# GSX and GS SERIES LINEAR ACTUATOR INSTALLATION AND SERVICE MANUAL

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**Please visit www.exlar.com for information pertaining to connectors and cables.**

# 1.0 INTRODUCTION

## 1.1 Warranty and Limitation of Liability

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 in accordance with Exlar's specifications for the product(s) as published at the time of purchase unless otherwise agreed to in writing by an authorized Exlar representative. In no event, however, 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 at www.exlar.com), 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. Uses of components under load to the extent of their expected life according to typical ratings are not covered by this warranty. Any damage due to excessive loading is not covered by this warranty.

Costs for shipment of units returned to the factory for warranty repairs are the responsibility of the customer. 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 customer.

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.

## 1.2 Safety Considerations

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

**CAUTION** 

**WARNING** 

Pay particular attention to these paragraphs. They are intended to provide you with helpful information to ensure safe and trouble-free installation.

# 2.0 SYSTEM CONFIGURATION

## 2.1 GS/X Series Actuator System Configuration

GS/X Series actuators incorporate an integral brushless servo motor. The design of this motor and selection of the proper feedback configuration allows GS/X Series actuators to be powered by nearly every brand of brushless motor amplifier on the market.

This flexibility allows GS/X Series actuators to be incorporated into the highest performance single and multi-axis motion control systems in use today. In applications varying from food and beverage packaging to multi-axis turning centers to aircraft assembly, the GS/X Series of actuators show incredible performance and durability.

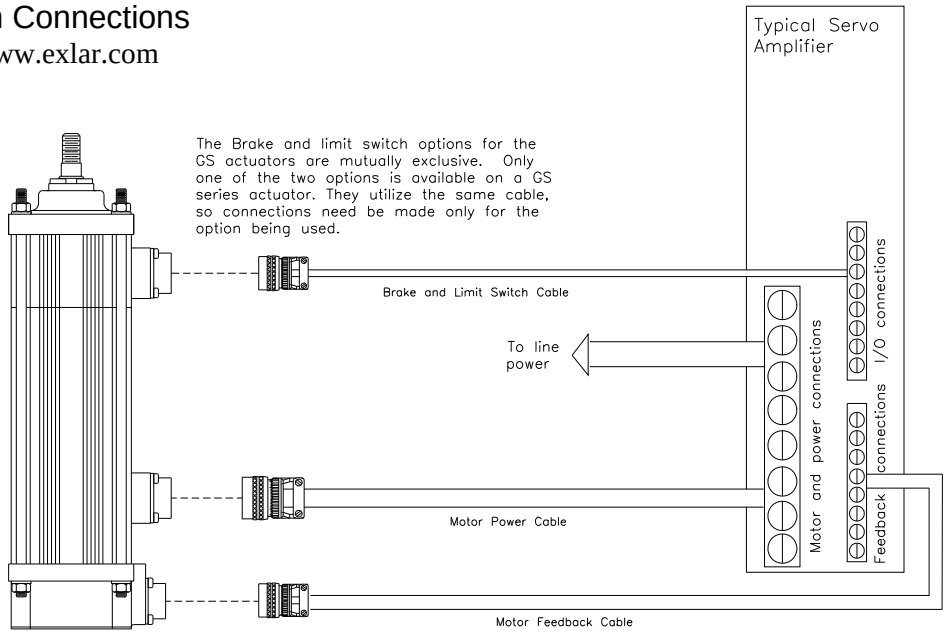
The high torque to volume ratio available from a brushless motor, combined with the robust, high speed and high load capability of the planetary roller screw, make the Exlar line of linear actuators a true, all electric replacement for cumbersome high maintenance hydraulics. The use of electronic servo control provides simpler set up and more precise control than hydraulic systems as well. Shown below is a typical single axis system incorporating an Exlar GS/X Series actuator and a brushless motor amplifier.

Each brand of brushless motor amplifiers may have unique wiring requirements, parameter settings and operational principles that affect how the actuator operates. The drawing on the following page shows general connection principles for typical resolver and encoder feedback amplifiers. Details on connections to specific brands of amplifiers can be obtained from www.exlar.com.

**WARNING: Attempting to connect the power cable to the motor feedback connector may cause damage to the connector. Verify that pin patterns match before attempting to connect cables to actuator.**

**Never attempt to connect or disconnect the actuator with power applied. Dangerous voltages are present. Damage to equipment and injury to personnel can result. Many amplifiers have voltage present for a considerable time period after incoming power is removed. Take care to insure that the amplifier has discharged all power.**

Typical System Connections
(Please refer to www.exlar.com



## 2.2 Standard Actuator Pin-outs and Connections

Please refer to www.exlar.com.

## 2.3 Feedback Information

Most GS/X Series actuators incorporate a 2 pole resolver or quadrature incremental encoder with commutation signals as the primary rotary feedback device. The selection of this feedback device is dictated by the amplifier used to operate the actuator. This amplifier is indicated in the model number of the GS/X Series actuator as a 3 digit code.

Each amplifier has specific requirements for the feedback on the motor. Not all resolver-based amplifiers can use the same resolver, resolver alignment, or relative direction of resolver rotation. Not all encoder-based amplifiers can use the same encoder, encoder alignment or relative direction of encoder rotation.

Many amplifiers offer software that allows the entering of parameters or the downloading of "motor data files" that dictate how the feedback must be set up on the motor. Exlar can provide many of these "motor files" or the proper parameters to enter. Entering motor parameter data to some amplifiers may require assistance from the amplifier manufacturer.

### Feedback Alignment

When Exlar manufactures a GS/X Series actuator, the proper feedback is selected, mounted, aligned and test run on the amplifier that the customer plans to use, or one that is known to be equivalent for confirming proper feedback alignment and operation. In any case where it is determined that the feedback has become misaligned, or an amplifier change is made requiring the feedback to be aligned differently, it is recommended that Exlar be contacted and arrangements made to have that procedure performed.

### Feedback Wiring

The wiring of the feedback device is critical to the operation of the actuator with the selected amplifier. Improperly wiring the feedback cable can cause unstable operation, incorrect operation or no operation at all. In some cases, improper current limits set in the amplifier, along with incorrect wiring of the feedback cable can lead to damage of the motor.

### Resolvers

A resolver is a non-electronic device that works like a small transformer. When rotated, it generates two sine waves that are out of phase with one another. By decoding these two sine waves, the amplifier can monitor the direction, revolutions traveled, and speed of rotation of the motor. Each sine wave typically represents one revolution of the motor, so the amplifier can also use these signals to know where the motor is within that revolution. By knowing the motor's position, the amplifier can properly time the supply of current and voltage to the motor for it to rotate. This process is ***commutation.*** For the amplifier to properly commutate the motor, it must have a reference, or zero, point from which to track the motor's rotation. This reference point is critical, and is provided to the amplifier through the proper alignment of the resolver to the phases of the motor during the actuator assembly.

### Encoders

An incremental encoder is an electronic rotary device that transmits a string of electrical pulses when rotated. Most brushless motors or servo systems that use incremental encoders use what is called a quadrature encoder. Typical brushless motor encoders use two data channels labeled A&B to provide direction, velocity and position information. The Channel labeled I or Z has one pulse per revolution and is called the index. The channels labeled as hall signals or commutation signals are typically labeled S1, S2 & S3; Hall 1, 2 & 3; or Hall A, B & C, depending on the manufacturer's conventions. These signals give the amplifier the commutation information that it needs to properly rotate the motor.

**GS/X Series Feedback Devices**

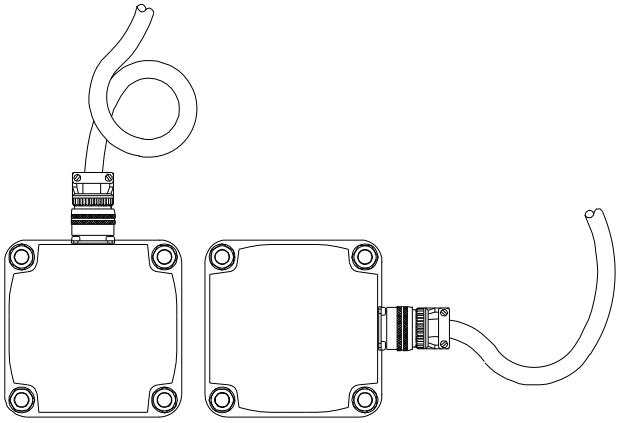
Standard GS/X Series actuators use either resolvers or encoders as their primary feedback device. Depending on the amplifier that will be used to operate the actuator, the hookup of the actuator can vary. Always consult Section 7.0 for proper wiring, or contact Exlar for the correct wiring details.

## 2.4 Cable Routing

Over time, liquid contaminants such as oil and cleaning solutions will run down the cables and into the connectors if they are of an exposed type. To minimize the introduction of contaminants to the connector, route the cables so that there is a loop in the cable just prior to its attachment to the connector.

Two examples are shown below depending on the orientation of the connectors. Units mounted in such a way that the connectors are on the bottom surface of the actuator require no looping.

**Top Mount Loop**



**Side Mount Loop**

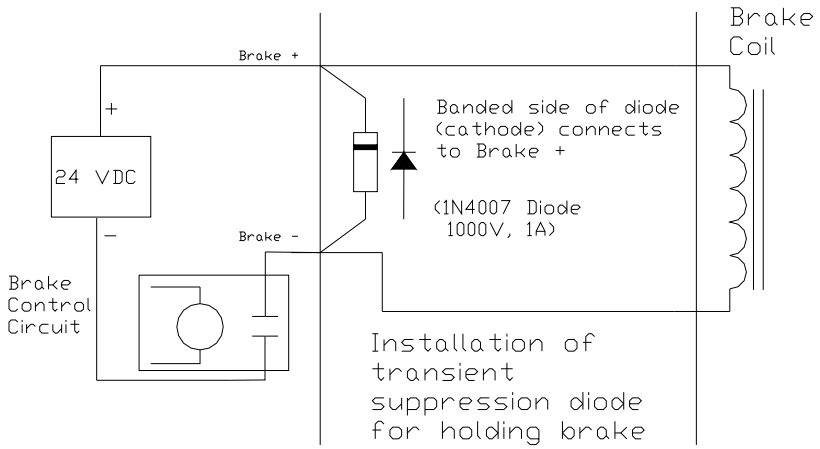
## 2.5 Internal Holding Brake

Many applications require the addition of the Exlar internal holding brake. The brake is held open by the supply of power to a magnetic/mechanical clutch. Whenever there is not power to the brake, the armature is held in place which prevents the inverted roller screw from turning and prevents the output rod from back driving, which in turn prevents the output rod from moving.

The RB holding brake is permanent magnet engaged, the EB is spring engaged and both are electrically released. The mechanical advantage of the roller screw allows the holding brake to prevent back driving of the load. The holding capacity of the brakes is sufficient to hold the rated force of the actuator when used in grease lubricated units. The use of oil as a lubricant reduces the holding capacity of the brake.

Historically, Exlar actuators and motors which had holding brakes are supplied with a transient suppression diode which can be wired to the actuator or motor brake connector. With the changes in servo amplifier and control technology, there are now instances where the diode is not required to be within the motor. An example of this is a control system using a dedicated brake control relay which contains transient suppression components.

Because of this change in technology, Exlar now provides the transient suppression diode separately from the actuator, for inclusion in the brake control circuitry as needed by the end user. A schematic, shown below, is provided with the shipped product showing the typical use of the transient suppression diode.




If the user is uncertain about their requirements for transient suppression, they should refer to their servo amplifier or controller technical documentation, or contact their servo amplifier or controller manufacturer for technical support.

For connection of your amplifier and actuator refer to www.exlar.com.

### RB (Rear Brake) Specifications

| BRAKE SPECIFICATIONS | GSX20 | GSX30 | GSX40 | GSX50 | GSX60 |
|---|---|---|---|---|---|
| Holding torque (w/o oil) | 19 lbf-in (2.2 Nm) | 70 lbf-in (8 Nm) | 97 lbf-in (11 Nm) | 354 lbf-in (40 Nm) | 708 lbf-in (80 Nm) |
| Current @ 24 VDC | 0.75 Amps | 0.75 Amps | 0.88 Amps | 1.0 Amps | 1.3 Amps |
| Coil resistance (polarity sensitive) | 113 Ohms | 33 Ohms | 27 Ohms | 24 Ohms | 21 Ohms |

### EB (Front Brake) Specifications

| BRAKE SPECIFICATIONS | GS/X20 | GS/X30 | GSX40 | GS45 | GS/X60 |
|---|---|---|---|---|---|
| Holding torque (w/o oil) | 25 lbf-in (2.8 Nm) | 40 lbf-in (4.5 Nm) | 120 lbf-in (13.56 Nm) | 80 lbf-in (9 Nm) | 708 lbf-in (65 Nm) |
| Current @ 24 VDC | 0.75 Amps | 0.75 Amps | 0.88 Amps | 0.88 Amps | 1.3 Amps |

**DO NOT attempt to operate the actuator with the brake applied. Allowing the actuator to operate with the brake applied may cause serious damage to the actuator and/or the brake. Do not use the brake to support heavy loads while an operator is under the load. Provide another means to lock the load in position. The brake is a spring applied friction mechanism and does not provide a positive lock.**

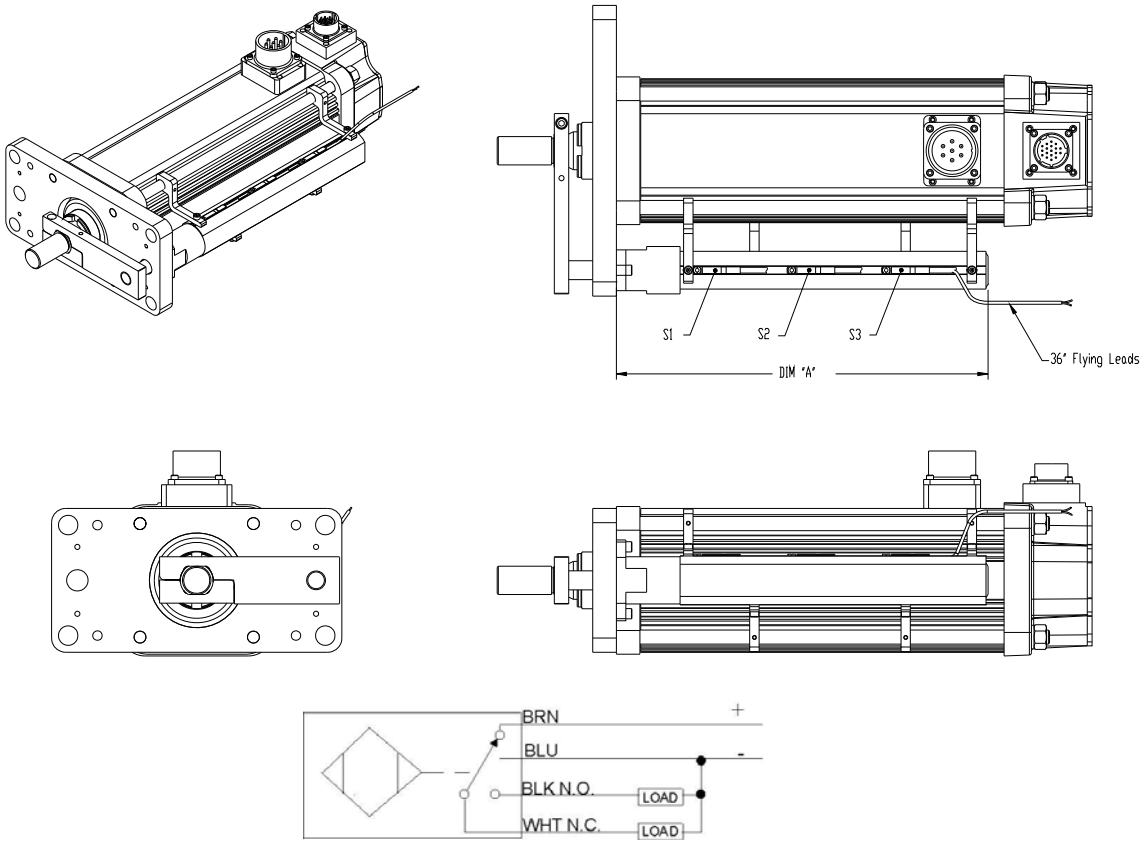
## 2.6 GS/X Linear Actuator External Limit Switch

With the anti-rotate option (Section 2.8) the GSX actuator can accommodate 1, 2 or 3 external limit switches for use as end of travel limit switches or home position sensors in a low profile extruded channel housing. A bracket with inductive proximity switches mounts to the tie rods and senses a traveling magnet inside the extrusion.

The number of switches desired is selected by ordering the L1, L2 or L3 option, in which 1, 2 or 3 switches will be provided, respectively.

The switches are 9-30 VDC powered, PNP output, with either normally open or normally closed logic operation depending on the switch configuration ordered. Below is a diagram indicating which logic operation will be provided for each switch, based on the option ordered.

### External Limit Switch Locations



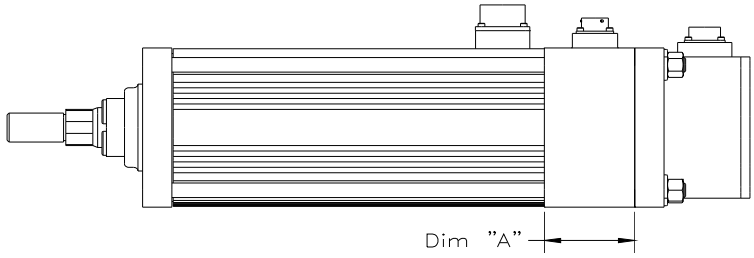

| DIM "A" | 3" Stroke | 6" Stroke | 8" Stroke | 10" Stroke | 12" Stroke | 14" Stroke | 18" Stroke |
|---|---|---|---|---|---|---|---|
| **GSX20** | 5.515 | 8.515 | *n/a* | 12.500 | 14.515 | *n/a* | *n/a* |
| **GSX30** | 6.932 | 9.832 | *n/a* | 13.832 | 15.832 | 17.832 | 21.832 |
| **GSX40** | *n/a* | 9.832 | 11.83 | 13.832 | 15.832 | *n/a* | 21.832 |
| **GSX50** | *n/a* | 11.667 | *n/a* | 15.667 | *n/a* | 19.667 | *n/a* |
| **GSX60** | *n/a* | *10.461* | *n/a* | 14.461 | *n/a* | *n/a* | *n/a* |

| CONFIGURATION OF LOGIC OF STANDARD SWITCH OPTION SELECTIONS | | | |
|---|---|---|---|
| **Option** | **SW1** | **SW2** | **SW3** |
| L1 | Not Supplied | Normally Open | Not Supplied |
| L2 | Normally Closed | Not Supplied | Normally Closed |
| L3 | Normally Closed | Normally Open | Normally Closed |

| **Switch Type** | **Exlar Part Number** | **Turck Part Number** |
|---|---|---|
| Normally Closed Switch | 43404 | BIM-UNT-RP6X |
| Normally Open Switch | 43403 | BIM-UNT-AP6X |

## 2.7 GS/X Linear Actuator Brake Extensions

The brake option may add a third connector to the actuator and require a case extension to accommodate the internal components. Option also slightly reduces the available stroke from the actuator. The case extension dimension and stroke reductions are shown below.



