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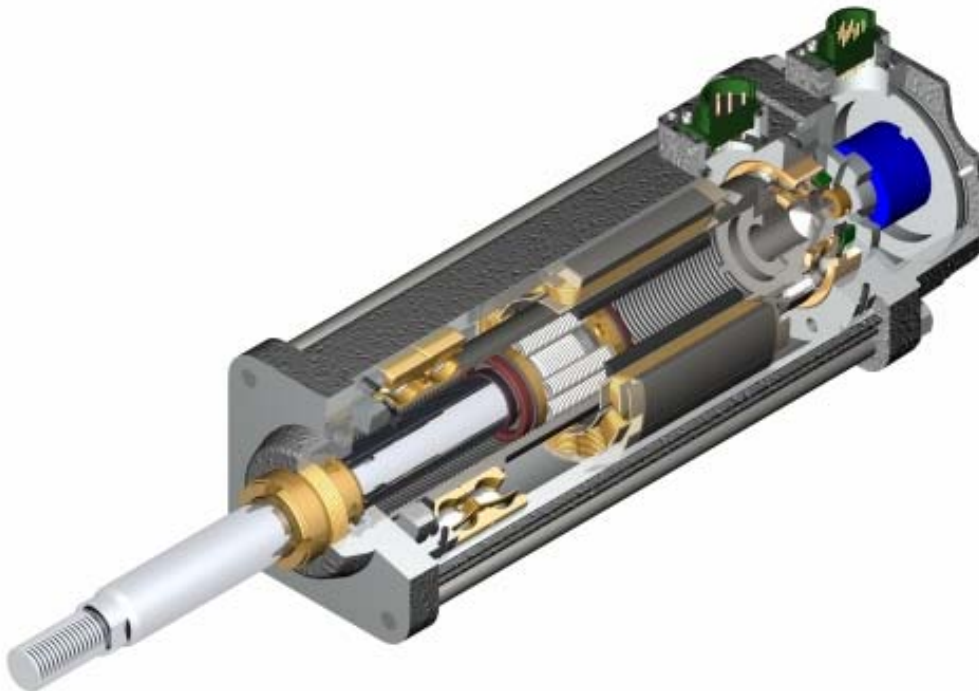
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# GSX and GS SERIES LINEAR ACTUATOR INSTALLATION AND SERVICE MANUAL



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# 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 defect in material and workmanship and to be made in accordance with the buyer's specifications which have been accepted in writing by EXLAR. In no event shall EXLAR be liable or have any responsibility under such warranty if the products have been improperly stored, installed, used or maintained, or if Buyer has permitted any unauthorized modifications, adjustments and/or repairs to such product(s).

Seller's obligation hereunder is limited solely to repairing or replacing (at its option), at the factory, any product(s), or parts thereof, which prove to Seller's satisfaction to be defective materials or workmanship, and within the period of time in accordance with the seller's stated product warranty (see terms and conditions), however, that written notice of claimed defects shall have been given to EXLAR within 30 days from the date any such defect is first discovered. The product(s) or part(s) claimed to be defective must be returned to EXLAR, transportation prepaid by Buyer, with written specification of the claimed defect.

Components such as seals, wipers, bearings, bushings, splines and roller screw components 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.

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 THE TERMS OF THE WARRANTY OTHERWISE FOR SPECIAL, INCIDENTAL OR CONSEQUENTIAL LOSSES RESULTING FROM INABILITY TO USE THE PRODUCT(S), INCREASED OPERATING COST, LOSS OF PRODUCTION, LOSS OF 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 apply to products or parts that have been repaired or replaced pursuant to such warranty, and within the period of time, in accordance with the Seller's stated warranty.

No person including any agent of EXLAR, is authorized to make any representation of warranty on behalf of EXLAR concerning any products manufactured by EXLAR, except to refer 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 system incorporating an Exlar GS/X Series actuator and a brushless motor amplifier.

The schematic below shows the typical connections for a single axis system with actuator and servo amplifier.

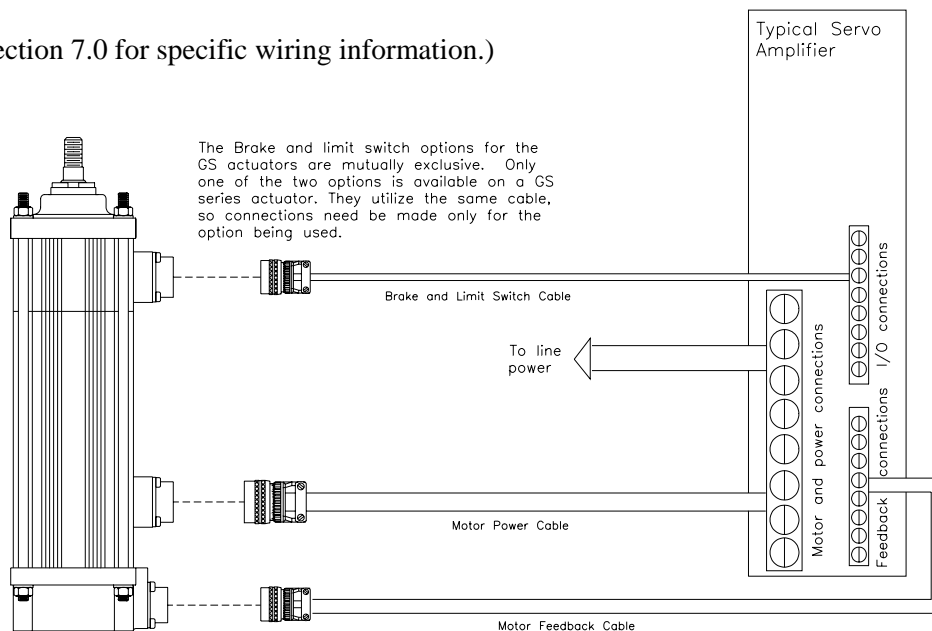
Each brand of brushless motor amplifiers may have unique wiring requirements, parameter settings and operational principles that affect how the actuator operates. The drawing on the following page shows general connection principles for typical resolver and encoder feedback amplifiers. Details on connections to specific brands of amplifiers can be obtained from Exlar applications engineering or from Section 7.0.



**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 Section 7.0 for specific wiring information.)



## 2.2 Standard Actuator Pin-outs and Connections

Please refer to Section 7.0 for specific pin-out and connections information.

## 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 consisting of 2 letters and 1 number.

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 "data 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.

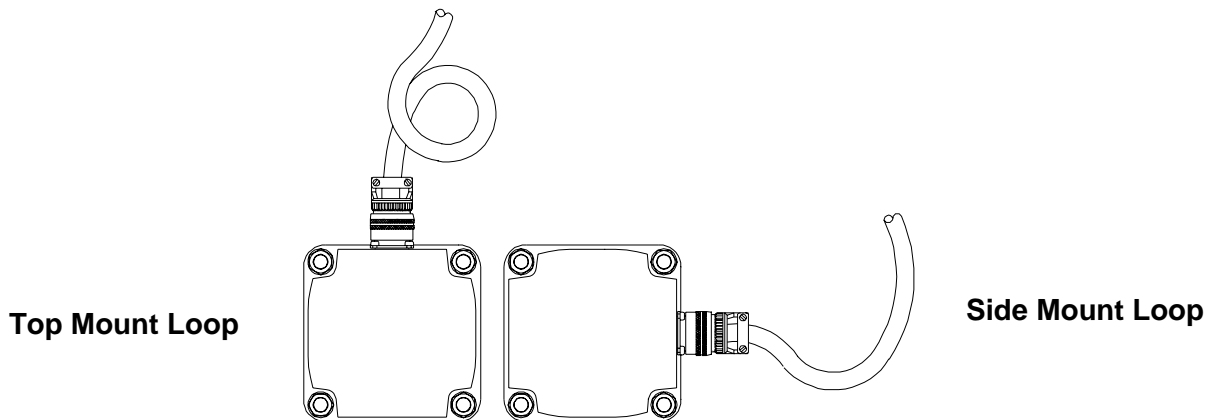
## GS/X Series Feedback Devices

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.



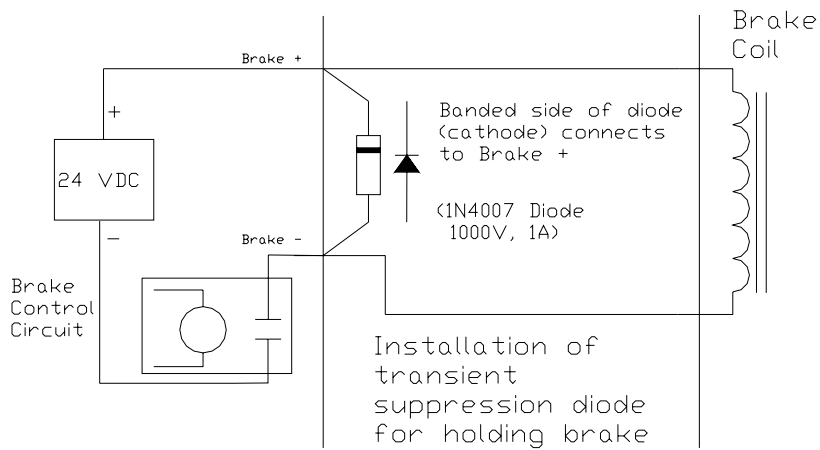
### 2.5 Internal Holding Brake

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 holding brake is spring engaged and 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 provided a transient suppression diode wired internally to the actuator or motor. 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 the wiring information in Section 7.0 of this manual.

