

TTX SERIES actuators

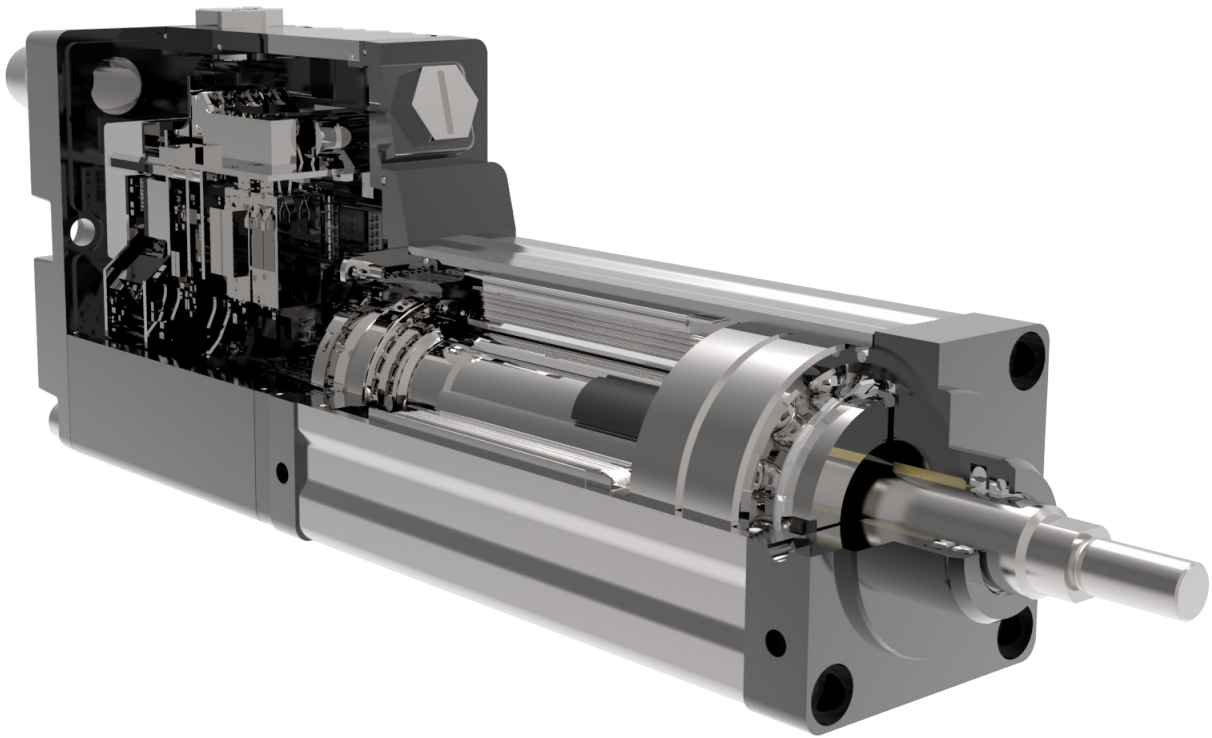
**CURTISS -
WRIGHT**

Installation & Service Instructions

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EXLAR®

TTX080 240 VAC Models



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1.0 INTRODUCTION

1.1 GENERAL PRODUCT DESCRIPTION

The TTX Series is Exlar's latest family of fully integrated linear actuators. They feature a robust planetary roller screw mechanism integrated into the rotor of a brushless servomotor and drive. This unique design combines the high speed and high load capacity of the roller screw with the high torque-to-volume ratio of the brushless servomotor. This manual applies only to the 80 mm frame size with 240 Vac input power. Other manuals will cover the 60 and 80 mm frame size, 48 Vdc powered actuators and the 100 mm frame size, 240 Vac powered actuators. All of the required power components and the motion

processor are contained in the actuator housing. Software configuration and set-up uses the Exlar Expert software tools used on all Tritex II integrated actuators

Actuator Mechanical Specifications and Ratings

Please refer to the TTX section of the 2018 Standard Product Catalog for mechanical specifications and output force ratings. The catalog also contains available model options and ordering information for specific model selection.

TTX Series actuators feature an Ingress Protection Rating of IP65S.

1.2 PRODUCT FEATURES

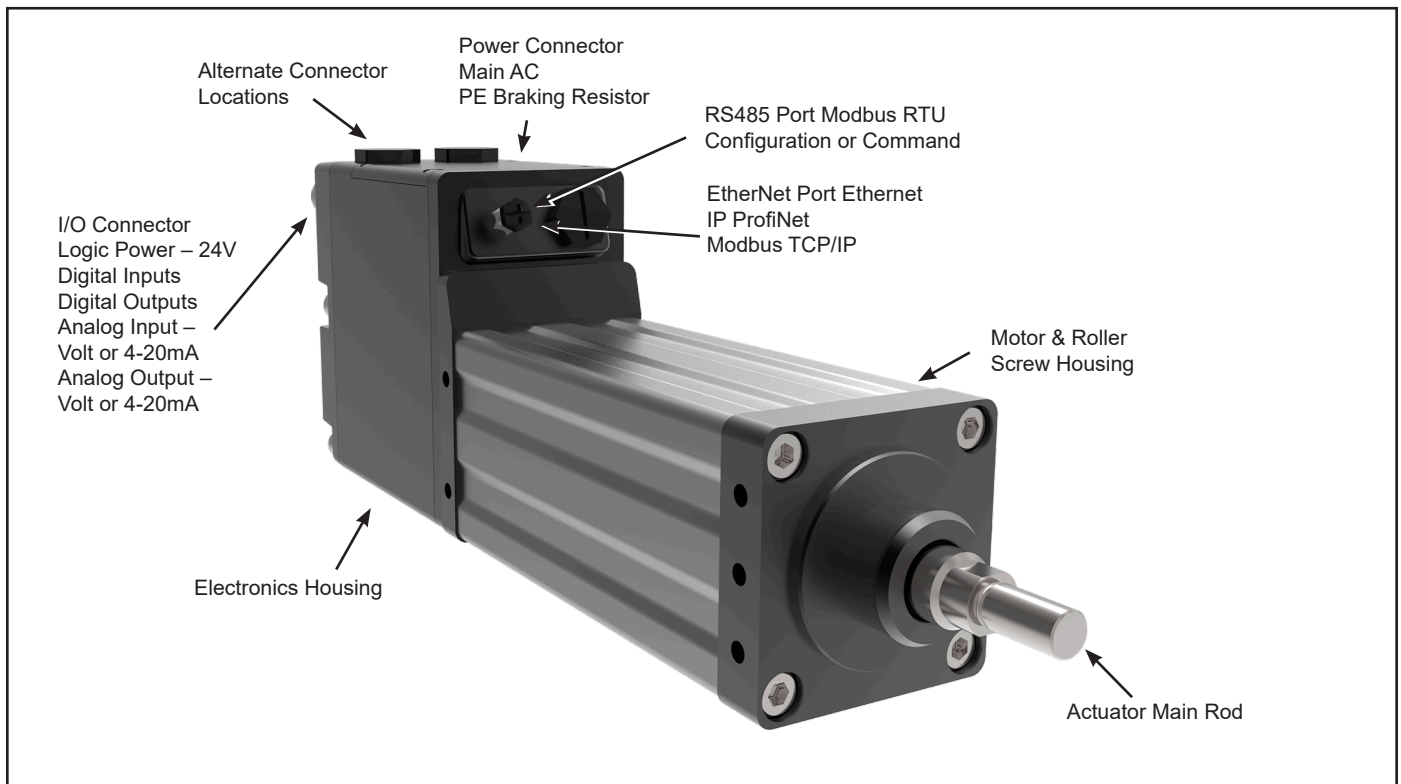


Figure 1 – TTX Series Actuator features

DRIVE SPECIFICATIONS FOR ALL TTX080 240 VOLT MODELS

Drive Specifications	
Main Power Input Voltage	Nominal Input Voltage: 100 to 240 Volts AC Tolerance: +/-10% of nominal Overvoltage Category II Electrical supply system: Type TN (Grounded)
External I/O Power Supply (Optional)	24 V dc +/- 10% - 0.8 A dc max load Provides power for processor with main power off Provides power for Digital IO and brake Requires Class 2 source, or protected by 3A maximum fuse
Internal 24V Power Supply	23 V dc +/- 5% - Provides power for optional brake and up to 100mA to power digital I/O from main power when External I/O Power Supply is not used
Digital Inputs	10 to 30 Vdc for ON state 0 to 1 Vdc or 0 to 1mA for OFF state Common return at "I/O Common" terminal Programmable functions. Number of channels varies by I/O option: 4 for 4-20ma and 8 for all others
Digital Outputs	Powered at I/O Power Supply terminal which can be jumpered from the Internal 24V Power Supply 1V maximum drop from supply voltage 100 mA continuous load per channel Short circuit and overload protected Programmable functions Number of channels varies by I/O option: 3 for 4-20ma and 4 for all others
Analog Input	Not available on 4-20mA I/O option 0-10 Volts or +/- 10 Volts differential input 13 bit resolution. Programmable function – Position, Velocity, or Torque
Analog Output	Not available on 4-20mA option 0-10 Volts at up to 10 mA 11 bit resolution Programmable function
4-20 mA Analog Input	4-20mA I/O option only Externally powered, fully isolated 11.5V max lift-off at 20mA 14 bit resolution Programmable function – Position, Velocity, or Torque
4-20 ma Analog Output	4-20mA I/O option only Externally powered, fully isolated 12V max lift-off at 20mA 12 bit resolution
Serial Interface	Optically isolated RS-485, Modbus RTU protocol Selectable bit rate: 38.4kbaud max
Commutation	Sinusoidal, 10kHz PWM, space vector voltage
Position Feedback	Resolution: 0.001 revolution Accuracy: + / - 0.002 revolution Multi-turn absolute position is standard, but may be disabled and battery back-up removed
Enclosure Rating	IP65S with plugs, caps, and cover properly installed and connectors or wiring ports properly sealed
Environmental	Operating temperature range: 0° to 65° C Derate continuous current 1 % per °C above 25° C Storage Temperature: -40°C to 85°C Operational Altitude: up to 3000 meters Long-term vibration: 1g 5 to 500 Hz Occasional vibration: 2.5g rms 5 to 500 Hz. Shock: 5g peak

1.3 SAFETY CONSIDERATIONS

Safety is of paramount importance during the installation and operation of your TTX Series actuator. Throughout this manual, content flagged with the cautionary symbols shown below should be read carefully by installers and operators to help avoid property damage, personal injury or death.



WARNING! Indicates a potentially hazardous situation which could result in serious injury or death if precautions are not



CAUTION! Indicates the information following is necessary for avoiding a risk of damage to the product or other equipment.

IMPORTANT Identifies statements that provide important information to help ensure safe and trouble-free installation and operation.

Several general warnings and cautions follow. In addition, refer to the AGENCY APPROVALS section for Conditions of Use for additional limits and requirements to ensure safe installation and operation.



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 the 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 TTX actuator may be used to ensure safety of personnel. 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 fail safe 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! 3-Minutes. Risk of Electric Shock

Allow 3 minutes for Discharge Time

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 remove cable or cover or touch power wiring terminals until this discharge time has expired.

2.0 SYSTEM CONFIGURATION



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°C under normal operation and can take a long time to cool, resulting in a risk of burns when touched.

2.1 TTX SERIES ACTUATOR

TTX Series actuators provide a robust solution for long-life, continuous-duty applications even when environmental contaminants are an issue. In most rotary-to-linear devices, critical mechanisms are exposed to the environment and must be frequently inspected, cleaned and lubricated. In contrast, TTX Series actuators are designed with all converting components mounted within sealed motor housings. With a simple bushing and seal on the smooth extending rod, abrasive particles or other contaminants are prevented from reaching the actuator’s critical mechanisms. As a result, actuator life can exceed that of a ball screw actuator by 15 times, even in high-speed, high-force applications. In addition, the TTX Series has an on-board amplifier with control software and firmware available from Exlar.

2.2 OPTIONS

2.2.1 Internal Holding Brake

Many applications require the addition of a holding brake. The Exlar internal holding brake is engaged by a permanent-magnet. The mechanical advantage of the roller screw allows the holding brake to prevent the output rod from back-driving the load. The holding capacity of the brake is sufficient to hold the rated force of the actuator.

2.2.2 Anti-Rotation Assembly

The unique design of TTX Series actuators helps simplify actuator setup by allowing the user to rotate the extending rod and thread it in and out of the actuator for mechanical attachment or system testing. In most applications, the load is coupled to linear bearings or some other support device, preventing rotation during operation. To ensure proper linear motion in applications in which the rod is free to rotate, an Anti-Rotate Assembly is required to prevent the rod from rotating.

2.2.3 External Limit Switch

A TTX Series actuator equipped with the anti-rotate and limit switch options can accommodate multiple limit switches for use as end-of-travel limit switches or home position sensors positioned outside the low-profile extruded channel housing.

3.0 MECHANICAL INSTALLATION

3.1 MOUNTING CONFIGURATIONS

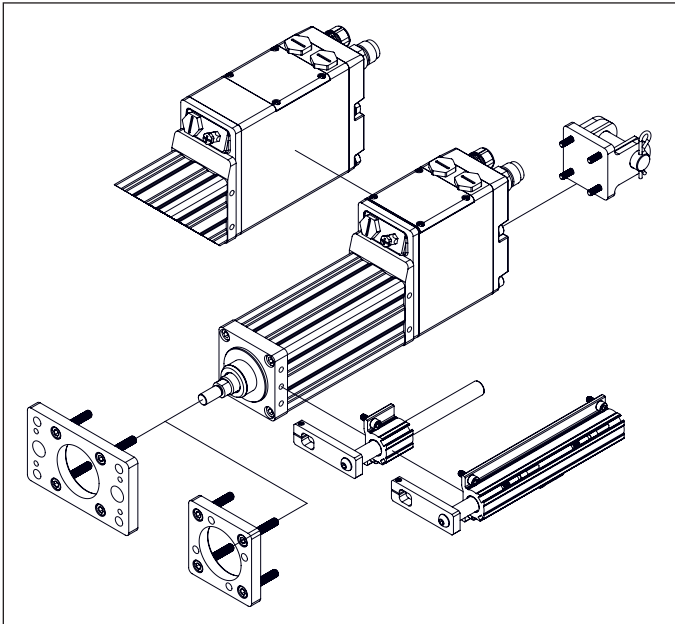


Figure 2 – Mounting configurations

TTX Series actuators mounting configurations:

- Rear clevis
- Front flange
- Tapped face
- Side mount.

