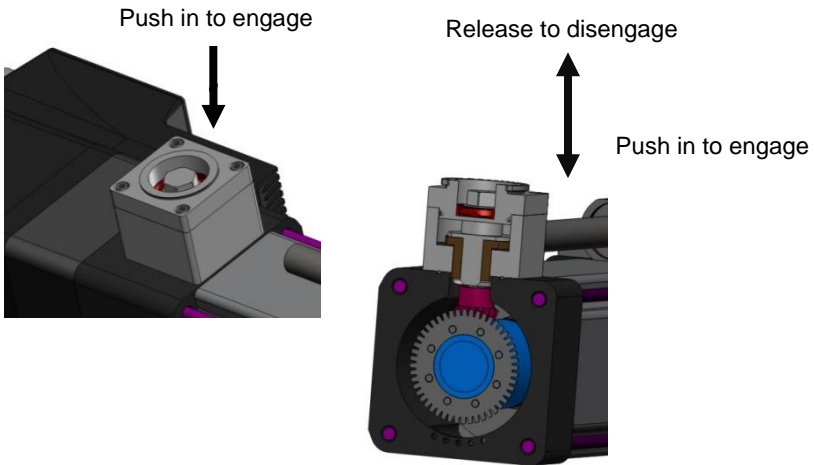
- If manually driving with a brake engaged or high force is necessary, please consult Exlar Application Engineering.
- If a power tool is used to operate the manual side drive the speed should be limited to 600 RPM
- An impact driver should never be used to operate the manual side drive.
- Determine 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)

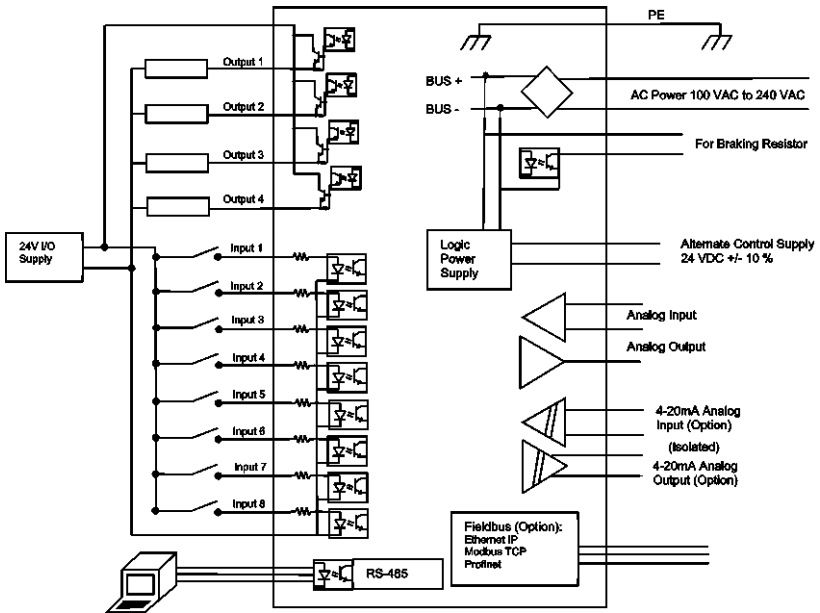


# ELECTRICAL INSTALLATION

## Introduction

All of the required power components, motion processor, and I/O and communications ports are contained in the actuator or motor housing.

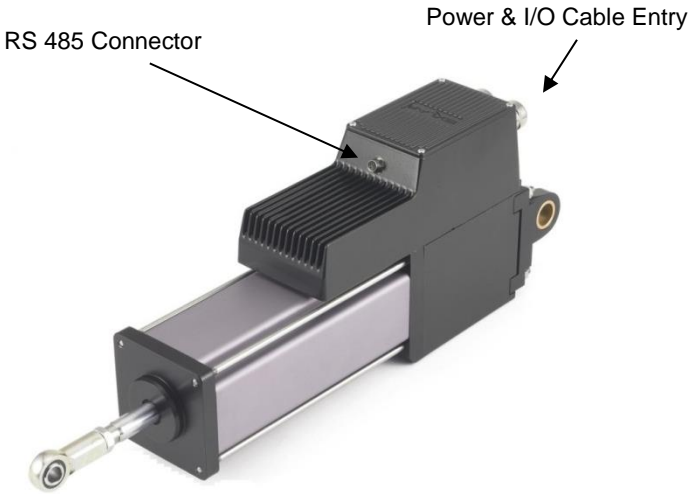
The following diagram shows the electrical connections schematically:





## Tritex Configurations

The models T2M, T2X, R2M & R2G include the drive and motion controller integrated into the rear of the actuator. Various power and I/O connections are available: Cable glands for customer wiring, M23 connectors, embedded cable, embedded cables with M23 connectors, and ½ in NPT ports, as well as custom versions.



*T2M090*

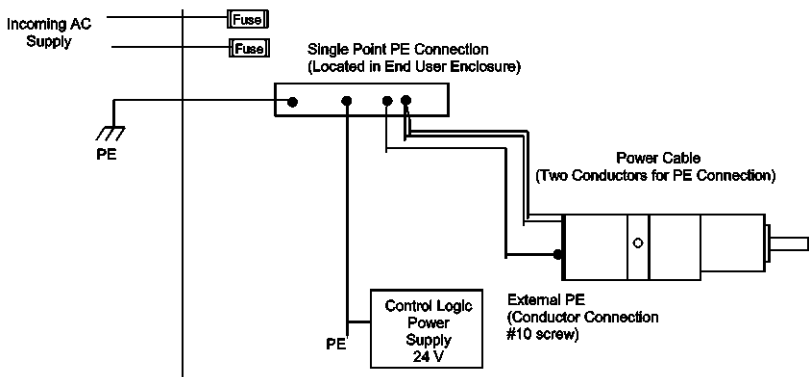
## WARNING



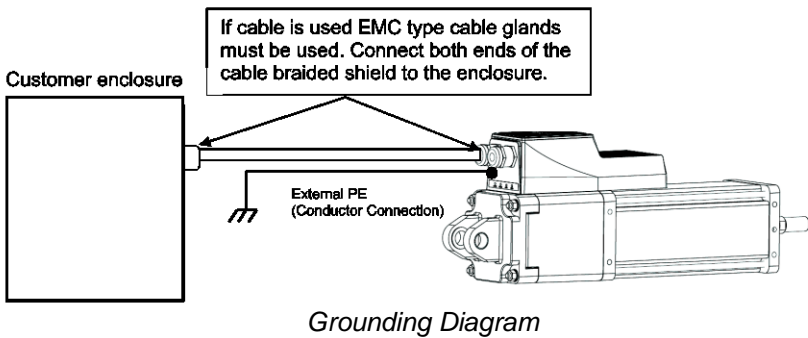
### Grounding

Fixed Protective Earth (PE) connections are required for human safety as well as proper operation. PE connections must not be fused or interrupted. Failure to follow proper PE wiring can cause death or serious injury. This equipment has high earth leakage current and requires a redundant PE connection to comply with EU Low Voltage Directive.

There are three PE terminals on the actuator, two on the main terminal block under the wiring access cover, and a grounding screw on the rear. Always use the PE terminal next to the L1 terminal on the main terminal block. Either remaining terminal may be used for a redundant PE connection where needed. For actuators with connectors, the rear grounding screw can be used as a second PE connection. RF emissions may be best limited by using the rear grounding screw as a second PE connection.

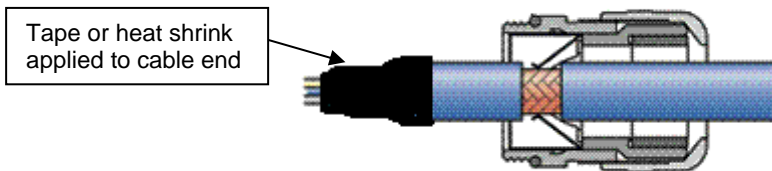


*Grounding Schematic*



## Shielding

In order to meet the European EMC Directive for an installation and to provide immunity from radio frequency (rf) interference and to minimize rf emissions, the power and I/O wiring or cables must be shielded. Metallic conduit (solid or flexible) can serve as a shield. Shields must be connected to the enclosure at the entry / exit point. This is most easily accomplished with EMC type cable glands.



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

## CAUTION



### Avoid Loose Conductive Material

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 or compromising spacing.

## NPT Connections

When the connector option “N” is selected 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 to maintain UL Type 4 enclosure ratings. Due to the enclosure rating requirement,

the only wiring and connection method approved for UL Listed Tritex II products is conduit with NPT fittings. Therefore, only models with NPT fittings carry the UL logo.

**AC Input Power**

Tritex II actuators require 100 Vac to 240 Vac (nominal) single phase 50/60 Hz to operate. An additional 24 Vdc power supply is required for I/O and holding brake, if used. The following sections contain important information on ratings, acceptable power sources and connections, situations requiring isolation transformers, overcurrent protection (fusing), and details of wiring to power terminal blocks or connectors.

See diagrams below for connections to 3 phase and single phase power sources. The AC supply must be earthed with PE connected to the earthed point at the source. In terminology used in the EU, Tritex II must be connected to a Type TN system, and must not be used on a Type TT or IT system without an isolation transformer so that the secondary can be earthed.