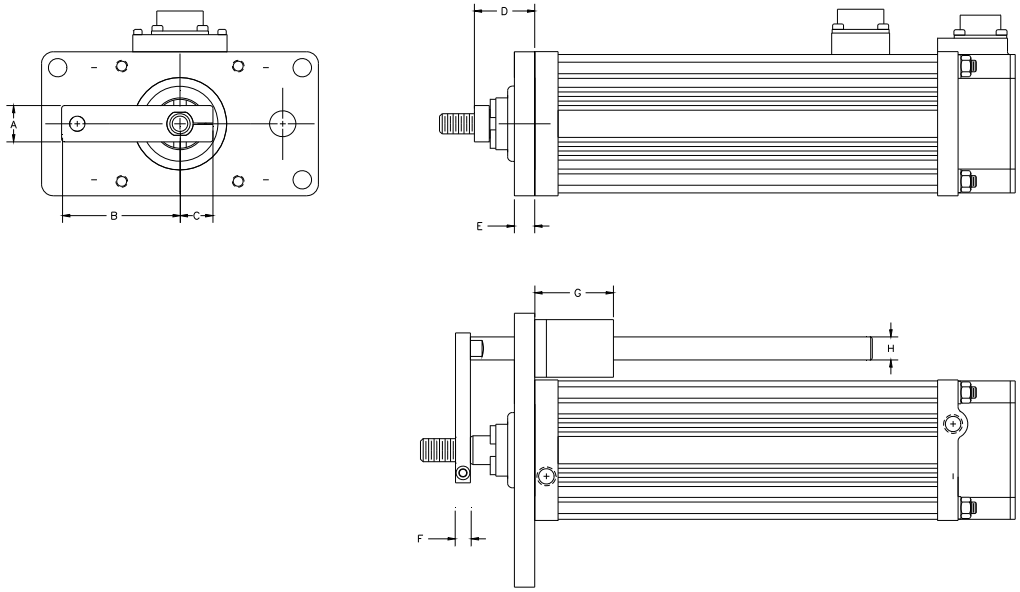

| **GSX Actuator** | **A – Brake Length Ext.** | | **GS Actuator** | **A – Brake Length Ext.** |
|---|---|---|---|---|
| GSX20 | 1.78 in (45.21 mm) | | GS20 | 1.78 in (45.21 mm) |
| GSX30 | 1.61 in (40.9 mm) | | GS30 | 1.77 in (44.96 mm) |
| GSX40 | 2.33 in (59.18 mm) | | GS45 | 2.498 in (63.45 mm) |
| GSX50 | 2.5 in (63.45 mm) | | GS50 | 3.544 in (90.02 mm) |
| GSX60 | 3.575 in (90.81 mm) | | | |

## 2.8 GS/X Series Linear Actuator Anti-rotation Option

The unique design of the GS/X Series linear actuators allows the extending rod to rotate. This provides simple setup of the actuator by allowing the user to rotate the rod and thread it in and out of the actuator for mechanical attachment or system testing. This feature also requires that the rod be kept from rotating when used in its dedicated application to insure proper linear motion. In most applications, such as those where the load is coupled to linear bearings, or some other support device, the load cannot rotate, and thus provides anti-rotation for the extending rod of the actuator.

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

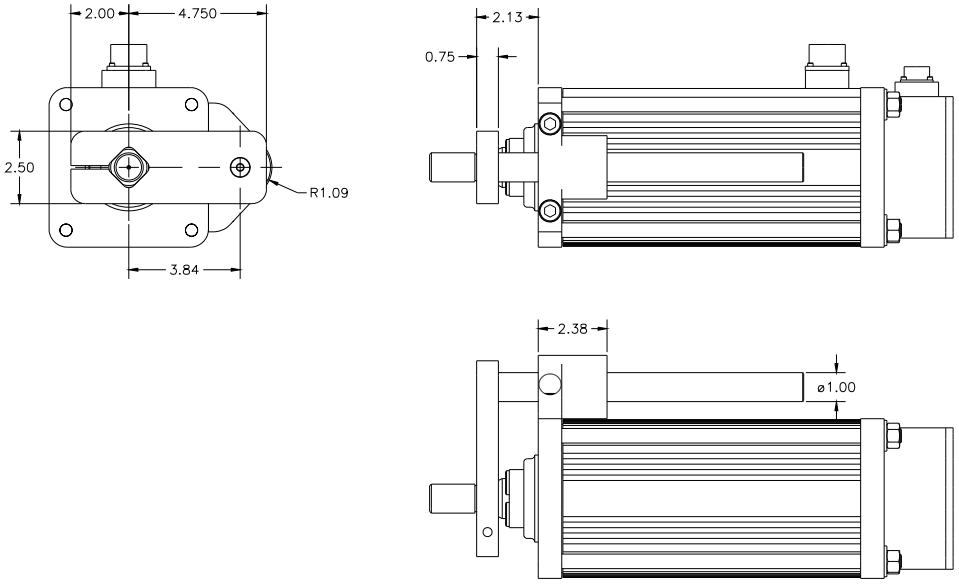
**Anti-rotate Dimensions GS/X20, 30, 40, 45 and 60 (For GSX50 see next page)**




| Dimensions in (mm) | GS/X20 | GS/X30 | GS/X40 and 45 | GS/X60 |
|---|---|---|---|---|
| **A** | 0.60 (15.2) | 0.79 (20.1) | 1.25 (31.8) | 1.75 (44.5) |
| **B** | 1.81 (46.0) | 2.54 (64.5) | 3.78 (96.0) | 5.79 (147) |
| **C** | 0.54 (13.7) | 0.71 (18.0) | 0.98 (24.9) | 1.55 (39.4) |
| **D** | 1.00 (25.4) | 1.30 (33.0) | 1.64 (41.7) | 1.94 (49.3) |
| **E** | 0.44 (11.2) | 0.44 (11.2) | 0.63 (16.0) | 0.75 (19.1) |
| **F** | 0.28 (7.11) | 0.32 (8.13) | 0.38 (9.65) | 0.50 (12.7) |
| **G** | 0.31 (7.87) | 1.69 (42.9) | 1.69 (42.9) | 2.81 (71.4) |
| **H** | 0.37 (9.40) | 0.50 (12.7) | 0.50 (12.7) | 1.00 (25.4) |

For GSX50 anti-rotate dimensions, see page 13.

**Anti-rotate Dimensions (GSX50)**



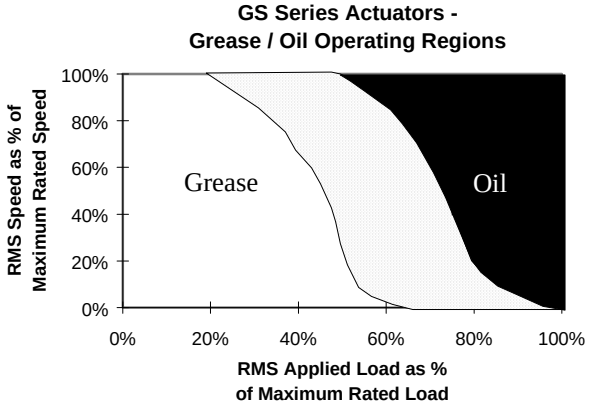

# 3.0 INSTALLATION AND OPERATION

## 3.1 Lubrication Requirements

GS/X Series actuators require either grease or oil lubrication. Actuators that operate in the lower range of their performance capabilities may use grease. Oil lubrication is required for actuators that will be running near the upper end of their performance limits. Recirculating oil provides lubrication and cools the actuator.

Determining if an application will require oil or grease lubrication should be done prior to ordering the actuator.

The following chart can be used to help determine oil vs. grease lubrication requirements:



## 3.2 Grease Lubrication

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

## 3.3 Oil Lubrication for High Power / Low Maintenance Operation

While greased lubrication is ideal for low speed or intermittent duty applications, GS/X Series actuators are specifically designed for high power applications involving high speed, high force, or both. To allow operation at these high power levels and/or to eliminate the periodic maintenance required of all greased devices, GS/X Series actuators are provided with porting and an internal circulation design that allows the use of externally supplied oil. This feature makes the GS/X Series the only all-electric actuators on the market capable of true continuous-duty performance in moderate and high power applications.

A typical oil cooling system is shown next page. The oil provides lubrication for the actuator, but the more important feature of circulating oil lubrication is the cooling that it provides. When application requirements are such that the RMS current requirement exceeds the continuous current rating of the GS/X Series, oil cooling allows the actuator to perform while maintaining a case temperature below the maximum of 85 degrees C.

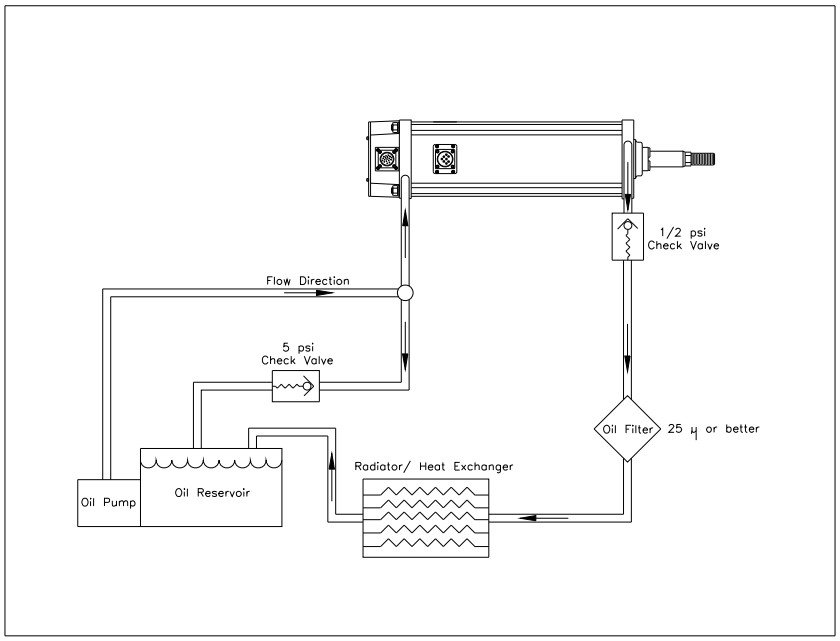
To effectively provide cooling for the actuator, the oil system should be arranged such that the oil exits the actuator at a point above the centerline, preferably in the top quarter region of the actuator, based on the actuator mounting position. This insures that the stator windings of the actuator are receiving the cooling benefits of the oil.

IMPORTANT! Some types of connectors or cabling MAY NOT be used with recirculated oil cooling because they are not constructed to prevent oil from passing through them. Some examples of these are any M23 type connectors (Intercontec/Interconnecctron style), any embedded leads, or 'M' connectors with –AB5, AB6, AB7, AB8, AB9, ABA and ABB feedback callouts. Please consult Exlar to confirm that your selected connectorization is acceptable for use with oil cooling.

**The maximum allowable internal oil pressure for the GS/X Series actuators is 10 psi. Take care to insure that this pressure limit is maintained. Failure to do so may cause damage to the internal sealing components.**

When using an oil cooled/lubricated system, Exlar recommends to regularly check the oil during operation to insure that it is flowing properly and maintaining case temperature. It is also recommended to check the lubrication regularly to insure that the lubricant being supplied to the actuator is clean. A filtering system is recommended.

## Simple Oil System Schematic




As shown in the schematic to the left, a check valve or other method of pressure regulation should be used to maintain an internal actuator oil pressure of 5 psi.

Filtering of 25 microns or better should be used. Simple radiators or heat exchangers can be used to maintain oil temperature.

Exlar recommends the use of petroleum based gear oils with EP additive. An ISO 100 grade is suitable for most applications. Examples of this type of oil are: Mobil Mobilgear, Exxon Spartan EP, Shell Omala and Texaco Meropa. Oils meeting the FDA's food grade specifications are also available such as Mobil DTE FM 32.

### Self Contained Lubrication Systems

One source for lubrication systems is Lytron (www.lytron.com). The MCS30 & MCS40 are suitable for cooling a GSX actuator in many applications.

## 3.4 Oil Cooling and Lubrication Calculations

Oil, being a superior lubricant, will extend the life of the actuator and improve its efficiency. More importantly, oil is required in high power applications for cooling. In applications where the RMS current exceeds $I_G$, oil lubrication is required in order to maintain the case temperature below its maximum of 85°C[1]. Once it is determined that oil lubrication will be used, oil flow rates and case temperatures are determined via the following information:

**ACTUATOR LOAD CONSTANTS: $K_L$**

| | | |
|---|---|---|
| $K_{L\ GSX0}$ | = | 40 |
| $K_{L\ GSX30}$ | = | 70 |
| $K_{L\ GSX40}$ | = | 95 |
| $K_{L\ GS45/GSX50}$ | = | 125 |
| $K_{L\ GSX60}$ | = | 260 |

**APPLICATION LOAD FACTOR: $F_L$**

$$F_L = \left( \frac{I_{rms}}{I_G} \right)^2$$

Where:
$I_{rms}$ = actual application current
$I_G$ = Actuator current rating from specifications. (see Section 5.0)

**USE THE FOLLOWING RELATIONSHIP TO DETERMINE OIL FLOW REQUIREMENTS: W**

GAL / HOUR

$$W = K_L \cdot \frac{F_L}{\Delta T}$$

$$\Delta T = \left( T_{case} - T_{oil} \right)$$

***CONSIDER THE FOLLOWING EXAMPLE:***

A GSX30-238 requires 4 amps of RMS current to perform the required application. The incoming oil temperature is 45 degrees C, and we desire to maintain the actuator at its maximum case temperature of 85 degrees C.

$F_L=(4/3.4)^2 = 1.38$ W = [(1.38 x 70) / (85-45)] = 2.415 GAL / HOUR

**Operation of GS/X Series actuators at current levels in excess of continuous motor current ratings requires proper oil cooling to prevent damage to the motor.**

[1] GS/X Series actuators can be ordered with features that allow them to achieve case temperatures of 150 degrees C. Inquire with Exlar's application engineers or your local representative for details.

## 3.5 Mounting Configurations

The GS/X Series actuators come with a variety of mounting configurations. The standard configurations available are Side Mount, Extended Tie Rods, Rear Clevis and Front Flange. Side Mounted Trunnions are also available for some units. Certified drawings are available from Exlar. General drawings are shown in the Exlar catalog.

## 3.6 Mounting Considerations

Every effort should be made to minimize misalignment as much as is possible. Misalignment of the GS/X Series actuator with respect to whatever load the actuator is being used to move is of great concern. Any misalignment will decrease the life of the components within the actuator and also may create problems within the application associated with misalignment.

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

A GS/X Series actuator with the Side Mount option comes with threaded holes in the faceplate and endplate. Exlar recommends using hardened fasteners to mount a GS/X Series actuator to your machine frame. Exlar also recommends threading the mounting fastener into as much of the threaded hole in the actuator as possible, to prevent stripping out the threads in the actuator's mounting holes**.**

**Note: Side Mount actuators may have reduced maximum load rating.**

A GS/X Series actuator with the Extended Tie Rod mounting option comes with hex nuts on the faceplate that are tightened down enough to keep the actuator together during shipping. When mounting the actuator to your machine, these nuts should be removed and the tie rods should be placed through the machine frame and the nuts used on the back side of the machine's mounting flange. The tie rod nuts should then be tightened with a torque wrench to the following values:

GS/X20: 20 lbf-in (1.7 lbf-ft, 2.26 N-m)
GS/X30: 90 lbf-in (7.5 lbf-ft, 10.16 N-m)
GS/X40 and 45: 240 lbf-in (20 lbf-ft, 27.12 N-m)
GSX50: 600 lbf-in (50 lbf-ft, 67.79 N-m)
GS/X60: 600 lbf-in (50 lbf-ft, 67.79 N-m)

**Failure to properly tighten the tie rods can cause damage to the actuator and possible premature failure. Over-tightening of the tie rods can cause damage to the actuator and affect normal operation.**

## 3.7 General Operation

The GS/X Series 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 GS/X Series linear actuator.

See sections 2.6, 2.7 and 2.8 regarding the holding brake, external limit switches and anti-rotate mechanisms, 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:

**Linear Distance Traveled (in)** = (Motor Revolutions)*(Roller Screw Lead)

**Linear Speed (in/sec)** = ((Motor RPM) / 60)*(Roller Screw Lead)

**Linear Force (lbf)** = ((Motor Torque (in-lbf))*(2π)*(efficiency)) / (Roller Screw Lead (in))

All of the above relationships require proper anti-rotation of the GS/X Series actuator rod.

For more information on sizing and selection of GS/X Series actuators and servo amplifiers to power them, consult the sizing and selection section of the Exlar catalog.

**Motor RMS current must be maintained at a level below the continuous current rating of the GS/X Series actuator or damage to the motor stator will result.**

**The peak current setting must be maintained at a level below the peak current rating of the GS/X Series actuator or damage to the stator will result.**

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

# 4.0 MAINTENANCE PROCEDURES

## 4.1 Disassembly

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

Refer to the exploded view on the following page.

1.) Remove the actuator assembly from the machine by disconnecting the cables, main rod coupling and actuator mounting bolts or fasteners.

2.) If your unit does not have an external anti rotate assembly, skip this step. Loosen the two machine screws that clamp the anti-rotate cross member to the actuator output rod. Slide the anti-rotate mechanism forward and off the actuator.

3.) Remove the rear tie rod nuts from the back of the actuator.

**Extreme care should be taken when removing the tie rod nuts or tie rods so as not to twist or pull on the end cap of the actuator. The end cap houses the feedback device. Alignment of this feedback device to the phases of the motor is critical to the operation of the system. Some feedback devices are sensitive to movement of their mounting surface once installed and can be damaged if care is not taken.**

4.) If your actuator does not have a front flange, skip this step. Slide the front flange forward and off the actuator. The tie rods will remain attached to the front flange.