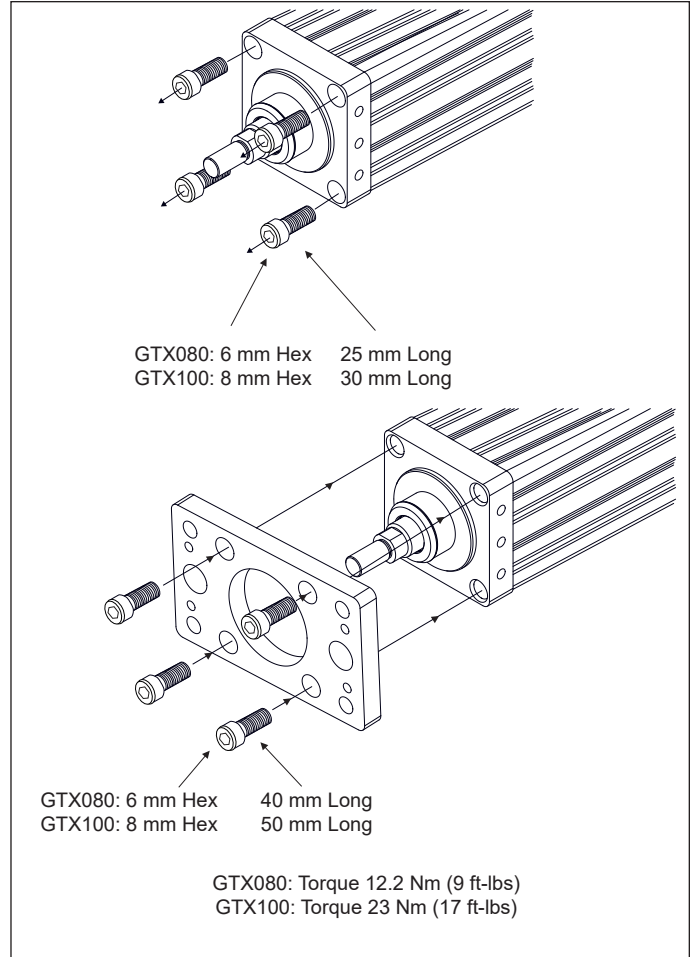


Figure 4 – Flange mount

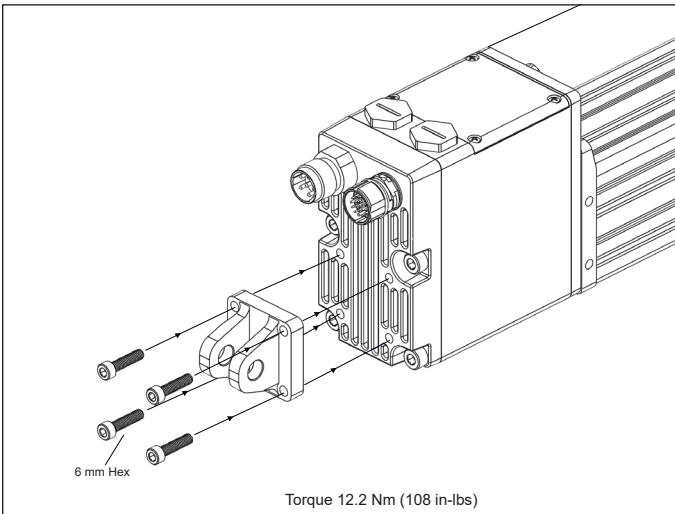


Figure 3 – Rear clevis mount (NOTE: Dimension drawings can be found in the TTX Series Actuator catalog or on the Exlar website.)

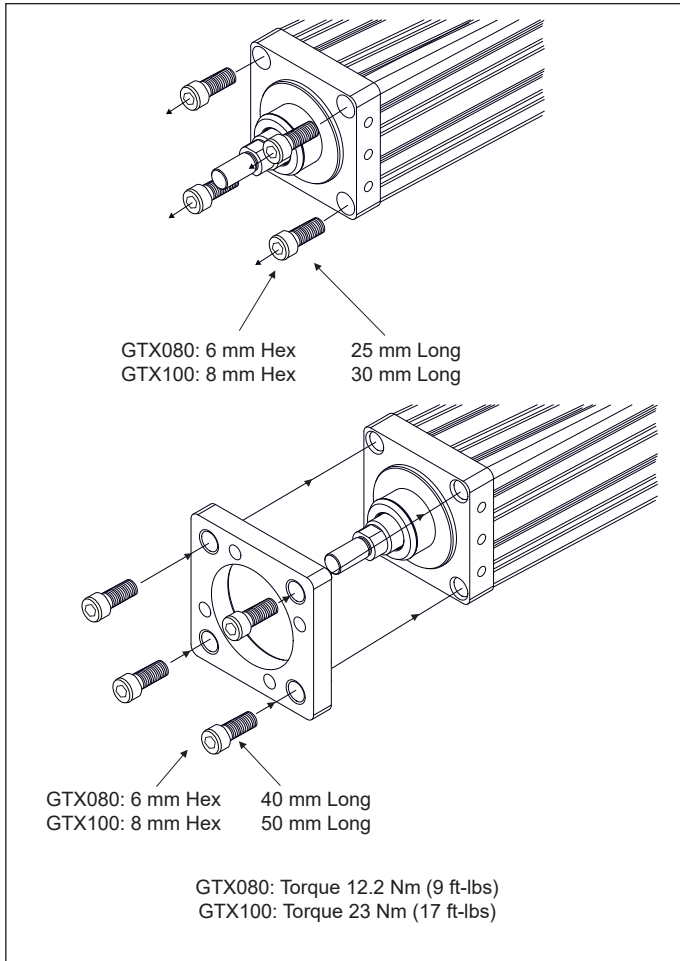


Figure 5 – Tapped face mount

3.2 MOUNTING CONSIDERATIONS

3.2.1 General Operation

The TTX linear actuators 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 TTX Series linear actuator.

See sections 2.2.1, 2.2.2 and 2.2.3 regarding the holding brake, anti-rotate mechanisms, and external limit switches and that can affect the operation and motion of the actuator.

The relationship between the rotary motion of the motor and the linear motion of the actuator corresponds to the following relationships:

English

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

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

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

Metric

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

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

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

All of the above relationships require proper anti-rotation of the TTX actuator rod. For more information on sizing and selection of TTX actuator and servo amplifiers to power them, consult the sizing and selection section of the Exlar catalog.



CAUTION! Care should be taken not to exceed the physical travel limits of TTX actuators. Doing so will cause the actuator to end-crash internally. End crashes can physically damage the roller screw and the internal components of the actuator. Care should be taken to avoid high-speed impact with objects of high rigidity that immediately stop the travel of the actuator with no deceleration or energy absorption. An example would be a high-speed impact of two solid steel parts. The resulting impact will create a very short effective deceleration time. Kinetic energy contained in the rotating inertia of the actuator and motor can possibly generate extremely high impact forces that exceed the mechanical capacities of the actuator and cause physical damage to the actuator. For applications requiring this type of impact, contact Exlar application engineering to insure that the actuator is properly sized or provisions are made to absorb the induced energy.

3.2.2 Actuator Alignment

IMPORTANT! Aligning the TTX Series actuator with respect to the load it is moving is critical. Any misalignment will decrease the life of the actuator's components and may adversely affect application performance.



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

Side-mounting notes:

TTX Series actuators include threaded holes in the faceplate and endplate. Exlar recommends using hardened fasteners to mount an actuator to your machine frame with an engagement depth of two times the screw diameter for tapped holes.

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. Apply appropriate deceleration ramps to end of moves, or velocity and acceleration limits in positioners to prevent over-travel.

IMPORTANT! Tighten four cap screws to 12.24 Nm (9.0 ft-lb) max. Failure to properly tighten the screws can affect normal operation, damage the actuator and/or cause possible premature actuator failure.

3.2.3 Anti-rotation Assembly

To keep the extending rod from rotating, Exlar offers the Anti-rotation Assembly shown below.

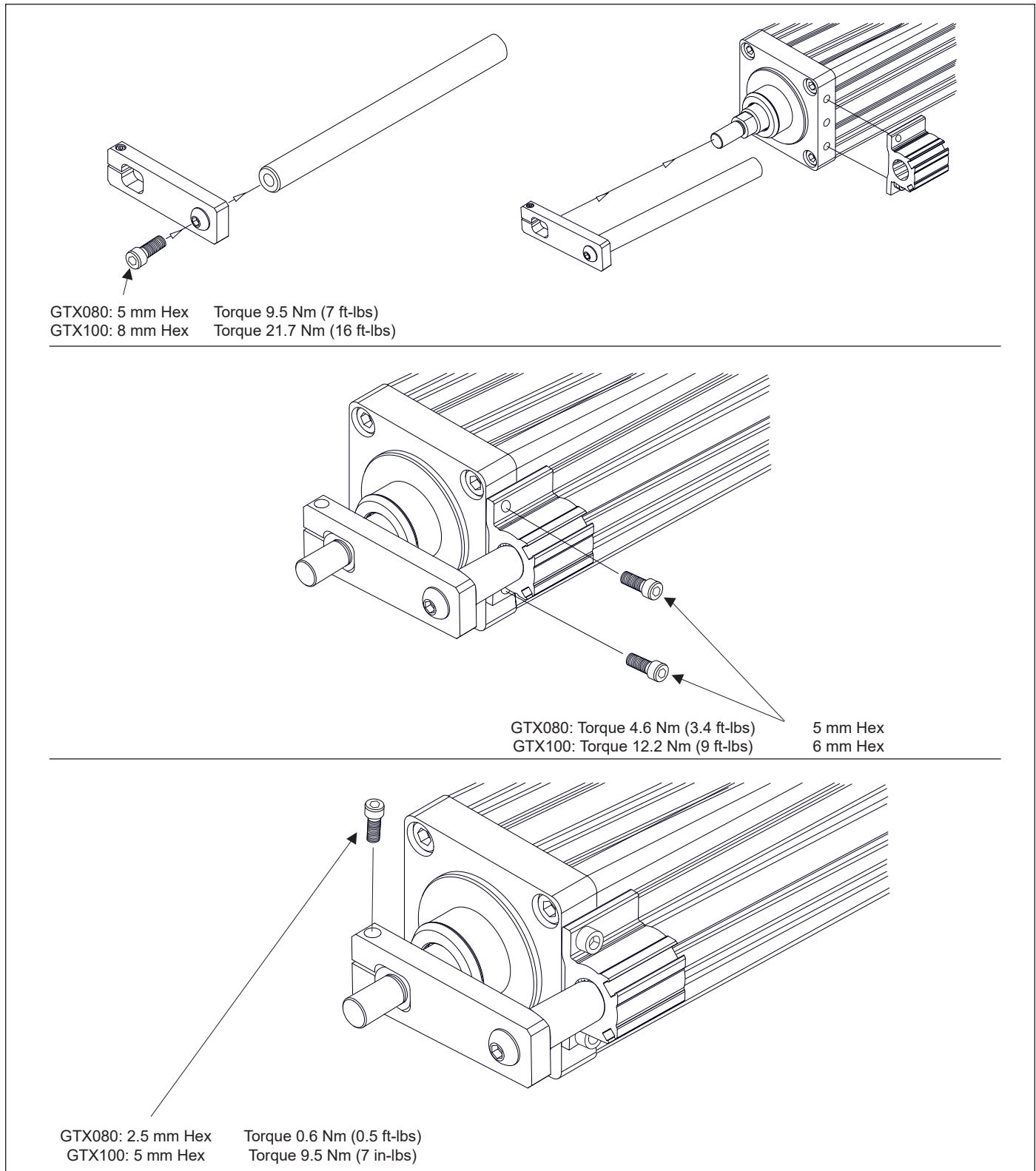


Figure 6 – Anti-rotation Assembly (shown in standard location)

3.2.4 External Limit Switches

This option allows multiple external switches (sold separately) to be externally mounted to the actuator. These adjustable switches provide travel indication to the controller. A bracket with inductive proximity switches mounts to the outside low-profile extrusion and senses a traveling magnet located inside the anti-rotate tube.

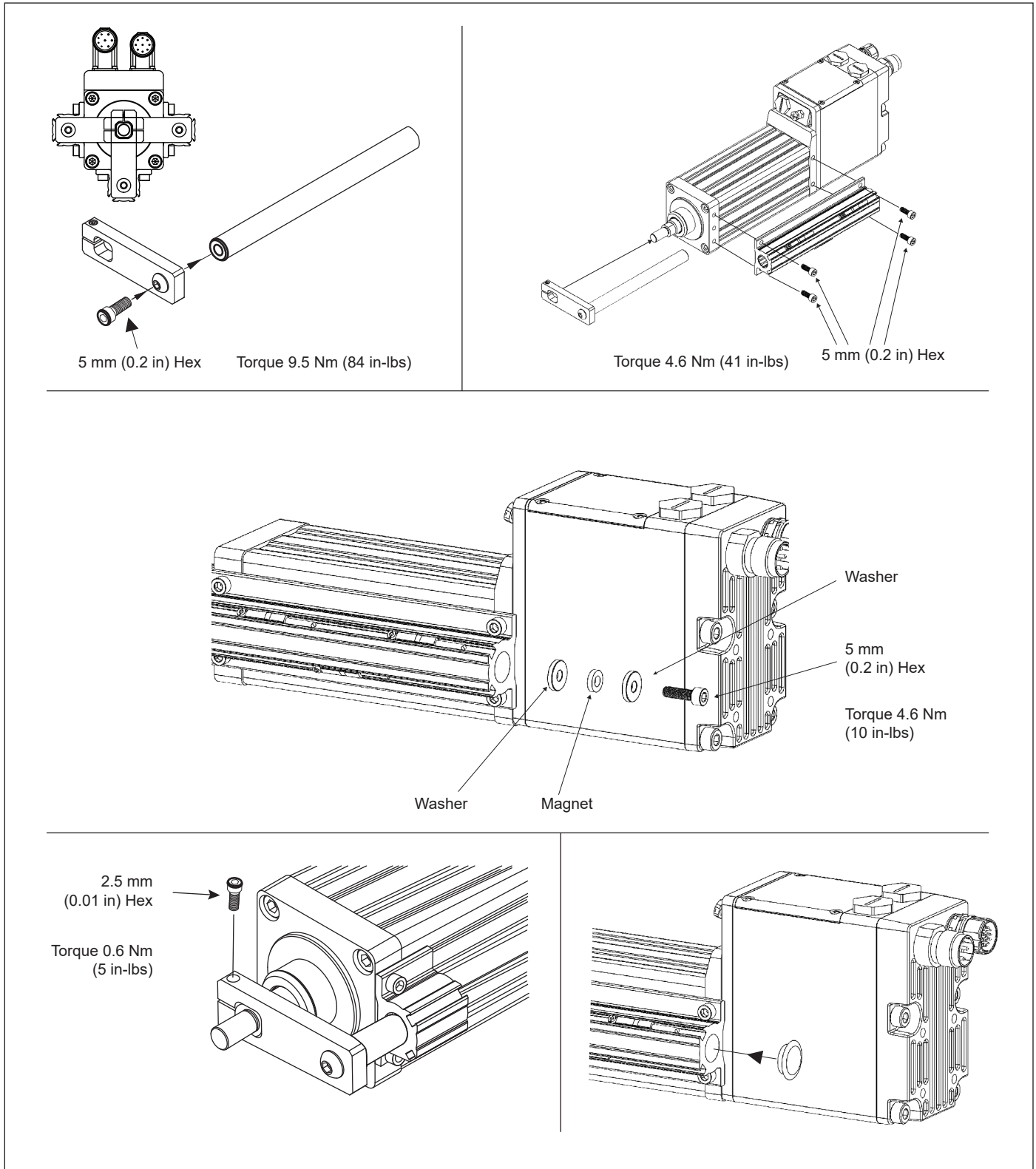


Figure 7 – Limit switch mounting

3.3 LUBRICATION

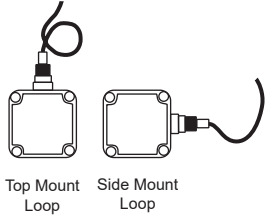
TTX linear actuators are shipped from the factory fully greased and ready for installation. Exlar uses Mobil SHC 220, a high performance, extreme-pressure grease. The unique physical properties of the synthetic base oil provide outstanding protection against wear, rust, corrosion, and high or low-temperature degradation. See section 6.1 for more information on lubrication.

3.4 OUTDOOR AND WASH DOWN INSTALLATIONS



CAUTION! Liquid ingress damages TTX electronics. Damage due to water or other liquids can be very extensive, may not show up immediately, and is not generally covered under warranty.

TTX ingress ratings: IP66S . TTX actuators are not intended for applications where the actuator could possibly be submerged. Liquid ingress causes serious damage to electronics over time. A frequent and often overlooked entry point is through conduit or wireways. When new, the seals are effective to IP65S or better. However, over time, and depending on the amount of side load, seals can wear and eventually allow moisture in. Contact Exlar application engineering for special options. Here are some additional recommendations to prevent liquid entry:

1. Avoid installations with main rod or shaft facing up if possible . Otherwise make external provisions to keep water away from the main rod or shaft.
2. When using the power and I/O connectors verify the cable end connectors can seal properly and have the desired IP rating. Be sure to screw the plug all the way on to the receptacle for proper sealing.
3. Position conduit fittings or create a drip loop in cable or flexible conduit so water does not drain towards the conduit fitting as shown.