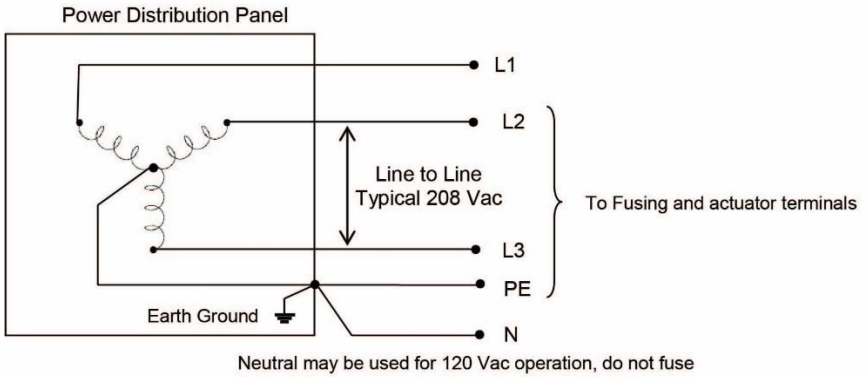
**Input Power Ratings**

The following table shows rated input voltage and current. The maximum voltage applied to the Tritex terminals must not exceed 264 Vac phase to phase or phase to PE ground. Operation on less than rated voltage results in proportionally reduced maximum speed. Refer to Torque/Speed diagrams in catalog for additional information.

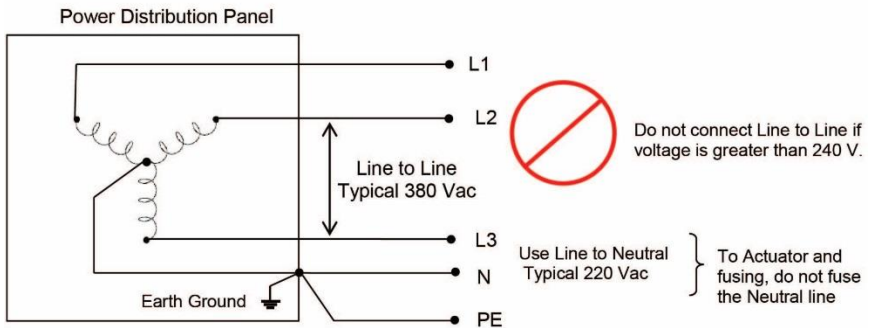
Actuator Size	Input Voltage (Volts ac)	Frequency (Hz)	Input Current at rated output power (Amps rms)	Inrush Current (Amps)
90 mm	240+/-10% 1Φ	47-63	6.3	50 (<5 msec)
115mm			8.3	70 (<5 msec)

**AC Supplies NOT Requiring Transformers**

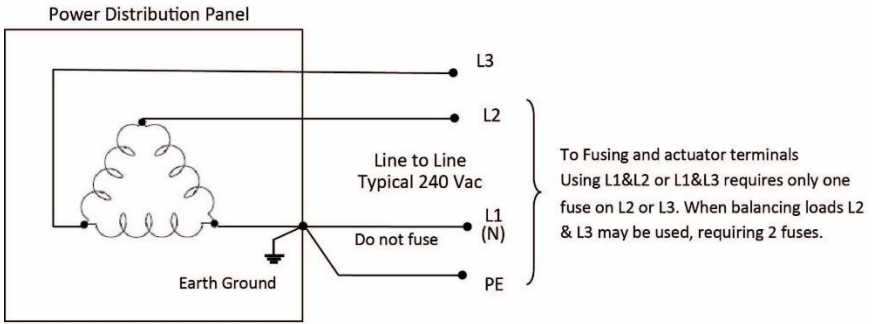
If the distribution transformer is configured as shown in the figures below, the AC power supply can be connected directly to the actuator terminals without an isolation transformer.



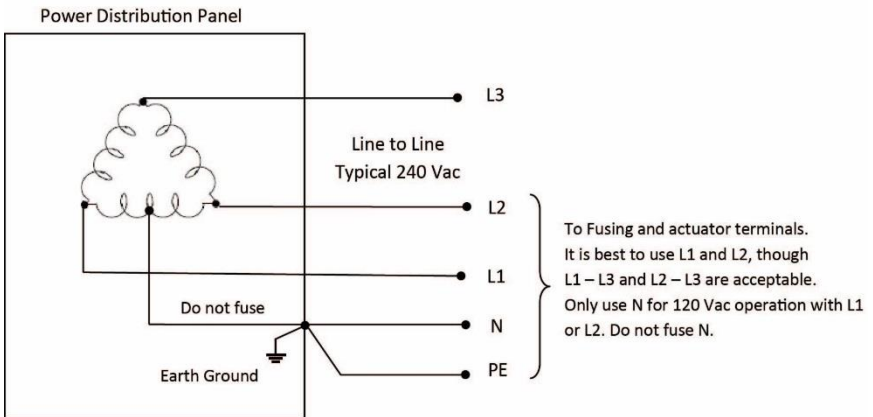
### Grounded WYE Power Connection, 120/208Y 3Φ



### Grounded WYE Power Connection, 220/380Y 3Φ



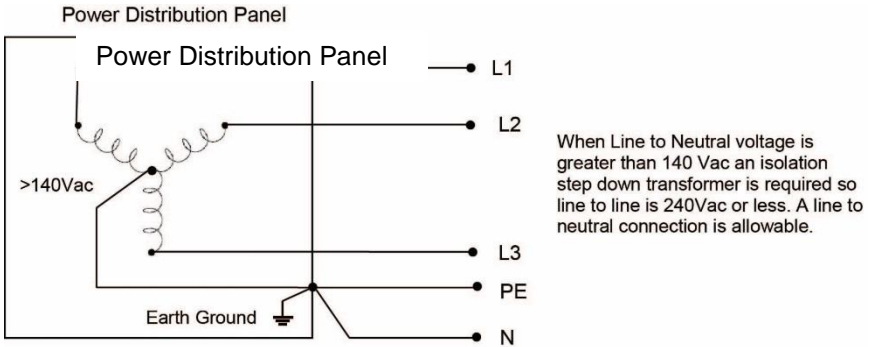
*Three Phase Grounded Delta Power Connection, 240 VAC*



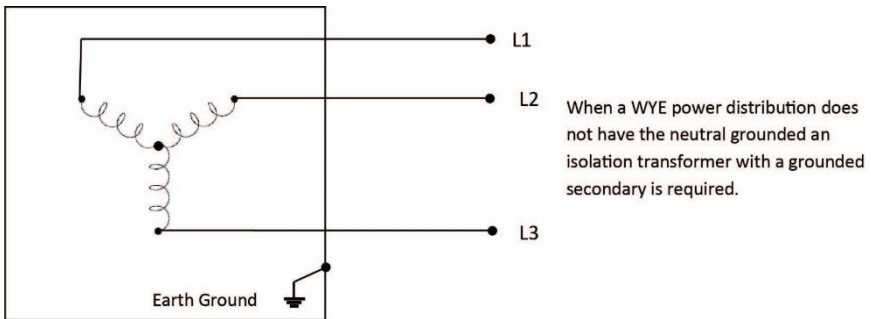
*Three Phase Delta with Mid-phase GND Power Connection, 240 VAC*

## AC Supplies Requiring Transformers

If the power distribution connection is configured as shown in the figures below, an isolation transformer must be installed between the power distribution and the actuator. The isolation transformers secondary must be grounded for safety reasons. Do not use buck-boost type transformers.

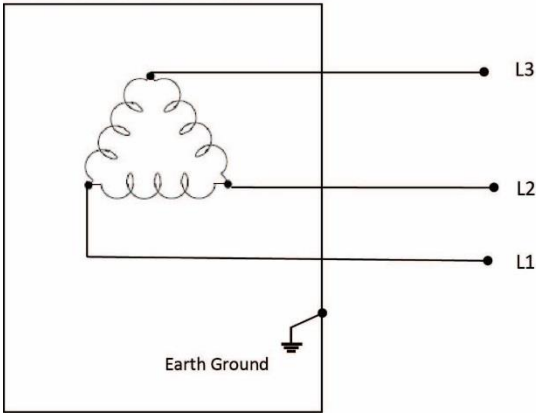


*Grounded WYE Power Distribution with > 140 VAC Line to Neutral*



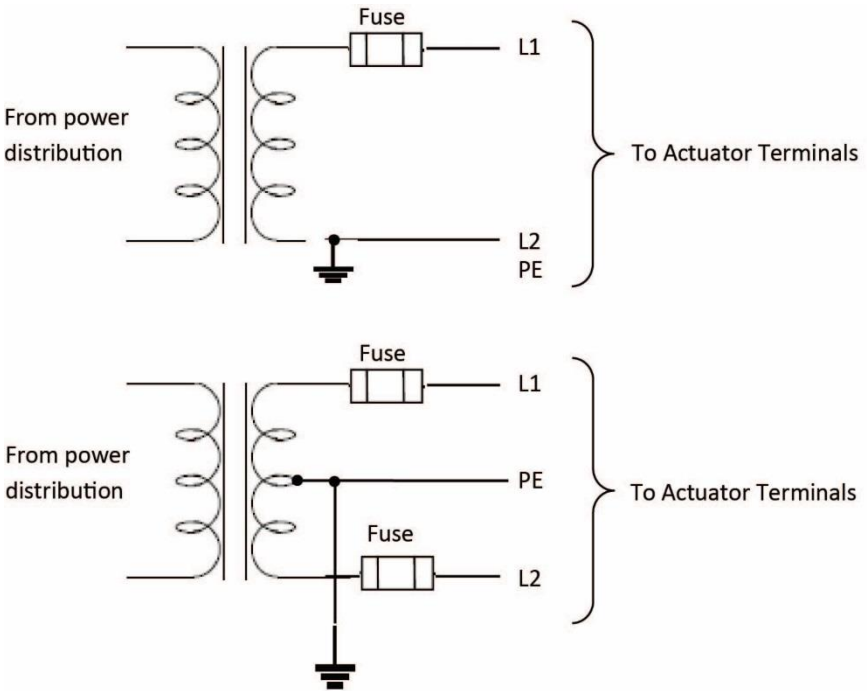
*Ungrounded WYE Power Distribution*

Power Distribution Panel



When a Delta power distribution does not have a grounded reference an isolation transformer with a grounded secondary is required.