5.) **If your actuator has an internal brake or internal limit switches, read the following three paragraphs before proceeding.** Remove the faceplate from the actuator by gently pulling it forward. It is sealed by an O-ring, and does require some force to remove. Take care not to damage the front seal on the threads of the actuator output rod when removing the faceplate.

### Limit Switches

If your unit has internal limit switches, you will see that there is an extension of the actuator case that houses the limit switches and has the limit switch connector mounted to it. This case extension has a cylindrical assembly inside it with mounting surfaces for the limit switches. Carefully pull this entire assembly (case extension and face plate) forward to remove it from the actuator. The mounting assembly for the switches is not fastened to the case extension, so remove it slowly and ensure that all of the parts are moving together so that damage is not done to the switches or their wires.

### Electric Brake

For units that have the EB option, there is also a case extension similar to the limit switch option. The brake housing is fastened to the back of the faceplate. The faceplate, case extension and brake housing can be removed together by gently pulling the case extension and faceplate forward. With the brake assembly

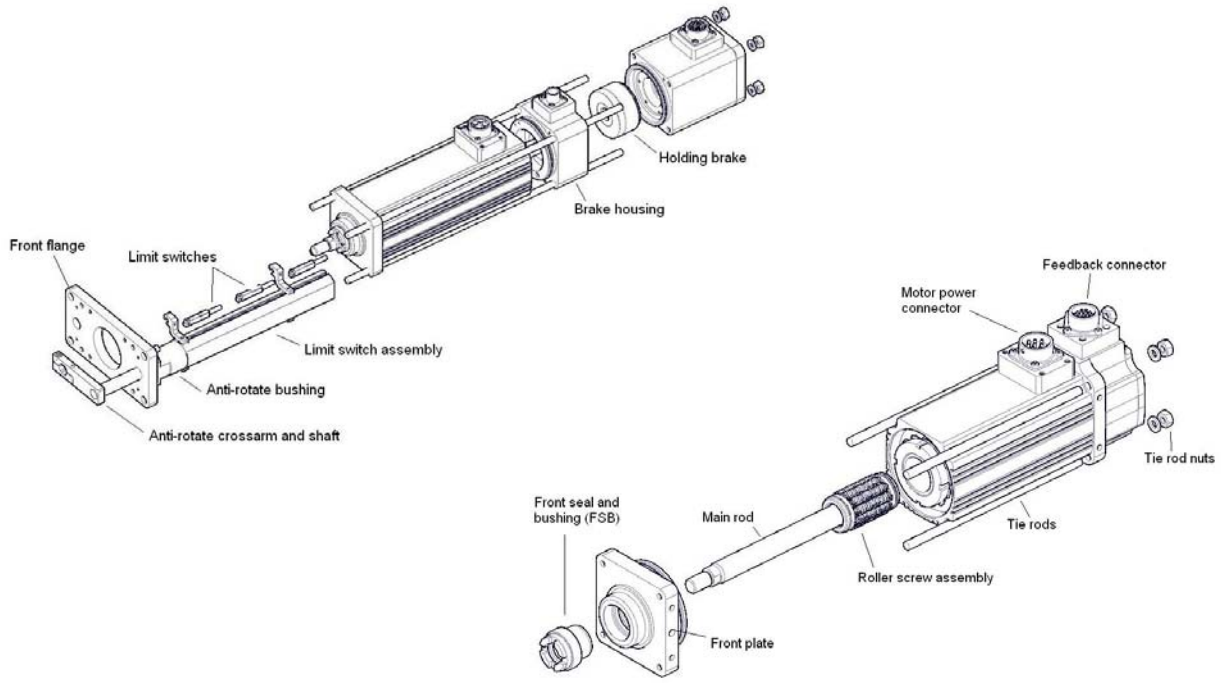
removed, you will see the brake spline attached to the roller screw cylinder. Remove the screws for the spline assembly and remove it from the roller screw cylinder.

The RB option requires removal of the feedback device to access and Exlar should be consulted for assistance, or the unit returned to Exlar.

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

6.) When the face plate and limit switch or brake assembly (including spline) is removed, the thrust bearing and the open end of the roller screw internally threaded cylinder (ITC) are visible. The roller screw can be removed by turning it counter clockwise and threading it out of the cylinder. It may be necessary to hold the roller screw cylinder from turning to remove the screw.

### Exploded View of GS Series Actuator




## 4.2 Lubrication Maintenance

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

| RMS Rotational speed(RPM) | Recommended Grease Renewal Period hours) | | |
|---|---|---|---|
| | CASE TEMP 65 degrees C (149 degrees F) | CASE TEMP 80 degrees C (176 degrees F) | CASE TEMP 95 degrees C (203 degrees 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 |

### Grease Renewal

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

1.) Use a brush to work approximately 0.5 $in^3$ of grease for every 3 inches of stroke length into the roller screw cylinder. Be sure to cover all of the threaded areas of the cylinder.

2.) Use a brush to work grease in to the roller screw assembly. Be sure to cover all the threaded surfaces of the screw assembly. This can be accomplished by applying grease to a few places on the roller screw assembly and rotating the components repeatedly in both directions to work the grease into the assembly.

3.) Force grease into the front of the thrust bearing assembly. Make a concerted effort to insure that the grease is well worked in. Grease must reach the bearing just behind the bearing that is visible as well. Use the following amounts of grease for each size roller screw and bearing:
**GS/X20:** 0.5 $in^3$ **GS/X30:** 0.75 $in^3$ **GS/X40/45:** 1.0 $in^3$ **GSX50:** 1.5 $in^3$ **GS/X60:** 2.0 $in^3$

### Oil Lubrication

It is recommended to regularly check the oil during operation to insure that it is flowing properly and maintaining case temperature. It is also recommended to check the lubrication regularly to insure that the lubricant being supplied to the actuator is clean. A filtering system is required, 25 microns or better filtering is recommended.

## 4.3 Reassembly

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

2.) Place a small amount of seal lubricant on the inside surface of the seal/bushing assembly.

3.) Replace faceplate and case extension:

### Units Without Electric Brake or Limit Switch Options

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

### Units With a Front Flange

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

### Units With Limit Switches

Carefully replace the faceplate and case extension taking care not to damage the seal on the threads of the rod end. Be sure to seat the mating portion of the case extension fully and squarely into the actuator housing. The inner surface of the case extension provides the pre-loading for the bearings, and it is important that it is properly seated. If the tie rods are attached to the faceplate, slide them through the holes in the end cap of the actuator.

### Units With an Electric Brake

If power was removed form the brake when the actuator was disassembled, the mating spline should be centered and in position to be remounted to the brake spline.
Remount the spline assembly to the roller screw internally threaded cylinder (ITC). Re-install the screws using Loc-tite 22231, and tighten to secure spline assembly in place. It is important to insure that the brake spline is square and fully seated when remounted to the cylinder.

With the spline assembly remounted to the roller screw cylinder, slide the brake housing and case extension onto the actuator. Take care not to damage the seal on the threaded portion of the rod. The mating of the two spline halves is a very tight fit and can make reassembling a brake unit very difficult. Press the case extension and brake assembly onto the actuator housing so that the splines mate, and the case extension seats fully. If the case extension does not seat fully the spline halves are not mated and the brake will not work properly. When the contact between the brake halves is felt, gently rotating the actuator extending rod clockwise until it has traveled fully into the actuator can rotate the roller screw cylinder. To achieve proper alignment of the spline halves, slowly rotate the cylinder while pressing the brake extension onto the actuator. As the splines align, the brake extension will fully seat onto the main actuator housing.

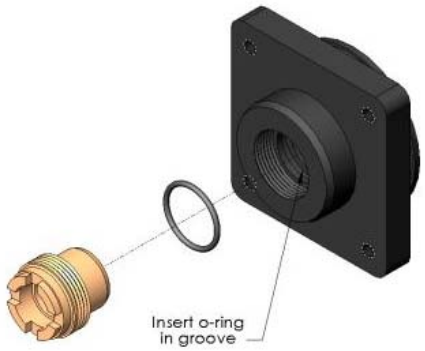
4.) Replace the rear tie rod washers and nuts and tighten to the proper torque. Tighten the nuts simultaneously by partially tightening each in an opposing corner pattern until each is torqued to the rated value shown below.

GS/X20: 20 lbf-in (1.7 lbf-ft, 2.26 N-m)
GS/X30: 90 lbf-in (7.5 lbf-ft, 10.16 N-m)
GS/X40/45: 240 lbf-in (20 lbf-ft, 27.12 N-m)
GSX50: 600 lbf-in (50 lbf-ft, 67.79 N-m)
GS/X60: 600 lbf-in (50 lbf-ft, 67.79 N-m)

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

## 4.4 Seal Maintenance

It is recommended that at the suggested time of lubrication the main rod seal and bushing assembly (FSB) be replaced. The main rod seal can be removed by threading it out of the face plate using a standard rod seal gland wrench or spanner wrench. A new main rod seal can be slid over the main rod, taking care not to touch the seal material to the threaded rod end. To have this service performed for you, contact Exlar Engineering or arrange with Exlar Returns Department to send your unit in for service.




| | Standard FSB Part Numbers | Install Torque |
|---|---|---|
| GSX20 | 18929 | 100 lb-in (11.29 N-m) |
| GSX30 | 19020 | 200 lb-in (22.58 N-m) |
| GSX40/GS45 | 19021 | 360 lb-in (40.67 N-m) |
| GSX50 | 22706 | 660 lb-in (74.57 N-m) |
| GSX60 | 19022 | 900 lb-in (101.69 N-m) |

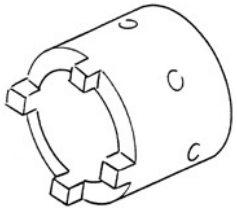
Main Rod Seal FSB and Bushing

Note: Some actuators are provided with special FSBs due to chemical exposure or other special requirements. Contact Exlar if there is a question about your particular actuator having a standard material FSB.

FSB Installation/Replacement:

1. Using proper sized gland or spanner wrench, remove existing FSB from actuator face plate, and slide off the actuator rod. This will require the removal of any rod attachments. One source for gland wrenches is Martin Fluid Power. http://www.mfpseals.com/seal_repair_kits/parker-2.shtml

| Exlar Actuator Model | Martin Fluid Power Part No. | Size (in) | Description |
|---|---|---|---|
| GSX20-30 | PH-0695900000 | 1/2, 5/8 | Rod Gland Wrench |
| GSX40 | PH-0695910000 | 1 | Rod Gland Wrench |
| GSX50 | PH-0695920000 | 1-3/8 | Rod Gland Wrench |
| GSX60 | PH-0695930000 | 1-3/4 | Rod Gland Wrench |



2. Remove the o-ring from the o-ring grove located inside the opening from which the FSB was just removed.

3. Replace the o-ring with the o-ring supplied with the new FSB.

4. Taking care not to touch the seal material to any sharp rod features such as threads, slide the FSB on to the actuator rod and to the face plate.

5. Using the appropriate gland and spanner wrench, tighten the FSB to the proper torque level indicated in the previous table.

# 5.0 SPECIFICATIONS

## 5.1 GSX Performance Specifications (See 5.1a for GS Performance Specs)

| Model | Frame Size in (mm) | Stroke in (mm) | Screw Lead in (mm) | Force Rating 1/2/3/Stack lb (N) | Max Velocity in/sec (mm/sec) | Approx* Cont. Motor Torque 1/2/3 Stack lb-in (N-m) | Maximum Static Load lb (N) | Armature Inertia lb-in-s$^2$ (Kg-m$^2$) | Dynamic Load Rating lb (N) | Weight (appr.) lb (Kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| GSX20-0301 | 2.25 (57) | 3 (76) | 0.1 (2.54) | 367/578/NA (1632/2571/NA) | 8.33 (211.67) | 7.3/11.5/NA (0.82/1.3/NA) | 1250 (5560) | 0.00101 (0.000114) | 2075 (9230) | 6.5 (2.9) |
| GSX20-0302 | 2.25 (57) | 3 (76) | 0.2 (5.08) | 183/289/NA (814/1286/NA) | 16.77 (423.33) | 7.3/11.5/NA (0.82/1.3/NA) | 1250 (5560) | 0.00101 (0.000114) | 1540 (6850) | 6.5 (2.9) |
| GSX20-0304 | 2.25 (57) | 3 (76) | 0.4 (10.16) | 92/145/NA (409/645/NA) | 33.33 (846.67) | 7.3/11.5/NA (0.82/1.3/NA) | 1250 (5560) | 0.00101 (0.000114) | 1230 (5471) | 6.5 (2.9) |
| GSX20-0601 | 2.25 (57) | 6 (152) | 0.1 (2.54) | 367/578/NA (1632/2571/NA) | 8.33 (211.67) | 7.3/11.5/NA (0.82/1.30/NA) | 1250 (5560) | 0.00114 (0.000129) | 2075 (9230) | 8.0 (3.6) |
| GSX20-0602 | 2.25 (57) | 6 (152) | 0.2 (5.08) | 183/289/385 (814/1286/1713) | 16.67 (423.33) | 7.3/11.5/15.3 (0.82/1.3/1.73) | 1250 (5560) | 0.00114 (0.000129) | 1540 (6850) | 8.0 (3.6) |
| GSX20-0604 | 2.25 (57) | 6 (152) | 0.4 (10.16) | 92/145/192 (409/645/854) | 33.33 (846.67) | 7.3/11.5/15.3 (0.82/1.3/1.73) | 1250 (5560) | 0.00114 (0.000129) | 1230 (5471) | 8.0 (3.6) |
| GSX20-1001 | 2.25 (57) | 10 (254) | 0.1 (2.54) | 367/578/NA (1632/2571/NA) | 8.33 (211.67) | 7.3/11.5/NA (0.82/1.30/NA) | 1250 (5560) | 0.00133 (0.000150) | 2075 (9230) | 9.5 (4.3) |
| GSX20-1002 | 2.25 (57) | 10 (254) | 0.2 (5.08) | 183/289/385 (814/1286/1713) | 16.67 (423.33) | 7.3/11.5/15.3 (0.82/1.3/1.73) | 1250 (5560) | 0.00133 (0.000150) | 1540 (6850) | 9.5 (4.3) |
| GSX20-1004 | 2.25 (57) | 10 (254) | 0.4 (10.16) | 92/145/192 (409/645/854) | 33.33 (846.67) | 7.3/11.5/15.3 (0.82/1.3/1.73) | 1250 (5560) | 0.00133 (0.000150) | 1230 (5471) | 9.5 (4.3) |
| GSX20-1201 | 2.25 (57) | 12 (304) | 0.1 (2.54) | 367/578/NA (1632/2571/NA) | 8.33 (211.67) | 7.3/11.5/NA (0.82/1.3/NA) | 1250 (5560) | 0.00143 (0.000162) | 2075 (9230) | 11.0 (4.9) |
| GSX20-1202 | 2.25 (57) | 12 (304) | 0.2 (5.08) | 183/289/385 (814/1286/1713) | 16.67 (423.33) | 7.3/11.5/15.3 (0.82/1.3/1.73) | 1250 (5560)) | 0.00143 (0.000162) | 1540 (6850) | 11.0 (4.9) |
| GSX20-1204 | 2.25 (57) | 12 (304) | 0.4 (10.16) | 92/145/192 (409/645/854) | 33.33 (846.67) | 7.3/11.5/15.3 (0.82/1.3/1.73) | 1250 (5560) | 0.00143 (0.000162) | 1230 (5471) | 11.0 (4.9) |
| GSX30-0301 | 3.125 (79) | 3 (76) | 0.1 (2.54) | 829/1347/NA 3688/5992/NA) | 5 (127) | 16.5/26.8/NA (1.86/3.03/NA) | 2700 (12010) | 0.00319 (0.000360) | 5516 (24536) | 9.5 (4.3) |
| GSX30-0302 | 3.125 (79) | 3 (76) | 0.2 (5.08) | 415/674/NA (1846/2998/NA) | 10 (254) | 16.5/26.8/NA (1.86/3.03/NA) | 2700 (12010) | 0.00319 (0.000360) | 5800 (25798) | 9.5 (4.3) |
| GSX30-0305 | 3.125 (79) | 3 (76) | 0.5 (12.7) | 166/269/NA (738/1197/NA) | 25 (635) | 16.5/26.8/NA (1.86/3.03/NA) | 2700 (12010) | 0.00319 (0.000360) | 4900 (21795) | 9.5 (4.3) |
| GSX30-0601 | 3.125 (79) | 5.9 (150) | 0.1 (2.54) | 829/1347/NA 3688/5992/NA) | 5 (127) | 16.5/26.8/NA (1.86/3.03/NA) | 2700 (12010) | 0.00361 (0.000408) | 5516 (24536) | 11.5 (5.2) |
| GSX30-0602 | 3.125 (79) | 5.9 (150) | 0.2 (5.08) | 415/674/905 (1846/2998/4026) | 10 (254) | 16.5/26.8/36 (1.86/3.03/4.07) | 2700 (12010) | 0.00361 (0.000408) | 5800 (25798) | 11.5 (5.2) |
| GSX30-0605 | 3.125 (79) | 5.9 (150) | 0.5 (12.7) | 166/269/362 (738/1197/1610) | 25 (635) | 16.5/26.8/36 (1.86/3.03/4.07) | 2700 (12010) | 0.00361 (0.000408) | 4900 (21795) | 11.5 (5.2) |
| GSX30-1001 | 3.125 (79) | 10 (254) | 0.1 (2.54) | 829/1347/NA 3688/5992/NA) | 5 (127) | 16.5/26.8/NA (1.86/3.03/NA) | 2700 (12010) | 0.00416 (0.000547) | 5516 (24536) | 19 (8.6) |
| GSX30-1002 | 3.125 (79) | 10 (254) | 0.2 (5.08) | 415/674/905 (1846/2998/4026) | 10 (254) | 16.5/26.8/36 (1.86/3.03/4.07) | 2700 (12010) | 0.00416 (0.000547) | 5800 (25798) | 19 (8.6) |
| GSX30-1005 | 3.125 (79) | 10 (254) | 0.5 (12.7) | 166/269/362 (738/1197/1610) | 25 (635) | 16.5/26.8/36 (1.86/3.03/4.07) | 2700 (12010) | 0.00416 (0.000547) | 4900 (21795) | 19 (8.6) |