BRAKE SPECIFICATIONS	GS/X20	GS/X30	GS/X40	GS45	GSX50	GS/X60
Holding torque (w/o oil)	25 lb-in	40 lb-in	120 lb-in	160 lb-in	354 lb-in	600 lb-in
Voltage	24 VDC	24 VDC	24 VDC	24 VDC	24 VDC	24 VDC
Current required	0.75 Amps	0.75 Amps	0.88 Amps	0.89 Amps	1.0 Amps	1.3 Amps
Coil resistance (polarity sensitive)	113 Ohms	33 Ohms	27 Ohms	27 Ohms	24 Ohms	21 Ohms
Actuator connector	MS 3112-E12-8P	MS 3112-E12-8P	MS 3112-E12-8P	MS 3112-E12-8P	MS 3112-E12-8P	MS 3112-E12-8P
Cable connector	MS 3116-E12-8S	MS 3116-E12-8S	MS 3116-E12-8S	MS 3116-E12-8S	MS 3116-E12-8S	MS 3116-E12-8S



**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.**

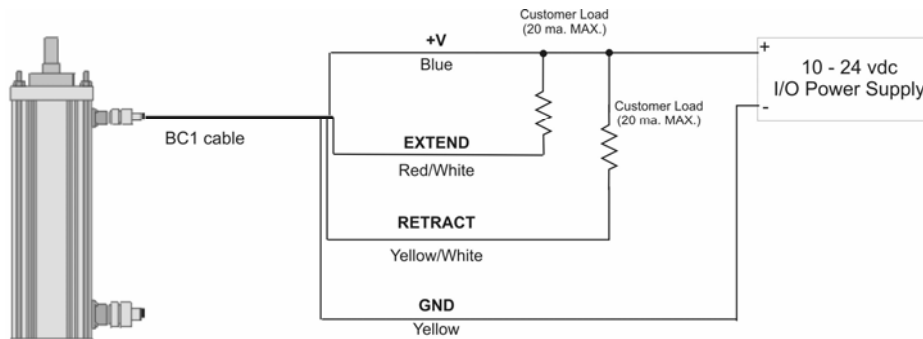
## 2.6 Internal End of Travel Limit Switch Option (N/A on GSX40 or GSX50)

The end of travel limit switch option provides for 2 internal limit switches. These switches are fixed in position and not adjustable. They are located in a position that will provide a signal approximately 0.2 inches prior to the end of physical travel of the GS/X Series actuator.

The switches are magnetically back biased hall effect sensors. They are triggered by a transition in the extending rod from stainless steel to mild steel. This transition is accomplished by precision targets that lie beneath the chrome plating of the actuator.

With proper programming of the control system, the end of travel switches can also be used as home switches.

The switches are normally closed, NPN, 9-24 VDC. See the wiring information in Section 7.0. The connectors used for the limit switch option are the same as for the brake option shown above.



Internal Limit Switch Wiring  
GSX20, 30, and 60 Actuators

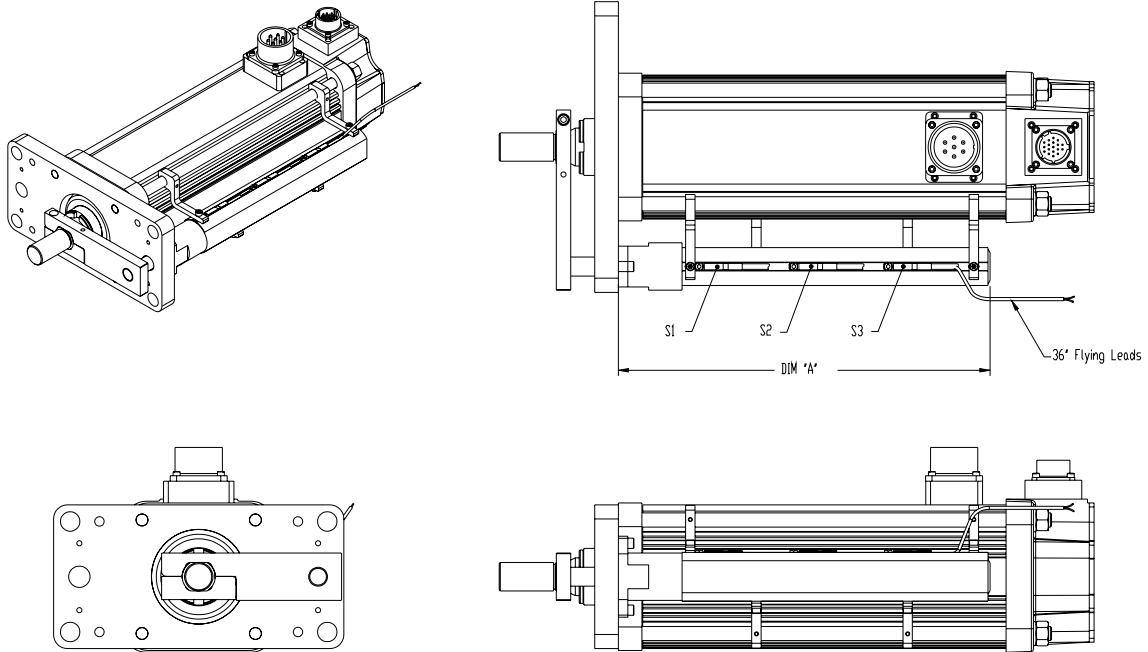
## 2.7 GS/X Linear Actuator External Limit Switch

With the anti-rotate option (Section 2.9) 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.

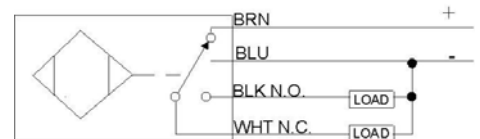
The number of switches desired is selected by ordering the L1, L2 or L3 option, in which 1, 2 or 3 switches will be provided, respectively.

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	10" Stroke	12" Stroke	14" Stroke	18" Stroke
GSX20/SR21	5.515	8.515	n/a	14.515	n/a	n/a
GSX30/SR31	6.932	9.832	13.832	15.832	17.832	21.832
GSX40/SR41	n/a	9.832	13.832	15.832	17.832	21.832
GSX50	n/a	11.667	n/a	n/a	19.667	23.667
GSX60	n/a	n/a	14.461	n/a	n/a	n/a



### CONFIGURATION OF LOGIC OF STANDARD SWITCH OPTION SELECTIONS

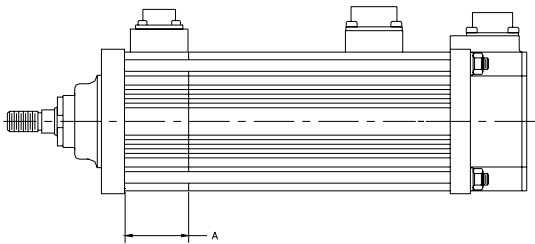
Option	SW1	SW2	SW3
L1	Not Supplied	Normally Open	Not Supplied
L2	Normally Closed	Not Supplied	Normally Closed
L3	Normally Closed	Normally Open	Normally Closed

Switch Type	Exlar Part Number	Turck Part Number
Normally Closed Switch	24631	BIM-INT-RP6X
Normally Open Switch	22303	BIM-INT-AP6X

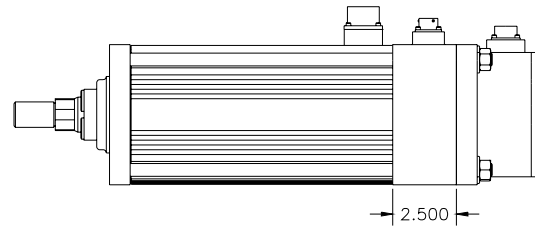
## 2.8 GS/X Linear Actuator Brake and Limit Switch Extensions

The brake or limit switch options add a third connector to the actuator and require a case extension to accommodate the internal components. Each option also slightly reduces the available stroke from the actuator. The case extension dimension and stroke reductions are shown next page.

**GS/X 20, 30, 40, 45, 60**



**GSX50**



Actuator	A - Limit Switch extension length - in(mm)	Stroke length reduction - in(mm)
<b>GS/X20</b>	1.780 (45.21)	0.4 (10.1)
<b>GS/X30</b>	1.770 (44.96)	0.4 (10.1)
<b>GS/X40</b>	No Internal Limit Switches	N/A
<b>GS45</b>	2.498 (63.44)	0.4 (10.1)
<b>GS50</b>	No Internal Limit Switches	N/A
<b>GS/X60</b>	3.575 (90.81)	0.4 (10.1)

Actuator	A - Brake extension length - in(mm)	Stroke length reduction - in(mm)
<b>GS/X20</b>	1.780 (45.21) Front Brake	0.170 (4.32)
<b>GS/X30</b>	1.770 (44.96) Front Brake	0.360 (9.14)
<b>GS/X40</b>	2.330 (59.18) Front Brake	0.360 (9.14)
<b>GS45</b>	2.498 (63.45) Front Brake	0.360 (9.14)
<b>GS50</b>	2.5 (63.5) Rear Brake	0 (Rear Brake)
<b>GS/X60</b>	3.575 (90.81) Front Brake	0.360 (9.14)



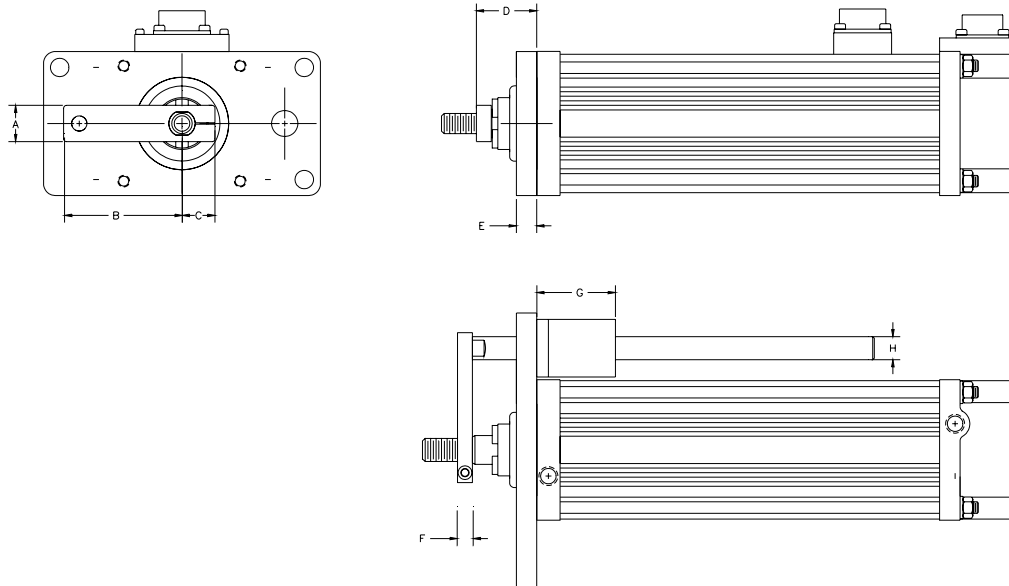
**The stroke limitation from the limit switch option is not mechanical. It represents the position at which the switches will activate. The stroke limitation for the brake is a mechanical limitation. The brake and limit switch options are mutually exclusive and are not available in the same unit.**