*Ungrounded Delta Power Distribution*



*Single Phase Isolation Transformer Connections*



## Wire Size, Branch Circuit Protection and Overcurrent Protection

Drives shall be protected by non-semiconductor fuses or inverse-time circuit breakers only, sized a maximum of 250% of the drives FLA and 250 Volts minimum. The table below lists approved fuses or circuit breaker and the manufacture:

Actuator Size	Required Wire Sizes for L1, L2 and PE	Fuse or Circuit Breaker				
		Fuse Class / Circuit Breaker Input Protection	Littelfuse	Cooper - Bussman	Mersen (Ferraz-Shawmut)	Schneider Electric
90mm and 115mm	14 AWG or ISO 2.5mm <sup>2</sup>	Class CC, Fast Acting (15A, 600Vac)	KLKR 015	KTK-R-15	ATMR15	-
		Class CC Time Delay (15A, 600Vac)	CCMR 015	LP-CC-15	ATDR15	-
		Class RK1 Fast Acting (15A, 250Vac)	-	KTN-R-15	A2K15R	-
		Class RK1 Time Delay (15A, 250Vac)	-	LPN-RK-15SP	A2D15R	-
		Inverse Time Circuit Breaker (15A, 240Vac, 2 Poles)	-	-	-	60146

## Power Terminal Wiring

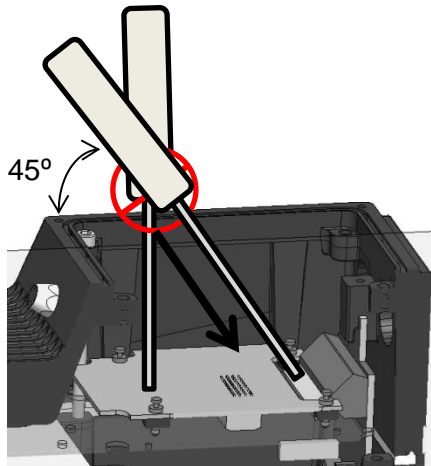
**CAUTION** **Use Correct Wires and Terminations for Power Wiring.** L1, L2, PE, R1 and R2 connections should be 14 AWG / 2.5 mm, 300V, 105°C minimum.



Smaller gauge wires can be used on the C+ and C- terminals for convince see Control Logic Power Supply section below. If ferrules are used with 14 AWG wire a precise crimp is required. The crimped ferrule must measure less than 2.1 mm on each side of the ferrule or it will not fit into the terminal opening.

The terminals are lever actuated spring terminals that retain high and constant contact force on any wire through thermal cycling. To operate, place a small flat bladed screwdriver in the indentation in the lever. Press down on the lever at approximately a 45° angle with only enough force to open the clamp, the clamp will full open with about 8 lbs of force, insert the wire, and release the force on the lever. Check that the wire is in position with insulation partly into the lead-in window, but not into the clamp area.

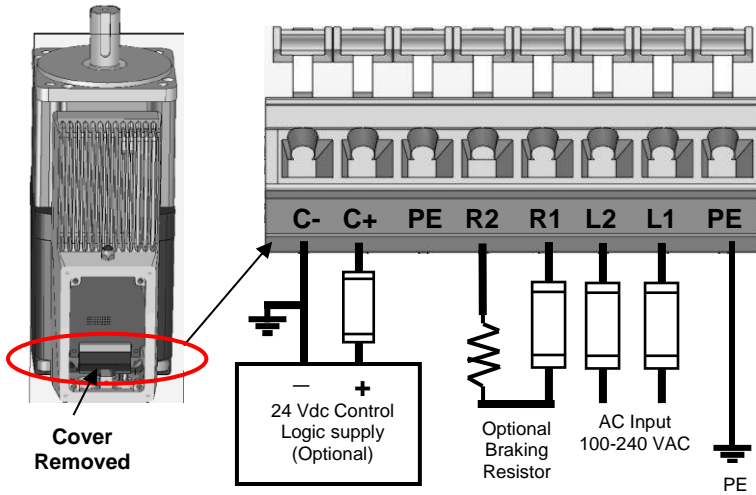
**CAUTION** Do not apply direct vertical force or excess force on the terminal levers. A force of 8 lbs at a 45° angle is sufficient to fully open the wire clamp, applying a force in excess of 12lbs can damage the terminal.



*Opening spring terminals on Power Connector*

## Power Terminal Connections

Refer to the diagram below for connections to the main power terminal block.



*Internal Power Terminal Block Connections*

### WARNING



#### **Check All Connections before Applying Power**

Connecting AC Power to any terminals other than L1 and L2 will severely damage the actuator and such damage is not covered by warranty. Connecting a 24 Vdc source to L1, L2, R1 or R2 in error can result in a shock hazard or damage at connected equipment. R1 and R2 may connect only to a braking resistor.

### WARNING



#### **Dangerous Voltages Present On R1 and R2 terminals and Connector Pins #4 and #5 with I connector option**

R1 and R2 terminals have dangerous voltages present under normal operation and for up to 6 minutes after main power is disconnected. With the I connection option these terminals come wired to Pins #4 and #5 of the M23 Power connector. Conductors attached to these pins must be terminated at the user end of the cable to avoid shorting even when a braking resistor is not used.

## Power Connector Wiring

Refer to the following table for standard pre-wired power connector, part of Option “I”.

### Wiring for “I” option - M23 power connector

Function	Pin	Internal wire color	Cable wire color	Function	Pin	Internal wire color	Cable wire color
L1	1	Black	Brown	R1	4	Red	Orange
L2	2	Black	Blue	R2	5	Blue	White
Drain/ Coupling	3	n/c	Drain	PE	6	Green	Grn/Yel

Note: See Cable section for cable details



Actuator view

## Over Temperature Protection

UL approved motor over temperature sensing is not provided by the drive.

The motor contains a UL recognized temperature sensor embedded in the stator windings which opens when the stator temperature reaches 130°C. This sensor is permanently connected to the Tritex drive and will generate an Actuator Overtemperature fault.

The drive also provides motor over temperature protection by limiting the continuous current to the motor. The continuous current limits are set at the factory and cannot be adjusted. These limits are set to keep the stator below 130°C while in a stall condition at 25°C Deg ambient. Additional over temperature protection is provided by a sensor in the drive electronics which generates a fault when the board reaches 100°C.

The factory default setting for action when reaching overtemperature and continuous overcurrent limits is to immediately disable the drive, providing drive, motor/actuator or customer tooling protection. The user may override this protection to allow the actuator to move to a safe position before disabling or take similar immediate controlled action. (See the Expert Software Manual, Fault Enables section)

## CAUTION



### **Do not continue normal operation after reaching temperature or current limits.**

If the fault action is other than DISABLE, the user must disable the drive as soon as possible if any of these conditions occur. Failure to act on these conditions can cause permanent damage to the drive or motor/actuator. Such damage will not be covered under warranty.

## **Brake / Shunt Resistor Considerations**

Many applications require a brake (or “braking” or “shunt”) resistor to dissipate energy regenerated from decelerating an inertial load, lowering a vertical load, or relaxing a return spring. There is little energy storage in internal capacitors and Tritex II AC does not return energy to the AC line. With gear motors and linear actuators, inertial energy is often not a significant factor. Vertical loads and return springs must always be considered a source of regenerated energy. A high bus fault will occur if an application requires a braking resistor but does not have one installed.

Terminals R1 and R2 on the power terminal block are provided for connection of an external Brake / Shunt resistor only. Each drive must have an independent resistor connected to only one drive. No other connections are allowed at the R1 and R2 terminals. Refer to the warnings in the Power Terminal Wiring and Power Connector Wiring sub-sections in this document pertaining to these connections.

## WARNING

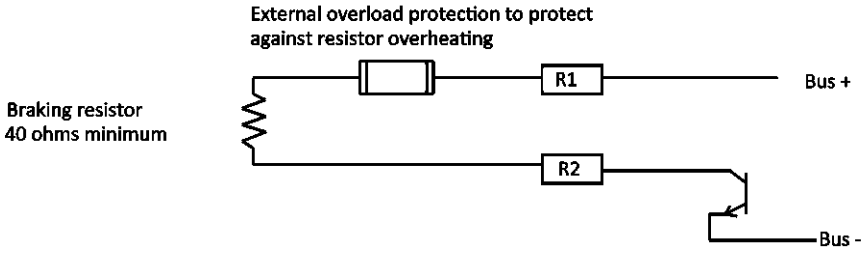


### **Protection Against Overloaded Brake Resistor Required**

It is essential that the external braking resistor be protected against overload caused by a failure of the shunt/brake control. The protection can simply open the circuit, such as a fuse or overtemperature switch, or be wired to a contactor that isolates input power to the actuator on an over temperature condition at the resistor. A thermal switch built into the resistor assembly is best. Fuses are difficult to size properly. A 3 to 5 amp, 250 V dual element time delay fuse is usually sufficient. The purpose of the fuse to protect the resistor from overheating not to protect the Tritex.