***Force Rating:*** *The linear force produced by the actuator at continuous motor torque.*
***Max Velocity:*** *The linear velocity that the actuator will achieve at rated motor rpm.*
***Continuous Motor Torque:*** *The torque produced by the motor at rated continuous current.*
***Maximum Static Load:*** *The mechanical load limit of the actuator if re-circulated oil or other cooling method is used to allow higher than rated torque from the motor.*
***Armature Inertia:*** *The rotary inertia of the armature of the GSX series actuators. For calculation purposes, this value includes the screw inertia in a GSX actuator. Inertia tolerance is +/- 5%*
***Dynamic Load Rating:*** *A design constant used in calculating the estimated travel life of the roller screw. The dynamic mean load is the load at which the device will perform one million revolutions.*

## 5.1 GSX Performance Specifications (cont'd)

| Model | Frame Size in (mm) | Stroke in (mm) | Screw Lead in (mm) | Force Rating 1/2/3 Stack lb (N) | Max Velocity in/sec (mm/sec) | Approx* Cont. Motor Torque 1/2/3 Stack lb-in (N-m) | Maximum Static Load lb (N) | Armature Inertia lb-in-s$^2$ (Kg-m$^2$) | Dynamic Load Rating lb (N) | Weight lb (Kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| GSX30-1201 | 3.125 (79) | 12 (305) | 0.1 (2.54) | 829/1347/NA (3688/5992/NA) | 5 (127) | 16.5/26.8/NA (1.86/3.03/NA) | 2700 (12010) | 0.00443 (0.000501) | 5516 (24536) | 20.5 (9.3) |
| GSX30-1202 | 3.125 (79) | 12 (305) | 0.2 (5.08) | 415/674/905 (1846/2998/4026) | 10 (254) | 16.5/26.8/36 (1.86/3.03/4.07) | 2700 (12010) | 0.00443 (0.000501) | 5800 (25798) | 20.5 (9.3) |
| GSX30-1205 | 3.125 (79) | 12 (305) | 0.5 (12.7) | 166/269/362 (738/1197/1610) | 25 (635) | 16.5/26.8/36 (1.86/3.03/4.07) | 2700 (12010) | 0.00443 (0.000501) | 4900 (21795) | 20.5 (9.3) |
| GSX30-1401 | 3.125 (79) | 14 (356) | 0.1 (2.54) | 829/1347/NA (3688/5992/NA) | 5 (127) | 16.5/26.8/NA (1.86/3.03/NA) | 2700 (12010) | 0.00473 (0.000534) | 5516 (24536) | 20.5 (9.3) |
| GSX30-1402 | 3.125 (79) | 14 (356) | 0.2 (5.08) | 415/674/905 (1846/2998/4026) | 10 (254) | 16.5/26.8/36 (1.86/3.03/4.07) | 2700 (12010) | 0.00473 (0.000534) | 5800 (25798) | 20.5 (9.3) |
| GSX30-1405 | 3.125 (79) | 14 (356) | 0.5 (12.7) | 166/269/362 (738/1197/1610) | 25 (635) | 16.5/26.8/36 (1.86/3.03/4.07) | 2700 (12010) | 0.00473 (0.000534) | 4900 (21795) | 20.5 (9.3) |
| GSX30-1801 | 3.125 (79) | 18 (457) | 0.1 (2.54) | 829/1347/NA (3688/5992/NA) | 5 (127) | 16.5/26.8/36 (1.86/3.03/4.07) | 2700 (12010) | 0.00533 (0.000602) | 5800 (25798) | 25 (11.3) |
| GSX30-1802 | 3.125 (79) | 18 (457) | 0.2 (5.08) | 415/674/905 (1846/2998/4026) | 10 (254) | 16.5/26.8/36 (1.86/3.03/4.07) | 2700 (12010) | 0.00533 (0.000602) | 5800 (25798) | 25 (11.3) |
| GSX30-1805 | 3.125 (79) | 18 (457) | 0.5 (12.7) | 166/269/362 (738/1197/1610) | 25 (635) | 16.5/26.8/36 (1.86/3.03/4.07) | 2700 (12010) | 0.00533 (0.000602) | 4900 (21795) | 25 (11.3) |
| GSX40-0601 | 3.9 (99) | 6 (152) | 0.1 (2.54) | 2393/3966/NA (10645/17642/NA) | 5 (127) | 47.6/78.9/NA (5.38/8.91/NA) | 5400 (24020) | 0.0152 (0.001717) | 7900 (35141) | 20 (9.1) |
| GSX40-0602 | 3.9 (99) | 6 (152) | 0.2 (5.08) | 1196/1983/NA (5320/8821/NA) | 10 (254) | 47.6/78.9/NA (5.38/8.91/NA) | 5400 (24020) | 0.0152 (0.001717) | 8300 (36920) | 20 (9.1) |
| GSX40-0605 | 3.9 (99) | 6 (152) | 0.5 (12.7) | 479/793/NA (2131/3527/NA) | 25 (635) | 47.6/78.9/NA (5.38/8.91/NA) | 5400 (24020) | 0.0152 (0.001717) | 7030 (31271) | 20 (9.1) |
| GSX40-0608 | 3.9 (99) | 6 (152) | 0.75 (19.05) | 319/529/718 (1419/2353/3194) | 37.5 (953) | 47.6/78.9/107.1 (5.38/8.91/12.1) | 5400 (24020) | 0.0152 (0.001717) | 6335 (28179) | 20 (9.1) |
| GSX40-0801 | 3.9 (99) | 8 (203) | 0.1 (2.54) | 2393/3966/NA (10645/17642/NA) | 5 (127) | 47.6/78.9/107.1 (5.38/8.91/12.1) | 5400 (24020) | 0.0163 (0.001842) | 7900 (35141) | 24 (10.9) |
| GSX40-0802 | 3.9 (99) | 8 (203) | 0.2 (5.08) | 1196/1983/2692 (5320/8821/11975) | 10 (254) | 47.6/78.9/107.1 (5.38/8.91/12.1) | 5400 (24020) | 0.0163 (0.001842) | 8300 (36920) | 24 (10.9) |
| GSX40-0805 | 3.9 (99) | 8 (203) | 0.5 (12.7 | 479/793/1077 (2131/3527/4791) | 25 (635) | 47.6/78.9/107.1 (5.38/8.91/12.1) | 5400 (24020) | 0.0163 (0.001842) | 7030 (31271) | 24 (10.9) |
| GSX40-0808 | 3.9 (99) | 8 (203) | 0.75 (19.05) | 319/529/718 (1419/2353/3194) | 37.5 (953) | 47.6/78.9/107.1 (5.38/8.91/12.1) | 5400 (24020) | 0.0163 (0.001842) | 6335 (28179) | 24 (10.9) |
| GSX40-1001 | 3.9 (99) | 10 (254) | 0.1 (2.54) | 2393/3966/NA (10645/17642/NA) | 5 (127) | 47.6/78.9/107.1 (5.38/8.91/12.1) | 5400 (24020) | 0.0175 (0.001972) | 7900 (35141) | 28 (12.7) |
| GSX40-1002 | 3.9 (99) | 10 (254) | 0.2 (5.08) | 1196/1983/2692 (5320/8821/11975) | 10 (254) | 47.6/78.9/107.1 (5.38/8.91/12.1) | 5400 (24020) | 0.0175 (0.001972) | 8300 (36920) | 28 (12.7) |
| GSX40-1005 | 3.9 (99) | 10 (254) | 0.5 (12.7 | 479/793/1077 (2131/3527/4791) | 25 (635) | 47.6/78.9/107.1 (5.38/8.91/12.1) | 5400 (24020) | 0.0175 (0.001972) | 7030 (31271) | 28 (12.7) |
| GSX40-1008 | 3.9 (99) | 10 (254) | 0.75 (19.05) | 319/529/718 (1419/2353/3194) | 37.5 (953) | 47.6/78.9/107.1 (5.38/8.91/12.1) | 5400 (24020) | 0.0175 (0.001972) | 6335 (28179) | 28 (12.7) |

***Force Rating:*** *The linear force produced by the actuator at continuous motor torque.*
***Max Velocity:*** *The linear velocity that the actuator will achieve at rated motor rpm.*
***Continuous Motor Torque:*** *The torque produced by the motor at rated continuous current.*
***Maximum Static Load:*** *The mechanical load limit of the actuator if re-circulated oil or other cooling method is used to allow higher than rated torque from the motor.*
***Armature Inertia:*** *The rotary inertia of the armature of the GSX series actuators. For calculation purposes, this value includes the screw inertia in a GSX actuator. Inertia tolerance value is +/- 5%.*
***Dynamic Load Rating:*** *A design constant used in calculating the estimated travel life of the roller screw. The dynamic mean load is the load at which the device will perform one million revolutions*

# 5.1 GSX Performance Specifications (cont'd)

| Model | Frame Size in (mm) | Stroke in (mm) | Screw Lead in (mm) | Force Rating 1/2/3 Stack lb (N) | Max Velocity in/sec (mm/sec) | Approx* Cont. Motor Torque 1/2/3 Stack lb-in (N-m) | Maximum Static Load lb (N) | Armature Inertia lb-in-s$^2$ (Kg-m$^2$) | Dynamic Load Rating lb (N) | Weight lb (Kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| GSX40-1201 | 3.9 (99) | 12 (305) | 0.1 (2.54) | 2393/3966/NA (10645/17642/NA) | 5 (127) | 47.6/78.9/107.1 (5.38/8.91/12.1) | 5400 (24020) | 0.0186 (0.002102) | 7900 (35141) | 32 (14.5) |
| GSX40-1202 | 3.9 (99) | 12 (305) | 0.2 (5.08) | 1196/1983/2692 (5320/8821/11975) | 10 (254) | 47.6/78.9/107.1 (5.38/8.91/12.1) | 5400 (24020) | 0.0186 (0.002102) | 8300 (36920) | 32 (14.5) |
| GSX40-1205 | 3.9 (99) | 12 (305) | 0.5 (12.7) | 479/793/1077 (2131/3527/4791) | 25 (635) | 47.6/78.9/107.1 (5.38/8.91/12.1) | 5400 (24020) | 0.0186 (0.002102) | 7030 (31271) | 32 (14.5) |
| GSX40-1208 | 3.9 (99) | 12 (305) | 0.75 (19.05) | 319/529/718 (1419/2353/3194) | 37.5 (953) | 47.6/78.9/107.1 (5.38/8.91/12.1) | 5400 (24020) | 0.0186 (0.002102) | 6335 (28179) | 32 (14.5) |
| GSX40-1801 | 3.9 (99) | 18 (457) | 0.1 (2.54) | 2393/3966/NA (10645/17642/NA) | 5 (127) | 47.6/78.9/NA (5.38/8.91/NA | 5400 (24020) | 0.0220 (0.002486) | 7900 (35141) | 44 (20) |
| GSX40-1802 | 3.9 (99) | 18 (457) | 0.2 (5.08) | 1196/1983/2692 (5320/8821/11975) | 10 (254) | 47.6/78.9/107.1 (5.38/8.91/12.1) | 5400 (24020) | 0.0220 (0.002486) | 8300 (36920) | 44 (20) |
| GSX40-1805 | 3.9 (99) | 18 (457) | 0.5 (12.7) | 479/793/1077 (2131/3527/4791) | 25 (635) | 47.6/78.9/107.1 (5.38/8.91/12.1) | 5400 (24020) | 0.0220 (0.002486) | 7030 (31271) | 44 (20) |
| GSX50-0601 | 5.0 (127) | 6 (152) | 0.1 (2.54) | 5127/8544/NA (22806/38006/NA) | 4 (101.6) | 102/170/NA (11.5/19.2/NA) | 13200 (58717) | 0.03241 (0.003662) | 15693 (69806) | 54 (24) |
| GSX50-0602 | 5.0 (127) | 6 (152) | 0.2 (5.08) | 2564/4272/NA (11405/19003/NA) | 8 (203) | 102/170/NA (11.5/19.2/NA) | 13200 (587.17) | 0.03241 (0.003662) | 13197 (58703) | 54 (24) |
| GSX50-0605 | 5.0 (127) | 6 (152) | 0.5 (12.7) | 1026/1709/NA (4564/7602/NA) | 20 (508) | 102/170/NA (11.5/19.2/NA) | 13200 (58717) | 0.03241 (0.003662) | 11656 (51848) | 54 (24) |
| GSX50-0610 | 5.0 (127) | 6 (152) | 1.0 (25.4) | 513/855/NA (2282/3803/NA) | 40 (1016) | 102/170/NA (11.5/19.2/NA) | 13200 (58717) | 0.03241 (0.003662) | 6363 (28304) | 54 (24) |
| GSX50-1001 | 5.0 (127) | 10 (254) | 0.1 (2.54) | 5127/8544/5655 (22806/38006/25155) | 4 (101.6) | 102/170/226 (11.5/19.2/25.5) | 13200 (58717) | 0.03725 (0.004209) | 15693 (69806) | 62 (28) |
| GSX50-1002 | 5.0 (127) | 10 (254) | 0.2 (5.08) | 2564/4272/NA (11405/19003/NA) | 8 (203) | 102/170/226 (11.5/19.225.5) | 13200 (58717) | 0.03725 (0.004209) | 13197 (58703) | 62 (28) |
| GSX50-1005 | 5.0 (127) | 10 (254) | 0.5 (12.7) | 1026/1709/2261 (4564/7602/10057) | 20 (508) | 102/170/226 (11.5/19.225.5) | 13200 (58717) | 0.03725 (0.004209) | 11656 (51848) | 62 (28) |
| GSX50-1010 | 5.0 (127) | 10 (254) | 1.0 (25.4) | 513/855/1131 (2282/3803/5031) | 40 (1016) | 102/170/226 (11.5/19.225.5) | 13200 (58717) | 0.03725 (0.004209) | 6363 (28304) | 62 (28) |
| GSX50-1402 | 5.0 (127) | 14 (356) | 0.2 (5.08) | 2564/4272/5655 (11405/19003/25155) | 8 (203) | 102/170/226 (11.5/19.225.5) | 13200 (58717) | 0.04208 (0.004754) | 13197 (58703) | 70 (32) |
| GSX50-1405 | 5.0 (127) | 14 (356) | 0.5 (12.7) | 1026/1709/2261 (4564/7602/10057) | 20 (508) | 102/170/226 (11.5/19.225.5) | 13200 (58717) | 0.04208 (0.004754) | 11656 (51848) | 70 (32) |
| GSX60-0603 | 7.0 (178) | 6 (152) | 0.25 (6.35) | 5098/NA/NA (22677/NA/NA) | 10 (254) | 241/NA/NA (27/NA/NA) | 25000 (111200) | 0.1736 (0.019614) | 25300 (112540) | 69 (31) |
| GSX60-0605 | 7.0 (178) | 6 (152) | 0.5 (12.7) | 2549/NA/NA (11339)/NA/NA) | 20 (508) | 241/NA/NA (27/NA/NA) | 25000 (111200) | 0.1736 (0.019614) | 22800 (101415) | 69 (31) |
| GSX60-0610 | 7.0 (178) | 6 (152) | 1.0 (25.4) | 1275/NA/NA (5671/NA/NA) | 40 (1018) | 241/NA/NA (27/NA/NA) | 25000 (111200) | 0.1736 (0.019614) | 21200 (94302) | 69 (31) |
| GSX60-1003 | 7.0 (178) | 10 (254) | 0.25 (6.35) | 5098/8656/12389 (22677/38504/55109) | 10 (254) | 241/409/585 (27/46/66) | 25000 (111200) | 0.1943 (0.021953) | 25300 (112540) | 101 (46) |
| GSX60-1005 | 7.0 (178) | 10 (254) | 0.5 (12.7) | 2549/4328/6195 (11339/19252/27557) | 20 (508) | 241/409/585 (27/46/66) | 25000 (111200) | 0.1943 (0.021953) | 22800 (101420) | 101 (46) |
| GSX60-1010 | 7.0 (178) | 10 (254) | 1.0 (25.4) | 1275/2164/3097 (5671/9626/13776) | 40 (1018) | 241/409/585 (27/46/66) | 25000 (111200) | 0.1943 (0.021953) | 21200 (94302) | 101 (46) |

***Force Rating:*** *The linear force produced by the actuator at continuous motor torque.*
***Max Velocity:*** *The linear velocity that the actuator will achieve at rated motor rpm.*
***Continuous Motor Torque:*** *The torque produced by the motor at rated continuous current.*
***Maximum Static Load:*** *The mechanical load limit of the actuator if re-circulated oil or other cooling method is used to allow higher than rated torque from the motor.*
***Armature Inertia:*** *The rotary inertia of the armature of the GSX series actuators. For calculation purposes, this value includes the screw inertia in a GSX actuator. Inertia tolerance value is +/- 5%.*
***Dynamic Load Rating:*** *A design constant used in calculating the estimated travel life of the roller screw. The dynamic mean load is the load at which the device will perform one million revolutions.*