Top Mount Loop Side Mount Loop
4. When the wire termination cover is re-installed, verify the gasket is in place and the surfaces of the gasket as well as the cover are free from debris so a good seal can be achieved.
5. When re-installing the termination cover install all four screws to within about one turn from contact, then hold the cover flat in position and bring all screws to seat. Then tighten the screws to about 7 lbf-in (0,8 Nt-m).
6. The TTX actuator has conduit hole plugs to cover unused conduit entries, verify they are all in place and fully seated.

4.0 ELECTRICAL INSTALLATION

4.1 INTRODUCTION

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

The following diagrams show the electrical connections schematically:

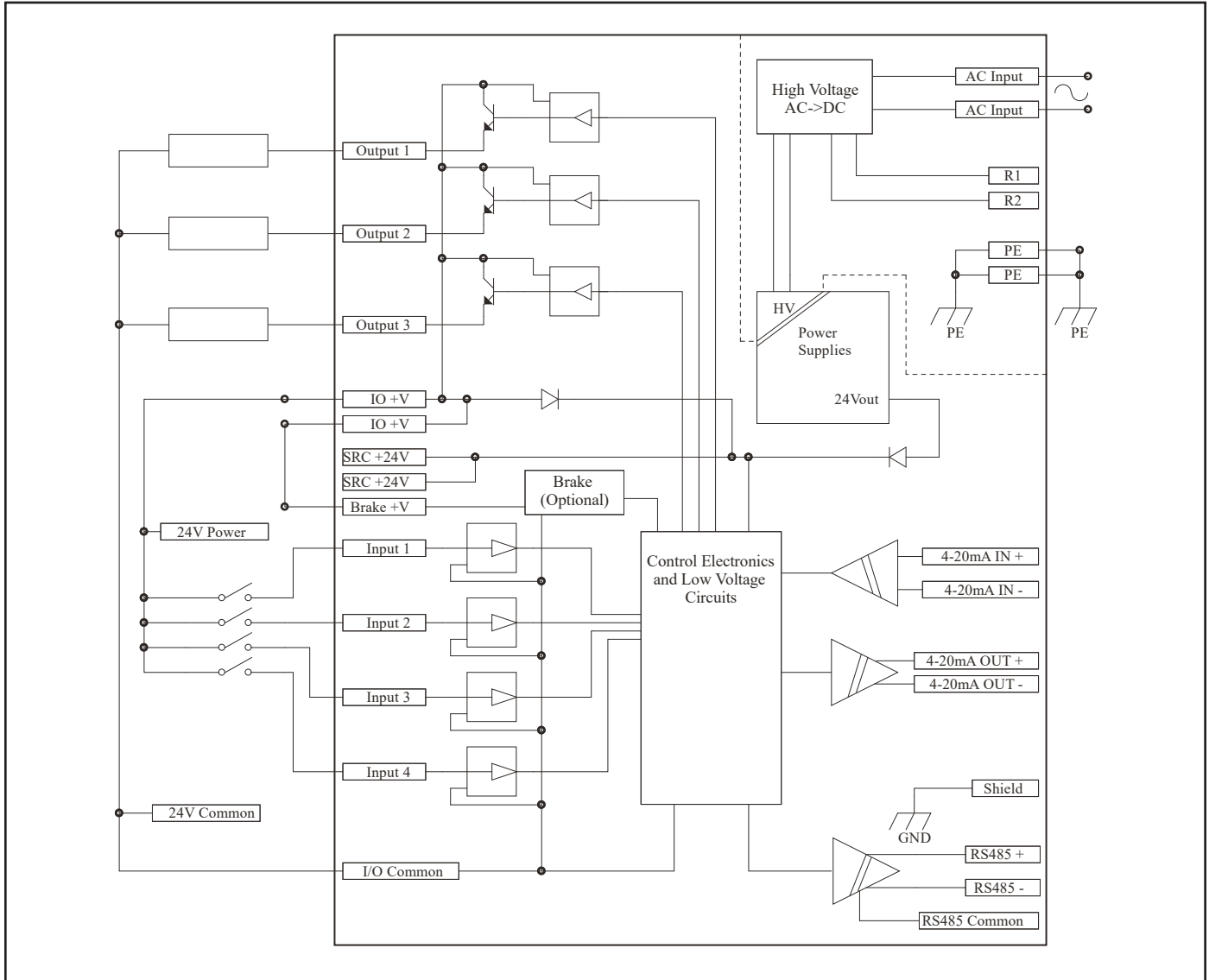


Figure 8 – Manual schematic 4-20 mA

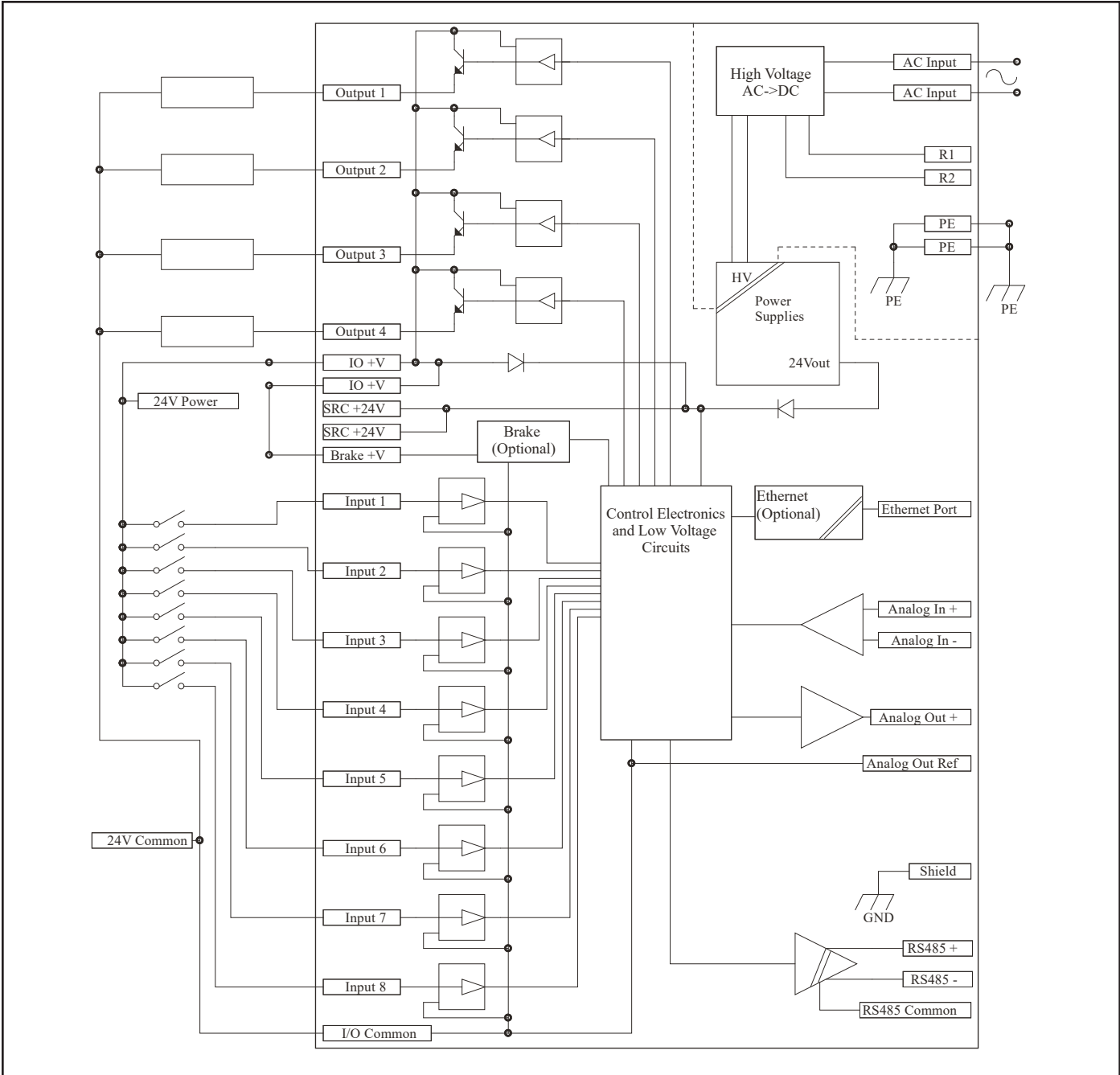


Figure 9 – Manual schematic STD I/O

4.2 SUPPLIED CONNECTORS

All standard models have connectors for external electrical interface, though the connectors may be removed as needed for direct wiring to internal terminals or connections.

There are four M20x1.5 threaded holes machined into the electronics housing as cable entry ports, two in the top and two in the rear. The two holes in the top are plugged with removable hole plugs. The power connector is installed in the right rear port and contains all higher voltage connections. The I/O connector is installed in the left rear port. The user may remove or relocate the connectors as needed as long as any unused holes are properly capped to prevent water or dust intrusion. Adapters for 1/2 inch NPT thread or cable glands may be used but are not furnished.

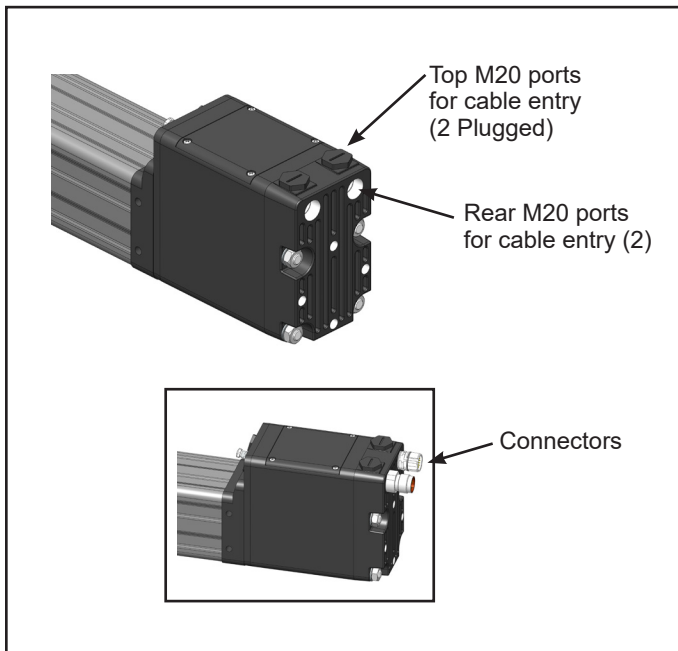


Figure 10 – M20 Cable Entry Ports

A PG 9 threaded hole is machined at the front of the electronic enclosure. This hole has a connector installed for Ethernet based communications options: ProfiNet, Ethernet-IP, or Modbus TCP. Otherwise the hole is plugged but available for alternate use.

All models have a connector for RS-485 communications at the front of the electronics enclosure most often used for temporary connection to the Expert software configuration tool, but also used for connection to a Modbus RTU host.

The enclosure cover may be removed for access to I/O and power terminals and some wiring option jumpers. Removing the cover also provides access to a battery for multi-turn absolute feedback. Always replace the cover immediately to prevent accidental entry of water, wire trimmings, or metal cuttings from nearby drilling or cutting operations during installation. See wiring section below.

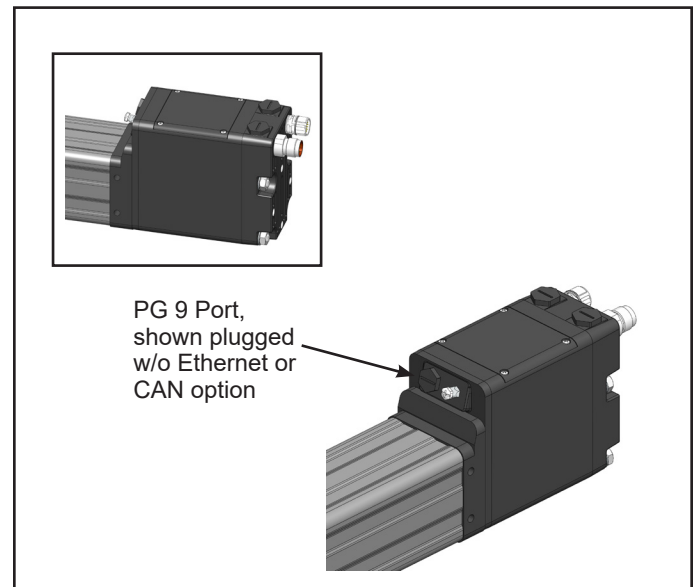


Figure 11 – PG9 Cable Entry Port / Communication Connector

4.3 GROUNDING (PE) CONNECTION



WARNING! Grounding

Fixed Protective Earth (PE) connections are required for personnel 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 the European Union Low Voltage Directive (EU LVD).

There are two PE terminals provided on the power terminal block under the wiring access cover. Both terminals are wired out to the standard power connector. To meet EU LVD requirements, both of these conductors must be connected independently to PE at the supply end of the cable. If the

power connector is not used, a PE conductor must be wired to each PE terminal. Redundant PE connections are highly recommended even where not required.

The AC power must be grounded at its source, which is with rare exceptions the transformer to which the actuator is directly connected. See the AC Input Power section for more information.

4.3.1 Shielding

In order to meet the European EMC Directive for an installation 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.

The connectors and cables supplied by Curtiss-Wright properly terminate shields. If cable glands are used, make sure the cable gland has a feature to make contact between the metal body and shield and that the outer jacket is removed as recommended by gland manufacturer and installed according to manufacturer instructions. Example shown in diagram below. A shield connection such as the one shown does not qualify as a PE connection.



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.

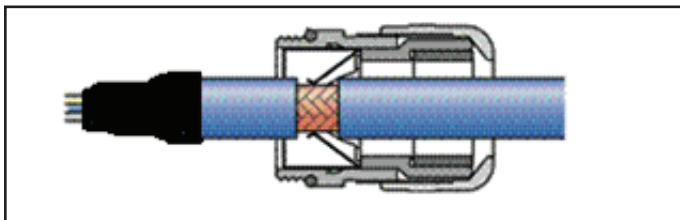


Figure 12 – Example of a shielding type cable gland.

An Ethernet cable is not required to be shielded, or if shielded, does not require that the shield is connected at the actuator end. Do not use a shielded RJ45 jack for an internal connection to this actuator.

4.3.2 Other Grounding Considerations

Extra-low voltage DC power supplies for I/O circuits or a holding brake must be ground referenced on the negative side to prevent stacking voltages where there is more than one source. Avoid use of independent “Instrument Ground” connections. All ground connections must run back to a single point.

It is recommended that driven parts are connected to stationary parts of the machine with grounding jumpers. Some applications produce static electric charges in the moving parts of a machine, for example plastic molding, that produce static charges or impulses that exceed those in EMC tests.

4.4 AC INPUT POWER

TTX series actuators require 100 VAC to 240 VAC (nominal) single phase 50/60 Hz to operate. 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.

The AC supply must be earthed with PE conductors connected to the earthed point at the source. In terminology used in the EU, the actuator must be connected to a Type TN-S system, and must not be used on a Type TT or IT system without an isolation transformer. “Earthing” is a low impedance connection into the premises or building grounding electrode system. This means that the conductors connected to the L1 and L2 terminals must have a fixed AC voltage with respect to PE. In the case of a Neutral conductor, this voltage would be zero. A high fault current would flow if any conductor with a non-zero voltage were shorted to PE, allowing a fuse to clear the fault.