The resistor used must be rated for dynamic braking applications for 240 Vac drives, meaning it is capable of peak working voltage of at least 400V and can absorb high energy within a short period. The minimum resistance is 40 Ohms. Recommended range is 40 to 50 Ohms. A higher ohms value has no advantage and may not be able to keep up with peak regenerative power, resulting in a high bus fault.

It is best to consider the energy in a regenerative event and the time between these events when sizing a braking resistor for energy and power. An example may provide the clearest presentation. A 100kg vertical load is lowered 0.2m in a move repeated every 10 seconds. Since 100kg exerts 980 Newtons, the move results in 196 Nt-m (or Joules) of energy. Assuming roughly 90% conversion efficiency, the regenerative event results in 180 Joules are delivered to the braking resistor. Since this happens every 10 seconds, the average power to the resistor is only 18 W. Though most resistors are not directly rated for energy, short term overload ratings can be used, though these ratings usually are for isolated events where the resistor can fully cool before another event. Using half the energy rating with repetitive events is generally appropriate. A resistor rated 100 W with an overload rating of 2 times continuous for 5 seconds which is 1000 Joules would be able to handle repetitive 500 Joule events, so would be adequate for the application.



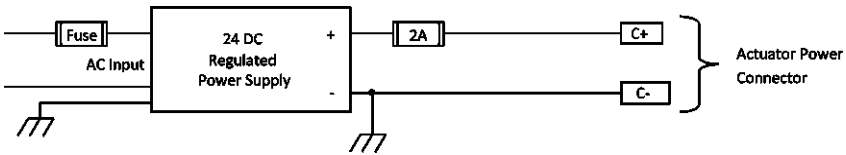
*Braking Resistor Connections*

## Control Logic Power Supply

An optional 24 Vdc power supply may be connected to the Control Logic Power terminals C+ and C- on the power terminal block. It is typically used to allow the Tritex II controller to remain powered while main AC power required for sustained motion is removed. This maintains position information (position feedback is still powered and active) so re-homing is not required, and keeps communications active to networked system components. A fuse is necessary unless power supply self-limits at 3A or less.

### Control Logic Power Supply Wiring and Fusing

Volts	Amps	Fuse	Wire
24V dc +/- 10%.	1	2 Amp, if power supply is not limited at 3A or less	18 AWG (0.8 mm <sup>2</sup> ) 300V, 105°C



Control Logic Power Supply Connections

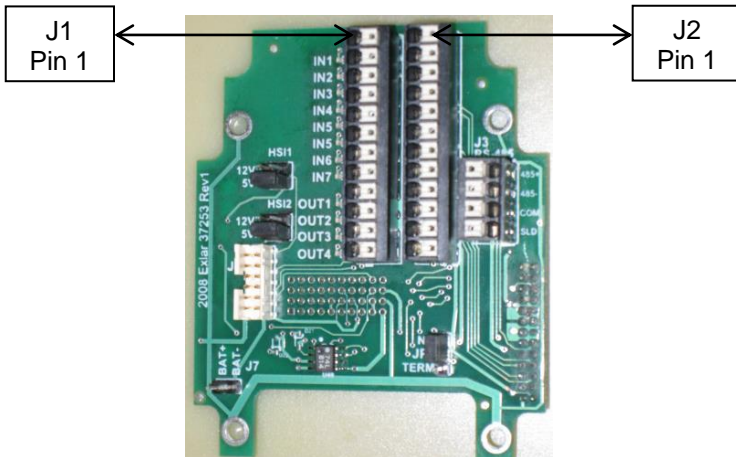
## Input / Output Connections

Tritex II units covered in this manual have different analog I/O and communications network options. All include 24V nominal digital inputs and digital outputs and RS-485 communications. Connections are through one of several versions of I/O Terminal Board accessible under the wiring compartment cover. This section describes digital and analog I/O connections, as well as connections for an optional holding brake.

### Terminal Board Connections for Digital and Standard Analog I/O

These connections are the same on all I/O and Comm options.

J1 Terminal #	Function	J2 Terminal #	Function
1	INPUT 1	1	Field I/O+ (+24V)
2	INPUT 2	2	Field I/O comm
3	INPUT 3	3	Analog In +
4	INPUT 4	4	Analog In -
5	INPUT 5	5	PE (Shield)
6	INPUT 6	6	Analog Out +
7	INPUT 7	7	Analog Out -
8	INPUT 8	8	PE (Shield)
9	Output 1	9	Field I/O+ (+24V)
10	Output 2	10	Field I/O comm
11	Output 3	11	Field I/O+ (+24V)
12	Output 4	12	Brake + 24 V



Wire Size: 24-16ga / 0.2–1.5mm<sup>2</sup>

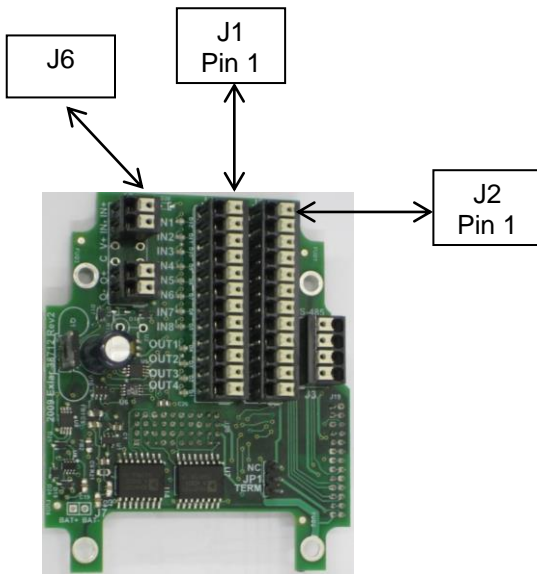


## Terminal Board Connections for IA4 Option (4-20 mA Isolated Analog I/O)

J6 is in two parts as shown and is present only with the IA4 option for 4-20mA.

The IA4 option is not available with advanced communications options: ProfiNet, Ethernet IP, Ethernet TCP or CANOpen

J6 Terminal Label	Function
IN+	+ 4-20 mA Input
IN-	- 4-20 mA Input
O+	+ 4-20 mA Output
O-	- 4-20 mA Output



Wire size: 24-16ga / 0.2–1.5mm<sup>2</sup>

## I/O Wiring for “I” option (M16 I/O connector)

In addition to the prewired power connector covered in the power wiring section, Option I provides a prewired 19 pin M16 connector at the rear of the actuator for quick field connection of I/O signals.

If the unit has the holding brake option installed, a jumper wire is installed on the Terminal Board from J2 pin 11 to J2 pin 12 to power the brake from the I/O power supply.

Units except those with Option IA4 for isolated 4-20mA signals have standard analog signals assigned to pins K, L, N and O as shown in the table. On units with Option IA4, the 4-20mA signals are wired to pins K, L, N and O as shown in the table and the standard analog signals are not wired out though they exist at the Terminal Board.

The following table shows the function, insulation color for internal wiring between the Terminal Board and connector in the wiring compartment, the connector pin assignment in both halves of the connector and the T2IOC cable insulation colors.

Function	Internal Wire Color	Pin #	Cable Wire Color
INPUT1	Blue	A	White/Yellow
INPUT2	Gray/Pink	B	White/Red
INPUT3	Red/Blue	C	White/Green
INPUT4	White/Green	D	White/Black
INPUT5	Black	E	Red/Black
INPUT6	Pink	G	Red/Green
INPUT7	White/Yellow	H	Red/Yellow
INPUT8	Green	I	Beige
Field I/O Power (+24 V) (also Brake Power)	Brown/Green	F	Red
Field I/O Common	Tan	U	Black
ANALOG IN+ / + 4-20mA Input	Yellow/Brown	K	Green
ANALOG IN- / - 4-20mA Input	Brown	L	White
ANALOG OUT+ / + 4-20mA Output	Grey/Brown	N	Blue
ANALOG OUT reference / - 4-20mA Output	Violet	O	Orange
ANALOG Out Shield	Orange	M	Drain
OUTPUT 4	White	P	White/Brown
OUTPUT 3	Red	R	White/Orange
OUTPUT 2	Grey	S	White/Blue
OUTPUT 1	Yellow	T	Light Red

Note: See cable section for T2IOC cable details



*Actuator View*



*Cable View*

## **I/O Power Supply**

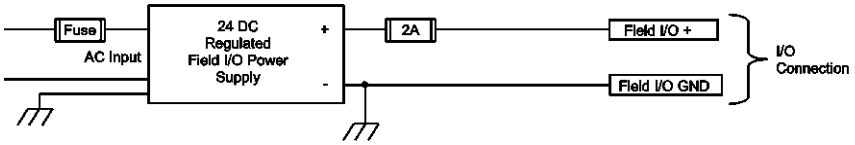
In order to use Digital Outputs, an external 24Vdc nominal power supply connected with positive side to one of the Field I/O + terminals and negative side to one of the Field I/O Common terminals on the Terminal Board. Typically terminals J2-1 and J2-2 are used for this purpose. For connector option I, refer to the preceding table for pin usage. The negative side of this power supply should be tied to PE near the power supply. As with the Control Logic Supply, a fuse is necessary unless power supply self-limits at 3A or less. The fuse should be rated 2A or less, depending on load and placed in the positive side.