## 2.9 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.

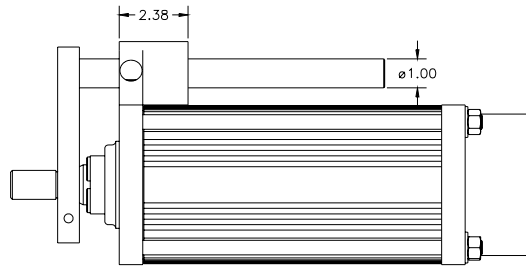
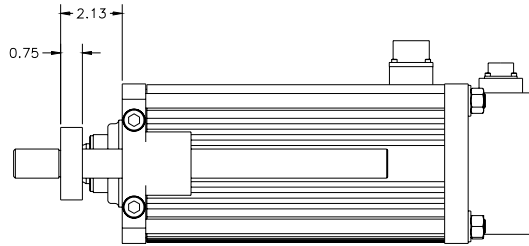
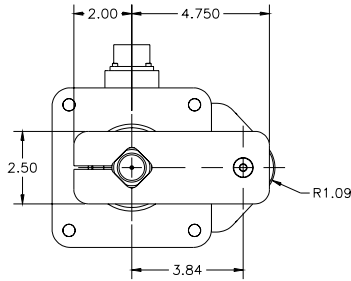
### Anti-rotate Dimensions (GS/X20, 30, 40, 45 and 60)



Dimensions in inches	GS/X20	GS/X30	GS/X40 and 45	GS/X60
A	0.60	0.79	1.25	1.75
B	1.81	2.54	3.78	5.79
C	0.54	0.71	0.98	1.55
D	1.00	1.30	1.64	1.94
E	0.44	0.44	0.63	0.75
F	0.28	0.32	0.38	0.50
G	0.31	1.69	1.69	2.81
H	0.37	0.50	0.50	1.00

For GSX50 anti-rotate dimensions, see below.

## Anti-rotate Dimensions (GSX50)



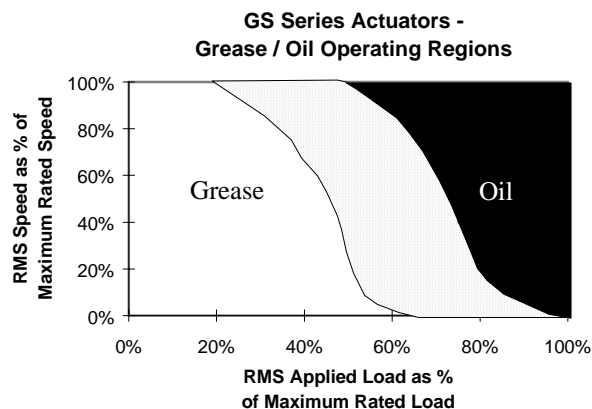
## 3.0 INSTALLATION AND OPERATION

### 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 °C.

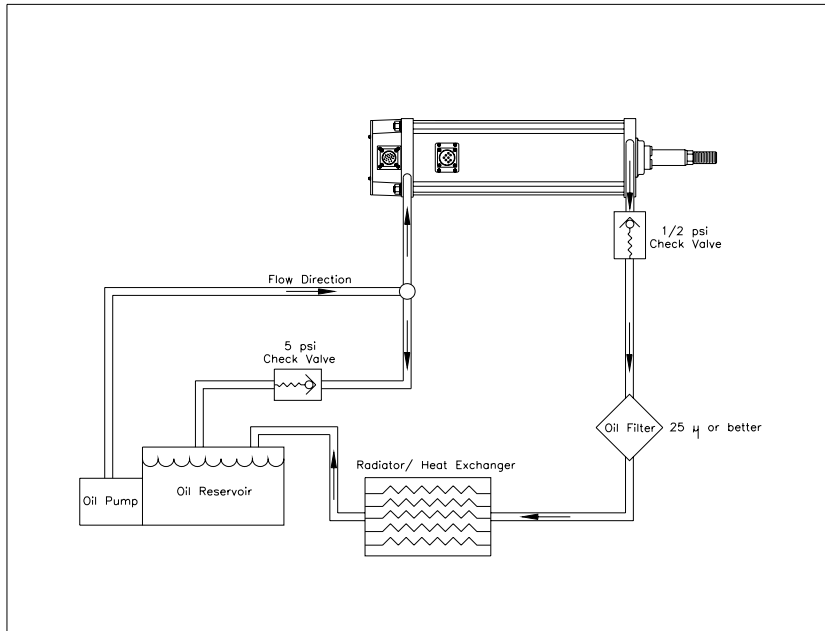
To effectively provide cooling for the actuator, the oil system should be arranged such that the oil exits the actuator at a point above the centerline, preferably in the top quarter region of the actuator, based on the actuator mounting position. This insures that the stator windings of the actuator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



**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](http://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<sup>1</sup>. 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	$W = K_L \cdot \frac{F_L}{\Delta T}$	$\Delta T = (T_{case} - T_{oil})$

**CONSIDER THE FOLLOWING EXAMPLES:**

**CASE 1:**  
 A GSX30-238 requires 4 amps of RMS current to perform the required application. The incoming oil temperature is 45 °C, and we desire to maintain the actuator at its maximum case temperature of 85 °C.

$$F_L = (4/3.4)^2 = 1.38 \quad W = [(1.38 \times 70) / (85-45)] = 2.415 \text{ GAL / HOUR}$$

**CASE 2:**  
 A GS45 requires 12 amps to perform the required application. The incoming oil temperature is 45 °C, and we desire to maintain the actuator at its maximum case temperature of 85 °C.

$$F_L = (12/8)^2 = 2.25 \quad W = [(2.25 \times 125) / (85-45)] = 7.0 \text{ GAL / HOUR}$$


**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.**

<sup>1</sup> GS/X Series actuators can be ordered with features that allow them to achieve case temperatures of 150°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, 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))\*(2 $\pi$ )\*(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.**

## 4.0 MAINTENANCE PROCEDURES

### 4.1 Disassembly

Refer to the exploded view on the following page.

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



**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**

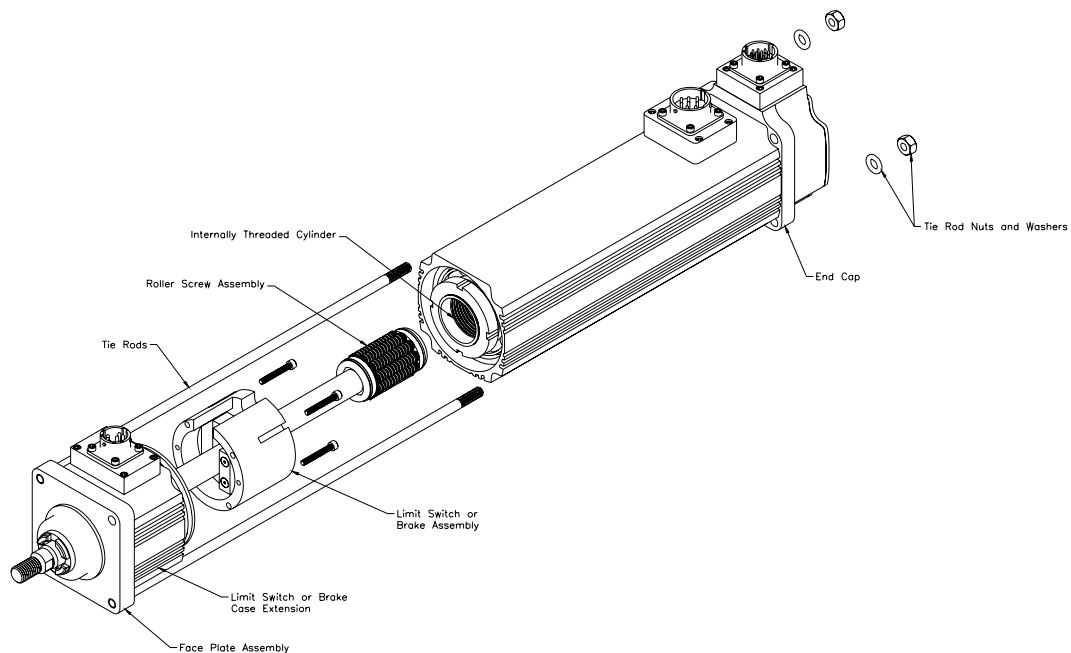
If your unit has internal limit switches, you will see that there is an extension of the actuator case that houses the limit switches and has the limit switch connector mounted to it. This case extension has a cylindrical assembly inside it with mounting surfaces for the limit switches. Carefully pull 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 electric brake 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.

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°C (149°F)	CASE TEMP 80°C (176°F)	CASE TEMP 95°C (203°F)
250	10,000	5,000	2,500
500	8,500	4,250	2,125
1000	6,000	3,000	1,500
1500+	3,500	1,750	875

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

3.) Force grease into the front of the thrust bearing assembly. Make a concerted effort to insure that the grease is well worked in. Grease must reach the bearing just behind the bearing that is visible as well. Use the following amounts of grease for each size roller screw and bearing:

**GS/X20:** 0.5 in<sup>3</sup>   **GS/X30:** 0.75 in<sup>3</sup>   **GS/X40/45:** 1.0 in<sup>3</sup>   **GSX50:** 1.5 in<sup>3</sup>   **GS/X60:** 2.0 in<sup>3</sup>

### **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 μ 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 from 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.

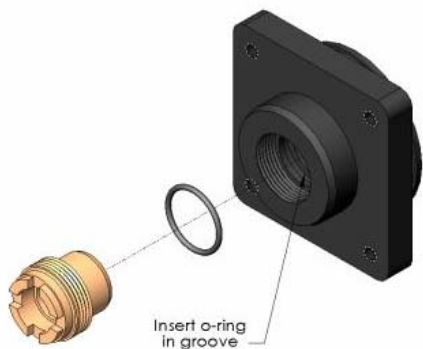
4.) Replace the rear tie rod washers and nuts and tighten to the proper torque. Tighten the nuts simultaneously by partially tightening each in an opposing corner pattern until each is torqued to the rated value shown below.

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.