See the following diagrams for connections to 3 phase and single phase power sources. No connection to a three-phase source uses all three phases and presents a single phase load to the supply.

4.4.1 Input Power Ratings

The following table shows rated input voltage and current. The maximum voltage applied to the TTX080 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)	Rated Continuous Input Current (Amps rms)	Maximum Inrush Current (Amps)
80 mm	240+/-10% 1Φ	47-63	4.3	50 (<5 msec)

4.5 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.

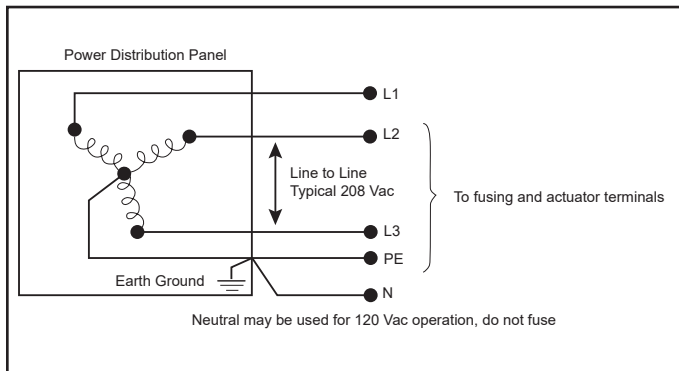


Figure 13 – Grounded WYE Power Connection, 120/208Y 3Φ

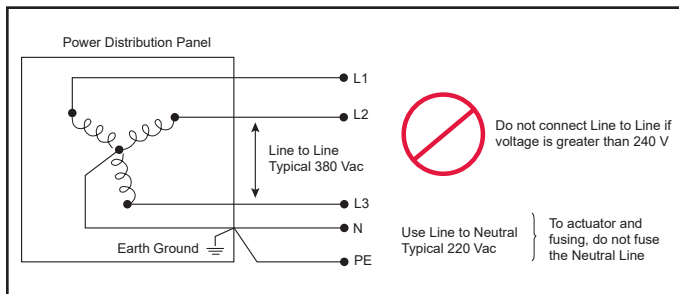


Figure 14 – Grounded WYE Power Connection, 220/380Y 3Φ

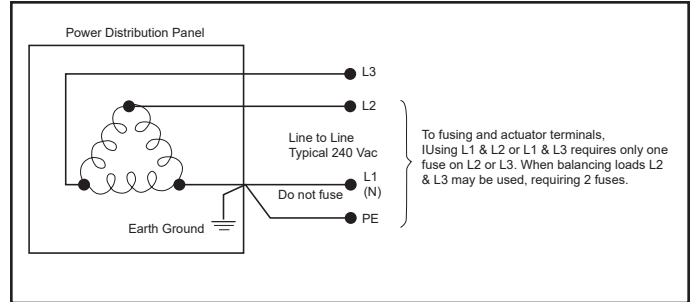


Figure 15 – Three Phase Grounded Delta Power Connection, 240 VAC

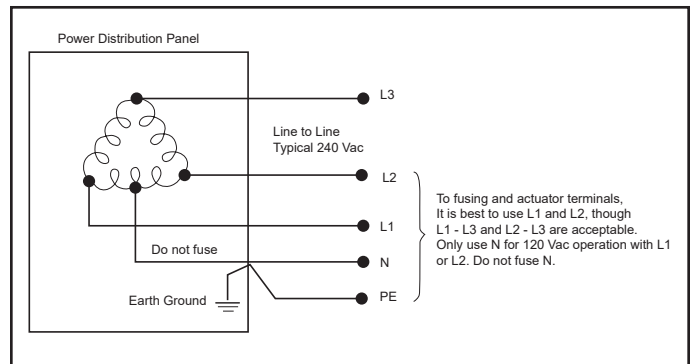


Figure 16 – Three Phase Delta with Mid-Phase GND Power Connection, 240 VAC

4.6 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 transformer's secondary must be grounded for safety reasons. Do not use buck-boost type transformers as they do not provide isolation.

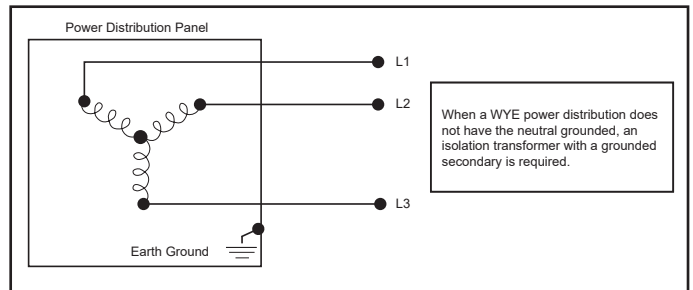


Figure 17 – Ungrounded WYE Power Distribution

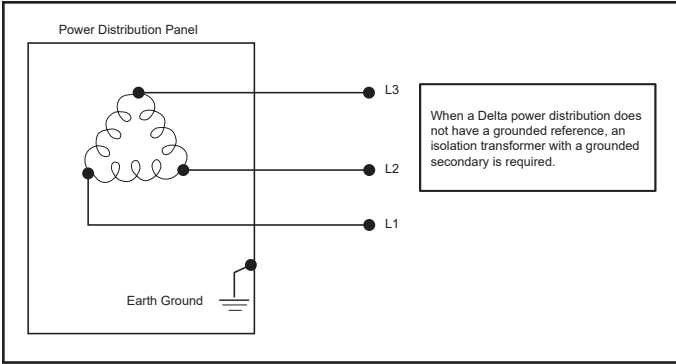
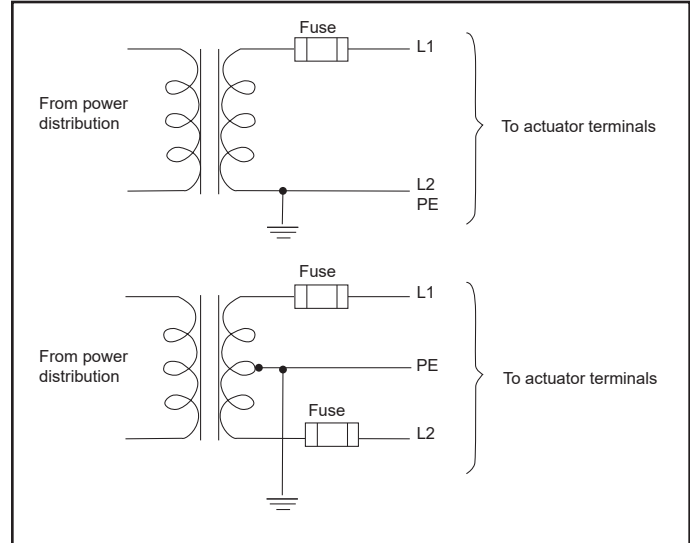


Figure 18 – Ungrounded Delta Power Distribution

The diagrams below show possible connections to isolation transformers:



4.7 WIRE SIZE, BRANCH CIRCUIT PROTECTION, AND OVERCURRENT PROTECTION

Drives must be protected by non-semiconductor fuses or inverse-time circuit breakers only. The table below lists approved fuses or circuit breaker and the manufacturer:

Actuator Size	Required Wire Sizes for L1, L2 and PE (two wires required)	Fuse or Circuit Breaker				
		Fuse Class / Circuit Breaker Input Protection	Littelfuse	Cooper - Bussman	Mersen (Ferraz-Shawmut)	Schneider Electric
5mm	14 AWG or ISO 2.5mm ²	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

4.8 POWER TERMINAL WIRING

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



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 After Main Power Removed. Braking resistor connections R1 and R2 remain at dangerous voltage after disconnection of AC Power. Power must be “Off” for a minimum of 6 minutes before touching these terminals.



CAUTION! Use Correct Wires and Terminations for Power Wiring in UL Installations.

L1, L2, PE, R1, and R2 connections should be 14 AWG / 2.5 mm, 300V, 105°C minimum. Ferrules are not required, but if used, a precise crimp is required. The crimped ferrule must measure less than 2.1 mm (diameter or square) or it will not fit into the terminal opening.

The terminals are a lever actuated spring type that retain constant high contact force on any wire, even through thermal cycling. There is no screw to torque, eliminating under- or over-tightening. Wires are to be stripped .24 to .28 inch (6 to 7 mm).

To operate, place a small flat bladed screwdriver in the indentation in the lever with the screwdriver shaft perpendicular to the face of the terminal block, or 45° from vertical. Press in the direction of the screwdriver shaft with only enough force to open the clamp. The clamp will fully open with about 8 lbs of force (35 N). While holding the clamp open, fully insert the wire, and release the force on the lever. Check that the wire is in position with no stray strands. Check that the clamp is not on the insulation, resulting from too short a strip length, or that the insulation extends less than 1/16 inch (1.6 mm) below the front surface of the terminal block, indicating too long a strip length or wire not fully inserted.



CAUTION! Do not apply direct vertical force or excess force on the terminal levers. A force of 8 lbs (35 N) parallel to wire entry direction is sufficient to fully open the wire clamp. Applying a force in excess of 12 lbs will damage the terminal.

4.9 POWER CONNECTOR WIRING

Refer to the following table for standard M23 pre-wired power connector

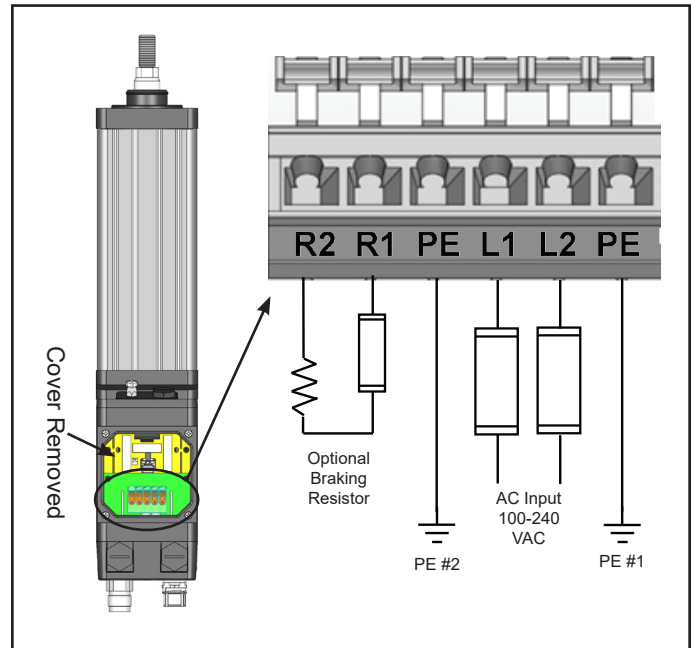


Figure 19 – Internal Power Terminal Block Connections



WARNING! Dangerous Voltages Present On Connector Pins #4 and #5. Pins #4 and #5 connect to terminals R1 and R2 for use with a braking resistor and have dangerous voltages present under normal operation and for up to 6 minutes after main power is disconnected. Conductors attached to these pins must be terminated or insulated at the user end of the cable to prevent contact with other wires or PE even when a braking resistor is not used.

Power Wiring for standard 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
PE / Shield	3	None*	Drain	PE	6	Green	Grn/Yel

* Pin 3 is connected to the M23 connector shell and the TTX housing.

Note: See Cable section for cable details

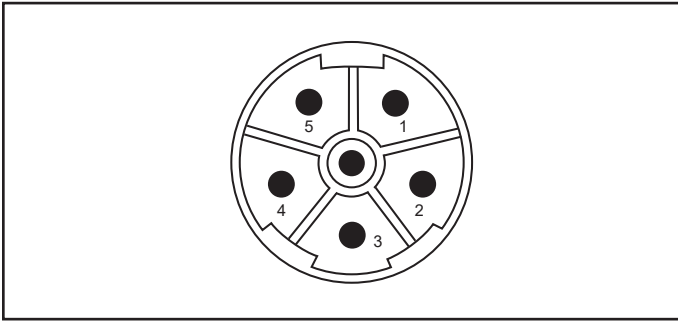


Figure 20 – Actuator view, pin side

4.10 OVER TEMPERATURE PROTECTION

UL/CSA approved motor over temperature sensing is not provided by the actuator. Motor over temperature protection relies on limiting maximum current to the motor and if time-averaged motor current exceeds a continuous current setting, the actuator trips or faults and disables the drive indicating a Continuous Current fault. The continuous current fault level is 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 40°C ambient.

The motor contains a temperature sensor embedded in the stator windings to provide an actual temperature indication. The actuator trips or faults when the temperature reaches 130°C and disables the drive indicating an Actuator Over-temperature fault.

Additional over temperature protection is provided by a sensor in the drive electronics which generates a fault when the board reaches 110°C.

Though some fault conditions may be configured to take action other than to disable the actuator immediately, reconfiguration of these two faults is not allowed in order to protect the actuator motor and electronics.

4.11 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 TTX does not return energy to the AC line. With 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, immediately disabling the actuator.

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.

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. The T2BR1 resistor available through Curtiss-Wright / Exlar works well for most applications. It can handle 100W average power and 2500 Joule single events.



WARNING! Protection Against Brake Resistor

Overload. The external braking resistor must be protected against overload caused by excessive regenerative energy and the unlikely failure where the brake control is stuck ON. For most applications where powered at 208 Vac to 240 Vac, a 3 Amp slow-blow fuse is adequate. A thermal cut-out switch in addition to the fuse provides more complete protection, and is necessary if the actuator is normally powered at 120 Vac. The switch should be attached to the resistor mounting / heat sink plate next to the resistor.

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 N-m (or Joules) of energy. Assuming roughly 90% conversion efficiency, the regenerative event results in 180 Joules 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.

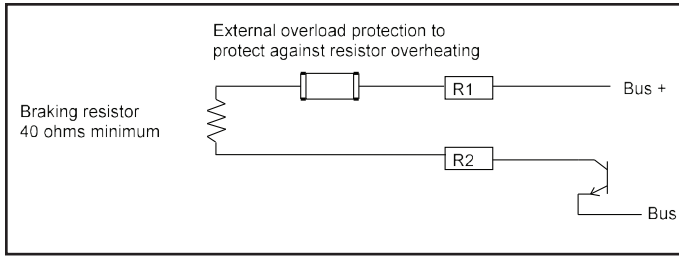


Figure 21 – Braking Resistor Connections

4.12 LOGIC AND I/O POWER SUPPLY

An external 24 VDC power supply may be connected to the “IO+V” and “IO connector pins” terminals. See diagram below. It provides “logic power” for the drive microprocessor and electronic controls, position feedback, communications, and standard analog I/O even when the actuator is isolated from main power. With standard jumpers installed, it also powers digital outputs and an internal holding brake if installed. When a system 24V supply is available, it should be the first choice for logic power for best system readiness by maintaining correct status on all signals and keeping 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
24 Vdc +/- 10%.	1	2 Amp, if power supply is not limited at 3 Amp or less	18 AWG (0.8mm ²)

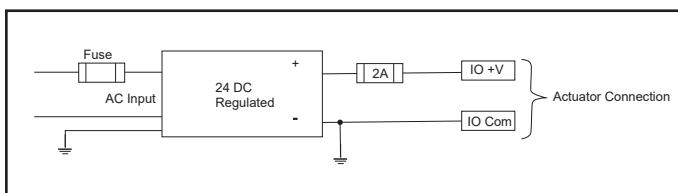


Figure 22 – Wiring for External 24 Volt Supply



CAUTION! It is important that the 24 VDC power supply for logic and I/O has its negative terminal connected to PE at or near the supply.

Additional flexibility is available by changing the wiring at the internal termination board. The TTX080 contains a built in 24 Vdc (nominal) power supply sourced from the main power for all internal electronics. It can also be used to power an optional internal brake as well as provide some power for I/O.