Digital Inputs are typically powered from the same supply externally through the contact or sourcing output providing the signal, but the only requirement is that the supplies for Digital Outputs and all Digital Inputs have the negative sides connected.

The same supply may be used for control logic power by installing jumper wires from J2-9 to power terminal C+ and from J2-10 to power terminal C-. The same power supply can also provide power for the optional holding brake; option RB, by installing a jumper wire from J2-11 to J2-12. This jumper is factory installed with connector option I if a holding brake is also present. A 2A fuse is necessary if the supply is used for Control Logic or a brake.

For UL applications, the I/O power supply must be a UL recognized or listed Class 2 power supply and shall be marked "Class 2" next to the voltage rating of the device.

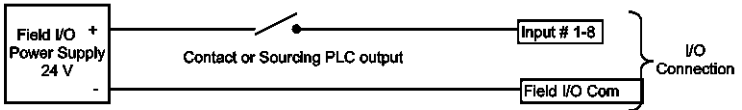
For applications to meet the CE Low Voltage Directive an approved 24V supply must be used and the negative side must be grounded to PE.



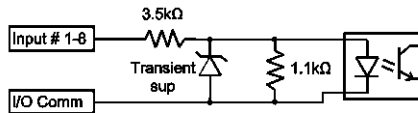
*I/O supply connection*

## Digital Inputs

The Tritex II 90 mm and 115 mm have 8 digital inputs. They have a common negative side but are optically isolated from other circuits within the Tritex to allow the I/O Supply to be grounded. Digital Inputs are sourcing only; they require a positive voltage to turn on. Each input can be assigned to any of the internal input functions. (See Software Manual)



*Input wiring (external)*



*Input circuit (internal)*

## Digital Input Specifications

Description	Specification
Input Voltage Range	0 to 30 VDC
On state voltage range	10-30 VDC
Off state voltage range	0-5 VDC
On state current	
10 V (min)	2.6 mA
24 v (nominal)	6.6 mA
30 V (maximum)	8.3 mA
Nominal Impedance (24V)	3.6kΩ
Off state current (max)	1.0 mA
Update rate	2 msec (typical)

## Digital Outputs

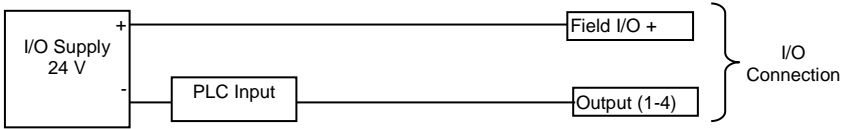
The Tritex II 90 mm and 115 mm have 4 optically isolated digital outputs. These outputs are sourcing only, they provide a positive voltage when on. Each output can be assigned to any of the internal output functions. (See Software Manual) Outputs are individually short circuit protect at 500mA and thermally protected against overload. These outputs can absorb the energy in an inductive “kick” at turn-off up to 0.5 Joule, so an external freewheeling diode would be needed only in rare cases.

### CAUTION

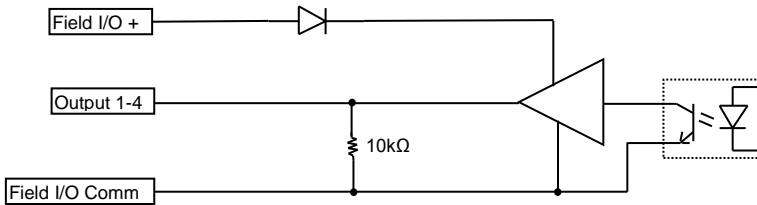


#### Do not overload outputs.

Outputs are rated at 100 mA continuous. An overloaded output will cycle off and on to protect itself, which will send an incorrect signal to other system components.



*External wiring of outputs for connection to PLC*



*Output Circuit (internal)*

## Digital Output Specifications

Description	Specification
Operating voltage range	0 to 30 VDC
On state maximum continuous current	100 mA (0.100 Amps)
On state voltage drop (@ 100 mA)	1 V typical
Short circuit protection	0.5 Amps
Overload protection	Internal thermal limit
Inductive Energy Handling	0.5 Joule
Update rate	2 msec

### Actuator Brake Option

The actuators may be ordered with a holding brake option. This brake is a “Parking Brake” and will wear out rapidly if used as a “Stopping Brake”, It should only be allowed to apply during motion when other control is not possible, such as a drive fault condition. The brake engages when power is removed from the brake. The Tritex II has internal brake control logic so the recommended installation is to simply connect a constant 24 Vdc +/- 10% power source for the brake circuit. Typically a single supply is used for brake power and I/O power. Note that the voltage tolerance for the brake is tighter than for I/O power. If a separate supply is used, it must have overcurrent protection with the same ratings as with the I/O supply.

### CAUTION



**Do not apply or drag the brake when motor / actuator is moving.**

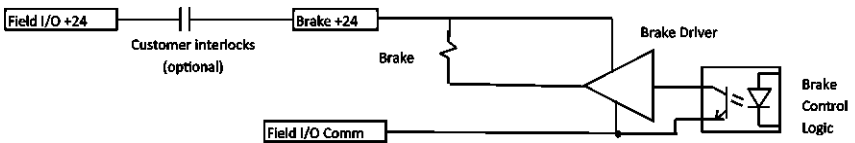
System design must avoid routine application of the brake when in motion. Only limited motion under infrequent conditions is acceptable. Brake control voltage lower or higher than 24V +/- 10% may cause the brake to drag which causes wear and heat.

It is not possible to apply power directly to the brake to disengage it. If the brake is to be released when main power is removed, control logic power must be applied and the brake override function must be used. Brake, I/O and Control Logic power may all use a single power supply. If the actuator has a Manual Drive option, it is acceptable and may be necessary to move the actuator manually without releasing the brake.

If customer supplied interlocks remove power to the Brake +24V terminal, the brake will engage even while the drive is enabled and commanding motion. The interlocks should also disable (not just stop) the drive to prevent the drive from pushing against the brake.

The negative side of the brake is connected to Field I/O common. The Brake +24V can be connected directly to Field I/O +24V. A jumper is pre-wired on units with connectors for this purpose. Power may be applied to the Brake +24V terminal from a separate supply or through customer interlocks.

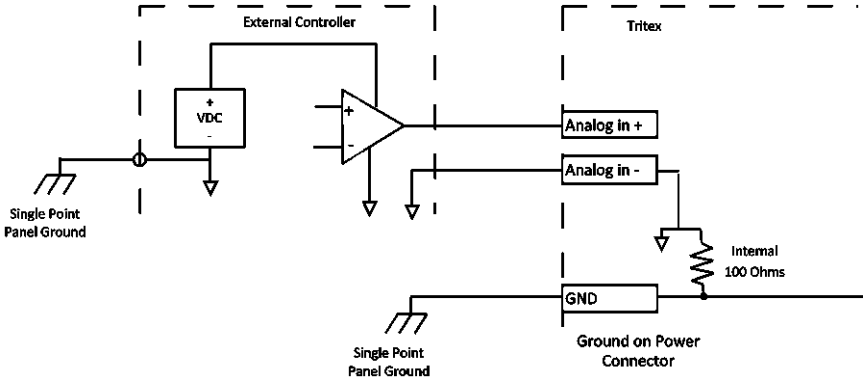
Internal brake control logic operates as follows: Starting from the disabled state with brake engaged, when the drive enables the brake releases after a release delay to allow time for the motor current to become active and hold the load. Starting from the enabled state with the brake released, when the drive is disabled the drive will immediately apply full current toward zero velocity, bringing the motor to an abrupt stop and engage the brake, then after an engage delay the drive will be disabled. See the I-O Assignment section of the Software Manual for more information on brake related status and command signals.



*Brake Connections*

## Analog Input

An analog input is provided for use as a position, velocity or current command. The input can be configured to operate using a 0-10 Vdc signal, or using a +/- 10 Vdc signal. (See Software Manual for configuration and scaling of the analog input)



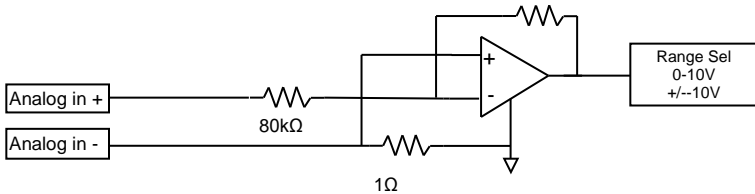
*Analog Input Wiring from Voltage or Current Control External Controller*

**CAUTION**



**Analog In – must be connected to a ground reference point or isolated source.**

Analog in – is low impedance to internal ground reference and PE in the Tritex and must be connected to a ground (PE) referenced point or an isolated source to prevent damage to the analog input circuit or connected equipment.