# 5.1a GS Performance Specifications

| Model | Frame Size in (mm) | Stroke in (mm) | Screw Lead in (mm) | Force* Rating lb (N) | Max Velocity in/sec (mm/sec) | Continuous Motor Torque lb-in (N-m) | Maximum Static Load lb (N) | Armature Inertia lb-in-s$^2$ (Kg-m$^2$) | Dynamic Load Rating lb (N) | Weight (appr.) lb (Kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| GS20-0301 | 2.25 (57) | 3 (76) | 0.1 (2.54) | 402 (1788) | 8.33 (211.67) | 8.0 (0.88) | 1000 (4448) | 0.00101 (0.000114) | 2075 (9230) | 5.5 (2.5) |
| GS20-0302 | 2.25 (57) | 3 (76) | 0.2 (5.08) | 201 (894) | 16.67 (423.33) | 8.0 (0.88) | 1000 (4448) | 0.00101 (0.000114) | 1540 (6850) | 5.5 (2.5) |
| GS20-0304 | 2.25 (57) | 3 (76) | 0.4 (10.16) | 101 (449) | 33.33 (846.67) | 8.0 (0.88) | 1000 (4448) | 0.00101 (0.000114) | 1230 (5471) | 5.5 (2.5) |
| GS20-0601 | 2.25 (57) | 6 (152) | 0.1 (2.54) | 402 (1788) | 8.33 (211.67) | 8.0 (0.88) | 1000 (4448) | 0.00114 (0.000129) | 2075 (9230) | 9.5 (4.3) |
| GS20-0602 | 2.25 (57) | 6 (152) | 0.2 (5.08) | 201 (894) | 16.67 (423.33) | 8.0 (0.88) | 1000 (4448) | 0.00114 (0.000129) | 1540 (6850) | 9.5 (4.3) |
| GS20-0604 | 2.25 (57) | 6 (152) | 0.4 (10.16) | 101 (449) | 33.33 (846.67) | 8.0 (0.88) | 1000 (4448) | 0.00114 (0.000129) | 1230 (5471) | 9.5 (4.3) |
| GS20-1201 | 2.25 (57) | 12 (304) | 0.1 (2.54) | 402 (1788) | 8.33 (211.67) | 8.0 (0.88) | 1000 (4448) | 0.00143 (0.000162) | 2075 (9230) | 17.5 (8) |
| GS20-1202 | 2.25 (57) | 12 (304) | 0.2 (5.08) | 201 (894) | 16.67 (423.33) | 8.0 (0.88) | 1000 (4448) | 0.00143 (0.000162) | 1540 (6850) | 17.5 (8) |
| GS20-1204 | 2.25 (57) | 12 (304) | 0.4 (10.16) | 101 (449) | 33.33 (846.67) | 8.0 (0.88) | 1000 (4448) | 0.00143 (0.000162) | 1230 (5471) | 17.5 (8) |
| GS30-0302 | 3.125 (79) | 3 (76) | 0.2 (5.08) | 503 (2237) | 10 (254) | 20 (2.26) | 2000 (8896) | 0.00319 (0.00036) | 5800 (25798) | 9.5 (4.3) |
| GS30-0305 | 3.125 (79) | 3 (76) | 0.5 (12.7) | 201 (894) | 25 (635) | 20 (2.26) | 2000 (8896) | 0.00319 (0.00036) | 4900 (21795) | 9.5 (4.3) |
| GS30-0602 | 3.125 (79) | 5.9 (150) | 0.2 (5.08) | 503 (2237) | 10 (254) | 20 (2.26) | 2000 (8896) | 0.00361 (0.000408) | 5800 (25798) | 11.5 (5.2) |
| GS30-0605 | 3.125 (79) | 5.9 (150) | 0.5 (12.7) | 201 (894) | 25 (635) | 20 (2.26) | 2000 (8896) | 0.00361 (0.000408) | 4900 (21795) | 11.5 (5.2) |
| GS30-1002 | 3.125 (79) | 10 (254) | 0.2 (5.08) | 503 (2237) | 10 (254) | 20 (2.26) | 2000 (8896) | 0.00416 (0.00047) | 5800 (25798) | 19 (8.6) |
| GS30-1005 | 3.125 (79) | 10 (254) | 0.5 (12.7) | 201 (894) | 25 (635) | 20 (2.26) | 2000 (8896) | 0.00416 (0.00047) | 4900 (21795) | 19 (8.6) |
| GS30-1402 | 3.125 (79) | 14 (356) | 0.2 (5.08) | 503 (2237) | 10 (254) | 20 (2.26) | 2000 (8896) | 0.00473 (0.000534) | 5800 (25798) | 22 (10) |
| GS30-1405 | 3.125 (79) | 14 (356) | 0.5 (12.7) | 201 (894) | 25 (635) | 20 (2.26) | 2000 (8896) | 0.00473 (0.000534) | 4900 (21795) | 22 (10) |
| GS30-1802 | 3.125 (79) | 18 (457) | 0.2 (5.08) | 503 (2237) | 10 (254) | 20 (2.26) | 2000 (8896) | 0.00533 (0.000602) | 5800 (25798) | 25 (11.3) |
| GS30-1805 | 3.125 (79) | 18 (457) | 0.5 (12.7) | 201 (894) | 25 (635) | 20 (2.26) | 2000 (8896) | 0.00533 (0.000602) | 4900 (21795) | 25 (11.3) |

***Definitions***
***Force Rating:*** *The linear force produced by the actuator at continuous motor torque.*
***Max Velocity:*** *The linear velocity that the actuator will achieve at rated motor rpm.*
***Continuous Motor Torque:*** *The torque produced by the motor at rated continuous current.*
***Maximum Static Load:*** *The mechanical load limit of the actuator if re-circulated oil or other cooling method is used to allow higher than rated torque from the motor.*
***Armature Inertia:*** *The rotary inertia of the armature of the GS series actuators. For calculation purposes, this value includes the screw inertia in a GS actuator. Inertia tolerance is +/- 5%.*
***Dynamic Load Rating:*** *A design constant used in calculating the estimated travel life of the roller screw. The dynamic mean load is the load at which the device will perform one million revolutions.*

# 5.1a GS Performance Specifications (cont'd)

| Model | Frame Size in (mm) | Stroke in (mm) | Screw Lead in (mm) | Force* Rating lb (N) 1/2 Stack | Max Velocity in/sec (mm/sec | Cont. Motor Torque lb-in (N-m) 1/2 Stack | Maximum Static Load lb (N) | Armature Inertia lb-in-s$^2$ (Kg-m$^2$) | Dynamic Load Rating lb (N) | Wght. lb (Kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| GS40-0602 | 3.9 (99) | 6 (152) | 0.2 (5.08) | 1282 (5703) | 10 (254) | 51 (5.76) | 5000 (22400) | 0.0152 (0.001718) | 8300 (36920) | 20 (9.1) |
| GS40-0605 | 3.9 (99) | 6 (152) | 0.5 (12.7) | 513 (2282) | 25 (635) | 51 (5.76) | 5000 (22400) | 0.0152 (0.001718) | 7030 (31271) | 20 (9.1) |
| GS40-0802 | 3.9 (99) | 8 (203) | 0.2 (5.08) | 1282 (5703) | 10 (254) | 51 (5.76) | 5000 (22400) | 0.0163 (0.001845) | 8300 (36920) | 24 (10.9) |
| GS40-0805 | 3.9 (99) | 8 (203) | 0.5 (12.7 | 513 (2282) | 25 (635) | 51 (5.76) | 5000 (22400) | 0.0163 (0.001845) | 7030 (31271) | 24 (10.9) |
| GS40-1202 | 3.9 (99) | 12 (305) | 0.2 (5.08) | 1282 (5703) | 10 (254) | 51 (5.76) | 5000 (22400) | 0.0186 (0.002101) | 8300 (36920) | 32 (14.5) |
| GS40-1205 | 3.9 (99) | 12 (305) | 0.5 (12.7) | 513 (2282) | 25 (635) | 51 (5.76) | 5000 (22400) | 0.0186 (0.002101) | 7030 (31271) | 32 (14.5) |
| GS40-1802 | 3.9 (99) | 18 (457) | 0.2 (5.08) | 1282 (5703) | 10 (254) | 51 (5.76) | 5000 (22400) | 0.0220 (0.002483) | 8300 (36920) | 44 (20) |
| GS40-1805 | 3.9 (99) | 18 (457) | 0.5 (12.7) | 513 (2282) | 25 (635) | 51 (5.76) | 5000 (22400) | 0.0220 (0.002483) | 7030 (31271) | 44 (20) |
| GS45-0601 | 5.0 (127) | 6 (152) | 0.1 (2.54) | 3760/5894 (16725/26218) | 4 (101.6) | 74/116 (8.36/13.1) | 10000 (44800) | 0.0299 (0.003883) | 12674 (56377) | 31.5 (14.3) |
| GS45-0602 | 5.0 (127) | 6 (152) | 0.2 (5.08) | 1860/2916 (8274/12971) | 8 (203) | 74/116 (8.36/13.1) | 10000 (44800) | 0.0299 (0.003883) | 12500 (55600) | 31.5 (14.3) |
| GS45-0605 | 5.0 (127) | 6 (152) | 0.5 (12.7) | 774/1213 (3309/5396) | 20 (508) | 74/116 (8.36/13.1) | 10000 (44800) | 0.0299 (0.003883) | 10600 (47150) | 31.5 (14.3) |
| GS45-0610 | 5.0 (127) | 6 (152) | 1.0 (25.4) | 372/583 (1655/2593) | 40 (1016) | 74/116 (8.36/13.1) | 10000 (44800) | 0.0299 (0.003883) | 9500 (42260) | 31.5 (14.3) |
| GS45-1001 | 5.0 (127) | 10 (254) | 0.1 (2.54) | 37605894 (1672526218) | 4 (101.6) | 74/116 (8.36/13.1) | 10000 (44800) | 0.0353 (0.004584) | 12674 (56377) | 36.5 (16.5) |
| GS45-1002 | 5.0 (127) | 10 (254) | 0.2 (5.08) | 1860/2916 (8274/12971) | 8 (203) | 74/116 (8.36/13.1) | 10000 (44800) | 0.0353 (0.004584) | 12500 (55600) | 36.5 (16.5) |
| GS45-1005 | 5.0 (127) | 10 (254) | 0.5 (12.7) | 774/1213 (3309/5396) | 20 (508) | 74/116 (8.36/13.1) | 10000 (44800) | 0.0353 (0.004584) | 10600 (47150) | 36.5 (16.5) |
| GS45-1010 | 5.0 (127) | 10 (254) | 1.0 (25.4) | 372/583 (1655/2593) | 40 (1016) | 74/116 (8.36/13.1) | 10000 (44800) | 0.0353 (0.004584) | 9500 (42260) | 36.5 (16.5) |
| GS45-1402 | 5.0 (127) | 14 (356) | 0.2 (5.08) | 1860/2916 (8274/12971) | 8 (203) | 74/116 (8.36/13.1) | 10000 (44800) | 0.0408 (0.005298) | 12500 (55600) | 41 (18.7) |
| GS45-1405 | 5.0 (127) | 14 (356) | 0.5 (12.7) | 774/1213 (3309/5396) | 20 (508) | 74/116 (8.36/13.1) | 10000 (44800) | 0.0408 (0.005298) | 10600 (47150) | 41 (18.7) |
| GS45-1802 | 5.0 (127) | 18 (457) | 0.2 (5.08) | 1860/2916 (8274/12971) | 8 (203) | 74/116 (8.36/13.1) | 10000 (44800) | 0.0468 (0.006077) | 12500 (55600) | 47 (21.4) |
| GS45-1805 | 5.0 (127) | 18 (457) | 0.5 (12.7) | 774/1213 (3309/5396) | 20 (508) | 74/116 (8.36/13.1) | 10000 (44800) | 0.0468 (0.006077) | 10600 (47150) | 47 (21.4) |

***Force Rating:*** *The linear force produced by the actuator at continuous motor torque.*
***Max Velocity:*** *The linear velocity that the actuator will achieve at rated motor rpm.*
***Continuous Motor Torque:*** *The torque produced by the motor at rated continuous current.*
***Maximum Static Load:*** *The mechanical load limit of the actuator if re-circulated oil or other cooling method is used to allow higher than rated torque from the motor.*
***Armature Inertia:*** *The rotary inertia of the armature of the GS series actuators. For calculation purposes, this value includes the screw inertia in a GS actuator. Inertia tolerance is +/- 5%.*
***Dynamic Load Rating:*** *A design constant used in calculating the estimated travel life of the roller screw. The dynamic mean load is the load at which the device will perform one million revolutions.*

# 5.2 GSX Mechanical / Electrical Specifications (See 5.2a for GS Performance Specs)

| | GSX20 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nominal Backlash in (mm) | 0.004(.10) | | | | | | | | | | | |
| Maximum Backlash (pre-loaded) in (mm) | 0 | | | | | | | | | | | |
| Lead Accuracy in/ft (mm/300 mm) | 0.001 (.025) | | | | | | | | | | | |
| Maximum Radial Load lb (N) | 20 (90) | | | | | | | | | | | |
| Environmental Rating: Standard / Optional | IP65/67 | | | | | | | | | | | |
| **MOTOR STATOR** | **118** | **138** | **158** | **168** | **218** | **238** | **258** | **268** | **318** | **338** | **358** | **368** |
| **RMS Sinusoidal Commutation** | | | | | | | | | | | | |
| Continuous Motor Torque Lbf-in | 7.6 | 7.3 | 7.0 | 7.0 | 11.9 | 11.5 | 11.2 | 11.3 | 15.3 | 15.3 | 14.8 | 15.0 |
| (N-m) | (0.86) | (0.83) | (0.79) | (0.79) | (1.35) | (1.30) | (1.27) | (1.28) | (1.73) | (1.73) | (1.67) | (1.69) |
| Torque Constant (Kt) Lbf-in/A | 2.5 | 5.2 | 8.3 | 9.5 | 2.5 | 5.2 | 8.9 | 10.2 | 2.3 | 5.3 | 8.8 | 10.2 |
| +/- 10% @ 25 °C (N-m/A) | (0.28) | (0.59) | (0.94) | (1.07) | (0.28) | (0.59) | (1.00) | (1.15) | (0.26) | (0.60) | (0.99) | (1.15) |
| Cont. Current Rating:Greased (IG), A | 3.4 | 1.6 | 0.9 | 0.8 | 5.4 | 2.5 | 1.4 | 1.2 | 7.3 | 3.2 | 1.9 | 1.6 |
| Oiled (IL), A | 6.9 | 3.1 | 1.9 | 1.6 | 10.8 | 4.9 | 2.8 | 2.5 | 14.6 | 6.5 | 3.8 | 3.3 |
| Peak Current Rating A | 6.9 | 3.1 | 1.9 | 1.6 | 10.8 | 4.9 | 2.8 | 2.5 | 14.6 | 6.5 | 3.8 | 3.3 |
| **Trapezoidal Commutation** | | | | | | | | | | | | |
| Continuous Motor Torque Lbf-in | 7.3 | 7.0 | 6.7 | 6.7 | 11.4 | 11.0 | 10.7 | 10.8 | 14.7 | 14.6 | 14.1 | 14.3 |
| (N-m) | (0.82) | (0.79) | (0.76) | (0.76) | (1.29) | (1.24) | (1.21) | (1.22) | (1.66) | (1.65) | (1.60) | (1.61) |
| Torque Constant (Kt) Lbf-in/A | 1.9 | 4.1 | 6.5 | 7.4 | 1.9 | 4.1 | 6.9 | 7.9 | 1.8 | 4.1 | 6.9 | 7.9 |
| +/- 10% @ 25 °C (N-m/A) | (0.22) | (0.46) | (0.73) | (0.84) | (0.22) | (0.46) | (0.78) | (0.89) | (0.21) | (0.46) | (0.77) | (0.89) |
| Cont. Current Rating:Greased (IG), A | 4.2 | 1.9 | 1.1 | 1.0 | 6.6 | 3.0 | 1.7 | 1.5 | 9.0 | 4.0 | 2.3 | 2.0 |
| Oiled (IL), A | 8.4 | 3.9 | 2.3 | 2.0 | 13.2 | 6.0 | 3.5 | 3.0 | 17.9 | 8.0 | 4.6 | 4.0 |
| Peak Current Rating A | 8.4 | 3.9 | 2.3 | 2.0 | 13.2 | 6.0 | 3.5 | 3.0 | 17.9 | 8.0 | 4.6 | 4.0 |
| **Motor Stator Data** | | | | | | | | | | | | |
| Voltage Constant (Ke) Vrms / Krpm | 16.9 | 35.6 | 56.9 | 64.9 | 16.9 | 35.6 | 60.5 | 69.4 | 16.0 | 36.0 | 60.0 | 69.4 |
| +/- 10% @ 25 °C Vpk / Krpm | 23.9 | 50.3 | 80.5 | 91.8 | 23.9 | 50.3 | 85.5 | 98.1 | 22.6 | 50.9 | 84.9 | 98.1 |
| Pole Configuration | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Resistance (L-L) +/- 5% @ 25 °C Ohms | 2.6 | 12.5 | 35.2 | 45.8 | 1.1 | 5.3 | 16.0 | 20.7 | 0.62 | 3.1 | 9.4 | 12.2 |
| Inductance (L-L) +/- 15% mH | 5.1 | 22.8 | 58.3 | 75.8 | 2.5 | 11.0 | 31.7 | 41.7 | 1.5 | 7.4 | 20.5 | 27.4 |
| Brake Inertia lbf-in-sec$^2$ | 0.00012 | | | | | | | | | | | |
| kg-cm$^2$ | (0.135) | | | | | | | | | | | |
| Brake Current @ 24 Vdc A | 0.33 | | | | | | | | | | | |
| Brake Holding Torque lbf-in | 19 | | | | | | | | | | | |
| (Nm) | (2.2) | | | | | | | | | | | |
| Brake Engage/Disengage Time ms | 14/28 | | | | | | | | | | | |
| Mechanical Time Constant (tm), ms min | 6.0 | 6.5 | 7.1 | 71 | 2.5 | 2.7 | 2.9 | 2.8 | 1.6 | 1.6 | 1.7 | 1.7 |
| max | 8.5 | 9.2 | 10.1 | 10.1 | 3.6 | 3.9 | 4.0 | 4.0 | 2.2 | 2.2 | 2.4 | 2.4 |
| Electrical Time Constant (te) ms | 2.0 | 1.8 | 1.7 | 1.7 | 2.2 | 2.1 | 2.0 | 2.0 | 2.4 | 2.4 | 2.2 | 2.2 |
| Damping Constant lbf-in/krpm | 0.55 | 0.55 | 0.55 | 0.55 | 0.55 | 0.55 | 0.55 | 0.55 | 0.55 | 0.55 | 0.55 | 0.55 |
| (N-m/krpm) | (0.06) | (0.06) | (0.06) | (0.06) | (0.06) | (0.06) | (0.06) | (0.06) | (0.06) | (0.06) | (0.06) | (0.06) |
| Friction Torque lbf-in | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| (Nm) | (0.11) | (0.11) | (0.11) | (0.11) | (0.11) | (0.11) | (0.11) | (0.11) | (0.11) | (0.11) | (0.11) | (0.11) |
| Bus Voltage Vrms | 115 | 230 | 400 | 460 | 115 | 230 | 400 | 460 | 115 | 230 | 400 | 460 |
| Speed @ Bus Voltage RPM | 5000 | 5000 | 5000 | 5000 | 5000 | 5000 | 5000 | 5000 | 5000 | 5000 | 5000 | 5000 |
| Thermal Switch, case temperature deg C | 100 | | | | | | | | | | | |
| Motor Wire Insulation | Class 180 H | | | | | | | | | | | |
| Motor Stator Rating | Class 180 H | | | | | | | | | | | |

All ratings at 25 degrees Celsius. For amplifiers using peak sinusoidal ratings, multiply $K_t$ by .707 and current by 1.414. Refer to Performance Specifications for availability of 3 stack stator by stroke/lead combination. Test data derived using NEMA recommended aluminum heatsink 10" x 10" x ¼".