Main Rod Seal FSB and Bushing

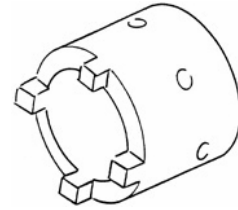
	Standard FSB Part Numbers	Install Torque
GSX20	18929	100 lb-in (11.29 N-m)
GSX30	19020	200 lb-in (22.58 N-m)
GSX40/GS45	19021	360 lb-in (40.67 N-m)
GSX50	22706	660 lb-in (74.57 N-m)
GSX60	19022	900 lb-in (101.69 N-m)

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](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 groove 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	Stroke	Screw Lead	Force Rating	Max Velocity	Approx* Cont. Motor Torque	Maximum Static Load	Armature Inertia	Dynamic Load Rating	Weight (appr.)
	in (mm)	in (mm)	in (mm)	lb (N)	in/sec (mm/sec)	1/2/3 Stack lb-in (N-m)	lb (N)	lb-in-s <sup>2</sup> (Kg-m <sup>2</sup> )	lb (N)	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)	7.0 (3.2)
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)	7.0 (3.2)
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)	7.0 (3.2)
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)	7.5 (3.4)
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)	7.5 (3.4)
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)	7.5 (3.4)
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)	8.0 (3.6)
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)	8.0 (3.6)
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)	8.0 (3.6)
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)

**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 <sup>2</sup> (Kg-m <sup>2</sup> )	Dynamic Load Rating lb (N)	Weight lb (Kg)
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)
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)	22 (10)
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)	22 (10)
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)	22 (10)
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)	22 (10)
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)	22 (10)
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 <sup>2</sup> (Kg-m <sup>2</sup> )	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)
GSX40-1802	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 (58717)	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/NA (22806/38006/NA)	4 (101.6)	102/170/NA (11.5/19.2/NA)	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 <sup>2</sup> (Kg-m <sup>2</sup> )	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 <sup>2</sup> (Kg-m <sup>2</sup> )	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)	3760/5894 (16725/26218)	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)

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**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											
<b>MOTOR STATOR</b>		<b>118</b>	<b>138</b>	<b>158</b>	<b>168</b>	<b>218</b>	<b>238</b>	<b>258</b>	<b>268</b>	<b>318*</b>	<b>338*</b>	<b>358</b>	<b>368*</b>
<b>Trapezoidal Commutation</b>													
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
<b>RMS Sinusoidal Commutation</b>													
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
<b>Motor Stator Data</b>													
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 <sup>2</sup>	.000025	.000025	.000025	.000025	.000025	.000025	.000025	.000025	.000025	.000025	.000025	.000025
	kg-cm <sup>2</sup>	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)
Brake Current @ 24 Vdc	A	.21	.21	.21	.21	.21	.21	.21	.21	.21	.21	.21	.21
Brake Holding Torque – Dry	lbf-in	24	24	24	24	24	24	24	24	24	24	24	24
	(Nm)	(2.71)	(2.71)	(2.71)	(2.71)	(2.71)	(2.71)	(2.71)	(2.71)	(2.71)	(2.71)	(2.71)	(2.71)
Brake Holding Torque – Oil Lub	lb	8	8	8	8	8	8	8	8	8	8	8	8
	(N)	(0.90)	(0.90)	(0.90)	(0.90)	(0.90)	(0.90)	(0.90)	(0.90)	(0.90)	(0.90)	(0.90)	(0.90)
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	250/50
Mechanical Time Constant (tm), ms	min	6.0	6.5	7.1	7.1	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	°C	100	100	100	100	100	100	100	100	100	100	100	100
Std. Connectors ("O" Option):	Motor	MS-3112-E16-8P											
	Feedback	MS-3112-E14-18P											
	Brake / Limit Switch	MS-3112-E12-8P											
End Switches (optional)		NC, NPN 9-24VDC 20mA											
Motor Wire Insulation		Class H											
Motor Stator Rating		Class H											

All ratings at 25 degrees Celcius. For amplifiers with peak sinusoidal commutation  $K_t = K_{trms}(0.707)$ ,  $c = I_{crms}/(0.707)$ ,  $I_{pk} = I_{pkrms}/(0.707)$ . The 2 stack lamination fits only the 6 inch and longer GSX20 and 30 and the 8 inch and longer GSX40. The shortest length of each actuator can accommodate only the 1 or 2 stack. \*The 3 stack motor is not available with the .1" lead GSX20.

		<b>GSX30</b>											
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											
<b>MOTOR STATOR</b>		<b>118</b>	<b>138</b>	<b>158</b>	<b>168</b>	<b>218</b>	<b>238</b>	<b>258</b>	<b>268</b>	<b>318</b>	<b>338</b>	<b>358</b>	<b>368</b>
<b>Trapezoidal Commutation</b>													
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
<b>RMS Sinusoidal Commutation</b>													
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
<b>Motor Stator Data</b>													
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 <sup>2</sup>	.00012	.00012	.00012	.00012	.00012	.00012	.00012	.00012	.00012	.00012	.00012	.00012
	kg-cm <sup>2</sup>	(0.136)	(0.136)	(0.136)	(0.136)	(0.136)	(0.136)	(0.136)	(0.136)	(0.136)	(0.136)	(0.136)	(0.136)
Brake Current @ 24 Vdc	A	.72	.72	.72	.72	.72	.72	.72	.72	.72	.72	.72	.72
Brake Holding Torque – Dry	lbf-in	78	78	78	78	78	78	78	78	78	78	78	78
	(Nm)	(8.81)	(8.81)	(8.81)	(8.81)	(8.81)	(8.81)	(8.81)	(8.81)	(8.81)	(8.81)	(8.81)	(8.81)
Brake Holding Torque – Oil Lub	lbf-in	26	26	26	26	26	26	26	26	26	26	26	26
	(Nm)	(2.94)	(2.94)	(2.94)	(2.94)	(2.94)	(2.94)	(2.94)	(2.94)	(2.94)	(2.94)	(2.94)	(2.94)
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	250/50
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	°C	100	100	100	100	100	100	100	100	100	100	100	100
Std. Connectors (*O* Option):	Motor	MS-3112-E16-8P											
	Feedback	MS-3112-E14-18P											
	Brake / Limit Switch	MS-3112-E12-8P											
End Switches (optional)		NC, NPN 9-24VDC 20mA											
Motor Wire Insulation		Class H											
Motor Stator Rating		Class H											

All ratings at 25 degrees Celcius. For amplifiers with peak sinusoidal commutation  $K_t = K_{t,rms}(0.707)$ ,  $c = I_{c,rms}(0.707)$ ,  $I_{pk} = I_{pk,rms}(0.707)$ . The 2 stack lamination fits only the 6 inch and longer GSX20 and 30 and the 8 inch and longer GSX40. The shortest length of each actuator can accommodate only the 1 or 2 stack.

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									
<b>MOTOR STATOR</b>		<b>118</b>	<b>138</b>	<b>158</b>	<b>168</b>	<b>238</b>	<b>258</b>	<b>268</b>	<b>338</b>	<b>358</b>	<b>368</b>
<b>Trapezoidal Commutation</b>											
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
	(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
<b>RMS Sinusoidal Commutation</b>											
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
	(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
<b>Motor Stator Data</b>											
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
	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 <sup>2</sup>	.00186	.00186	.00186	.00186	.00186	.00186	.00186	.00186	.00186	.00186
	Kg-cm <sup>2</sup>	(2.102)	(2.102)	(2.102)	(2.102)	(2.102)	(2.102)	(2.102)	(2.102)	(2.102)	(2.102)
Brake Current @ 24 Vdc	A	.88	.88	.88	.88	.88	.88	.88	.88	.88	.88
Brake Holding Torque – Dry	lb	120	120	120	120	120	120	120	120	120	120
	(N)	(13.56)	(13.56)	(13.56)	(13.56)	(13.56)	(13.56)	(13.56)	(13.56)	(13.56)	(13.56)
Brake Holding Torque – Oil Lub	lbf-in	40	40	40	40	40	40	40	40	40	40
	(Nm)	(4.52)	(4.52)	(4.52)	(4.52)	(4.52)	(4.52)	(4.52)	(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
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	°C	100	100	100	100	100	100	100	100	100	100
Std. Connectors ("O" Option):	Motor	MS-3102-E20-15P									
	Feedback	MS-3112-E14-18P									
	Brake / Limit Switch	MS-3112-E12-8P									
End Switches (optional)		NC, PNP 9-24 VDC 20mA									
Motor Wire Insulation		Class H									
Motor Stator Rating		Class H									

All ratings at 25 degrees Celcius. For amplifiers with peak sinusoidal commutation  $K_t = K_{trms}(0.707)$ ,  $c = I_{crms}(0.707)$ ,  $I_{pk} = I_{pkrms}(0.707)$ . The 2 stack lamination fits only the 6 inch and longer GSX20 and 30 and the 8 inch and longer GSX40. The shortest length of each actuator can accommodate only the 1 or 2 stack.

<b>GSX50</b>									
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							
<b>MOTOR STATOR</b>		<b>138</b>	<b>158</b>	<b>168</b>	<b>238</b>	<b>258</b>	<b>268</b>	<b>358</b>	<b>368</b>
<b>Trapezoidal Commutation</b>									
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
	(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
<b>RMS Sinusoidal Commutation</b>									
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
	(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
<b>Motor Stator Data</b>									
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 <sup>2</sup>	.008408	.008408	.008408	.008408	.008408	.008408	.008408	.008408
	Kg-cm <sup>2</sup>	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5
Brake Current @ 24 Vdc	A	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Brake Holding Torque – Dry	lbf-in	354	354	354	354	354	354	354	354
	(Nm)	39.99	39.99	39.99	39.99	39.99	39.99	39.99	39.99
Brake Engage/Disengage Time	ms	73	73	73	73	73	73	73	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	°C	100							
Std. Connectors ("O" Option):	Motor	MS-3102-E20-8P							
	Feedback	MS-3112-E14-18P							
	Brake / Limit Switch	MS-3112-E12-8P							
End Switches (optional)		NC, PNP 9-24 VDC 20mA							
Motor Wire Insulation		Class H							
Motor Stator Rating		Class H							

All ratings at 25 degrees Celcius. For amplifiers with peak sinusoidal commutation  $K_t = K_{trms}(0.707)$ ,  $c = I_{crms}/(0.707)$ ,  $I_{pk} = I_{pkrms}/(0.707)$ . The 2 stack lamination fits only the 6 inch and longer GSX20 and 30 and the 8 inch and longer GSX40. The shortest length of each actuator can accommodate only the 1 or 2 stack.