*Internal Analog Input Circuit*

**Analog Input Specifications**

Description	Specification
Voltage Input Range	0V- 10V or +/- 10.0V (selected in software)
Input resolution	12 bits over selected range
Update interval	0.5 msec



## Analog Output

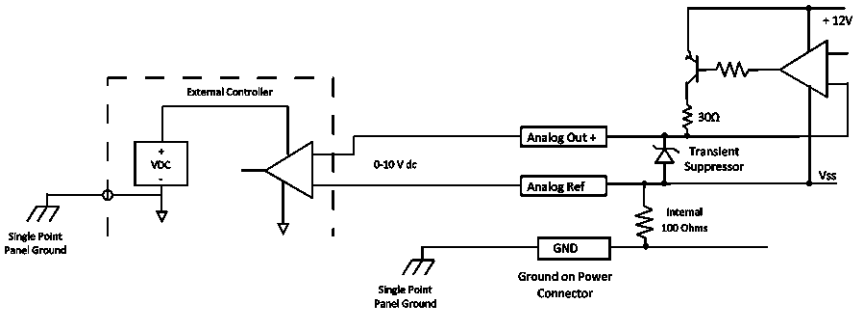
A 0-10 Vdc analog output is provided. The function of this output is programmable. It can be used for position, velocity or current monitoring. The intent of this output is to provide a “monitor” type value not a “control” value, meaning the performance is not intended for the user to close a high speed position loop around this signal.

### CAUTION



#### The Analog Output is a non-isolated circuit.

Analog out – is low impedance to internal ground reference and PE in the Tritex and must be connected to a ground (PE) referenced input or a differential or isolated input circuit at the external controller to prevent damage to Tritex circuits or connected equipment.



*Analog Output Connection*

### Analog Voltage Output Specifications

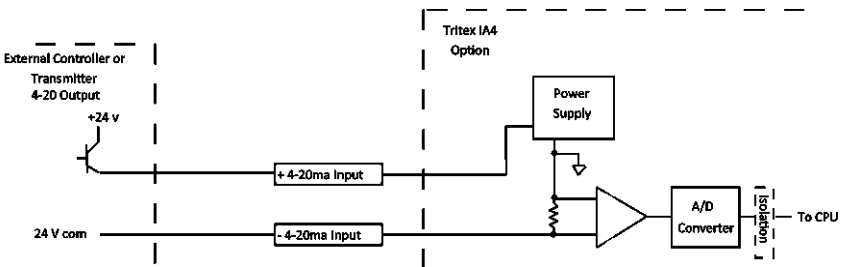
Description	Specification
Voltage Output Range	0 – 10 V dc
Load Range	20 mA max (short circuit protected)
Output resolution	12 bits
Update rate	1.0 msec

## 4-20 mA I/O - IA4 Option Board

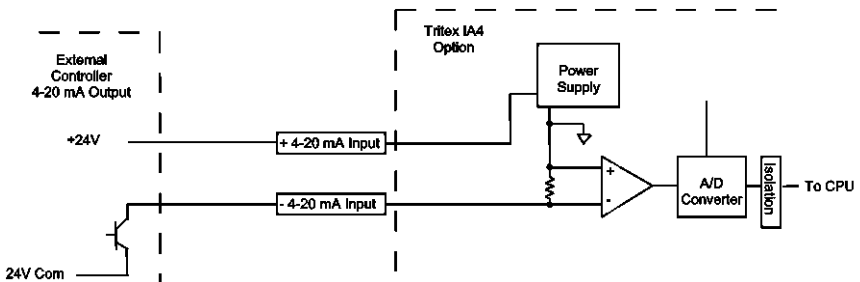
The IA4 option board provides one 4-20 mA isolated analog input and one 4-20 mA isolated analog output, these I/O circuits “loop powered” and are isolated from each other as well as all other actuator circuits. This input and output are in addition to the standard Tritex I/O provided on the SIO option board (see above). The IA4 Option is not available in combination with advanced communications options or ABZ Option.

### 4-20 mA Input

The 4-20 mA input is a 2 wire “loop powered” circuit. Power must be supplied by the output signal source. A small amount of power from the 4-20 mA signal is used to provide power for the A/D and isolator circuits. This allows the input to float with the transmitter or loop power supply without inference from the other Tritex II grounds or commons. Minimum current is 3 mA to produce a valid input. Lutoff is 7V at 21 mA. The diagrams below show that connection is the same whether the current loop is controlled on the high side or low side.



*Connection to High Side Controller*



*Connection to Low Side Controller*

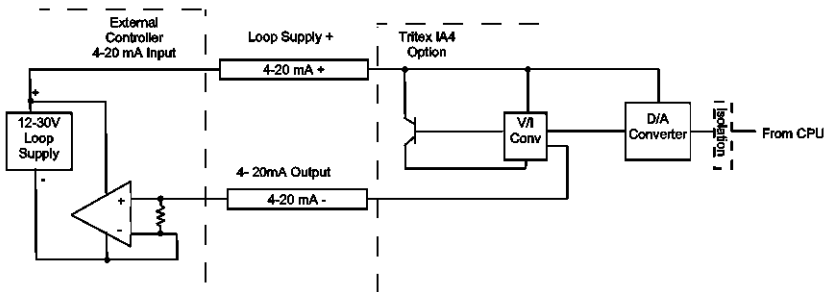
## 4-20 mA Input Specifications

Description	Specification
Input Range	3 mA to 21 mA (Loss of Signal condition <3.0 ma)
Input Impedance	325 Ohms at 20 mA
Loop Lift-Off	7V max @ 21mA
Input Resolution	15 bits over 4-20 mA range
Update Rate	0.5 msec

## 4-20 mA Output

The 4-20 mA output is a 2 wire “loop powered” circuit. It requires an external loop supply of 12 to 30 Volts DC to power the isolated circuits. The Tritex circuit requires 8 Volts to operate; therefore the maximum loop impedance the output can drive is dependent on the loop supply voltage.

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



*4-20 mA Output Connection*

### 4-20 mA Output Specifications:

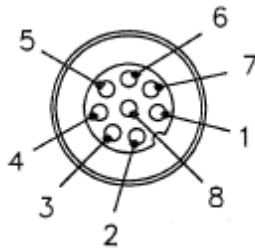
Description	Specification
Output Current Range	0-20.5 mA
Load Range	200 to 1100 Ohms (see table above)
Output resolution	12 bits
Update rate	1.0 msec

### ABZ Option, Encoder Output

The ABZ, encoder output option is only available when encoder feedback option is also selected. With these options the encoder signals used by the Tritex for motor position feedback, the A, B and Index channels, are also provided for external connection via an 8 pin M12 connector. These outputs are not isolated, pin 8 is connected to 0 volts or logic common of the Tritex logic supply which is referenced to PE. There must not potential difference between this signal and the 0v signal of the encoder receiver it is driving.

The ABZ Option is not available in combination with 4-20mA (IA4) or CAN Open or Absolute Feedback (AF).

Pin	Signal
1	A +
2	A-
3	PE
4	B+
5	B-
6	I+
7	I-
8	Vss (0 V)



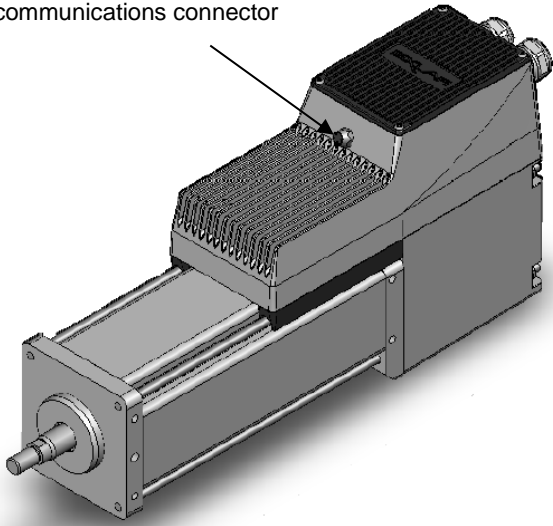
## Communications

All models of Tritex II include an RS485 Modbus RTU connection. Optional connections with several fieldbus standards are available as advanced communications options. These include Ethernet IP (EIP option), Ethernet TCP/IP (TCP option) Profinet (PIO option) and CAN Open. Only one advanced communications option is available in a single Tritex II and they are not available in combination with 4-20 mA (IA4).

### Standard Modbus RTU Communications

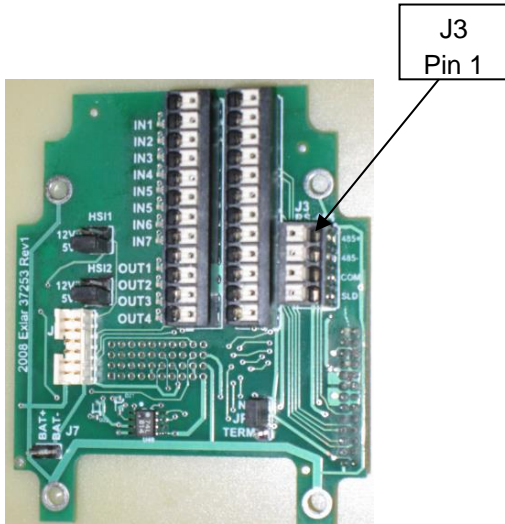
Serial communication to the actuator is provided through the 8mm Communication connector on the front of the actuator or via terminal connection on J3 under the cover. The serial interface is two wire option isolated RS-485 network. The actuator supports the Modbus RTU protocol for access to all drive parameters (see Modbus Parameter Reference). The Default baud rate is 19.2k. The default Modbus address is 1.