The maximum current the internal supply can provide is 600 mA. The brake will use 500 mA, leaving only 100 mA available for other I/O when the actuator has a brake, which is usually sufficient. This supply is intended for use where a 24 Vdc supply is not available or otherwise unnecessary, such as an application that uses main power and a communications channel, or main power and a 4-20mA loop as the only outside connections. Jumpers must be moved to use this supply for digital outputs or brake. It is not possible to mix an external 24V logic power supply and the internal supply. Use the internal supply only if no external supply will be connected.

Actuators are shipped with a jumper connecting the two +24V Source terminals as a place to park the jumper for future use and to prevent inadvertently installing a jumper in the wrong terminal. To make use of the internal supply for digital outputs, first remove the wire at J2 position 6 from the terminal block and tape off the end of this wire. Then move the end of the jumper at J2 position 1 to J2 position 6, leaving the other end connected to J2 position 2.

The diagram on the following page shows the logic and I/O supply interconnections. Note that all components shown are referenced to the negative side of the logic power supply, I/O Common. Digital Inputs have a common return connection at I/O Common. Digital Outputs have loads that return to I/O Common externally. The brake returns to I/O Common. The voltage signal Analog Input is not isolated from I/O Common but has a balanced high-resistance input that allows enough common-mode range. The voltage Analog Output negative side is referenced to I/O Common. The 4-20mA Analog Input and Output circuits replace the voltage Analog I/O on the 4-20mA option and are fully isolated from I/O Common.



CAUTION! Make sure 24 Vdc power supplies are connected in the correct polarity. Some reversed connections will cause damage to the circuits. The I/O Common terminal must be connected to the negative and grounded side of the power supply. An external supply should not be connected directly to the +24V Source terminals.

4.12.1 I/O CONNECTOR WIRING

Standard M23 19 pin Connector Pin Assignment and Wire Color Code

The analog voltage input and output are replaced with 4-20 mA input and output respectively.

FUNCTION	Connector Pins	Wire Color Code for Internal Wiring & TTIOC Cable
Digital Input 1	1	White/Yellow
Digital Input 2	2	White/Red
Digital Input 3	3	White/Green
Digital Input 4	4	White/Black
*Digital Input 5	5	Red/Black
IO +24V	6	Red
*Digital Input 6	7	Red/Green
*Digital Input 7	8	Red/Yellow
*Digital Input 8	9	Beige
*ANALOG IN+	10	Green
*ANALOG IN-	11	White
Shields	12	Gray (internal wire) or Clear (cable)
*Analog Out +	13	Blue
*Analog Ref	14	Orange
*Digital Output 4	15	White/Brown
Digital Output 3	16	White/Orange
Digital Output 2	17	White/Blue
Digital Output 1	18	Light Red (Pink)
IO Common	19	Black

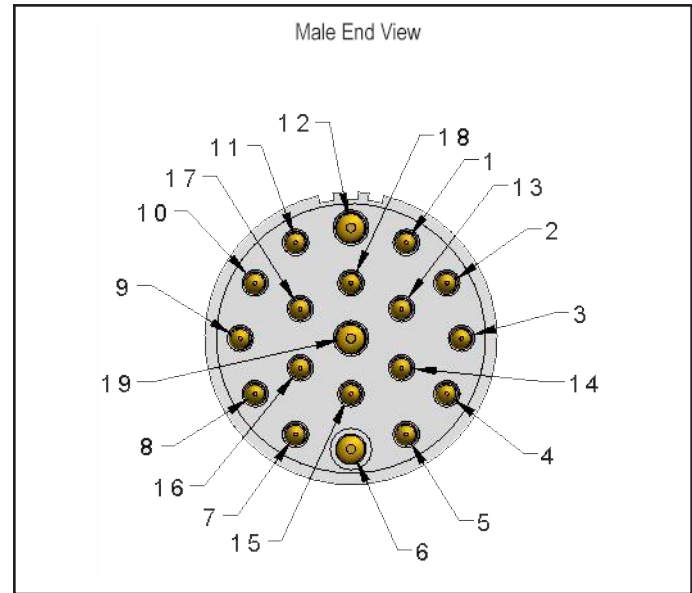


Figure 23 – Input /Output Standard M23 Connector Front View (19 pins)

* For the 4-20mA (-IA4) option:
Inputs 5, 6, 7 & 8 and Output 4 are not available.

Internal Termination Board Terminal Assignments

J3 Pos #	Label	Function	J2 Pos #	Label	Function	J5 Pos #	Label	Function
1	In 1	Digital Input 1	1	Src+24	+24V Source	1	*AI+	*Analog IN+
2	In 2	Digital Input 2	2	Src+24	+24V Source	2	*AI-	*Analog IN-
3	In 3	Digital Input 3	3	IOCom	I/O Common	3	*AO+	*Analog OUT
4	In 4	Digital Input 4	4	Brk+V	Brake +	4	*AO-	*Analog REF
5	*In 5	Digital Input 5	5	IO+V	I/O +V	5	RS485+	RS485+
6	*In 6	Digital Input 6	6	IO+V	I/O +V	6	RS485-	RS485-
7	*In 7	Digital Input 7	7	*Out 4	Digital Output 4	7	Com	RS485 COM
8	*In 8	Digital Input 8	8	Out 3	Digital Output 3	8	Shld	Shield (to PE)
9	Shld	Shield (to PE)	9	Out 2	Digital Output 2			
10	Shld	Shield (to PE)	10	Out 1	Digital Output 1			

* For the 4-20mA (-IA4) option:
Inputs 5, 6, 7 & 8 and Output 4 are not available.

The analog voltage input and output are replaced with 4-20 mA input and output respectively.

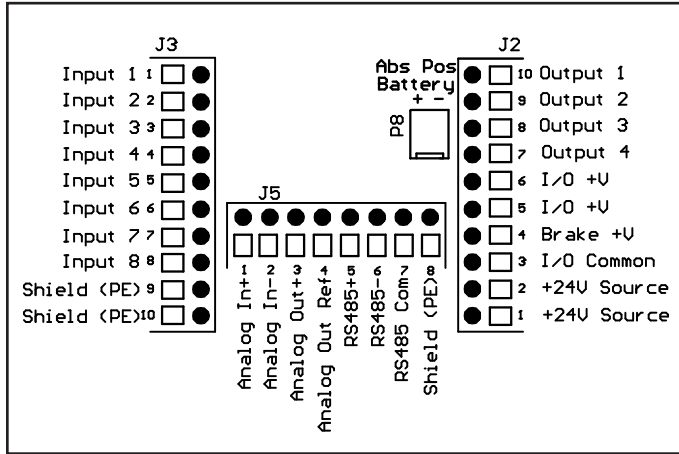


Figure 24 – SIO and Ethernet Option

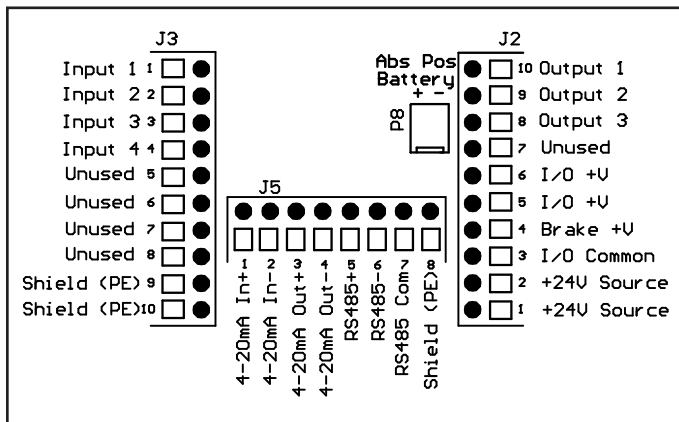


Figure 25 – IA4 Option

4.13 DIGITAL INPUTS

TTX digital inputs are single ended positive voltage inputs with negative side all to I/O Common. Standard I/O (-SIO in model) and Ethernet options have 8 inputs, and the 4-20mA I/O (-IA4 in model) have 4 inputs. Since they require a positive voltage to turn on, they are directly compatible with sourcing outputs only. The voltage for each input can be sourced from any supply with the negative side tied to I/O Common. Typically this is an external 24 V supply used for logic power and digital outputs. Each input can be assigned to any of the internal input functions using Expert software. It is important that the external power source common is connected to PE.

Where no external 24V supply is available and a local switch is desired, the standard wiring can be modified to use an internal 24V supply indirectly through a digital output. The digital output is short-circuit and overload protected. It can be configured as

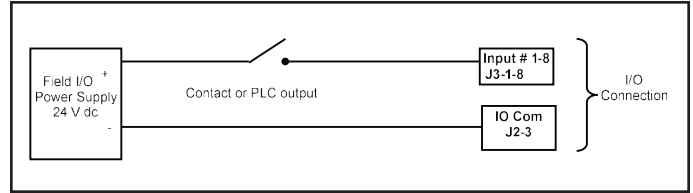


Figure 26 – Input Wiring with External 24Vdc Power Supply

“unassigned” with negative polarity and will always be in the ON state. Using the internal supply requires changing the position of a jumper on the Termination Board under the wiring access cover. I/O Power+ (“I/O+V”) must be jumpered to +24V Source (“Src+24”). Actuators ship with a jumper for this purpose parked in the two “Src+24” terminals. Do not allow the internal supply to back-power other external loads. Make no connection to I/O Connector pin 6 externally or disconnect the red wire internally from the “IO+V” terminal and tape off the end.



CAUTION! When using the internal supply with an I/O Connector, do not allow other external connections to I/O Power + connector pin 6.

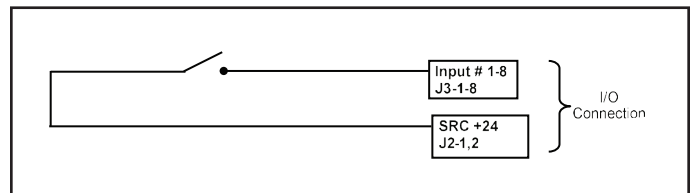


Figure 27 – Input Wiring Using TTX Internal 24Vdc Power Supply

Digital Input Specifications

Description	Specification
Absolute Max Input Voltage*	-10-40 Vdc to I/O Common
Operating Input Voltage Range	0-30 Vdc to I/O Common
On state voltage range	8 – 30 V dc
Off state voltage range	0 – 5 V dc
On state current	
10V (min)	3.3 mA
24V (nominal)	5.0 mA
30V (maximum)	5.7 mA
Effective Load Resistance (24V)	4.8 kΩ
Off state current (max)	2.0 mA
Update rate	1 ms (typical)

* Inputs are protected from switching transients. Sustained voltage outside the Absolute Max range may damage the circuit.

4.14 DIGITAL OUTPUTS

TTX digital outputs are the sourcing type with power from the I/O Power+ (“IO+V”) terminal. SIO and Standard I/O (-SIO in model) and Ethernet options have 4 outputs, and the 4-20mA I/O (-IA4 in model) have 3 outputs. The outputs have a weak pull-down resistor to I/O Common (“IOCom”) terminal just to prevent leakage current creating a floating voltage on an output. Typically power comes from an external 24 V supply used for logic power. It is important that the external power source common is connected to PE. Outputs have short circuit and thermal protection, and protection against inductive kick at turn-off. Each output can be assigned to any of the internal output functions using Expert software.

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

Where no external 24V supply is available and a local indicator or other output or local input is desired, the standard wiring can be modified to use an internal 24V supply. Note: The internal supply is limited to 600mA maximum, which is plenty unless also used to power an internal brake. The brake requires up to 500mA, leaving 100mA for remaining I/O. Using the internal supply requires changing the position of a jumper on the Termination Board under the wiring access cover. I/O Power+ (“I/O+V”) must be jumpered to +24V Source (“Src+24”). Actuators ship with a jumper for this purpose parked in the two “Src+24” terminals. Do not allow the internal supply to back-power other external loads. Make no connection to I/O Connector pin 6 externally or disconnect the red wire internally from the “IO+V” terminal and tape off the end.

CAUTION! When using the internal supply with an I/O Connector, do not allow other external connections to I/O Power + connector pin 6.

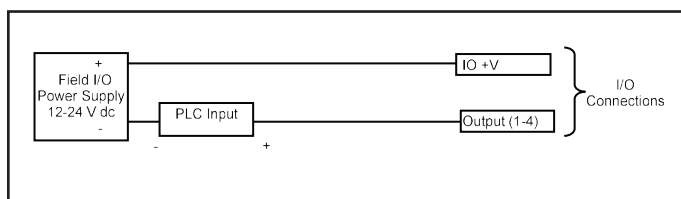


Figure 28 – Wiring of Outputs with External 24V Supply for Connection to PLC or Any Load

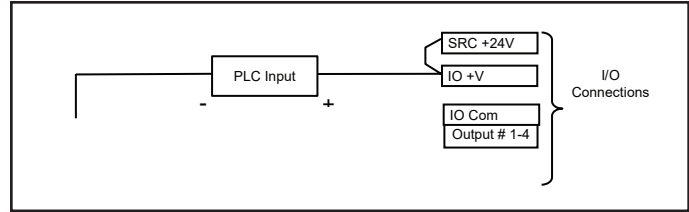


Figure 29 – Wiring of Outputs with TTX Internal 24V Supply for Connection to PLC or Any Load

Digital Output Specifications

Description	Specification
Absolute Max Voltage on Output*	-50 Vdc to 0 V measured to I/O Power +
Operating voltage range for I/O Power +	12 to 30 Vdc to I/O Common (24V ±10% with brake)
On state maximum continuous current	100 mA
On state voltage drop (@ 50 mA)	.5 V typical
Short circuit protection (auto reset)	.5 A
Update rate	1 mSec

* Outputs are protected from switching transients, including kick from ordinary inductive loads. Sustained voltage outside the Absolute Max range may damage the circuits. Note that an output should not be driven more positive than I/O Power +.

4.15 ACTUATOR BRAKE OPTION

The actuators may be ordered with a brake option. This brake is intended as a “parking brake” and must not be used as a “stopping brake” while the actuator is in motion in any normal operation. Brake operation is controlled by internal logic signals, so power for the brake is normally applied at all times and the actuator engages and dis-engages the brake. The brake engages when brake voltage is removed. Brake voltage is 24 V +/- 10%. Since “Brk+V” and “I/O+V” terminals are jumpered in standard connectorized actuators, use of a brake places an additional voltage range limitation and increased load on the I/O supply. Brake current returns through IO common.

The brake can be released without main AC power applied as long as an external 24 Vdc supply is connected to I/O Power +. It is not possible to directly release the brake unless the actuator controls are running so it is able to respond to a command to release the brake through I/O or communications.

It is worth providing details of internal brake control and how that affects motion. 24V is applied to Brake + continuously. Starting from a disabled status with brake engaged, when the actuator receives an Enable signal, it enables with a 0 velocity command which holds the motor position and applies voltage to the brake. A 0.1 sec time delay occurs before starting any motion to make sure the brake is fully released. Starting from the enabled state with the brake released or when the drive is disabled for any reason the drive will immediately apply full current to decelerate a moving motor to bring it to an abrupt stop and remove power to the brake. Then after a .1 sec delay to allow the brake to engage, the drive will be disabled. The brake can be released with the actuator disabled by turning on the Brake Override Input function. See the I/O Assignment section of the Expert Software Manual.



WARNING! If the brake is released using the Brake Override function and AC power is off or the drive is not enabled the load will be free. This may be dangerous in some applications.

If an external 24V supply is not available, an internal supply may be used to release the brake, which requires changing the position of some jumpers on the Termination Board under the wiring access cover. I/O Power+ (“I/O+V”) must be jumpered to +24V Source (“Src+24”). Actuators ship with a jumper for this purpose parked in the two “Src+24” terminals. Because there is already a jumper from one “I/O+V” terminal to “Brk+V”, disconnect the red wire to the I/O Connector from the “I/O+V” terminal and tape off the end. This also prevents the internal supply from back-powering other external loads.