GSX60									
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)	75 (337)							
Environmental Rating:	Std / Opt.	IP65							
<b>MOTOR STATOR</b>		<b>138</b>	<b>158</b>	<b>168</b>	<b>238</b>	<b>258</b>	<b>268</b>	<b>358</b>	<b>368</b>
<b>Trapezoidal Commutation</b>									
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
<b>RMS Sinusoidal Commutation</b>									
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
<b>Motor Stator Data</b>									
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 <sup>2</sup>	.0167	.0167	.0167	.0167	.0167	.0167	.0167	.0167
	Kg-cm <sup>2</sup>	(18.86)	(18.86)	(18.86)	(18.86)	(18.86)	(18.86)	(18.86)	(18.86)
Brake Current @ 24 Vdc	A	1.13	1.13	1.13	1.13	1.13	1.13	1.13	1.13
Brake Holding Torque – Dry	lb-in	600	600	600	600	600	600	600	600
	(Nm)	(67.8)	(67.8)	(67.8)	(67.8)	(67.8)	(67.8)	(67.8)	(67.8)
Brake Holding Torque – Oil Lub	lb-in	375	375	375	375	375	375	375	375
	(Nm)	(42.38)	(42.38)	(42.38)	(42.38)	(42.38)	(42.38)	(42.38)	(42.38)
Brake Engage/Disengage Time	ms	250/50	250/50	250/50	250/50	250/50	250/50	250/50	250/50
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	°C	100	100	100	100	100	100	100	100
Std. Connectors ("O" Option):	Motor	MS-3102-E24-10P							
	Feedback	MS-3112-E14-18P							
	Brake / Limit Switch	MS-3112-E12-8P							
End Switches (optional)		NC, NPN 9-24 VDC 20mA							
Motor Wire Insulation		Class H							
Motor Stator Rating		Class H							

All ratings at 25 degrees Celcius. For amplifiers with peak sinusoidal commutation  $K_t = K_{trms}(0.707)$ ,  $c = I_{crms}(0.707)$ ,  $I_{pk} = I_{pkrms}(0.707)$ . The 2 stack lamination fits only the 6 inch and longer GSX20 and 30 and the 8 inch and longer GSX40. The shortest length of each actuator can accommodate only the 1 or 2 stack. \*The 3 stack motor is not available with the .1" lead GSX20.

## 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		
<b>MOTOR STATOR</b>		<b>L6</b>	<b>M6</b>	<b>M6-DS</b>	<b>H6</b>	<b>L6</b>	<b>M6</b>	<b>M6-DS</b>	<b>H6</b>	<b>L8</b>	<b>M8</b>	<b>H8</b>
<b>Trapezoidal Commutation Motor Data</b>												
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
<b>RMS Sinusoidal commutation motor data</b>												
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 Celcius. For amplifiers with peak sinusoidal commutation  $K_t = K_{trms}(0.707)$ ,  $c = I_{crms}/(0.707)$ ,  $I_{pk} = I_{pkrms}/(0.707)$

## 5.2a GS Mechanical / Electrical Specifications

		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	
<b>MOTOR STATOR</b>		<b>L6</b>	<b>M6</b>	<b>M6-DS</b>	<b>H6</b>	<b>H6-DS</b>	<b>M6</b>	<b>H6</b>
<b>Trapezoidal commutation stator data</b>								
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
<b>RMS Sinusoidal amplifier information</b>								
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 <sup>2</sup>	.00272	.00272	.00272	.00272	.00272	--	--
	Kg-cm <sup>2</sup>	(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	lbf-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 Celcius. For amplifiers with peak sinusoidal commutation  $K_t = K_{trms}(0.707)$ ,  $c = I_{crms}/(0.707)$ ,  $I_{pk} = I_{pkrms}/(0.707)$

## 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.

<b>Symptom / Trouble</b>	<b>Possible Cause / Troubleshooting Procedure</b>
No response from actuator.	<ol style="list-style-type: none"> <li>1. Check amplifier for faults that may indicate problem.</li> <li>2. Check to insure that amplifier is enabled.</li> <li>3. Check for proper wiring.</li> </ol>
Actuator seems to be enabled (receiving current) but is not operating or is operating erratically.	<ol style="list-style-type: none"> <li>1. 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.</li> <li>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.</li> <li>3. Feedback wiring may be incorrect.</li> <li>4. Feedback conductors touching, or feedback cable may be damaged.</li> <li>5. Motor phases are wired incorrectly or in incorrect order. (R,S,T).</li> <li>6. Feedback (resolver or encoder) is improperly aligned. Contact Exlar.</li> </ol>
Actuator cannot move load.	<ol style="list-style-type: none"> <li>1. Load is too large for the capacity of the actuator or too much friction is present.</li> <li>2. Excessive side load.</li> <li>3. Misalignment of output rod to load.</li> <li>4. Amplifier has too low of current capacity or is limited to too low of current capacity.</li> </ol>
Actuator housing moves or vibrates when shaft is in motion.	<ol style="list-style-type: none"> <li>1. Check actuator mounting. Insure that the actuator is securely mounted.</li> <li>2. Amplifier is improperly tuned (wrong gain settings.) Tune amplifier.</li> </ol>
Output rod rotates during motion and thus does not provide proper linear motion.	<ol style="list-style-type: none"> <li>1. Install Exlar anti-rotation assembly or incorporate anti-rotation into the application.</li> </ol>
Limit switches not functioning.	<ol style="list-style-type: none"> <li>1. Limit switches wired improperly. Refer to manual.</li> <li>2. The device being driven by the limit switches is not compatible with the electrical output of the limit switch. Check device requirements.</li> <li>3. Switches have been damaged by improper wiring or improper voltage applied. Replace switches.</li> </ol>
Brake does not hold load in place.	<ol style="list-style-type: none"> <li>1. Load is larger than the capacity of the brake. <ul style="list-style-type: none"> <li>-check load level against actuator rating</li> <li>-oil lubricated units reduce holding capacity of the brake</li> </ul> </li> <li>2. Brake is not engaged. (Power is not removed, or only partially removed from brake).</li> <li>3. Brake is being used as other than a power loss holding brake.</li> </ol>
Actuator is overheating.	<ol style="list-style-type: none"> <li>1. Insufficient cooling for application requirements. See oil cooling section of this manual or Exlar catalog or contact Exlar engineering.</li> <li>2. Actuator is being operated outside of continuous ratings.</li> <li>3. Amplifier is poorly tuned causing excessive unnecessary current to be applied to motor. Check Gain settings.</li> </ol>

## 7.0 SYSTEM INSTALLATION

This section provides you with cable and wiring information for operation of your GS/X Series with both Exlar's and other manufacturers' servo drives. (NOTE: If the amplifier you are using is not represented in the following sections, contact Exlar for assistance.)

The "M" connector option on the GS/X series of actuators provides for an actuator configured with connectors that allow the end user to purchase the feedback cable, or power and feedback cables for their actuator from the manufacturer of their servo amplifier, thus eliminating the headaches and confusion that can arise from power and feedback wiring.

The "O" connector option on the GS/X series of actuators provides for an actuator with Exlar's standard MS style connectors, compatible with Exlar's standard cables.

For amplifier manufacturers who use standard style military connectors, with molded and shielded cables, the feedback cable can be purchased from the amplifier manufacturer, and the power cable purchased from Exlar. The Exlar power cables with the PCx-MC-xxx model numbers are molded and shielded and provide a good match with the cables provided by the amplifier manufacturer.

For some amplifier manufacturers who utilize a different style of connector, when the "M" option is available from Exlar, both the connectors will be configured to allow the feedback and power cables to be purchased from the amplifier manufacturer. Consult Exlar for details on all connector configurations.

In some instances, depending on actuator size, voltage, and the cable availability from the amplifier manufacturer, some cables will still need to be obtained from Exlar. The following pages contain interconnect information and cable pin-outs for several brands of servo amplifiers. These are also available on our website at [www.exlar.com](http://www.exlar.com).

### CABLE SELECTION FOR GSX SERIES ACTUATORS WITH "O" CONNECTORS

Power Cables	Connectorization	Description	Exlar Part Number
GSX20, GSX30	O	Standard Power, Molded, Shielded	PC6-MC-xxx
	O	Standard Power, Anodized	PC1-AC-xxx
	E	Standard Power, Electroless Nickel, Environmentally Sealed, EMI/RFI shielded	PC1-EC-xxx
GS/X40, 45, 50	O	Standard Power, Molded, Shielded	PC7-MC-xxx
	O	Standard Power, Anodized	PC7-AC-xxx
GSX60	O	Standard Power, Anodized	PC3-AC-xxx
	E	Standard Power, Electroless Nickel, Environmentally Sealed, EMI/RFI shielded	PC3-EC-xxx
Feedback Cables	Connectorization	Description	Exlar Part Number
GSX20, GSX30	O	Standard Resolver Feedback, anodized	RC1-AC-xxx
	O	Standard Encoder Feedback, anodized	EC1-AC-xxx
	E	Standard Resolver Feedback, Electroless Nickel, Environmentally Sealed, EMI/RFI	RC1-EC-xxx
GS/X40, 45, 50	E	Standard Encoder Feedback, Electroless Nickel, Environmentally Sealed, EMI/RFI	EC1-EC-xxx
	O	Standard Resolver Feedback, anodized	RC1-AC-xxx
	O	Standard Encoder Feedback, anodized	EC1-AC-xxx
GSX60	E	Standard Resolver Feedback, Electroless Nickel, Environmentally Sealed, EMI/RFI	RC1-EC-xxx
	E	Standard Encoder Feedback, Electroless Nickel, Environmentally Sealed, EMI/RFI	EC1-EC-xxx
	O	Standard Resolver Feedback, anodized	RC1-AC-xxx
GSX60	O	Standard Encoder Feedback, anodized	EC1-AC-xxx
	E	Standard Resolver Feedback, Electroless Nickel, Environmentally Sealed, EMI/RFI	RC1-EC-xxx
	E	Standard Encoder Feedback, Electroless Nickel, Environmentally Sealed, EMI/RFI	EC1-EC-xxx
Brake Cables	Connectorization	Description	Exlar Part Number
GSX20, GSX30	O	Standard Brake Cable, Anodized	BC1-AC-xxx
	E	Standard Brake Cable, Electroless Nickel, Environmentally Sealed, EMI/RFI	BC1-EC-xxx
GS/X40, 45, 50	O	Standard Brake Cable, Anodized	BC1-AC-xxx
	E	Standard Brake Cable, Electroless Nickel, Environmentally Sealed, EMI/RFI	BC1-EC-xxx
GSX60	O	Standard Brake Cable, Anodized	BC1-AC-xxx
	E	Standard Brake Cable, Electroless Nickel, Environmentally Sealed, EMI/RFI	BC1-EC-xxx

Each of the cables shown in the tables is connectorized with military connectors on the motor end and has flying leads on the amplifier end. These cables will require the end user to attach any required connectors on the amplifier end. Amplifiers with screw terminals or interface terminal strips can be directly connected using these cables.