# 5.2 GSX Mechanical / Electrical Specifications (cont'd)

| | GSX30 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nominal Backlash in (mm) | 0.004(.10) | | | | | | | | | | | |
| Maximum Backlash (pre-loaded) in (mm) | 0 | | | | | | | | | | | |
| Lead Accuracy in/ft (mm/300 mm) | 0.001(.025) | | | | | | | | | | | |
| Maximum Radial Load lb (N) | 30(134) | | | | | | | | | | | |
| Environmental Rating: Standard / Optional | IP65/67 | | | | | | | | | | | |
| **MOTOR STATOR** | **118** | **138** | **158** | **168** | **218** | **238** | **258** | **268** | **318** | **338** | **358** | **368** |
| **RMS Sinusoidal Commutation** | | | | | | | | | | | | |
| Continuous Motor Torque Lbf-in | 16.6 | 16.5 | 15.7 | 15.7 | 26.8 | 26.8 | 26.7 | 26.7 | 38.7 | 38.3 | 36.3 | 36.3 |
| (N-m) | (1.88) | (1.87) | (1.77) | (1.78) | (3.03) | (3.03) | (3.02) | (3.01) | (4.38) | (4.33) | (4.10) | (4.10) |
| Torque Constant (Kt) Lbf-in/A | 4.4 | 8.7 | 15.5 | 17.5 | 4.4 | 8.7 | 15.5 | 17.5 | 4.4 | 8.7 | 15.7 | 17.6 |
| +/- 10% @ 25 °C (N-m/A) | (0.49) | (0.99) | (1.75) | (1.98) | (0.49) | (0.99) | (1.75) | (1.98) | (0.50) | (0.98) | (1.77) | (1.98) |
| Cont. Current Rating:Greased (IG), A | 4.2 | 2.1 | 1.1 | 1.0 | 6.9 | 3.4 | 1.9 | 1.7 | 9.7 | 4.9 | 2.6 | 2.3 |
| Oiled (IL), A | 8.5 | 4.2 | 2.3 | 2.0 | 13.7 | 6.8 | 3.8 | 3.4 | 19.5 | 9.9 | 5.2 | 4.6 |
| Peak Current Rating A | 8.5 | 4.2 | 2.3 | 2.0 | 13.7 | 6.8 | 3.8 | 3.4 | 19.5 | 9.9 | 5.2 | 4.6 |
| **Trapezoidal Commutation** | | | | | | | | | | | | |
| Continuous Motor Torque Lbf-in | 15.9 | 15.8 | 14.9 | 15.0 | 25.6 | 25.6 | 25.5 | 25.5 | 37.0 | 36.6 | 34.6 | 34.7 |
| (N-m) | (1.79) | (1.78) | (1.69) | (1.70) | (2.89) | (2.89) | (2.88) | (2.88) | (4.18) | (4.13) | (3.91) | (3.92) |
| Torque Constant (Kt) Lbf-in/A | 3.4 | 6.8 | 12.1 | 13.6 | 3.4 | 6.8 | 12.1 | 13.6 | 3.5 | 6.8 | 12.2 | 13.7 |
| +/- 10% @ 25 °C (N-m/A) | (0.39) | (0.77) | (1.37) | (1.54) | (0.39) | (0.77) | (1.37) | (1.54) | (0.39) | (0.76) | 1.38 | (1.55) |
| Cont. Current Rating:Greased (IG), A | 5.2 | 2.6 | 1.4 | 1.2 | 8.4 | 4.2 | 2.4 | 2.1 | 11.9 | 6.0 | 3.2 | 2.8 |
| Oiled (IL), A | 10.4 | 5.2 | 2.8 | 2.5 | 16.8 | 8.4 | 4.7 | 4.2 | 23.9 | 12.1 | 6.3 | 5.7 |
| Peak Current Rating A | 10.4 | 5.2 | 2.8 | 2.5 | 16.8 | 8.4 | 4.7 | 4.2 | 23.9 | 12.1 | 6.3 | 5.7 |
| **Motor Stator Data** | | | | | | | | | | | | |
| Voltage Constant (Ke) Vrms / Krpm | 29.9 | 59.7 | 106.0 | 119.5 | 29.9 | 59.7 | 106.0 | 119.5 | 30.3 | 59.2 | 106.9 | 119.9 |
| +/- 10% @ 25 °C Vpk / Krpm | 42.2 | 84.5 | 149.9 | 169.0 | 42.2 | 84.5 | 149.9 | 168.9 | 42.9 | 83.8 | 151.2 | 169.6 |
| Pole Configuration | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Resistance (L-L) +/- 5% @ 25C Ohms | 2.8 | 11.2 | 39.5 | 49.6 | 1.1 | 4.5 | 14.1 | 18.0 | 0.65 | 2.6 | 9.3 | 11.6 |
| Inductance (L-L) +/- 15% mH | 7.7 | 30.7 | 96.8 | 123.0 | 3.7 | 14.7 | 46.2 | 58.7 | 2.5 | 9.5 | 30.9 | 38.8 |
| Brake Inertia lbf-in-sec$^2$ | 0.00033 | | | | | | | | | | | |
| kg-cm$^2$ | (0.38) | | | | | | | | | | | |
| Brake Current @ 24 Vdc A | 0.5 | | | | | | | | | | | |
| Brake Holding Torque lbf-in | 70 | | | | | | | | | | | |
| (Nm) | (8) | | | | | | | | | | | |
| Brake Engage/Disengage Time ms | 19/29 | | | | | | | | | | | |
| Mechanical Time Constant (tm), ms min | 6.5 | 6.5 | 7.3 | 7.2 | 2.6 | 2.6 | 2.6 | 2.6 | 1.5 | 1.5 | 1.7 | 1.7 |
| max | 10.8 | 10.9 | 12.2 | 12.0 | 4.3 | 4.3 | 4.4 | 4.4 | 2.5 | 2.5 | 2.8 | 2.8 |
| Electrical Time Constant (te) ms | 2.8 | 2.7 | 2.5 | 2.5 | 3.3 | 3.3 | 3.3 | 3.3 | 3.8 | 3.7 | 3.3 | 3.3 |
| Damping Constant lbf-in/krpm | 1.23 | 1.23 | 1.23 | 1.23 | 1.23 | 1.23 | 1.23 | 1.23 | 1.23 | 1.23 | 1.23 | 1.23 |
| (N-m/krpm) | (.14) | (.14) | (.14) | (.14) | (.14) | (.14) | (.14) | (.14) | (.14) | (.14) | (.14) | (.14) |
| Friction Torque lbf-in | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |
| (Nm) | (0.23) | (0.23) | (0.23) | (0.23) | (0.23) | (0.23) | (0.23) | (0.23) | (0.23) | (0.23) | (0.23) | (0.23) |
| Bus Voltage Vrms | 115 | 230 | 400 | 460 | 115 | 230 | 400 | 460 | 115 | 230 | 400 | 460 |
| Speed @ Bus Voltage RPM | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| Thermal Switch, case temperature deg C | 100 | | | | | | | | | | | |
| Motor Wire Insulation | Class 180 H | | | | | | | | | | | |
| Motor Stator Rating | Class 180 H | | | | | | | | | | | |

All ratings at 25 degrees Celsius. For amplifiers using peak sinusoidal ratings, multiply $K_t$ by .707 and current by 1.414. Refer to Performance Specifications for availability of 3 stack stator by stroke/lead combination. Test data derived using NEMA recommended aluminum heatsink 10" x 10" x 3/8".

# 5.2 GSX Mechanical / Electrical Specifications (Cont'd)

| | GSX40 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Nominal Backlash in (mm) | 0.004 (.10) | | | | | | | | | |
| Maximum Backlash (pre-loaded) in (mm) | 0 | | | | | | | | | |
| Lead Accuracy in/ft (mm/300 mm) | 0.001 (.025) | | | | | | | | | |
| Maximum Radial Load lb (N) | 40 (179) | | | | | | | | | |
| Environmental Rating: Std / Opt. | IP65/67 | | | | | | | | | |
| **MOTOR STATOR** | **118** | **138** | **158** | **168** | **238** | **258** | **268** | **338** | **358** | **368** |
| **RMS Sinusoidal Commutation** | | | | | | | | | | |
| Continuous Motor Torque Lbf-in | 47.6 | 47.6 | 44.7 | 45.5 | 78.9 | 78.8 | 79.7 | 107.1 | 105.5 | 107.1 |
| (N-m) | (5.38) | (5.37) | (5.05) | (5.14) | (8.91) | (8.91) | (9.00) | (12.10) | (11.92) | (12.10) |
| Torque Constant (Kt) Lbf-in/A | 4.1 | 8.2 | 14.6 | 16.8 | 8.2 | 14.6 | 16.8 | 8.4 | 14.6 | 16.8 |
| +/- 10% @ 25 °C (N-m/A) | (0.46) | (0.93) | 1.65 | (1.90) | (0.93) | (1.65) | (1.90) | (0.95) | (1.65) | (1.90) |
| Cont. Current Rating: Greased (IG), A | 12.9 | 6.5 | 3.4 | 3.0 | 10.7 | 6.0 | 5.3 | 14.2 | 8.1 | 7.1 |
| Oiled (IL), A | 25.9 | 12.9 | 6.9 | 6.0 | 21.4 | 12.1 | 10.6 | 28.5 | 16.2 | 14.2 |
| Peak Current Rating A | 25.9 | 12.9 | 6.9 | 6.0 | 21.4 | 12.1 | 10.6 | 28.5 | 16.2 | 14.2 |
| **Trapezoidal Commutation** | | | | | | | | | | |
| Continuous Motor Torque Lbf-in | 45.5 | 45.4 | 42.7 | 43.5 | 75.3 | 75.3 | 76.1 | 102.3 | 100.7 | 102.3 |
| (N-m) | (5.14) | (5.13) | (4.83) | (4.91) | (9.51) | (8.50) | (8.60) | (11.56) | (11.38) | (11.56) |
| Torque Constant (Kt) Lbf-in/A | 3.2 | 6.4 | 11.4 | 13.1 | 6.4 | 11.4 | 13.1 | 6.6 | 11.4 | 13.1 |
| +/- 10% @ 25 °C (N-m/A) | (0.36) | (0.72) | (1.28) | (1.48) | (0.72) | (1.28) | (1.48) | (0.74) | (1.28) | (1.48) |
| Cont. Current Rating:Greased (IG), A | 15.9 | 7.9 | 4.2 | 3.7 | 13.1 | 7.4 | 6.5 | 17.4 | 9.9 | 8.7 |
| Oiled (IL), A | 31.7 | 15.8 | 8.4 | 7.4 | 26.3 | 14.8 | 13.0 | 34.9 | 19.8 | 17.4 |
| Peak Current Rating A | 31.7 | 15.8 | 8.4 | 7.4 | 26.3 | 14.8 | 13.0 | 34.9 | 19.8 | 17.4 |
| **Motor Stator Data** | | | | | | | | | | |
| Voltage Constant (Ke) Vrms / Krpm | 28.1 | 56.1 | 99.5 | 114.8 | 56.1 | 99.5 | 114.8 | 57.4 | 99.5 | 114.8 |
| +/- 10% @ 25 °C Vpk / Krpm | 39.7 | 79.4 | 140.7 | 162.4 | 79.4 | 140.7 | 162.4 | 81.2 | 140.7 | 162.4 |
| Pole Configuration | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Resistance (L-L) +/- 5% @ 25 °C Ohms | 0.4 | 1.7 | 6.0 | 7.8 | 0.7 | 2.26 | 3.0 | 0.5 | 1.52 | 1.9 |
| Inductance (L-L) +/- 15% mH | 3.0 | 11.9 | 37.5 | 49.9 | 5.8 | 18.2 | 24.2 | 4.0 | 12.0 | 16.0 |
| Brake Inertia lbf-in-sec$^2$ | 0.00096 | | | | | | | | | |
| Kg-cm$^2$ | (1.08) | | | | | | | | | |
| Brake Current @ 24 Vdc A | 0.67 | | | | | | | | | |
| Brake Holding Torque lb | 97 | | | | | | | | | |
| (N) | (11) | | | | | | | | | |
| Brake Engage/Disengage Time ms | 20/29 | | | | | | | | | |
| Mechanical Time Constant (tm), ms min | 5.3 | 5.3 | 6.0 | 5.8 | 2.3 | 2.3 | 2.2 | 1.5 | 1.5 | 1.5 |
| max | 7.7 | 7.7 | 8.7 | 8.4 | 3.3 | 3.3 | 3.2 | 2.1 | 2.2 | 2.1 |
| Electrical Time Constant (te) ms | 7.0 | 7.0 | 6.2 | 6.4 | 8.0 | 8.0 | 8.2 | 8.2 | 7.9 | 8.2 |
| Damping Constant lbf-in/krpm | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 | 3.25 |
| (N-m/krpm) | (0.37) | (0.37) | (0.37) | (0.37) | (0.37) | (0.37) | (0.37) | (0.37) | (0.37) | (0.37) |
| Friction Torque lbf-in | 4.50 | 4.50 | 4.50 | 4.50 | 4.50 | 4.50 | 4.50 | 4.50 | 4.50 | 4.50 |
| (Nm) | (0.51) | (0.51) | (0.51) | (0.51) | (0.51) | (0.51) | (0.51) | (0.51) | (0.51) | (0.51) |
| Bus Voltage Vrms | 115 | 230 | 400 | 460 | 230 | 400 | 460 | 230 | 400 | 460 |
| Speed @ Bus Voltage RPM | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| Thermal Switch, case temperature deg C | 100 | | | | | | | | | |
| Motor Wire Insulation | Class H | | | | | | | | | |
| Motor Stator Rating | Class H | | | | | | | | | |

All ratings at 25 degrees Celsius. For amplifiers using peak sinusoidal ratings, multiply $K_t$ by .707 and current by 1.414. Refer to Performance Specifications for availability of 3 stack stator by stroke/lead combination. Test data derived using NEMA recommended aluminum heatsink 12" x 12" x 1/2".

# 5.2 GSX Mechanical / Electrical Specifications (Cont'd)

| | GSX50 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Nominal Backlash in (mm) | 0.004 (.10) | | | | | | | |
| Maximum Backlash (pre-loaded) in (mm) | 0.0 | | | | | | | |
| Lead Accuracy in/ft (mm/300 mm) | 0.001 (.025) | | | | | | | |
| Maximum Radial Load lb (N) | 75 (337) | | | | | | | |
| Environmental Rating: Std / Opt. | IP65 | | | | | | | |
| **MOTOR STATOR** | **138** | **158** | **168** | **238** | **258** | **268** | **358** | **368** |
| **RMS Sinusoidal Commutation** | | | | | | | | |
| Continuous Motor Torque Lbf-in | 106.9 | 104.4 | 106.2 | 179.2 | 178.2 | 177.2 | 236.4 | 237.5 |
| (N-m) | 12.07 | 11.80 | 12.00 | 20.25 | 20.13 | 20.02 | 26.71 | 26.83 |
| Torque Constant (Kt) Lbf-in/A | 11.8 | 20.1 | 23.5 | 11.8 | 20.1 | 23.5 | 20.1 | 23.9 |
| +/- 10% @ 25 °C (N-m/A) | 1.33 | 2.28 | 2.66 | 1.33 | 2.28 | 2.66 | 2.28 | 2.70 |
| Cont. Current Rating:Greased (IG), A | 10.2 | 5.8 | 5.0 | 17.0 | 9.9 | 8.4 | 13.1 | 11.1 |
| Oiled (IL), A | 20.3 | 11.6 | 10.1 | 34.1 | 19.8 | 16.8 | 26.2 | 22.2 |
| Peak Current Rating A | 20.3 | 11.6 | 10.1 | 34.1 | 19.8 | 16.8 | 26.2 | 22.2 |
| **Trapezoidal Commutation** | | | | | | | | |
| Continuous Motor Torque Lbf-in | 102.0 | 99.7 | 101.5 | 171.1 | 170.1 | 169.2 | 225.8 | 226.8 |
| (N-m) | 11.53 | 11.26 | 11.46 | 19.34 | 19.22 | 19.12 | 25.51 | 25.62 |
| Torque Constant (Kt) Lbf-in/A | 9.2 | 15.7 | 18.3 | 9.2 | 15.7 | 18.3 | 15.7 | 18.7 |
| +/- 10% @ 25 °C (N-m/A) | 1.04 | 1.77 | 2.07 | 1.04 | 1.77 | 2.07 | 1.77 | 2.11 |
| Cont. Current Rating:Greased (IG), A | 12.4 | 7.1 | 6.2 | 20.9 | 12.1 | 10.3 | 16.1 | 13.6 |
| Oiled (IL), A | 24.9 | 14.2 | 12.4 | 41.7 | 24.2 | 20.6 | 32.1 | 27.2 |
| Peak Current Rating A | 24.9 | 14.2 | 12.4 | 41.7 | 24.2 | 20.6 | 32.1 | 27.2 |
| **Motor Stator Data** | | | | | | | | |
| Voltage Constant (Ke) Vrms / Krpm | 80.3 | 137.6 | 160.6 | 80.3 | 137.6 | 160.6 | 137.6 | 163.4 |
| +/- 10% @ 25 °C Vpk / Krpm | 113.5 | 194.6 | 227.1 | 113.5 | 194.6 | 227.1 | 194.6 | 231.1 |
| Pole Configuration | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Resistance (L-L) +/- 5% @ 25 °C Ohms | 1.00 | 3.09 | 4.06 | 0.37 | 1.11 | 1.52 | 0.66 | 0.92 |
| Inductance (L-L) +/- 15% mH | 23.7 | 69.6 | 94.8 | 10.7 | 31.6 | 43.0 | 20.3 | 28.7 |
| Brake Inertia lbf-in-sec$^2$ | 0.0084 | | | | | | | |
| Kg-cm$^2$ | (9.5) | | | | | | | |
| Brake Current @ 24 Vdc A | 1.0 | | | | | | | |
| Brake Holding Torque lbf-in | 354 | | | | | | | |
| (Nm) | (40) | | | | | | | |
| Brake Engage/Disengage Time ms | 25/73 | | | | | | | |
| Mechanical Time Constant (tm), ms min | 3.3 | 3.4 | 3.3 | 1.2 | 1.2 | 1.2 | 0.7 | 0.7 |
| max | 4.7 | 5.0 | 4.8 | 1.8 | 1.8 | 1.8 | 1.1 | 1.0 |
| Electrical Time Constant (te) ms | 23.6 | 22.6 | 23.4 | 28.9 | 28.5 | 28.2 | 31.0 | 31.2 |
| Damping Constant lbf-in/krpm | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 | 7.00 |
| (N-m/krpm) | 0.79 | 0.79 | 0.79 | 0.79 | 0.79 | 0.79 | 0.79 | 0.79 |
| Friction Torque lbf-in | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 | 8.00 |
| (Nm) | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| Bus Voltage Vrms | 230 | 400 | 460 | 230 | 400 | 460 | 400 | 460 |
| Speed @ Bus Voltage RPM | 2400 | 2400 | 2400 | 2400 | 2400 | 2400 | 2400 | 2400 |
| Thermal Switch, case temperature deg C | 100 | | | | | | | |
| Motor Wire Insulation | Class H | | | | | | | |
| Motor Stator Rating | Class H | | | | | | | |

All ratings at 25 degrees Celsius. For amplifiers using peak sinusoidal ratings, multiply $K_t$ by .707 and current by 1.414. Test data derived using NEMA recommended aluminum heatsink 12" x 12" x 1/2".