Other modifications to standard wiring can provide other functionality. If a separate interlock is required to ensure that power is removed from the brake, while maintaining logic and I/O power, the jumper from “Brk+V” to “I/O+V” may be removed and a pin in the I/O Connector may be re-purposed for this.

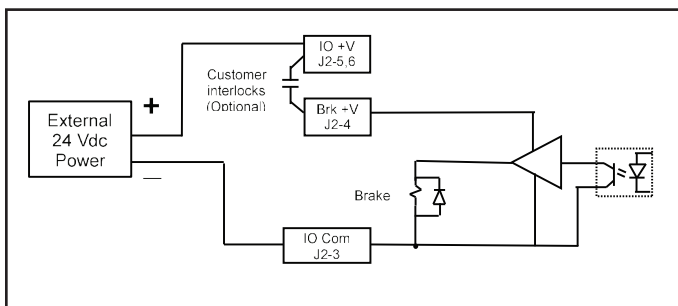


Figure 30 – Brake Connections with External 24V Power Supply

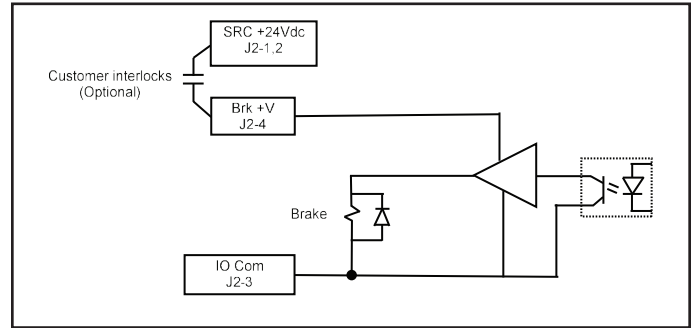


Figure 31 – Brake Connections Using TTX Internal 24Vdc Power Supply

4.16 ANALOG INPUT

An analog input is provided for use as a position, velocity or current command. It can also be used for a Velocity Override feature to dynamically moderate velocity during a move. With the 4-20mA option, the voltage input channel described here is replaced with a 4-20mA channel described in a different section.

The analog signal must be wired differentially with a return wire to the analog signal reference for best noise rejection. Differential input range is -10 V to +10 V. It is not isolated from I/O Common, but has a common mode range of at least +/-5 V, meaning that the ground reference at the analog signal source and I/O Common at the actuator can vary by up to 5V positive or negative without affecting the received signal voltage. The analog signal must be wired differentially with a return wire to the analog signal source for good noise rejection. An open circuit tends to 0 V, so it is recommended that a 0V signal produces zero command.

See Expert Software Manual for to configure the analog input, analog motion, and related parameters.

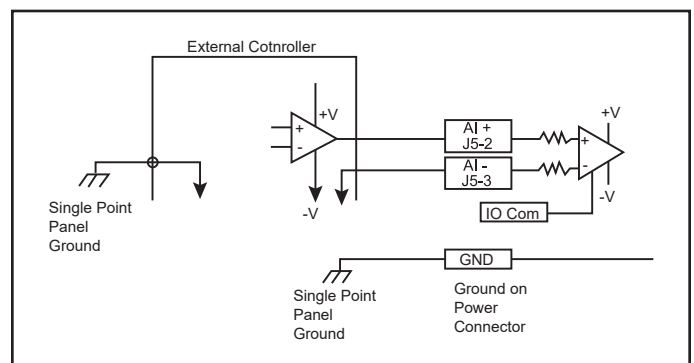


Figure 32 – Analog Input Wiring from External Controller

Analog Input Specifications

Description	Specification
Absolute Max Input Voltage *	+/- 40 Vdc to I/O Common
Differential Voltage Range	-10 V to +10 V
Analog In + Voltage Range	-15 V to +15 V
Analog In – Voltage Range	-15 V to +12 V
Input impedance	100 kΩ
Input resolution	13 bits over full -10 V to +10 V range
Update rate	0.5 ms

* Inputs are protected from switching transients. Sustained voltage outside the Absolute Max range may damage the circuit.

4.17 ANALOG OUTPUT

A 0-10 V analog output is provided. With the 4-20mA option, the voltage output channel described here is replaced with a 4-20mA channel described in a different section. The function of this output is programmable. It can be used for position, velocity or current monitoring, and can be dynamically switched between two sources.

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

The analog output signal is a voltage from the Analog OUT terminal to the Analog REF terminal. The channel is not isolated and Analog OUT is at the same voltage as the I/O Common terminal. The Analog Reference terminal should only be used when connected to an isolated input or a differential input. **DO NOT CONNECT TO A GROUNDED POINT EXTERNALLY!** A differential input should be used with this output to reduce interference from noise or differences in ground potential between opposite ends of the signals.

See Expert Software Manual for to configure the analog output, analog motion, and related parameters.

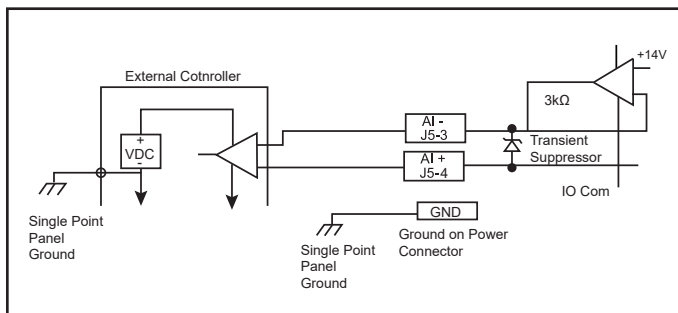


Figure 33 – Analog Output Wiring from External Controller

Analog Output Specifications

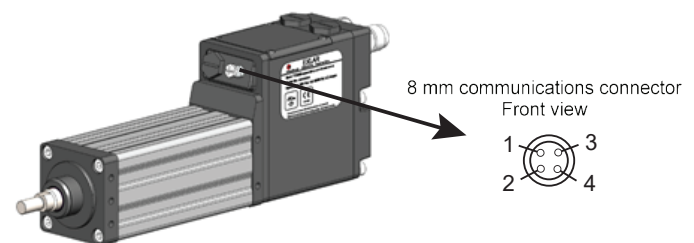
Description	Specification
Absolute Max Voltage *	-5 V to 15 V on Analog Out + +/- 5 V on Analog Ref
+/- 5 V on Analog Ref	0 - 10 V
Load Resistance	2 kΩ or higher
Output resolution	11 bits

* Circuits are protected from switching transients. Sustained voltage outside the Absolute Max range may damage the circuit. These signals are intended for connection only to higher impedance circuits.

4.18 COMMUNICATIONS

Serial communication to the actuator is provided through the 8 mm communication connector on the front of the actuator. The serial interface is two wire multi-drop RS485 and is optically isolated from all other circuits. The actuator supports Modbus RTU protocol for access to all drive parameters as described in the Tritex II Parameter Manual and Tritex Modbus Protocol Specification. Default settings for the port are: Baud Rate = 19.2k, Even Parity, Modbus device ID address = 1.

The following picture and table shows connector pin-outs. Refer to the Termination Board diagrams in the I/O Connector Wiring section for wiring to terminal block J5 under the access cover. Though in most cases only the 485+ and 485- signals are required, the 485 COM signal can enhance noise rejection if wired back to the master device signal common. The communications cable must be shielded with shield or shield drain wire connected to connector pin 2 or the connector body to meet EMC requirements.



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

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

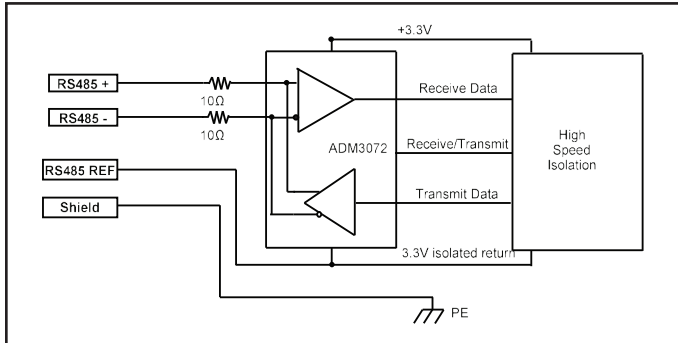


Figure 34 – Internal RS 485 Circuit

Modbus RTU is a multi-drop network, so multiple devices, some of which might not be Tritex actuators, may be connected to a single Modbus Master. Devices on any single network need to have unique Modbus Device ID's before connecting them to the network. A recommended approach to avoiding multi-drop address collisions is that in normal operation no units have Modbus Device address 1 and any spares or additions at default address 1 so that a new or replacement unit can be added and then the address changed to the operational address. Since multiple masters are not supported, it may be more convenient to configure units using Expert software before final installation.

Because Modbus RTU at speeds supported on TTX cannot be considered a high performance link, data throughput and latency issues will generally limit the capabilities of Modbus RTU as a multi-drop network. Due to biasing resistors at each node and data throughput limitations, the maximum number of devices on a network should not exceed 8. A multi-drop network can be very useful for reporting status and changing parameters dynamically for different “recipes”, or for providing a single access point for Expert software connection.

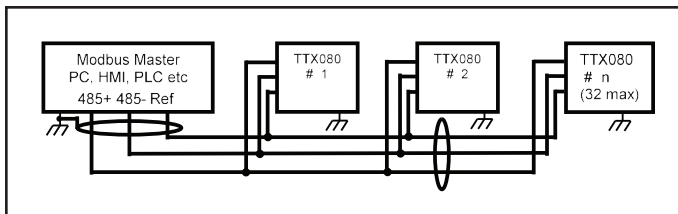


Figure 35 – Connecting multiple TTX actuators to a Modbus Master Host

In addition to the CBL-T2USB485-M8-xxx described above, the CBL-TTIOC-SMI-xxx cable assembly available in various lengths may be used to wire from the TTX080 connector to terminal blocks or screw terminal connectors. This cable is more suitable for permanent connection from one or more TTX actuators to other devices.

Cables supplied by Curtiss-Wright have the differential signal wires 485+ and 485-, the 0V reference for these signals 485 Com, and a shield. The 485 Com wire may not be needed but is recommended to reduce the effect of transients on signal quality. The 485+ and 485- signals should be a twisted pair, especially for long runs. Total RS485 cable length may be up to 100 m. Network topology is not important and termination resistors are generally not required.

4.19 IA4 OPTION BOARD CONNECTIONS

The IA4 4-20 mA I/O option board replaces the standard I/O board and provides one 4-20 mA isolated analog input and one 4-20 mA isolated analog output. These channels replace the standard Analog I/O input and output channels. The IA4 option board provides four isolated digital inputs and three isolated digital outputs, which is a reduction from the eight inputs and four outputs available on the standard I/O board. Due to space limitations, Ethernet based communications are not supported with the IA4 option, so it is not possible to combine 4-20 mA I/O channels with Ethernet based advanced communications.

The 4-20 mA input and output circuits are isolated from each other and all other circuits in the actuator, allowing unrestricted placement in any 4-20 mA loop. The isolated parts of the circuits are “loop powered” meaning that each circuit uses a small amount of power as voltage drop from the 4-20 mA loop, and uses that to generate the internal power supplies needed.

4.20 4-20 mA INPUT

As with the voltage analog input, the 4-20 mA input may be used as a position, velocity or current command. It can also be used for a Velocity Override feature to dynamically moderate velocity during a move.

The 4-20mA input circuit requires a minimum of 11 V of available loop voltage to operate. There is a fixed 5.6V drop plus 258 Ohms of loop resistance. The circuit reaches full accuracy when the input reaches 3 mA. Except during power-up and power-down, keep the signal presented to the input circuit between 3 mA and 21 ma. Loss of Signal settings are generally set a little below 4 mA and a little above 20 mA. If there is too

little voltage to power all devices in a 4-20 mA loop, the actual current will reach a maximum below the intended current. The TTX080 input channel will continue to report the actual current, if over 3 mA.

When the 4-20 mA loop is unpowered, the software reads an off-scale low value near 2 mA, not 0 mA. A signal with current above a value near 22 mA will also read as 2 mA. Therefore it is important to consider what should be done when an out of range signal is encountered.

The 4-20 mA input circuit is calibrated at the factory for accuracy and should not be recalibrated without proper equipment. Often what is desired is to match the source value before converting it to a 4-20 mA signal to the value used in the actuator. Rather than re-calibrating, this can be adjusted using scaling in either of two places using Expert software. The analog input is not used directly, but is converted to a 0% to 100% value on the IA4 Option Board page, Input Setup tab. This is the best place to make small scaling adjustments. The value is scaled again into position, velocity, or current units where used

4.20.1 4-20 mA Input Connection

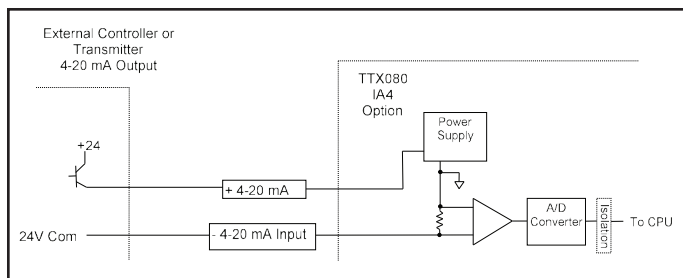


Figure 36 – Connection to High Side Controller

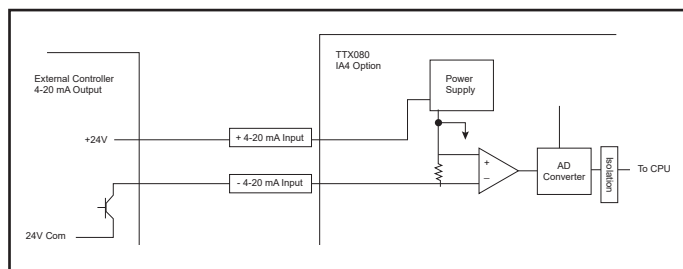


Figure 37 – Connection to Low Side Controller

4-20 mA Input Specifications

Description	Specification
Input Range	3 mA to 21 mA
Voltage drop at 20mA	11V max
Input Accuracy	+/-0.1 % of 4-20 mA span
Input Resolution	>14 bits over 4-20 mA span
Update Rate	0.5 ms

4.21 4-20 mA OUTPUT

The 4-20mA output channel, like the voltage Analog Output may be configured for position, velocity or current monitoring, and can be dynamically switched between two sources. Details for configuration are in the Expert Software Manual.

The 4-20 mA output is an isolated two wire circuit requiring an external loop power supply. The TTX080 circuit requires a minimum of 8 V to operate and can tolerate up to 30 V. The best approach to determining whether a particular loop will have enough voltage is to determine the voltage required for each device in the loop at 20 mA and make sure the loop power supply has enough voltage. If using a typical 24V source for the loop and having only one input device along with the Tritex output, it would be highly unusual for a loop to run out of voltage. However, if an output of 20 mA is expected from the Tritex and the actual loop current is less, check that there is enough loop voltage. If the 4-20 mA input circuit appears as a resistance, the maximum resistance that may be used depends the loop supply voltage. It is possible to convert the 4-20 mA signal into a voltage by running it through a precision resistor.

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

If the TTX actuator is powered down, the isolated part of the 4-20 mA output circuit could remain active since it is powered separately. A watchdog feature sets the 4-20 mA output to an off-scale low output of approximately 2mA when actuator main and logic power are removed.