### CABLE SELECTION FOR GS/X SERIES ACTUATORS WITH "M" CONNECTORS

Exlar Actuator	Amp Manufacturer and Model	Exlar Feedback Callout	Power Cable Manufacturer	Power Cable Part Number	Feedback Cable Mfr.	Feedback Cable Part Number
GS/X20 GSX30	Allen-Bradley Ultra 100/200	AB1	Exlar	PC6-MC-xxx	Allen-Bradley	9101-1366-xxx
	Allen-Bradley Ultra 3000/5000	AB7*	Allen-Bradley	2090-UXNPAMP-14Sxx	Allen-Bradley	2090-UXNFBMP-Sxx
	Allen-Bradley Ultra 3000/5000	AB4/AB5**	Allen-Bradley	2090-UXNPAMP-14Sxx	Allen-Bradley	2090-UXNFBMP-Sxx
	Control Techniques En, Epsilon and MDS Series	EM2	Control Techniques	CMDS-xxx	Control Techniques	CFCS-xxx
	Kollmorgen Servo Star and Servo Star CD	KM1	Kollmorgen	CSSSRHA1H-xxx (set includes feedback cable)	Kollmorgen	CSSSRHA1H-xxx (set includes power cable)
	Kollmorgen Servo Star 600	KM5/KM2	Kollmorgen	CSSSRHG1H-xxx (set includes feedback cable)	Kollmorgen	CSSSRHG1H-xxx (set includes power cable)
	Kollmorgen Servo Star 600	KM3/KM4	Kollmorgen	CSSSS3HG2H-xxx (set includes feedback cable)	Kollmorgen	CSSSS3HG2H-xxx (set includes power cable)
	Bosch/Rexroth Indramat DKC Series, ECO Drive	IN1	Bosch/Rexroth Indramat	IKG4077, IKG4017, IKG4009, IKG4008 depending on Indramat amplifier	Bosch/Rexroth Indramat	IKS4001
	Bosch/Rexroth Indramat DKC Series, ECO Drive	IN2	Bosch/Rexroth Indramat	IKG4077, IKG4017, IKG4009, IKG4008 depending on Indramat amplifier	Bosch/Rexroth Indramat	IKS4001
	Bosch/Rexroth Indramat DKC Series, ECO Drive	IN4/IN3	Bosch/Rexroth Indramat	IKG4009	Bosch/Rexroth Indramat	IKS4374
	Bosch/Rexroth Indramat DIA Series	IN1	Bosch/Rexroth Indramat	IKG4077	Bosch/Rexroth Indramat	IKS4001
	Bosch/Rexroth Indramat DIA Series	IN2	Bosch/Rexroth Indramat	IKG4077	Bosch/Rexroth Indramat	IKS4001
	Bosch/Rexroth Indramat DIA Series	IN3	Bosch/Rexroth Indramat	IKG4077	Bosch/Rexroth Indramat	IKS4374
	Parker Compumotor Gemini Series	PC3	Exlar	PC6-MC-xxx	Parker Compumotor	71-018308-XX
	Yaskawa Sigma II Series (3 inch and smaller motors 100/200VAC)	YS3	Yaskawa	B1E-xxA	Yaskawa	JZSP-CMP02-XX(B)
	Yaskawa Sigma II Series (3 inch and smaller motors 400VAC)	YS3	Yaskawa	BAE-xxA	Yaskawa	JZSP-CMP02-XX(B)
	Yaskawa Sigma II Series (4 inch and larger motors 100/200VAC)	YS2	Yaskawa	B1E-xxA	Yaskawa	JZSP-CMP02-XX(B)
	Yaskawa Sigma II Series (4 inch and larger motors 400VAC)	YS2	Yaskawa	BAE-xxA	Yaskawa	JZSP-CMP02-XX(B)

Table continued, next page

## CABLE SELECTION FOR GS/X SERIES ACTUATORS WITH "M" CONNECTORS (cont'd)

Exlar Actuator	Amp Manufacturer and Model	Exlar Feedback Callout	Power Cable Manufacturer	Power Cable Part Number	Feedback Cable Mfr.	Feedback Cable Part Number
GS/X40 GSX50 GS45	Allen-Bradley Ultra 100/200	AB1	Exlar	PC7-MC-xxx	Allen-Bradley	9101-1366-xxx
	Allen-Bradley Ultra 3000/5000	AB7*	Allen-Bradley	2090-UXNPAMP-14Sxx	Allen-Bradley	2090-UXNFBMP-Sxx
	Allen-Bradley Ultra 3000/5000	AB4/AB5**	Allen-Bradley	2090-UXNPAMP-14Sxx	Allen-Bradley	2090-UXNFBMP-Sxx
	Control Techniques En, Epsilon and MDS Series	EM2	Control Techniques	CMMS-xxx	Control Techniques	CFCS-xxx
	Kollmorgen Servo Star and Servo Star CD	KM1	Kollmorgen	CSSSRHA2H-xxx (set includes feedback cable)	Kollmorgen	CSSSRHA2H-xxx (set includes power cable)
	Kollmorgen Servo Star 600	KM5/KM2	Kollmorgen	CSSSRHG2H-xxx (set includes feedback cable)	Kollmorgen	CSSSRHG2H-xxx (set includes power cable)
	Kollmorgen Servo Star 600	KM3/KM4	Kollmorgen	CSSSS3HG2H-xxx (set includes feedback cable)	Kollmorgen	CSSSS3HG2H-xxx (set includes power cable)
	Bosch/Rexroth Indramat DKC Series, ECO Drive	IN1	Bosch/Rexroth Indramat	IKG4009	Bosch/Rexroth Indramat	IKS4001
	Bosch/Rexroth Indramat DKC Series, ECO Drive	IN2	Bosch/Rexroth Indramat	IKG4009	Bosch/Rexroth Indramat	IKS4001
	Bosch/Rexroth Indramat DKC Series, ECO Drive	IN3/IN4	Bosch/Rexroth Indramat	IKG4009	Bosch/Rexroth Indramat	IKS4374
	Bosch/Rexroth Indramat DIA Series	IN1	Bosch/Rexroth Indramat	IKG4077	Bosch/Rexroth Indramat	IKS4001
	Bosch/Rexroth Indramat DIA Series	IN2	Bosch/Rexroth Indramat	IKG4077	Bosch/Rexroth Indramat	IKS4001
	Bosch/Rexroth Indramat DIA Series	IN3	Bosch/Rexroth Indramat	IKG4077	Bosch/Rexroth Indramat	IKS4374
	Parker Compumotor Gemini Series	PC3	Exlar	PC7-MC-xxx	Parker Compumotor	71-018308-XX
	Yaskawa Sigma II Series (3 inch and smaller motors 100/200VAC)	YS3	Yaskawa	B1E-xxA	Yaskawa	JZSP-CMP02-XX(B)
	Yaskawa Sigma II Series (3 inch and smaller motors 400VAC)	YS3	Yaskawa	BAE-xxA	Yaskawa	JZSP-CMP02-XX(B)
	Yaskawa Sigma II Series (4 inch and larger motors 100/200VAC)	YS2	Yaskawa	B1E-xxA	Yaskawa	JZSP-CMP02-XX(B)
	Yaskawa Sigma II Series (4 inch and larger motors 400VAC)	YS2	Yaskawa	BAE-xxA	Yaskawa	JZSP-CMP02-XX(B)
GSX60	Same as in table above for GSX40, GS45 (all except for AB7)	As in table above for GSX40, GS45,50	Exlar	PC3-AC-xxx	As in table above for GSX40, GS45, GSX50	As in table above for GSX40, GS45
GSX60	Allen-Bradley Ultra 3000/5000	AB7*	Allen-Bradley	2090-UXNPAMP-10Sxx	Allen-Bradley	2090-UXNFBMP-Sxx

\*Brake cable for AB7, 2090-UXNBMP-18Sxx

\*\* Exlar Corporation uses absolute encoders for AB4 and AB5 configurations that are powered by 5 VDC. A customer not using Allen-Bradley's universal feedback cable referenced above must make provisions such that their wiring scheme provides connectivity according to Allen-Bradley's wiring requirements for 5 VDC encoder power from the amplifier to the encoder.

## DRIVE SET-UP WITH GS/X SERIES ACTUATORS

Specific set-up instructions for each manufacturer's drives are included at the beginning of each section. The following table contains Exlar's GS/X motor file names, which you will need to transfer to the amplifier's software to allow Exlar motors to be selected within the drive setup routine. All Motor files can be found and downloaded at [www.exlar.com](http://www.exlar.com).