# 5.2 GSX Mechanical / Electrical Specifications (Cont'd)

| | GSX60 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Nominal Backlash in (mm) | 0.004(.10) | | | | | | | |
| Maximum Backlash (pre-loaded) in (mm) | 0.0 | | | | | | | |
| Lead Accuracy in/ft (mm/300 mm) | 0.001 (.025) | | | | | | | |
| Maximum Radial Load lb (N) | 100 (445) | | | | | | | |
| Environmental Rating: Std / Opt. | IP65 | | | | | | | |
| **MOTOR STATOR** | **138** | **158** | **168** | **238** | **258** | **268** | **358** | **368** |
| **RMS Sinusoidal Commutation** | | | | | | | | |
| Continuous Motor Torque Lbf-in | 252.6 | 249.9 | 252.6 | 424.8 | 423.0 | 427.5 | 604.2 | 615.0 |
| (N-m) | (28.53) | (28.23) | (28.53) | (47.99) | (47.79) | (48.30) | (68.26) | (69.49) |
| Torque Constant (Kt) Lbf-in/A | 12.6 | 21.8 | 25.2 | 12.6 | 21.8 | 25.2 | 21.4 | 25.2 |
| +/- 10% @ 25 °C (N-m/A) | (1.42) | (2.46) | (2.84) | (1.42) | (2.46) | (2.84) | (2.42) | (2.84) |
| Cont. Current Rating:Greased (IG), A | 22.4 | 12.8 | 11.2 | 37.7 | 21.7 | 19.0 | 31.6 | 27.3 |
| Oiled (IL), A | 44.9 | 25.6 | 22.4 | 75.5 | 43.4 | 38.0 | 63.1 | 54.6 |
| Peak Current Rating A | 44.9 | 25.6 | 22.4 | 75.5 | 43.4 | 38.0 | 63.1 | 54.6 |
| **Trapezoidal Commutation** | | | | | | | | |
| Continuous Motor Torque Lbf-in | 241.2 | 238.6 | 241.2 | 405.7 | 404.0 | 408.3 | 577.0 | 587.3 |
| (N-m) | (27.25) | (26.96) | (27.25) | (45.83) | (45.69) | (46.13) | (65.19) | (66.35) |
| Torque Constant (Kt) Lbf-in/A | 9.8 | 17 | 19.6 | 9.8 | 17.0 | 19.6 | 16.7 | 19.6 |
| +/- 10% @ 25 °C (N-m/A) | (1.11) | (1.92) | (2.22) | (1.11) | (1.92) | (2.22) | (1.88) | (2.22) |
| Cont. Current Rating:Greased (IG), A | 27.5 | 15.7 | 13.7 | 46.2 | 26.5 | 23.3 | 38.7 | 33.4 |
| Oiled (IL), A | 54.9 | 31.4 | 27.5 | 92.4 | 53.0 | 46.5 | 77.3 | 66.9 |
| Peak Current Rating A | 54.9 | 31.4 | 27.5 | 92.4 | 53.0 | 46.5 | 77.3 | 66.9 |
| **Motor Stator Data** | | | | | | | | |
| Voltage Constant (Ke) Vrms / Krpm | 85.9 | 148.9 | 171.8 | 85.9 | 149.9 | 171.8 | 146.1 | 171.8 |
| +/- 10% @ 25 °C Vpk / Krpm | 121.5 | 210.6 | 243.0 | 121.5 | 210.6 | 243.0 | 206.6 | 243.0 |
| Pole Configuration | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Resistance (L-L) +/- 5% @ 25 °C Ohms | 0.33 | 1.0 | 1.3 | 0.13 | 0.41 | 0.53 | 0.23 | 0.30 |
| Inductance (L-L) +/- 15% mH | 8.3 | 24.8 | 33.0 | 3.9 | 11.8 | 15.8 | 7.5 | 10.3 |
| Brake Inertia lbf-in-sec$^2$ | 0.02815 | | | | | | | |
| Kg-cm$^2$ | (31.8) | | | | | | | |
| Brake Current @ 24 Vdc A | 1.45 | | | | | | | |
| Brake Holding Torque lb-in | 708 | | | | | | | |
| (Nm) | (80) | | | | | | | |
| Brake Engage/Disengage Time ms | 53/97 | | | | | | | |
| Mechanical Time Constant (tm), ms min | 5.0 | 5.1 | 5.0 | 2.0 | 2.1 | 2.0 | 1.2 | 1.2 |
| max | 5.6 | 5.7 | 5.6 | 2.3 | 2.3 | 2.3 | 1.3 | 1.3 |
| Electrical Time Constant (te) ms | 25.4 | 24.6 | 25.1 | 29.4 | 29.1 | 29.8 | 33.0 | 34.2 |
| Damping Constant lbf-in/krpm | 28.0 | 28.0 | 28.0 | 28.0 | 28.0 | 28.0 | 28.0 | 28.0 |
| (N-m/krpm) | (3.16) | (3.16) | (3.16) | (3.16) | (3.16) | (3.16) | (3.16) | (3.16) |
| Friction Torque lbf-in | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 | 40.0 |
| (Nm) | (4.52) | (4.52) | (4.52) | (4.52) | (4.52) | (4.52) | (4.52) | (4.52) |
| Bus Voltage Vrms | 230 | 400 | 460 | 230 | 400 | 460 | 400 | 460 |
| Speed @ Bus Voltage RPM | 2400 | 2400 | 2400 | 2400 | 2400 | 2400 | 2400 | 2400 |
| Thermal Switch, case temperature deg C | 100 | | | | | | | |
| Motor Wire Insulation | Class 180 H | | | | | | | |
| Motor Stator Rating | Class 180 H | | | | | | | |

All ratings at 25 degrees Celsius. For amplifiers using peak sinusoidal ratings, multiply $K_t$ by .707 and current by 1.414. Test data derived using NEMA recommended aluminum heatsink 16" x 16" x 1". The GSX60-06 can only accommodate a single stack stator.

# 5.2a GS Mechanical / Electrical Specifications

| | | GS20 | | | | GS30 | | | | GS40 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nominal Backlash | in (mm) | 0.004(.10) | | | | 0.004(.10) | | | | 0.004(.10) | | |
| Maximum Backlash (pre-loaded) | in (mm) | 0 | | | | 0 | | | | 0 | | |
| Lead Accuracy | in/ft (mm/300 mm) | 0.001(.025) | | | | 0.001(.025) | | | | 0.001(.025) | | |
| Maximum Radial Load | lb (N) | 20 (90) | | | | 30(134) | | | | 40(179) | | |
| Environmental Rating: Standard / Optional | | IP65/67 | | | | IP65/67 | | | | IP65/67 | | |
| **MOTOR STATOR** | | **L6** | **M6** | **M6-DS** | **H6** | **L6** | **M6** | **M6-DS** | **H6** | **L8** | **M8** | **H8** |
| Trapeziodal Commutation Motor Data | | | | | | | | | | | | |
| Continuous Motor Torque | Lbf-in (N-m) | 8.0 (0.91) | 7.7(0.87) | 11.5 (1.29) | 7.2 (0.81) | 18.8 (2.13) | 19.4 (2.19) | 27.5(3.11) | 19.3(2.18) | 49.8(5.62) | 47.3(5.35) | 49.5(5.59) |
| Torque Constant (Kt) | Lbf-in/A (N-m/A) | 2.11(0.24) | 4.37(0.49) | 4.80 (0.54) | 8.68 (0.98) | 3.44 (0.39) | 6.90 (0.78) | 7.21(0.81) | 13.79(1.56) | 3.14(0.36) | 6.21(0.70) | 12.57(1.42) |
| Continuous Current Rating:Greased (IG), Amps | | 3.80 | 1.75 | 2.39 | 0.82 | 5.47 | 2.81 | 3.82 | 1.40 | 15.84 | 7.61 | 3.94 |
| | Oiled (IL), Amps | 7.61 | 3.50 | 4.77 | 1.65 | 10.94 | 5.63 | 7.63 | 2.80 | 31.67 | 15.23 | 7.87 |
| Peak Current Rating | Amps | 7.61 | 3.50 | 4.77 | 1.65 | 10.94 | 5.63 | 7.63 | 2.80 | 31.67 | 15.23 | 7.87 |
| RMS Sinusoidal commutation motor data | | | | | | | | | | | | |
| Continuous Motor Torque | Lbf-in (N-m) | 8.4 (0.95) | 8.0 (0.91) | 12.0 (1.36) | 7.5 (0.85) | 19.7(2.23) | 20.3(2.30) | 28.8(3.26) | 20.2(2.28) | 52.1(5.89) | 49.5(5.60) | 51.8(5.85) |
| Torque Constant (Kt) | Lbf-in/A (N-m/A) | 2.71 (0.31) | 5.61 (0.63) | 6.16 (0.70) | 11.13 (1.26) | 4.41 (0.50) | 8.85 (1.00) | 9.25 (1.04) | 17.68 (2.00) | 4.03 (0.46) | 7.97 (0.90) | 16.12 (1.82) |
| Continuous Current Rating:Greased (IG), Amps | | 3.11 | 1.43 | 1.95 | 0.67 | 4.47 | 2.30 | 3.12 | 1.14 | 12.93 | 6.22 | 3.21 |
| | Oiled (IL), Amps | 6.21 | 2.86 | 3.90 | 1.35 | 8.93 | 4.60 | 6.23 | 2.29 | 25.86 | 12.43 | 6.43 |
| Peak Current Rating | Amps | 6.21 | 2.86 | 3.90 | 1.35 | 8.93 | 4.60 | 6.23 | 2.29 | 25.86 | 12.43 | 6.43 |
| Voltage Constant (Ke) | Vrms / Krpm | 19.6 | 40.80 | 43.7 | 81.60 | 31.2 | 62.4 | 63.5 | 124.8 | 28.7 | 56.90 | 114.70 |
| | Vpk / Krpm | 28.10 | 58.50 | 61.8 | 117.0 | 45.0 | 90.0 | 91.5 | 180 | 40.6 | 80.50 | 162.22 |
| Pole Configuration | | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 8 | 8 | 8 |
| Resistance (L-L) | Ohms | 1.72 | 8.10 | 4.36 | 36.52 | 2.37 | 8.96 | 4.87 | 36.17 | 0.3 | 1.29 | 4.81 |
| Inductance (L-L) | mH | 1.08 | 4.69 | 2.88 | 18.76 | 3.92 | 15.72 | 9.62 | 62.92 | 0.47 | 2.49 | 9.72 |
| Brake Current @ 24 Vdc | A | .21 | .21 | .21 | .21 | .72 | .72 | .72 | .72 | .88 | .88 | .88 |
| Brake Holding Torque – Dry | lbf-in | 24 | 24 | 24 | 24 | 78 | 78 | 78 | 78 | 120 | 120 | 120 |
| | (Nm) | (2.71) | (2.71) | (2.71) | (2.71) | (8.81) | (8.81) | (8.81) | (8.81) | (13.56) | (13.56) | (13.56) |
| Brake Holding Torque – Oil Lubricated | lb-in | 8 | 8 | 8 | 8 | 26 | 26 | 26 | 26 | 40 | 40 | 40 |
| | (Nm) | (0.90) | (0.90) | (0.90) | (0.90) | (2.94) | (2.94) | (2.94) | (2.94) | (4.52) | (4.52) | (4.52) |
| Brake Engage/Disengage Time | ms | 250/50 | 250/50 | 250/50 | 250/50 | 250/50 | 250/50 | 250/50 | 250/50 | 250/50 | 250/50 | 250/50 |
| Mechanical Time Constant (tm), ms | min | 3.06 | 3.35 | 1.56 | 3.80 | 5.12 | 4.82 | 2.47 | 4.87 | 3.71 | 4.09 | 3.76 |
| | max | 4.33 | 4.74 | 2.20 | 5.39 | 8.55 | 8.06 | 4.12 | 8.14 | 5.36 | 5.91 | 5.43 |
| Electrical Time Constant (te) | ms | 0.63 | 0.58 | 0.66 | 0.51 | 1.65 | 1.75 | 1.98 | 1.74 | 1.58 | 1.94 | 2.02 |
| Damping Constant | lbf-in/krpm (N-m/krpm) | 0.55(0.06) | 0.55(0.06) | 0.55(0.06) | 0.55(0.06) | 1.23(.14) | 1.23(.14) | 1.23(.14) | 1.23(.14) | 3.25(0.37) | 3.25(0.37) | 3.25(0.37) |
| Friction Torque | lbf-in (Nm) | 1.00(0.11) | 1.00(0.11) | 1.00(0.11) | 1.00(0.11) | 2.00(0.23) | 2.00(0.23) | 2.00(0.23) | 2.00(0.23) | 4.50(0.51) | 4.50(0.51) | 4.50(0.51) |
| Bus Voltage | VDC | 115 | 230 | 230 | 460 | 115 | 230 | 230 | 460 | 115 | 230 | 460 |
| Speed @ Bus Voltage | RPM | 5000 | 5000 | 5000 | 5000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| Thermal Switch, case temperature | °C | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Standard Connectors ("O" Option): | Motor | MS-3112-E16-8P | | | | MS-3112-E16-8P | | | | MS-3112-E16-8P | | |
| | Feedback | MS-3112-E14-18P | | | | MS-3112-E14-18P | | | | MS-3112-E14-18P | | |
| | Brake / Limit Sw. | MS-3112-E12-8P | | | | MS-3112-E12-8P | | | | MS-3112-E12-8P | | |
| End Switches (optional) | | NC, NPN 9-24VDC 20mA | | | | NC, NPN 9-24VDC 20mA | | | | Not Available | | |
| Motor Wire Insulation | | Class H | | | | Class H | | | | Class H | | |
| Motor Stator Rating | | Class F | | | | Class F | | | | Class F | | |

All ratings at 25 degrees Celsius. For amplifiers with peak sinusoidal commutation Kt = Ktrms(0.707), c = Icrms/(0.707), Ipk = Ipkrms/(0.707)

# 5.2a GS Mechanical / Electrical Specifications (Cont'd)

| | | GS45 | | | | | GS60 | |
|---|---|---|---|---|---|---|---|---|
| Nominal Backlash | in (mm) | 0.004(.10) | | | | | 0.004(.10) | |
| Maximum Backlash (pre-loaded) | in (mm) | 0.0 | | | | | 0.0 | |
| Lead Accuracy in/ft (mm/300 mm) | | 0.001(.025) | | | | | 0.001(.025) | |
| Maximum Radial Load | lb (N) | 50 (225) | | | | | 75(337) | |
| Environmental Rating: Standard / Optional | | IP65/67 | | | | | IP65/67 | |
| **MOTOR STATOR** | | **L6** | **M6** | **M6-DS** | **H6** | **H6-DS** | **M6** | **H6** |
| **Trapezoidal commutation stator data** | | | | | | | | |
| Continuous Motor Torque | Lb-in (N-m) | 70.3 (7.94) | 71.4 (8.07) | 125.0(14.12) | 69.1(7.80) | 116.5(13.16) | 375.1(42.38) | 384.1(43.39) |
| Torque Constant (Kt) | Lb-in/A (N-m/A) | 4.44(0.50) | 8.89(1.00) | 9.56(1.08) | 17.34(1.96) | 17.89(2.02) | 9.93(1.12) | 19.90(2.25) |
| Continuous Current Rating: Greased (IG) | Amps | 15.84 | 8.03 | 13.08 | 3.98 | 6.51 | 37.78 | 19.29 |
| Oiled (IL) | Amps | 31.67 | 16.06 | 26.15 | 7.96 | 13.03 | 75.55 | 38.59 |
| Peak Current Rating | Amps | 31.67 | 16.06 | 26.15 | 7.96 | 13.03 | 75.55 | 38.59 |
| **RMS Sinusoidal amplifier information** | | | | | | | | |
| Continuous Motor Torque | Lb-in (N-m) | 73.6 (8.32) | 74.8 (8.45) | 130.9 (14.79) | 72.3 (8.17) | 122.0 (13.79) | 392.9 (44.39) | 402.2 (45.44) |
| Torque Constant (Kt) | Lb-in/A (N-m/A) | 5.69 (0.64) | 11.40 (1.29) | 12.26 (1.39) | 22.24 (2.51) | 22.94 (2.59) | 12.74 (1.44) | 25.53 (2.88) |
| Continuous Current Rating: Greased (IG), Amps | | 12.93 | 6.56 | 10.68 | 3.25 | 5.32 | 30.84 | 15.75 |
| Oiled (IL), Amps | | 25.86 | 13.11 | 21.36 | 6.50 | 10.64 | 61.69 | 31.51 |
| Peak Current Rating | Amps | 25.86 | 13.11 | 21.36 | 6.50 | 10.64 | 61.69 | 31.51 |
| Voltage Constant (Ke) | Vrms / Krpm | 41.00 | 82.00 | 85.00 | 160.00 | 159.10 | 92.50 | 185.00 |
| | Vpk / Krpm | 57.00 | 114.00 | 118.50 | 223.00 | 222.50 | 130.00 | 260.00 |
| Pole Configuration | | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| Resistance (L-L) | Ohms | 0.45 | 1.75 | 0.66 | 7.12 | 2.66 | 0.18 | 0.69 |
| Inductance (L-L) | mH | 1.71 | 6.93 | 3.12 | 27.54 | 12.30 | 1.99 | 7.58 |
| Brake Inertia | lbf-in-sec$^2$ | .00272 | .00272 | .00272 | .00272 | .00272 | -- | -- |
| | Kg-cm$^2$ | (3.073) | (3.073) | (3.073) | (3.073) | (3.073) | -- | -- |
| Brake Current @ 24 Vdc | A | .89 | .89 | .89 | .89 | .89 | 1.13 | 1.13 |
| Brake Holding Torque – Dry | lbf-in | 220 | 220 | 220 | 220 | 220 | 600 | 600 |
| | (Nm) | (24.86) | (24.86) | (24.86) | (24.86) | (24.86) | (67.8) | (67.8) |
| Brake Holding Torque – Oil Lubricated | lb-in | 90 | 90 | 90 | 90 | 90 | 375 | 375 |
| | (Nm) | (10.17) | (10.17) | (10.17) | (10.17) | (10.17) | (42.38) | (42.38) |
| Brake Engage/Disengage Time | ms | 250/50 | 250/50 | 250/50 | 250/50 | 250/50 | 250/50 | 250/50 |
| Mechanical Time Constant (tm), ms | min | 5.56 | 5.40 | 1.82 | 5.76 | 2.09 | 2.84 | 2.71 |
| | max | 8.72 | 8.46 | 2.86 | 9.02 | 3.28 | 2.84 | 2.71 |
| Electrical Time Constant (te) | ms | 3.79 | 3.96 | 4.73 | 3.87 | 4.62 | 11.06 | 10.99 |
| Damping Constant | lb-in/krpm (N-m/krpm) | 6.33(0.71) | 6.33(0.71) | 6.33(0.71) | 6.33(0.71) | 6.33(0.71) | 28.00(3.16) | 28.00(3.16) |
| Friction Torque | lb-in (N-m) | 7.7(0.86) | 7.7(0.86) | 7.7(0.86) | 7.7(0.86) | 7.7(0.86) | 40.00(4.52) | 40.00(4.52) |
| Bus Voltage | VDC | 115 | 230 | 230 | 460 | 460 | 230 | 460 |
| Speed @ Bus Voltage | RPM | 2400 | 2400 | 2400 | 2400 | 2400 | 2400 | 2400 |
| Thermal Switch | °C | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| Standard Connectors: | Motor | MS-3112-E16-8P | | | | | MS-3102-E20-10P | |
| | Feedback | MS-3112-E14-18P | | | | | MS-3112-E14-18P | |
| | Brake / Limit Sw. | MS-3112-E12-8P | | | | | MS-3112-E12-8P | |
| End Switches (optional) | | NC, NPN 9-24VDC 20 mA | | | | | NC, NPN 9-24VDC 20 mA | |
| Motor Wire Insulation | | Class H | | | | | Class H | |
| Motor Stator Rating | | Class F | | | | | Class F | |