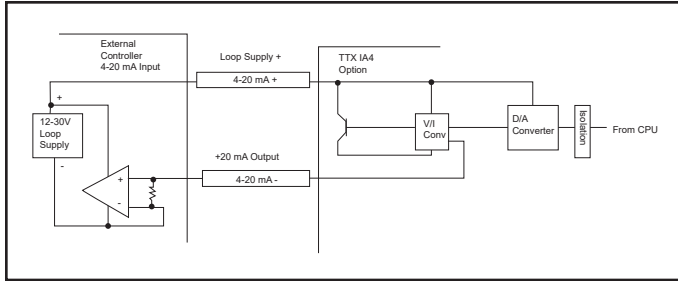


Figure 38 – 4-20mA Output Connection

4-20 mA Output Specifications:

Description	Specification
Output Current Range	3 – 21 mA
Load Range	200 to 1100 Ω (see table above)
Output Accuracy	+/-0.2% of span
Output resolution	12 bits
Update rate	0.5 ms

4.22 ABSOLUTE FEEDBACK

The TTX080 comes standard with multi-turn absolute position feedback. The system consists of a base magnetic feedback system that is always absolute over one turn and a low power battery-backed multi-turn counter. The counter will track the motor’s position, as long as battery voltage is present. Multi-turn absolute feedback allows a system to be powered off and re-started without having to re-establish a position reference through a Home move or manual positioning, even if a machine is packed up and relocated.

The multi-turn absolute position feature can be disabled and the low battery condition ignored, if desired. The battery can then be removed eliminating the need for any battery maintenance. Keeping I/O power on continuously can also maintain a position reference under most conditions and provides some other advantages in a system.

4.23 BATTERY LIFE INFORMATION

Battery Life is typically 2 years from time of product purchase.

4.23.1 Low Battery Voltage

When the battery voltage gets below 3 V, a low battery condition will be set. This condition is typically set to generate a warning status on the Fault Enable tab of the System Setup page. The

warning status can then be assigned to one of the outputs. The battery voltage can be displayed on the Diagnostic page while on-line with the actuator, or read by any communications connection.

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. A low or dead battery does not keep the system from running it just means a Home will required after a power-down.

4.23.2 Replacing the Battery



WARNING! High Voltage is present under wiring access cover. Isolate AC power to actuator and wait 3 minutes for stored energy to discharge before removing cover.

After removing AC power to actuator, remove the wiring access cover. To avoid loss of absolute position information if that is important, apply I/O power before disconnecting the battery. If not permanently connected to external I/O power, a temporary connection can be made at the terminals on the Termination Board. Unplug the two pin battery connector from the Termination Board and pull the battery out of the clip. The replacement battery kit is Exlar P/N 54108. Center the replacement battery on top of the clip and gently push it into the clip with a little rolling motion. Then route the battery wires away from the AC power wires and plug the two pin connector

4.24 ETHERNET OPTIONS, EIP, TCP OR PROFINET IO

The Ethernet Options EIP, PIO, or TCP in the model mask provide an Ethernet rated M12 connector for connection to the Network at the rear of the actuator.

An IP 67 4-pole M12 D coded connector is used, this type of connector must only be used with two pair cables. When the Ethernet connection is made via an Ethernet switch or hub a straight through cable set must be used. If there is a single node connection direct from the Ethernet PC/PLC to the TTX080 then a crossover cable may be required. Some PC Ethernet cards have capability to detect a crossover connection. See Expert Software manual for setup of TTX080 Ethernet parameters and Ethernet/IP or ProfiNet IO manuals for network specific setup information.

Cord sets

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

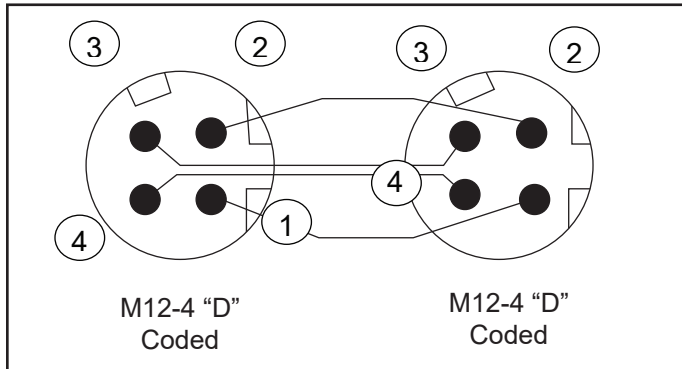


Figure 39 – M12 D Coded Straight Through Cord Set

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

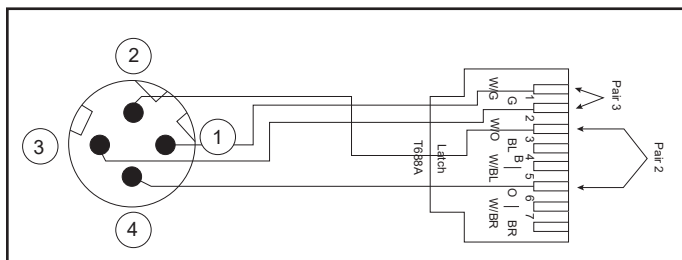


Figure 40 – Conversion from M12 D Coded to 8 Way Modular Straight Through Cord Set

For Options EIN, PIN or TCN in the model mask the M12 connector is not included; the Ethernet CAT 5 cable must be routed through the M20 IO port. The installer must then crimp on an RJ45 8 way Modular connector for installation to Ethernet port inside the wiring access area.

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

4.25 SHIELDED OR UNSHIELDED CABLES

The TTX080 can be used with either shielded or un-shielded Ethernet cables. If a shielded cable is used it is important that the shield is not connected at the TTX080 M12 end of the cable. Off the shelf shielded Ethernet cables with M12 connectors usually connect the shield through the M12 connector coupling nut, be sure the shield is not connected to the TTX080 end of the coupling nut. The TTX080 M12 connector is in direct contact with the enclosure which is connected directly to PE. Typically the shield should be connected to PE at the switch or hub end only. Connecting the shield at both ends can cause ground loop noise on the shield which can degrade communication performance.

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

5.0 STARTUP

5.1 CONSIDERATIONS FOR STARTUP

5.1.1 Safety Considerations



WARNING! NEVER attempt to connect or disconnect the actuator with power applied. Many amplifiers have voltage present after incoming power is removed. Ensure that the amplifier has discharged all power.



CAUTION! Do NOT exceed the maximum input voltage for TTX Series AC powered actuators (240 Vac).

5.1.2 Rotary-to-Linear Motion Relationship

The relationship between the rotary motion of the motor and the linear motion of the actuator is based on the following parameters:

$$L_D = \text{Rev} \times R$$
$$L_S = [\text{RPM}/60] \times R$$
$$L_F = [T \times (2p \times E/R)]$$

where:

E = Efficiency

L_D = Linear distance traveled

L_S = Linear speed

L_F = Linear force

R = Roller screw lead

REV = Motor revolutions

RPM = Motor revolutions per minute

T = Motor torque

NOTE: Each of the above relationships requires proper anti-rotation of the actuator rod.

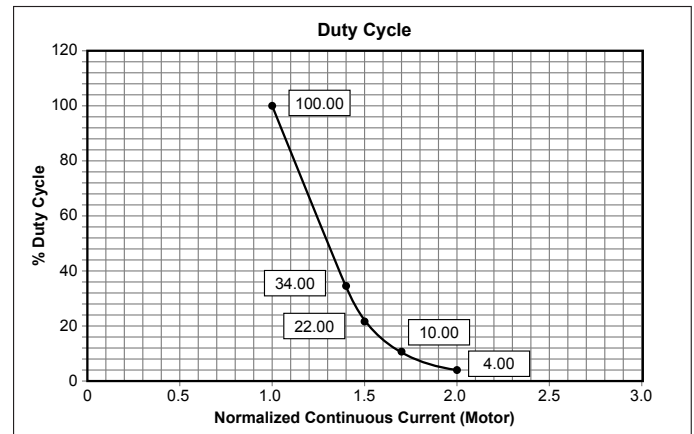
5.2 GENERAL STARTUP PROCEDURE

IMPORTANT! Exlar recommends testing new systems prior to live operation (see Expert Software manual for startup procedure).

1. A CD is provided with each actuator and contains the Expert software and manual. The software is also available to download from www.exlar.com.
2. The Expert software will need to be installed on your PC.
3. Follow the software installation and setup instructions contained in the Expert Software manual.

NOTES:

- TTX Series actuators can be operated at current levels two times the current rating for short amounts of time.
- When operating the actuator in the peak current range, follow the duty cycle limits shown in below.



Duty cycle for peak current operation

6.0 MAINTENANCE PROCEDURES

6.1 LUBRICATION

TTX Series actuators lubricated with grease require periodic inspection and renewal of the bearing and roller screw grease to maximize actuator life. Maintenance indicators during a physical inspection include:

- Contamination of grease with foreign matter
- Leaking seals
- “Burnt” smell of the grease
- Grease is gritty in appearance
- Grease is dehydrated (dried out)

Although application-specific performance makes it difficult to provide an exact number of hours of operation before maintenance is required, the following factors will help determine lubrication maintenance cycles.

Temperature – Temperature is the most significant factor affecting grease life. Exlar’s testing of Mobil SHC 220 synthetic grease indicates ideal performance operation in ambient temperature ranging from 32° C to 55° C (90° F to 130° F). Within this temperature range, the grease has a long service life. Operation in temperatures above this range decreases the effective grease life. For every temperature rise of 15° C (60° F), grease life is reduced by approximately 50%.

Speed – The rotational speed of the actuator will generate heat (thus raising the grease temperature) and potentially resulting in lubricant being thrown off the roller screw.

Load – Load contributes to the stress applied to the roller screw mechanism and the pressure applied to the grease thus impacting the overall lubricant life and relubrication interval. Load directly impacts the amount of power put into the actuator adding to the heat generated by roller screw speed. This heat is transmitted to the lubricant eventually separating the oils from the thickener and reducing grease life.

Orientation – Gravity can cause grease migration over time, especially in vertical applications at elevated temperatures. The table below provides a general guideline for recommended lubrication renewal cycles.

RMS Rotational Speed (RPM)	Recommended Grease Renewal Period (hours)		
	Case Temp. 65° C (149° F)	Case Temp. 80° C (176° F)	Case Temp. 95° C (203° F)
250	10,000	5,000	2,500
500	8,500	4,250	2,125
1000	6,000	3,000	1,500
1500+	3,500	1,750	875

Recommended lubrication renewal cycles

Grease renewal procedure

1. Remove the four bolts connecting the faceplate and any mounting accessories from the front of the actuator.
2. Remove the roller screw by turning it counter clockwise and threading it out of the cylinder. To remove the screw, it may be necessary to hold the roller screw cylinder to keep it from turning. Turning the shaft will help force the faceplate assembly to break free of its housing.
3. Use a brush to work approximately 10 cm³ (0.6 in³) of grease into the roller screw assembly for every 100 mm (3.9 in) of stroke length. Be sure all the threaded surfaces of the screw assembly are covered. 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. **IMPORTANT!** Excess grease does not improve lubrication and requires greater torque when the motor is returned to operation.
4. With the actuator in the vertical position and 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 roller screw cylinder.
5. Slowly turn the roller screw clockwise in ¼- to ½-turn increments while maintaining contact with the interior threaded cylinder (ITC). This helps align the threads on the roller screw with the threads in the ITC. Do NOT force the roller screw into the cylinder.

If the roller screw does not turn freely, remove it and begin again. When the screw is properly threaded into the cylinder, it will roll freely into the actuator. **NOTE:** When the roller screw reaches the portion of the cylinder that contains the motor magnets, it 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 until it reaches the bottom (it will become difficult to turn and the motor and bearings will begin to rotate with it).

6. Place a small amount of seal lubricant on the inside surface of the seal/bushing assembly.
7. Carefully slide the faceplate over the actuator rod end while guiding the four cap screws through their respective holes in the rear end cap of the actuator. Ensure the faceplate seats completely and squarely on the front of the actuator. **NOTE:** The seal is a tight fit on the rod end. Use caution to avoid damaging the seal on the threads of the extending rod. The inner surface of the faceplate provides the pre-loading for the bearings, so it is important that it be properly seated. Torque the four cap screws of the faceplate assembly to 12.2 Nm (9 ft-lb).
8. For actuators equipped with an external anti-rotate mechanism and/or limit switch assembly, slide the rod of the anti-rotate mechanism rod into the guide bushing. Tighten the two screws used to hold the anti-rotate assembly or the four screws used by the limit switch assembly to clamp that assembly to the actuator rod.

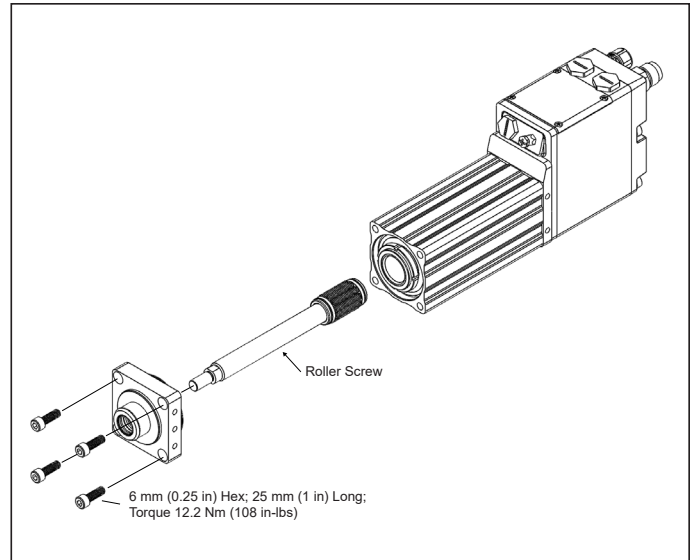
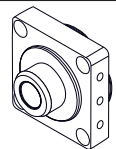


Figure 41 - Grease renewal reference

6.2 SEAL MAINTENANCE

Exlar recommends that the faceplate assembly containing the main rod seal and bushing assembly be replaced during the re-lubricating procedure. To have this service performed for you, contact the Exlar Returns Department to send your unit in for service (see Section 9.0, “Product Returns”). If any additional maintenance or repair is needed, consult Exlar. It may be necessary to return the actuator to the factory for refurbishment.

6.3 REPLACEMENT FACEPLATE ASSEMBLY KIT

Faceplate	Model	Part Number	Parts Included
	TTX080	PN 71457	Faceplate, O-ring, bushing, seal, wiper, and fasteners

Faceplate Assembly Kit

7.0 TROUBLESHOOTING

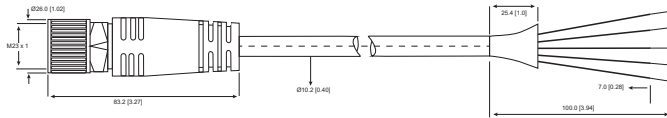
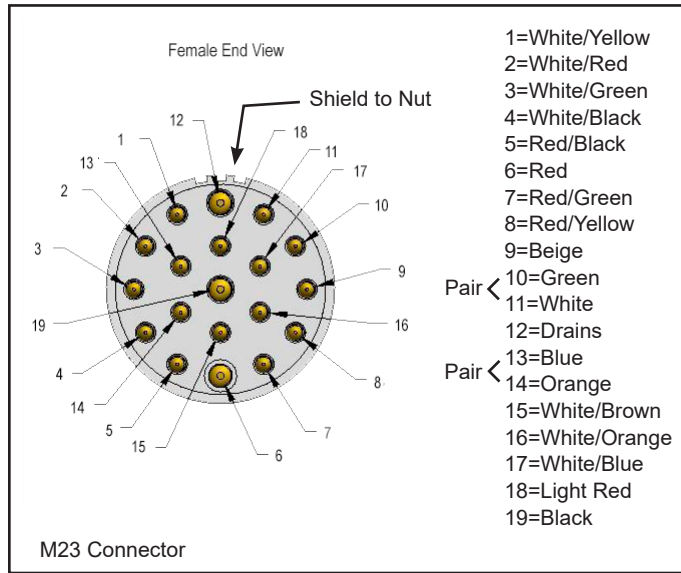
TTX Series actuators are engineered for years of trouble-free operation. If problems are encountered while installing or using the actuator, the information in the guidelines below may help solve the problem.