GSX Series Motor Name Selection for All Amplifiers							
Actuator Motor Model	3" stroke	6" stroke	8" stroke	10" stroke	12" stroke	14" stroke	18" stroke
<b>GSX20</b>							
1 Stack, 115V, 8 Pole	GX211803	GX211806	--	GX211810	GX211812	--	--
1 Stack, 230V, 8 Pole	GX213803	GX213806	--	GX213810	GX213812	--	--
1 Stack, 400V, 8 Pole	GX215803	GX215806	--	GX215810	GX215812	--	--
1 Stack, 460V, 8 Pole	GX216803	GX216806	--	GX216810	GX216812	--	--
2 Stack, 170V, 8 Pole	GX221803	GX221806	--	GX221810	GX221812	--	--
2 Stack, 230V, 8 Pole	GX223803	GX223806	--	GX223810	GX223812	--	--
2 Stack, 400V, 8 Pole	GX225803	GX225806	--	GX225810	GX225812	--	--
2 Stack, 460V, 8 Pole	GX226803	GX226806	--	GX226810	GX226812	--	--
3 Stack, 115V, 8 Pole	--	GX231806	--	GX231810	GX231812	--	--
3 Stack, 230V, 8 Pole	--	GX233806	--	GX233810	GX233812	--	--
3 Stack, 400V, 8 Pole	--	GX235806	--	GX235810	GX235812	--	--
3 Stack, 460V, 8 Pole	--	GX236806	--	GX236810	GX236812	--	--
<b>GSX30</b>							
1 Stack, 115V, 8 Pole	GX311803	GX311806	--	GX311810	GX311812	GX311814	GX311818
1 Stack, 230V, 8 Pole	GX313803	GX313806	--	GX313810	GX313812	GX313814	GX313818
1 Stack, 400V, 8 Pole	GX315803	GX315806	--	GX315810	GX315812	GX315814	GX315818
1 Stack, 460V, 8 Pole	GX316803	GX316806	--	GX316810	GX316812	GX316814	GX316818
2 Stack, 115V, 8 Pole	GX321803	GX321806	--	GX321810	GX321812	GX321814	GX321818
2 Stack, 230V, 8 Pole	GX323803	GX323806	--	GX323810	GX323812	GX323814	GX323818
2 Stack, 400V, 8 Pole	GX325803	GX325806	--	GX325810	GX325812	GX325814	GX325818
2 Stack, 460V, 8 Pole	GX326803	GX326806	--	GX326810	GX326812	GX326814	GX326818
3 Stack, 115V, 8 Pole	--	GX331806	--	GX331810	GX331812	GX331814	GX331818
3 Stack, 230V, 8 Pole	--	GX333806	--	GX333810	GX333812	GX333814	GX333818
3 Stack, 400V, 8 Pole	--	GX335806	--	GX335810	GX335812	GX335814	GX335818
3 Stack, 460V, 8 Pole	--	GX336806	--	GX336810	GX336812	GX336814	GX336818
<b>GSX40</b>							
1 Stack, 115V, 8 Pole	--	GX411806	GX411808	GX411810	GX411812	--	GX411818
1 Stack, 230V, 8 Pole	--	GX413806	GX413808	GX413810	GX413812	--	GX413818
1 Stack, 400V, 8 Pole	--	GX415806	GX415808	GX415810	GX415812	--	GX415818
1 Stack, 460V, 8 Pole	--	GX416806	GX416808	GX416810	GX416812	--	GX416818
2 Stack, 230V, 8 Pole	--	GX423806	GX423808	GX423810	GX423812	--	GX423818
2 Stack, 400V, 8 Pole	--	GX425806	GX425808	GX425810	GX425812	--	GX425818
2 Stack, 460V, 8 Pole	--	GX426806	GX426808	GX426810	GX426812	--	GX426818
3 Stack, 230V, 8 Pole	--	--	GX433808	GX433810	GX433812	--	GX433818
3 Stack, 400V, 8 Pole	--	--	GX435808	GX435810	GX435812	--	GX435818
3 Stack, 460V, 8 Pole	--	--	GX436808	GX436810	GX436812	--	GX436818
Table Continued Next Page							

**GSX Series Motor Name Selection for All Amplifiers (Continued)**

Actuator Motor Model	3" stroke	6" stroke	10" stroke	12" stroke	14" stroke	18" stroke
<b>GSX50</b>						
1 Stack, 230V, 8 Pole	--	GX513806	GX513810	--	GX513814	--
1 Stack, 400V, 8 Pole	--	GX515806	GX515810	--	GX515814	--
1 Stack, 460V, 8 Pole	--	GX516806	GX516810	--	GX516814	--
2 Stack, 230V, 8 Pole	--	GX523806	GX523810	--	GX513814	--
2 Stack, 400V, 8 Pole	--	GX525806	GX525810	--	GX525814	--
2 Stack, 460V, 8 Pole	--	GX526806	GX526810	--	GX526814	--
3 Stack, 400V, 8 Pole	--	GX535806	GX535810	--	GX535814	--
3 Stack, 460V, 8 Pole	--	GX536806	GX536810	--	GX536814	--
<b>GSX60</b>						
1 Stack, 230V, 8 Pole	--	GX611806	GX611810	--	--	--
1 Stack, 400V, 8 Pole	--	GX615806	GX615810	--	--	--
1 Stack, 460V, 8 Pole	--	GX616806	GX616810	--	--	--
2 Stack, 230V, 8 Pole	--	GX623806	GX623810	--	--	--
2 Stack, 400V, 8 Pole	--	GX625806	GX625810	--	--	--
2 Stack, 460V, 8 Pole	--	GX626806	GX626810	--	--	--
3 Stack, 400V, 8 Pole	--	GX635806	GX635810	--	--	--
3 Stack, 460V, 8 Pole	--	GX636806	GX636810	--	--	--

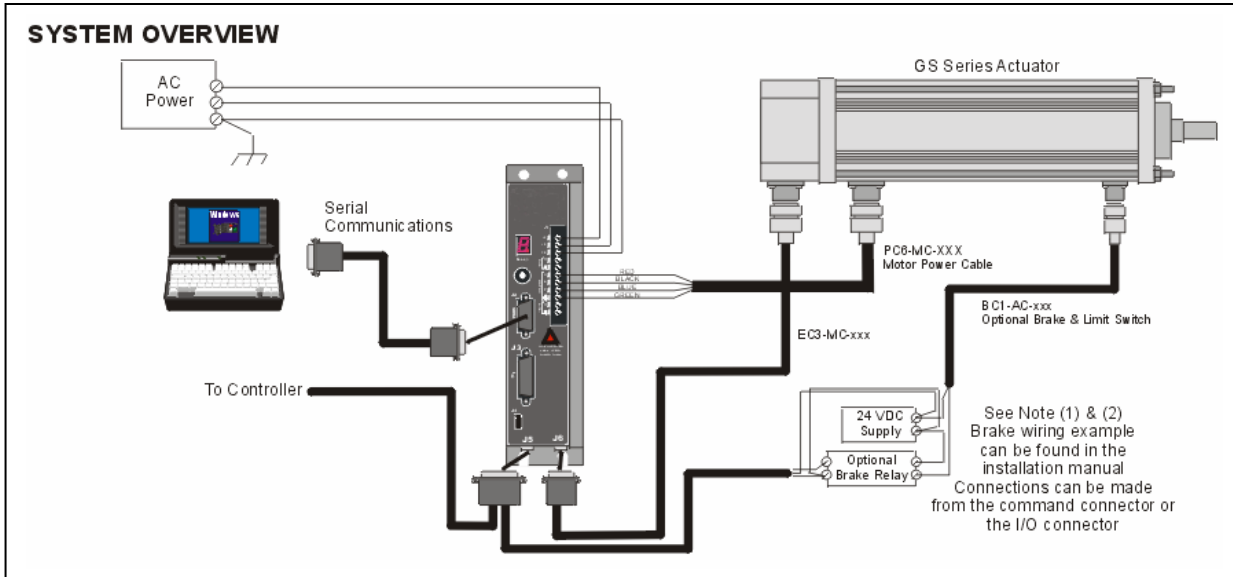
GS/X Series Actuator <sup>1</sup>	Inertia lb-in-s <sup>2</sup>
GS/X20-03xx	0.00101
GS/X20-06xx	0.00114
GS/X20-12xx	0.00143
GS/X30-03xx	0.00319
GS/X30-06xx	0.00361
GS/X30-10xx	0.00416
GS/X30-14xx	0.00473
GS/X30-18xx	0.00533
GS/X40-06xx	0.0152
GS/X40-08xx	0.0163
GS/X40-12xx	0.0186
GS/X40-18xx	0.0220
GS45-06xx	0.0299
GS45-10xx	0.0353
GS45-14xx	0.0408
GS45-18xx	0.0468
GSX50-06xx	0.03241
GSX50-10xx	0.03725
GSX50-14xx	0.04208
GS60-10xx	0.1943

<sup>1</sup> Standard stack length.  
Contact factory for specials.

### GS Series Motor Name Selection for All Amplifiers

Actuator Motor Model	3" stroke	6" stroke	10" stroke	12" stroke	14" stroke	18" stroke
<b>GS20</b>						
Low Voltage Single Stack 4 Pole	G20LS403	G20LS406	--	G20LS412	--	--
Medium Voltage A Single Stack 4 Pole	G2AMS403	G2AMS406	--	G2AMS412	--	--
Medium Voltage B Single Stack 4 Pole	G20MS403	G20MS406	--	G20MS412	--	--
High Voltage Single Stack 4 Pole	G20HS403	G20HS406	--	G20HS412	--	--
Low Voltage Single Stack 6 Pole	G20LS603	G20LS606	--	G20LS612	--	--
Medium Voltage Single Stack 6 Pole	G20MS603	G20MS606	--	G20MS612	--	--
High Voltage Single Stack 6 Pole	G20HS603	G20HS606	--	G20HS612	--	--
<b>GS30</b>						
125 Volt Double Stack 6 Pole	--	G30XA606	G30XA610	--	G30XA614	G30XA618
Low Voltage Single Stack 6 Pole	G30LS603	G30LS606	G30LS610	--	G30LS614	G30LS618
Medium Voltage Single Stack 6 Pole	G30MS603	G30MS606	G30MS610	--	G30MS614	G30MS618
Medium Voltage Double Stack 6 Pole	--	G30MD606	G30MD610	--	G30MD614	G30MD618
High Voltage Single Stack 6 Pole	G30HS603	G30HS606	G30HS610	--	G30HS614	G30HS618
<b>GS40</b>			<b>GS40 = 8 in</b>			
Low Voltage Single Stack 8 Pole	--	G40LS806	G40LS808	G40LS812	--	G40LS818
Medium Voltage Single Stack 8 Pole	--	G40MS806	G40MS808	G40MS812	--	G40MS818
Medium Voltage Double Stack 8 Pole	--	--	G40MD808	G40MD812	--	G40MD818
High Voltage Single Stack 8 Pole	--	G40HS806	G40HS808	G40HS812	--	G40HS818
High Voltage Double Stack 8 Pole	--	--	G40HD808	G40HD812	--	G40HD818
<b>GS45</b>						
Low Voltage Single Stack 6 Pole	--	G45LS606	G45LS610	G45LS612	G45LS614	G45LS618
Medium Voltage Single Stack 6 Pole	--	G45MS606	G45MS610	G45MS612	G45MS614	G45MS618
Medium Voltage Double Stack 6 Pole	--	--	G45MD610	G45MD612	G45MD614	G45MD618
High Voltage Single Stack 6 Pole	--	G45HS606	G45HS610	G45HS612	G45HS614	G45HS618
High Voltage Double Stack 6 Pole	--	--	G45HD610	G45HD612	G45HD614	G45HD618
<b>GS60</b>						
Medium Voltage Single Stack 6 Pole	--	--	G60MS610	--	--	--
High Voltage Single Stack 6 Pole	--	--	G60HS610	--	--	--

## 7.1 Emerson Epsilon Drive with GS/X Series Actuator (M Connector Option)



**Note:** Dangerous voltages exist, so use extreme caution when operating this equipment. Sufficient energy remains in the Epsilon drive to cause motion even with the power removed. Wait for the 7-segment display to dim to off when powering down the drive. At start-up, be sure to have the proper motor file selected and limit the maximum acceleration until proper operation is verified.