8mm communications connector

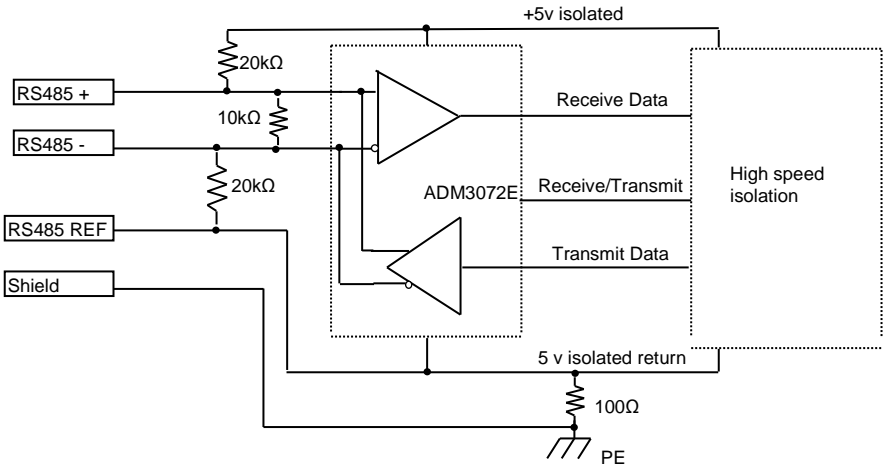


8mm communications connector  
Front view

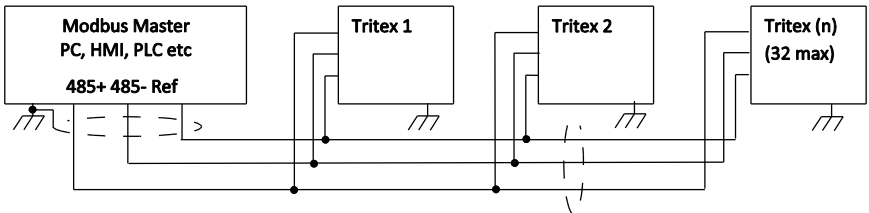




Function	8mm Pin number	Wire color for TTCOM	J3 Terminal #
485+	1	Brown	1
485-	3	Blue	2
485 COM	4	Black	3
Shield	2	Drain	4



*Internal RS 485 circuit*



*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.

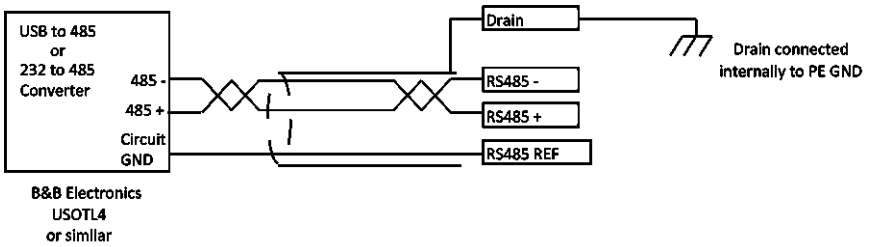
## PC Communications

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 RS-485. This can be either a USB to 485 converter, such as the B&B Electronics® USOTL4 or an RS 232 to RS485 converter, such as the 485OT9L. See Accessories section.

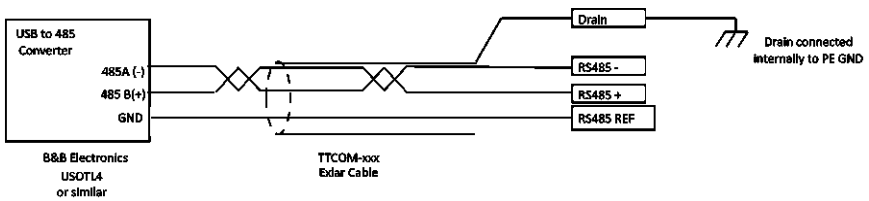
### CAUTION



It is important that the RS485 REF is connected to the circuit common of the converters 485 output. Failure to connect could cause damage to the drive, the converter or the PC port.



*Typical RS 485 Connection to External Converter*



*Connection to B&B USOTL4 Using TTCOM Cable*



## CANopen

The CANopen circuit is optically isolated from the drive main power as well as other IO power.

There are two methods of connecting to the Tritex with the CANopen option. If the COP option from model mask is chosen a single five pin 12 mm connector (Turck FS 57-.1) will be presented to the user for connection or “T-ing”.

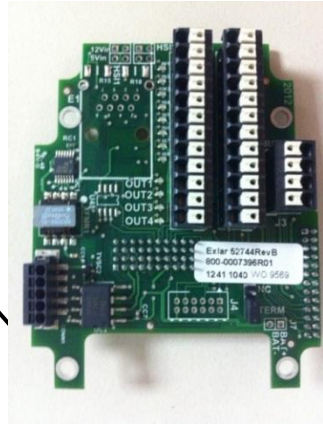
If the CON is chosen no connectors are provided, user wiring can be passed through the cable gland or NPT port and inserted into connectors on the termination board, see below. A 120 Ω resistor is installed from the factory, in CONN 1 pins 5 & 6, as a termination resistor and can be removed for daisy chaining or changed to another value if desired.

\*NOTE: Follow wiring of SIO board for IO and RS485 communications.

Function	CONN 1 Terminal #
CAN H	1
CAN L	2
PE	3
CAN H	4
CAN L	5

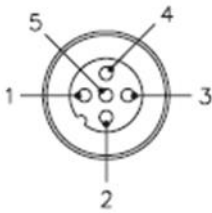
120Ω

CONN 1  
PIN 1



*CON Option*

## Male



Signal	M12 Pin	Color	CONN 1 Pin
CAN H	4	White	1
CAN L	5	Blue	2
Shield	1	Gray	3

### COP Option

### Ethernet Options, EIP or TCP or ProfiNET

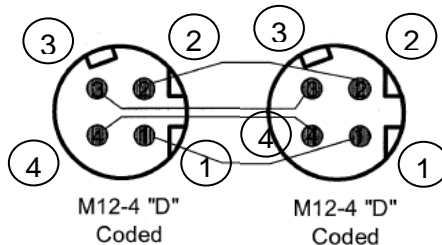
The Ethernet Option provides an Ethernet rated M12 connector for connection to the Network at the rear of the actuator.

An IP 67 4-pole M12 D coded connector is used, this type of connector must only be used with 2 pair cables. When the Ethernet connection is via an Ethernet switch or hub, a straight through cable set must be used. If there is single node connection direct from the Ethernet PC/PLC to the Tritex then a crossover cable must be used. See Expert Software section for setup of Tritex Ethernet parameters.

### Cord sets

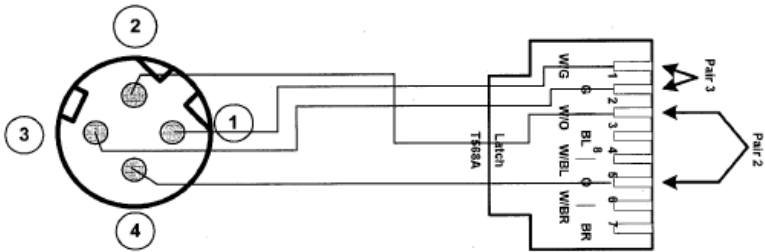
Pin	Signal Name	
1	Transmit + (TX+)	Pair
3	Transmit - (TX-)	
2	Receive + (RX+)	Pair
4	Receive - (RX-)	

①



*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. However shielded cable may be required to meet EMC emissions requirements on some systems.

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

### AF Option - Absolute Feedback

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

#### Battery life information:

The battery can provide power to counter for about 1.5 years of power off time, so for an application that has power applied 50% of the time the expected battery life would be approximately 3 years, more than 50% power on time = longer life, less power on time = shorter life. With power off, movement of the motor causes extra battery power consumption and will shorten battery life, for applications that produce frequent or

continuous motor movement with power off, use of the 24 V control logic back should be considered, see the Control Logic Power Supply section above. Constant high or low temperatures can also shorten battery life.

*Low battery voltage:*

When the battery voltage gets below 2 Volts a battery fault will be generated. This fault is typically set to a warning status on the Fault Enable tab of the System Set page. The warning status can then be assigned to one of the outputs or to one of the actuator led indicators. 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 off on the subsequent power up, requiring the actuator to be re-homed.

**WARNING**



***Replacing the battery:***

The battery is located under the removable cover on the top of the actuator. For replacement unplug the 2 pin connector and unsnap the plastic band holding the battery in place and install a new assembly. Order Exlar PN 42712. The AC input terminals are located in close proximity, for safety remove AC power before replacing battery.

**Important:** If the battery is removed with both AC and Logic power also removed, leave all power **off** and do **not** reconnect the battery 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 reestablished.

*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 reestablished.