All ratings at 25 degrees Celsius. For amplifiers with peak sinusoidal commutation Kt = Ktrms(0.707), c = Icrms/(0.707), Ipk = Ipkrms/(0.707)

# 6.0 TROUBLESHOOTING PROCEDURES

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

| Symptom / Trouble | Possible Cause / Troubleshooting Procedure |
|---|---|
| No response from actuator. | 1. Check amplifier for faults that may indicate problem.<br>2. Check to insure that amplifier is enabled.<br>3. Check for proper wiring. |
| Actuator seems to be enabled (receiving current) but is not operating or is operating erratically. | 1. Amplifier may be improperly tuned. Check all gain settings. If a motor file, or parameters specific to your amplifier/actuator combination have been supplied by Exlar, be sure that they are entered or downloaded properly.<br>2. Amplifier may be set up improperly for the particular motor being used. Check amplifier settings for number of poles, voltage, current, resistance, inductance, inertia, etc.<br>3. Feedback wiring may be incorrect.<br>4. Feedback conductors touching, or feedback cable may be damaged.<br>5. Motor phases are wired incorrectly or in incorrect order. (R,S,T).<br>6. Feedback (resolver or encoder) is improperly aligned. Contact Exlar. |
| Actuator cannot move load. | 1. Load is too large for the capacity of the actuator or too much friction is present.<br>2. Excessive side load.<br>3. Misalignment of output rod to load.<br>4. Amplifier has too low of current capacity or is limited to too low of current capacity. |
| Actuator housing moves or vibrates when shaft is in motion. | 1. Check actuator mounting. Insure that the actuator is securely mounted.<br>2. Amplifier is improperly tuned (wrong gain settings.) Tune amplifier. |
| Output rod rotates during motion and thus does not provide proper linear motion. | 1. Install Exlar anti-rotation assembly or incorporate anti-rotation into the application. |
| Limit switches not functioning. | 1. Limit switches wired improperly. Refer to manual.<br>2. The device being driven by the limit switches is not compatible with the electrical output of the limit switch. Check device requirements.<br>3. Switches have been damaged by improper wiring or improper voltage applied. Replace switches. |
| Brake does not hold load in place. | 1. Load is larger than the capacity of the brake.<br>-check load level against actuator rating<br>-oil lubricated units reduce holding capacity of the brake<br>2. Brake is not engaged. (Power is not removed, or only partially removed from brake).<br>3. Brake is being used as other than a power loss holding brake. |
| Actuator is overheating. | 1. Insufficient cooling for application requirements. See oil cooling section of this manual or Exlar catalog or contact Exlar engineering.<br>2. Actuator is being operated outside of continuous ratings.<br>3. Amplifier is poorly tuned causing excessive unnecessary current to be applied to motor. Check Gain settings. |

## 6.1 Returning Product for Repair

### STANDARD REPAIR LEADTIME:

- Two weeks for written evaluation from Exlar
- Two weeks from receipt of approval (by fax or email) for repair where parts are available.
- An evaluation charge per unit after evaluation applies if customer chooses not to repair; or if product is found not in need of repair.

### EXPEDITED REPAIR LEADTIME:

- An expedite charge per unit can be quoted.
- This provides one week for written evaluation from Exlar
- This provides one week from receipt of approval (by fax or email) for repair where parts are available.

### PROCEDURE:

- Please discuss the return with Exlar Technical Support prior to requesting an RGA number to see if it is possible to resolve the issue prior to return.
- If it is determined that an RGA number is required, please do so by contacting the Returned Goods Administrator. Phone 952-500-6200 or email returns@exlar.com.
    - International Repairs: Closely follow instructions provided by the Exlar Returned Goods Administrator. Failure to comply with issued instructions may result in delays for repair and return.
- Exlar requires a purchase order at the time of RGA; $0 on warranty returns, or for the standard evaluation charge per unit on all non-warranty units for the evaluation fee.
- Following the evaluation, you will receive a quote from Exlar on the charges that will apply. If the actuator repair is approved, the evaluation fee will be waived and we will request an amended PO for the actual repair value.

# 7.0 GSX Force Measuring Option

## 7.1 Overview

This option features an internal strain gage type load cell. The load cell is factory preloaded to approximately 10,000 pounds. This preload can be measured by applying the 10V excitation and reading the mV output, and scaling the output by the calibration factor.

Example: If the calibration factor is 1.656 mV/V at full load, and the excitation supply is 10 volts, and the output signal is .894 mV, then without any external load on the actuator, the preload is:

Q = .894 x 20000/(1.656 x 10) = 1079 pounds

This preload will vary with time and temperature. Note that power supplies commonly used with load cells will also amplify the output signal to volts rather than millivolts.

## 7.2 Operation

Prior to applying load, sample the signal, either at rest or during move to load. Determine best method to minimize friction biasing.

At application of load, sample the signal and compare to unloaded value. The result is the load.

Example: Given the preload Q of 1079 pounds, and the signal after a load is applied is .338 mV, what is the load?

P = (.894-.338) x 20000 / (1.656 x 10) = 671 pounds

Note a positive value indicates the load is a compressive load on the actuator rod and a negative value indicates a tensile load on the rod actuator.

## 7.3 Specifications and Calibration Data

**GSX40 Specifications**
Excitation: 10VDC
Input Impedance: 352 Ohms
Output Impedance: 353 Ohms
Electrical Leakage: Infinite Meg Ohm

**Capacities:**
500 – 4000 lbs
200 Hz frequency response
**For specifications on other frame sizes please contact Exlar Applications Engineering Dept.**

## 7.4 Wiring Code

Wiring for the load cell connector depends on the type of connectors used on the actuator for power and feedback. If the connection option selects MS style connectors, an MS style load cell connector is used. If the connection option selects M23 or other style of connectors, an M12 eurofast style connector is used.

Mating cable for the MS style connector is CBL-ASSY1-SMA-xxx (length in ft).

| Pin | Function | |
|---|---|---|
| A | ( + )Excitation | 10V |
| B | ( - ) Excitation | |
| C | ( - ) Output | |
| D | ( + ) Output | |
| E | | |
| F | Shield | |
| G | | |
| H | | |

Continued next page.

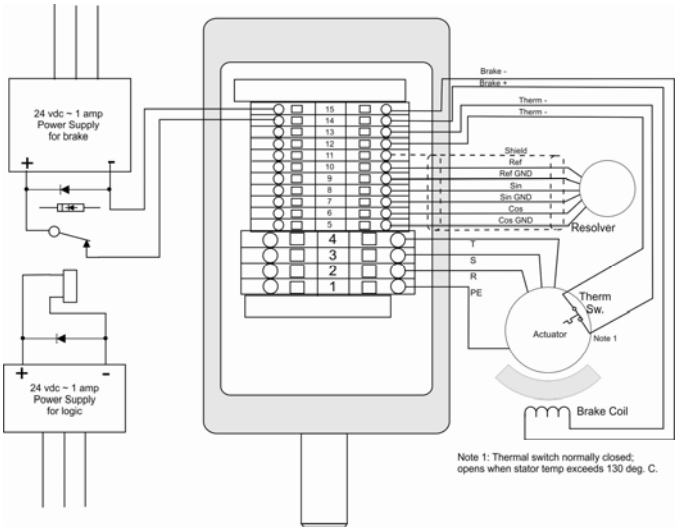
Mating cable for the M12 Euro style connector is CBL-ASSY1-SM1-xxx (length in ft.).

| Pin | Function | |
|---|---|---|
| 1 | ( + )Excitation | 10V |
| 2 | ( - ) Excitation | |
| 3 | ( - ) Output | |
| 4 | ( + ) Output | |
| 5 | Shield | |

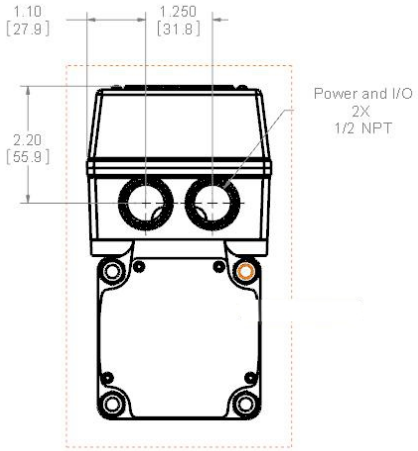
# 8.0 GSX Class I Division 2 Option

Class I division 2 products are provided with an electrical box containing terminal strips for customer wiring access. The electrical box has two ½-NPT ports for customer conduit connection. It is the responsibility of the installer to insure that the interconnecting wire, cabling and conduit meet any local or regional required electrical codes and standards.

## 8.1 Terminal Box Wiring diagram




## 8.2 Terminal Box Dimensions



## 9.0 Certifications

# Certificate of Compliance

Certificate Number 20111220 – E225288B
Report Reference E225288 – 2002 May 31
Issue Date 2011 December 20



Underwriters Laboratories

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

*This is to certify that representative samples of* **Servo and Stepper Motors**

**Permanent Magnet servo motors, GSX or SR Series, Model GSM or GSX or SR; *followed by 20, 21, 30, 31, 40, 41, 50, 60, 90 or 115; followed by 01 through 24 or XX; followed by 01 through 99 or XX; followed by A, B, D, E, I, J, M, N, O, P, S, T or X; *followed by B, C, D, E, F, G, J, K, M, q, R, S, T, Z or X; followed by A, B, F, L, M, R, V, W or X; followed by three letters or numbers; followed by 1,2, 3 or X; followed by A, B, C, 1, 3, 5, 6 or X; followed by 6 or 8;may be followed by 01 through 99, AR, AS, AX, CF, EB, EN, ES, ET, FC, FF, FG, FM, FX, HB, HC, HW, L1, L2, L3, LT, MW, NI, P5, PB, *PF, RB, RD, SD, SR, SS, XH, XL, XM, N4, XT, XX; may be followed by 00000 through 99999.**

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

*Standard(s) for Safety:* **ANSI/UL 1004-1, "Rotating Electrical Machines - General Requirements" and CSA-C22.2 No. 100, "Motors and Generators."**

*Additional Information:* See UL On-line Certification Directory at WWW.UL.COM for additional information.

**Only those products bearing the UL Recognized Component Marks for the U.S. and Canada should be considered as being covered by UL's Recognition and Follow-Up Service and meeting the appropriate U.S. and Canadian requirements.**

The UL Recognized Component Mark for the U.S. generally consists of the manufacturer's identification and catalog number, model number or other product designation as specified under "Marking" for the particular Recognition as published in the appropriate UL Directory. As a supplementary means of identifying products that have been produced under UL's Component Recognition Program, UL's Recognized Component Mark: may be used in conjunction with the required Recognized Marks. The Recognized Component Mark is required when specified in the UL Directory preceding the recognitions or under "Markings" for the individual recognitions. The UL Recognized Component Mark for Canada consists of the UL Recognized Mark for Canada: and the manufacturer's identification and catalog number, model number or other product designation as specified under "Marking" for the particular Recognition as published in the appropriate UL Directory.

**Look for the UL Recognized Component Mark on the product**

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

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

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

# *Declaration of Conformity*

(according to ISO/IEC 17050-1 and ISO/IEC 17050-2)

**Manufacturer's Name:** Exlar Corporation

**Manufacturer's Address:** 18400 West 77th Street
Chanhassen, MN 55317
USA

*declares, that the product:*

**Product Name:** GSX, GSM, SR, SLM, SLG Series
(Complete Model Listing Below)

**Models:** **GSX20, GSX30, GSX40, GSX50, GSX60, GSX90, GSX115**
**SR21, SR31, SR41**
**SLM060, SLM090, SLM115, SLM142,SLM180**
**SLG060, SLG090, SLG115**
**GSM20, GSM30, GSM40**

to which this declaration relates, **meets the essential health and safety requirements** and is in conformity with the relevant EU Directives listed below:

**EU EMC Directive 2004/108/EC**
**EU Low Voltage Directive 2006/95/EC**

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

EMC: EN 55014-1: 2006
EN 55014-2: 1997 + A1: 2001 + A2: 2008

Safety: EN 60034-1: 2004

**October 29th, 2004**
Date of issue

Chief Technology Officer

**European Contact:**

**Exlar GmbH**
**Frankfurter Str. 107**
**65479 Raunheim, Germany**

CSA INTERNATIONAL

# Certificate of Compliance

**Certificate:** 2257566 **Master Contract:** 163694

**Project:** 2293203 **Date Issued:** 2010/04/01

**Issued to:** **Exlar Corporation**

**1470 Lake Dr W**
**Chanhassen, MN 55317**
**USA**
**Attention: Bill Zerull**

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

C US

*Rob Kohuch, P.Eng.*

**Issued by:** Rob Kohuch, P.Eng.

**PRODUCTS**

**CLASS 3228 02** - VALVES - Actuators - For Hazardous Locations
**CLASS 3228 82** - VALVES - Actuators - For Hazardous Locations-Certified to U.S. Standard

Class I, Division 2, Group A, B, C and D:

• GSX & GSM Series Linear Actuators and SLM & SLG Series Rotary Actuators, input rated 24Vdc, 48Vdc, 120Vdc, 115Vrms, 230Vrms, 400Vrms, 460Vrms or a Special Voltage Rating (not exceeding 460 Vrms), 50A max. Temperature Code T4 (135°C), -50°C ≤ Ta ≤ +65°C (see note 2).

Model Code Information:

GSX/GSMxx-xx xx-Txx-aaa-xbx-xx..c..NI..xx

aaa – resolver feedback

b - Voltage Rating

A = 24Vdc

B = 48Vdc

C = 120Vdc

1 = 115Vrms

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| | | | |
|---|---|---|---|
| **Certificate:** | 2257566 | **Master Contract:** | 163694 |
| **Project:** | 2293203 | **Date Issued:** | 2010/04/01 |

3 = 230Vrms

5 = 400Vrms

6 = 460Vrms

X = Special Voltage Rating - Not to Exceed 460Vrms

c – Optional Mechanical and Speed Designations

HW = Hand-Wheel Switch

xx = denotes other options not affecting safety

x – denotes options not affecting safety

SLM/SLGxxx-xxx-xTxx-aaa-xbx-xx..NI..xx

aaa – Resolver Feedback

b - Voltage Rating

A = 24Vdc

B = 48Vdc

C = 120Vdc

1 = 115Vrms

3 = 230Vrms

5 = 400Vrms

6 = 460Vrms

X = Special Voltage Rating - Not to Exceed 460Vrms

x – denotes options not affecting safety

**Conditions of Certification**

1. This Certification covers the actuator only. The end use suitability of the combination of the associated electronic controller and the actuator is to be determined by the local inspection authority having jurisdiction.

CSA INTERNATIONAL

| | | | |
|---|---|---|---|
| **Certificate:** | 2257566 | **Master Contract:** | 163694 |
| **Project:** | 2293203 | **Date Issued:** | 2010/04/01 |

2. The actuators may include a hand-wheel switch (denoted by HW in Model Code). In such cases, the hand-wheel switch conduit must be sealed within 18 inches. When the handwheel option is included the maximum ambient temperature rating is -20°C ≤ Ta ≤ +40°C.

3. The actuators may include a holding brake. The thermal effects of the brake pad have not been evaluated and are to be considered by the authority having jurisdiction.

**APPLICABLE REQUIREMENTS**

CSA C22.2 No 0 - M1991 - General Requirements - Canadian Electrical Code Part II

CSA C22.2 No 0.4 - 04 - Bonding of Electrical Equipment

CSA C22.2 No 139 - M1982 - Electrically Operated Valves

CSA C22.2 No 213 - M1987 - Non-Incendive Electrical Equipment for Use in Class I, Division 2 Hazardous Locations

UL 429 - 2004 - Electrically Operated Valves

ISA 12.12.01: 2007 - Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations

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