Troubleshooting guidelines

Symptom / Trouble	Possible Cause / Troubleshooting Procedure
No response from actuator.	<ol style="list-style-type: none">1. Connect to Expert software and check operating mode, fault, and status information2. Check for proper wiring
Actuator cannot move load.	<ol style="list-style-type: none">1. Load is too large for the capacity of the actuator or too much friction is present2. Excessive side load3. Misalignment of output rod to load
Actuator housing moves or vibrates when shaft is in motion.	<ol style="list-style-type: none">1. Check actuator mounting. Insure that the actuator is securely mounted2. Check tuning
Output rod rotates during motion and thus does not provide proper linear motion.	<ol style="list-style-type: none">1. Install Exlar anti-rotation assembly or incorporate anti-rotation into the application
Brake does not hold load in place.	<ol style="list-style-type: none">1. Load is larger than the capacity of the brake-check load level against actuator rating2. Brake is being used as other than a power loss holding brake and now is worn out
Actuator is overheating.	<ol style="list-style-type: none">1. Insufficient cooling for application requirements2. Actuator is being operated outside of continuous ratings3. Amplifier is poorly tuned causing excessive unnecessary current to be applied to motor. Refer to tuning information through Expert software

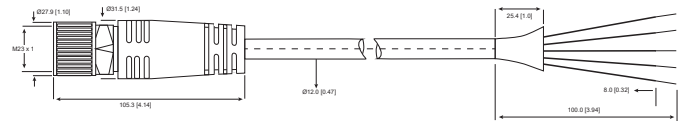
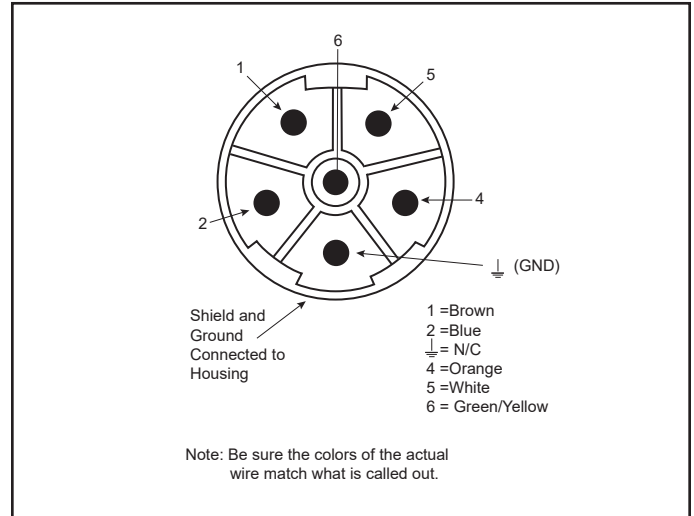
8.0 CABLE ACCESSORIES

8.1 TTIOC-xxx I/O CABLE



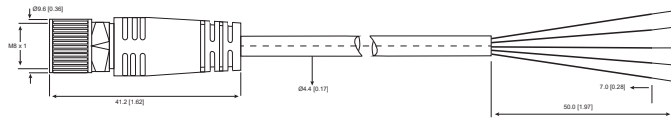
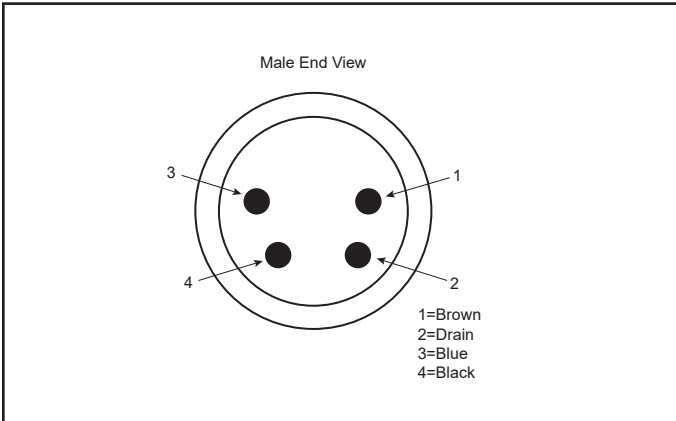
Specifications	
Contact Carrier Material / Color	Nylon or PBT / Gray
Molded Head Material Color	Thermoplastic Pur / Black
Contact Material / Plating	Brass / Gold
Coupling Nut Material / Plating	Brass / Nickel
Rated Current [A]	3.0 A
Rated Voltage [V]	150 V
Outer Jacket Material / Color	PVC / Black
Conductor Insulation Material	PVC
Number of Conductors [AWG]	18 X 22 AWG / 2X22 AWG Drain
Shield / Braid	Aluminum Foil Shield / T-C Braid
Temperature Range	-40°C to +105°C (-40°F to +221°F)
Protection Class	IEC IP67

8.2 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 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

8.3 TTICO-xxx COMMUNICATIONS CABLE



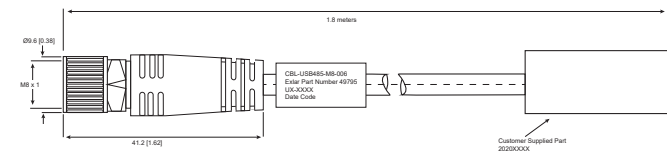
Specifications	
Contact Carrier Material / Color	Nylon or PUR / Black
Molded Head Material Color	Thermoplastic Pur / Yellow
Contact Material / Plating	Brass / Gold
Coupling Nut Material / Plating	Brass / Nickel
Rated Current [A]	2.0 A
Rated Voltage [V]	125 VAC / VDC
Outer Jacket Material / Color	PUR / 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 & IEC IP67

Communication Converter

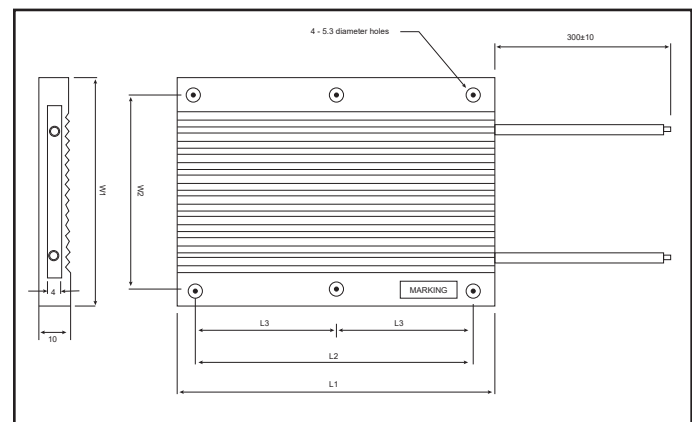
When connecting the TTX080 RS485 port to PC, a communication converter will typically be required.

Exlar offers a USB to RS485 converter with an M8 connector ready to connect to the TTX080 port. Model # CBL-T2USB485-M8-xxx. This converter is not isolated and is not recommended for permanent installation.

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



8.4 T2BR1 BRAKING RESISTOR



Dimensions

Model	Dimensions (mm)				Weight (g)
	L1 ±1	L2 ±0.3	W1 ±0.3	W2 ±0.3	
ULN100	120	100	60	50	160

9.0 PRODUCT RETURNS

Procedure to return products for repair or replacement:

1. Before requesting an RGA number, please contact Exlar Technical Support to see if it is possible to resolve the issue prior to return.
2. If it is determined that an RGA number is required, please do so by completing an online RGA request form found on the Exlar website. For 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.

Input Voltage (all models): 240 VAC, 1 Φ , 50/60 Hz

Drive/Motor Model	Stator "X" in the part numbers	Input Continuous Current (Arms)
TTX080-xxxx-xx- "X"-x-x-A-xxx-x-x-x	Where "X" is "4" for Universal speed winding	4.3
TTX080-xxxx-xx- "X"-x-x-A-xxx-x-x-x	Where "X" is any alphanumeric character. Reserved for future winding(s)*	See label for continuous current rating

* TTX080 label and ratings will change per the winding used:
Whereas: X – Indicates stator winding code 4 or L or 2 any other alphanumeric character (indicates future winding).

10.0 CERTIFICATIONS

10.1 UNDERWRITERS LABORATORIES UL RECOGNIZED



TTX080 Linear Actuators are marked "UL Recognized" after passing a rigorous set of design and testing criteria developed by Underwriters Laboratories.

The safety standards used to are:

- UL 1004-1, Rotating Electrical Machines – General Requirements.
- UL 1004-6, Servo and Stepper Motors.
- UL 1004-3, Thermally Protected Motors.
- CSA C22.2 No. 100-14, Motors and Generators.
- CSA C22.2 No. 77-14, Motors with Inherent Overheating Protection.

This UL logo indicates that UL certifies this product is certified for use in both the United States and Canada. To be safe and maintain this certification it must be installed according to the installation instructions and used in the conditions of acceptability required by UL.

The conditions of acceptability required for UL are:

- Drive input maximum continuous operating ratings:

- Full load ratings are at a maximum surrounding air temperature of 40°C.
- Suitable for use on a circuit capable of delivering not more than 10,000 rms symmetrical amperes, 240 Volts maximum when protected by Class CC or Class RK1 fuses, or when protected with by a Class RK1 or Class CC fuse or Inverse Time Circuit Breaker, rated at 15 Arms.
- 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.
- Use 14 AWG wire with insulation rated for 105°C input power and PE terminals.
- Multiple connection options covered in the model mask nomenclature in the report.
- The suitability of or need for an ultimate enclosure shall be determined in the end use.
- The suitability of motor mounting means, motor leads, strain relief, and lead terminations must be evaluated for each end use.
- The motors covered in this certification report employ a Class H insulation system.
- The motors covered in this report are thermally protected and been evaluated both for Locked Rotor and Running Heating Protection.
- The motors are equipped provided with protection features included in the integral controller which require user interaction to reset, therefore the protection is considered manual reset for this recognition.

10.2 UL CERTIFICATE OF COMPLIANCE FOR UNITED STATES AND CANADA

CERTIFICATE OF COMPLIANCE

Certificate Number 20181129-E353255
Report Reference E353255-20180119
Issue Date 2018-NOVEMBER-29

Issued to: EXLAR CORP
 18400 W 77TH ST
 CHANHASSEN MN 55317-9257

This certificate confirms that representative samples of COMPONENT - ELECTRONICALLY PROTECTED MOTORS WITH INTEGRAL CONTROLLERS FOR INDUSTRIAL USE
 See Addendum Page for Models

Have been investigated by UL in accordance with the component requirements in the Standard(s) indicated on this Certificate. UL Recognized components are incomplete in certain constructional features or restricted in performance capabilities and are intended for installation in complete equipment submitted for investigation to UL LLC.

Standard(s) for Safety: See Addendum Page for Standards
Additional Information: See the UL Online Certifications Directory at <https://iq.ulprospector.com> for additional information.

This Certificate of Compliance does not provide authorization to apply the UL Recognized Component Mark.
 Only those products bearing the UL Recognized Component Mark should be considered as being UL Certified and covered under UL's Follow-Up Services.
 Look for the UL Recognized Component Mark on the product.

Bruce Mahrenholz
 Bruce Mahrenholz, Director North American Certification Program
 UL LLC
Any information and documentation including UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL. For questions, please contact a local UL Customer Service Representative at <http://ul.com/about/contact>.



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CERTIFICATE OF COMPLIANCE

Certificate Number 20181129-E353255
Report Reference E353255-20180119
Issue Date 2018-NOVEMBER-29

This is to certify that representative samples of the product as specified on this certificate were tested according to the current UL requirements.

Electronically Protected (for Industrial Use) Class H Insulated Servo motors:
 TTX080 Series Linear Actuators, TTX080-###-X-#-A-###-#

X – indicated stator winding code, maybe any alphanumeric character.
 # – Represents a single alphanumeric character, indicating exterior mechanical, shaft/thread, and cosmetic configurations

UL 1004-1, Rotating Electrical Machines – General Requirements
 UL 1004-6, Servo and Stepper Motors
 UL 1004-3, Standard for Thermally Protected Motors
 CSA C22.2 No. 100, Motors and Generators
 CSA C22.2 No. 77, Motors with Inherent Overheating Protection

Bruce Mahrenholz
 Bruce Mahrenholz, Director North American Certification Program
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10.3 CE DECLARATION OF CONFORMITY



The TTX080 Linear 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 standards, and electromagnetic immunity and emissions (EMC) standards when installed according to the installation instructions. It also indicates conformance to the Reduction of Hazardous Substances 2 (RoHS) requirements.

The conditions of acceptability required for CE are:

- Drive input maximum continuous operating ratings:

Input Voltage (all models): 240 VAC, 1 Φ , 50/60 Hz

Drive/Motor Model	Stator “X” in the part numbers	Input Continuous Current (Arms)
TTX080-xxxx-xx-“X”-x-x-A-xxx-x-x-x	Where “X” is “4” for Universal speed winding	4.3
TTX080-xxxx-xx-“X”-x-x-A-xxx-x-x-x	Where “X” is any alphanumeric character. Reserved for future winding(s)*	See label continuous current rating

- Full load ratings in the table above are at a maximum surrounding air temperature of 40°C.
- This product is suitable for use on a circuit capable of delivering up to 10,000 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 Arms.
- IP65S rating: To maintain IP ratings, all electrical connectors and ports must be connected using sealed connectors or capped.
- Field installation power connection wires: Use 2.5mm² copper wires with 300 VAC minimum and 105° C minimum rated insulation.
- Because the power electronics has earth leakage “touch current” greater than 3.5 mA, redundant PE connections are required using 2.5mm² conductors. The power connector has pin 6 wired to an internal PE terminal and pin 3 connected to the case through the connector body. Both are to be used. For other wiring methods, two conductors must be used and connected to the two PE terminals. Note: A single conductor (not part of a cable assembly) that is not protected from mechanical damage must be 4.0 mm² size.

- All cables except optional Ethernet cable must have overall shields, with the shield connected to the case at the cable entry point.
- 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.

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

EU Declaration of Conformity

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

<p><i>The undersigned, representing the Manufacturer</i> Exlar Corporation 18400 West 77th Street Chanhassen, MN 55317 USA</p>	<p><i>and the authorized representative established within the community</i> Exlar GmbH Frankfurter Str: 107 65479 Raunheim, Germany</p>
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Declares, that the Exlar Brand Products:
TTX Powered Linear Actuators

(Complete Model Listing Below)
Model identification:
TTX080-xxx-xx-x-x-A-xxx-x-x

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

Per directives listed below:


*EU EMC Directive 2014/30/EU
EU Low Voltage Directive 2014/35/EU
EU RoHS Directive 2011/65/EU and amended with Directive 2015/863*

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: 2018

Signature: 

Name: Robert Panning
Position: Manager Product Development, Engineering
Date of Issue: July 10th, 2018

NOTE: TTX Series actuators that are intended as components in a third-party machine in which the enclosure and assembly will affect the EMC emissions, are covered by the EMC standard that relates to the final product.

Per EU directives implemented on April 20th, 2016, the following procedures must be followed by importers and distributors.

IMPORTER REQUIREMENTS

- Importers shall indicate their name, registered trade name or registered trade mark, and the postal address at which

DISTRIBUTOR REQUIREMENTS

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

11.0 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 and tracked by individual product serial number.

Exlar Corporation (“Exlar”) 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.

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.

About Curtiss-Wright Commercial / Industrial Segment

Curtiss-Wright provides highly engineered products and services with a focus on advanced technologies for high performance platforms and critical applications. Our technological expertise spans decades of innovation and we have compiled an extensive portfolio of critical technologies serving commercial, defense, energy and industrial markets. Our technologies, some that are sole source or first-of-a-kind, achieve the demanding performance levels required for optimal safety, performance and reliability in difficult “must not fail” applications.

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