*Speed limitations:*

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

## MAINTENANCE PROCEDURES FOR RE-GREASING

### Maintenance Procedure for Roller Screw Re-Greasing



**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

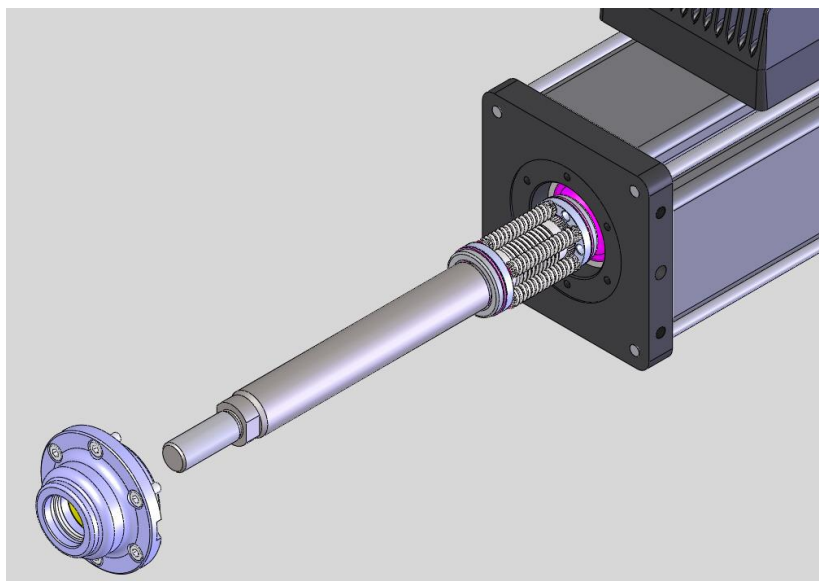
Refer to the exploded view on the following page.

- 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.



**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

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 T2M 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 & 80:** 10 in-lbs (0.83 lbf-ft, 1.13 N-m)  
**Tritex 90 & 115:** 27 in-lbs (2.25 lbf-ft, 3.05 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.

## Maintenance Procedures for Complete Re-Greasing

### Disassembly

Refer to the exploded view on the following page.

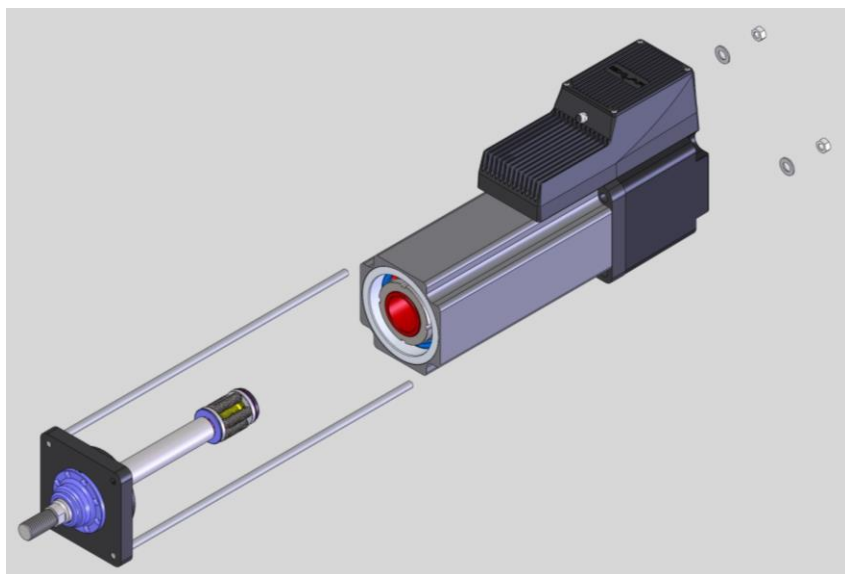
- 1.) Remove the actuator assembly from the machine by disconnecting the cables, main rod coupling and actuator mounting bolts or fasteners.
- 2.) If your unit does not have an external anti rotate assembly, skip this step. Loosen the two machine screws that clamp the anti-rotate cross member to the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



**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.**

- 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

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

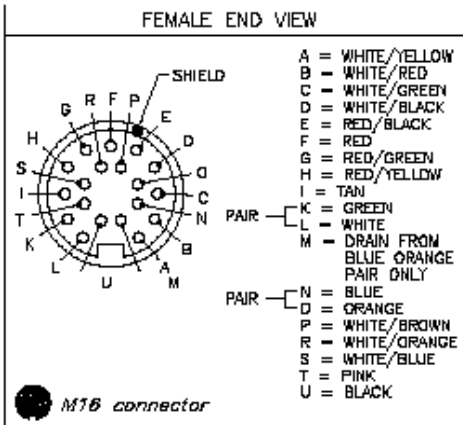
Replace the faceplate as described above. Remount front flange by sliding tie rods through the holes in the faceplate and through the holes in the rear end cap. Pilot the flange on the pilot diameter located on the front of the faceplate.

- 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 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

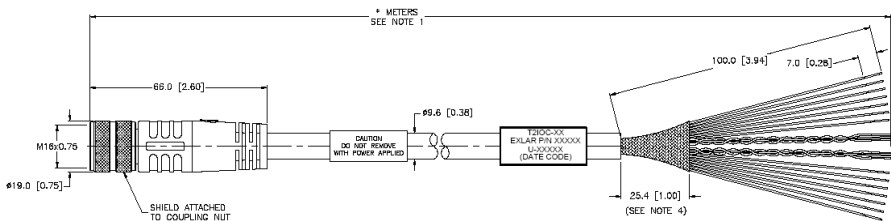
## Cables

### T210C-xxx I/O Cable

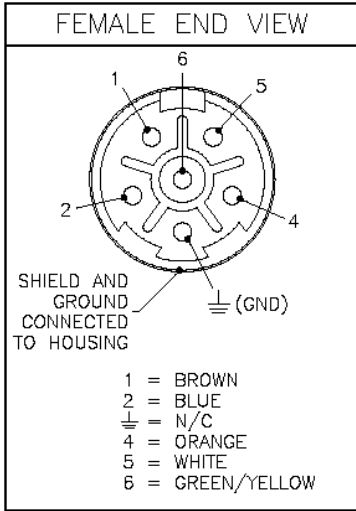


### SPECIFICATIONS

MOLDED HEAD MATERIAL/COLOR	PUR/YELLOW
CONTACT CARRIER MATERIAL/COLOR	THERMOPLASTIC PUR/BLACK
CONTACT MATERIAL/PLATING	BRASS/GDLD
CDUPLING NUT MATERIAL/PLATING	BRASS/NICKEL
RATED CURRENT [A]	3.0 A
RATED VOLTAGE [V]	30 VAC/VDC
OUTER JACKET MATERIAL/COLOR	PVC/BLACK
CONDUCTOR INSULATION MATERIAL	PVC
NUMBER OF CONDUCTORS [AWG]	18x22 AWG, 2x22 AWG DRAIN
SHIELD	ALUMINUM FOIL SHIELD/T-C BRAID
TEMPERATURE RANGE	-40°C TO +90°C (-40°F TO +194°F)
PROTECTION CLASS	MEETS IEC IP67

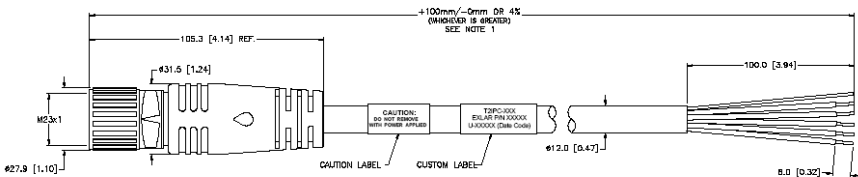


## T2IPC-xxx Power Cable

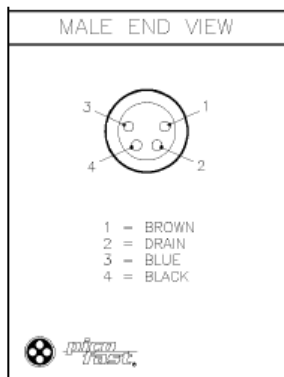


## SPECIFICATIONS

CONTACT CARRIER MATERIAL/COLOR	NYLON/GRAY
MOLDED HEAD MATERIAL/COLOR	THERMOPLASTIC PUR/BLACK
CONTACT MATERIAL/PLATING	BRASS/GOLD
COUPLING NUT MATERIAL/PLATING	BRASS/NICKEL
RATED CURRENT [A]	15.0 A
RATED VOLTAGE [V]	300 V
OUTER CABLE JACKET MATERIAL/COLOR	PVC/BLACK
CONDUCTOR INSULATION MATERIAL	PVC
NUMBER OF CONDUCTORS [AWG]	5x14 AWG
DRAIN/SHIELD	16 AWG/ALUM.-POLYESTER FOL & T-C BRAIDED
TEMPERATURE RANGE	-40°C to +105°C (-40°F to +221°F)
PROTECTION CLASS	MEETS IEC IP67

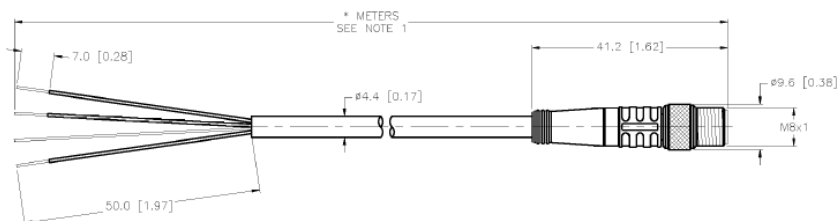


## TTICO-xxx Communications Cable



### 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



## **RETURNING A 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.