### SETTING UP THE EMERSON EPSILON SERIES DRIVE TO RUN GS/X SERIES ACTUATORS

The quick touch setup cannot be used to select the Exlar actuator. The motor file containing the Exlar actuators is supplied by Exlar and must be saved as the motor.ddf file in the Power Tools main directory of the personal computer. When running PTOOLS, the actuator can be selected from the motor list and downloaded to the Epsilon Series drive by following these steps:

1. Click on the PowerTools Icon
2. From the menu bar, select File-New
3. Select Predefined Setup Selection appropriate for the application
4. Enter the appropriate ID name, drive address, line voltage, and operating mode.
5. Enter the Epsilon Series drive type
6. At this point if it asks you to enter a motor, then from the pull down menu, select the appropriate GS actuator.
7. Click on the Inputs, then Outputs tabs and configure the I/O as required.
8. Click on the Position, Velocity, and Torque tabs and configure the I/O as required.
9. Click on the Motor tab, then the drop-down Motor Type. The Exlar GS Series actuators should be included in the list. If they are not, the motor.ddf file from Exlar must be loaded into the Power Tools directory.
10. Download to the Epsilon Series drive by clicking on Device – Download from the menu items.


**Basic GS/X Series Parameter Settings for Emerson Epsilon Drives <sup>1</sup>**

		GS/X20	GS/X30	GS/X40	GS45	GSX50	GS/X60
Number of Poles		GS-6 GSX-8	GS-6 GSX-8	GS-8 GSX-8	GS-6	8	GS-6 GSX-8
Maximum Speed	RPM	5000	3000	3000	2400	2400	2400
J <sub>m</sub>	Lb-in-s <sup>2</sup>	See Inertia Table in section 7.0					
Encoder Size	Lines	2048	2048	2048	2048	2048	2048
Index Offset	Degrees	330	330	330	330	330	330
Hall Offset	Degrees	330	330	330	330	330	330

<sup>1</sup> Appropriate motor files may be obtained from Exlar or www.exlar.com and downloaded to Epsilon-XXX drives.

**CABLES FOR EMERSON EPSILON DRIVE WITH GS/X SERIES ACTUATOR (M CONNECTOR OPTION)**

**Motor Cable PC6-MC-XXX for GSX20/30  
PC7-MC-XXX for GS/X40 and GS45**

Exlar Connector	Wire Color	Function	Epsilon-XXX Connection
A	Red	R Phase	R
B	Black	S Phase	S
C	Blue	T Phase	T
D	Green/Yellow & Shield	GND	

<sup>1</sup> GS60 uses PC3-AC-XXX, refer to "O" connector wiring section

**Brake and Limit Switch Cable BC1-AC-XXX**

Exlar Connector	Wire Color	Function	Epsilon Connection
A	Blue	+24 VDC	24 vdc PS+
B	Yellow	24V GND	24 vdc PS-
C	Red/White	Lim Sw +	J3 or J5
D	Yellow/White	Lim Sw -	J3 or J5
E			
F	Black	24V GND	24 vdc PS-
G	Red	Brake Relay Contact -	Brake Relay connection
		Brake Relay Contact +	24 vdc PS+
		Brake Relay Coil +	J3 or J5
		Brake Relay Coil -	24 vdc PS-

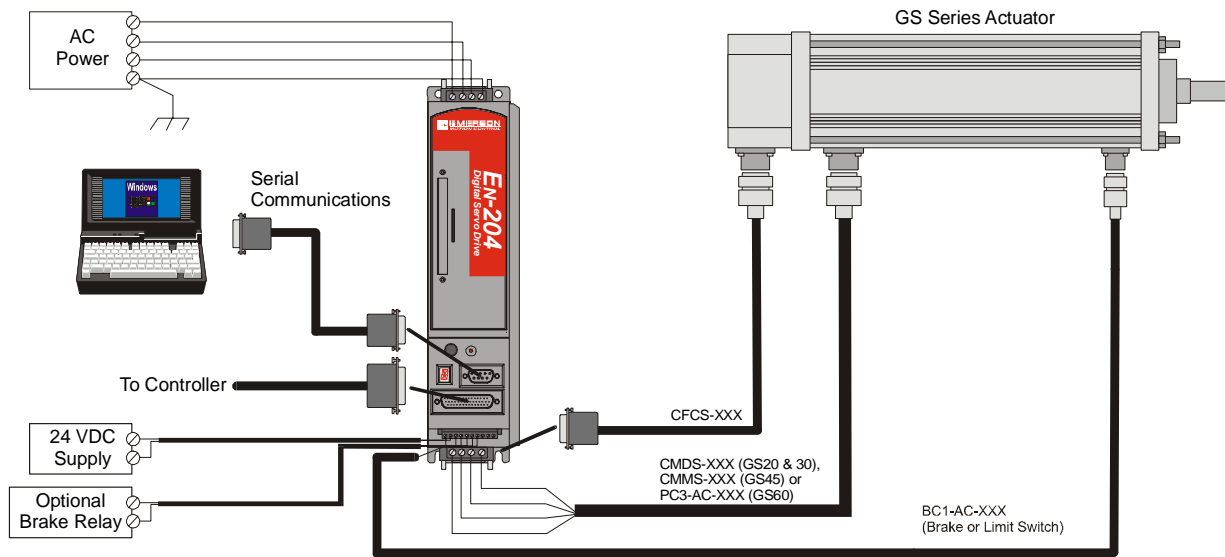
NOTES: (1) GS Series travel limits are current sinking. EN Series Drive inputs are current sourcing requiring a 2.2k Ohm ¼ Watt pull resistor to the input power supply + for correct operation. Check to verify that the EN drives travel limits are configured to "Active Off" to insure correct operation. (2) An external relay is required for brake operation. (3) Connectors A, B, C and D are for limit switches. Connectors F and G are for brake.

**Encoder Cable EC3-MC-XXX**

Exlar Connector	Wire Color	Function	J5, DB-26 Connection
A	Red/Green	Motor Overtemp	9
B	Blue	A+	1
C	Orange	A-	10
D		Overtemp Gnd	17
E	White/Brown	U+	4
F	White/Gray	V+	5
G	Red/Orange	W+	6
H	Orange/Red	W-	15
J			16
K	Red/Blue	+ 5 VDC	7
L		+ 5 VDC	N/C
M	Black	Z+	3
N	Green	B+	2
P	Brown	B-	11
R	Brown/White	U-	13
S	Gray/White	V-	14
T	Blue/Red	GND	17
U	Yellow	Z-	12
V			N/C
W			N/C
X			N/C
Y			N/C
Z	Shield		N/C

## 7.2 Emerson EN Series Drive with GS/X Series Actuator (M Connector Option)

### Emerson EN Series



**Note:** Dangerous voltages exist, so use extreme caution when operating this equipment. Sufficient energy remains in the EN Series drive to cause motion even with the power removed. Wait for the 7-segment display to dim to off when powering down the drive. At start-up, be sure to have the proper motor file selected and limit the maximum acceleration until proper operation is verified.

### SETTING UP THE EMERSON EN SERIES DRIVE TO RUN THE GS/X SERIES ACTUATOR

The quick touch setup cannot be used to select the Exlar actuator. The motor file containing the Exlar actuators is supplied by Exlar and must be saved as the motor.ddf file in the Power Tools main directory of the personal computer. When running PTOOLS, the actuator can be selected from the motor list and downloaded to the EN Series drive by following these steps:

1. Click on the PowerTools Icon.
2. From the menu bar, select File-New.
3. Select Predefined Setup Selection appropriate for the application.
4. Enter the appropriate ID name, drive address, line voltage, and operating mode.
5. Enter the EN Series drive type.
6. At this point if it asks you to enter a motor, then from the pull down menu, select the appropriate GS/X Series actuator.
7. Click on the Inputs, then Outputs tabs and configure the I/O as required.
8. Click on the Position, Velocity, and Torque tabs and configure the I/O as required.
9. Click on the Motor tab, then the drop-down Motor Type. The Exlar GS/X Series actuators should be included in the list. If they are not, the motor.ddf file from Exlar must be loaded into the Power Tools directory.
10. Download to the EN Series drive by clicking on Device – Download from the menu items.

Basic GS/X Series Parameter Settings for Emerson EN-XXX Drives <sup>1</sup>							
		GS20	GS30	GS40	GS45	GSX50	GS/X60
Number of Poles		GS-6 GSX-8	GS-6 GSX-8	GS-8 GSX-8	GS-6	8	GS-6 GSX-8
Maximum Speed	RPM	5000	3000	3000	2400	2400	2400
J <sub>m</sub>	Lb-in-s <sup>2</sup>	See Inertia Table in section 7.0					
Encoder Size	Lines	2048	2048	2048	2048	2048	2048
Index Offset	Degrees	330	330	330	330	330	330
Hall Offset	Degrees	330	330	330	330	330	330

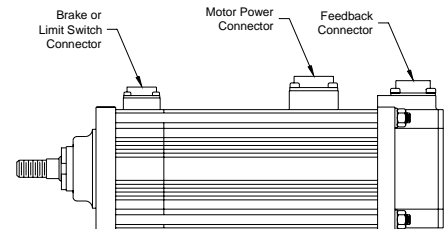
<sup>1</sup> Appropriate motor files may be obtained from Exlar and downloaded to EN-XXX drives.

## CABLES FOR EMERSON EN SERIES WITH GS/X SERIES ACTUATOR (M CONNECTOR OPTION)

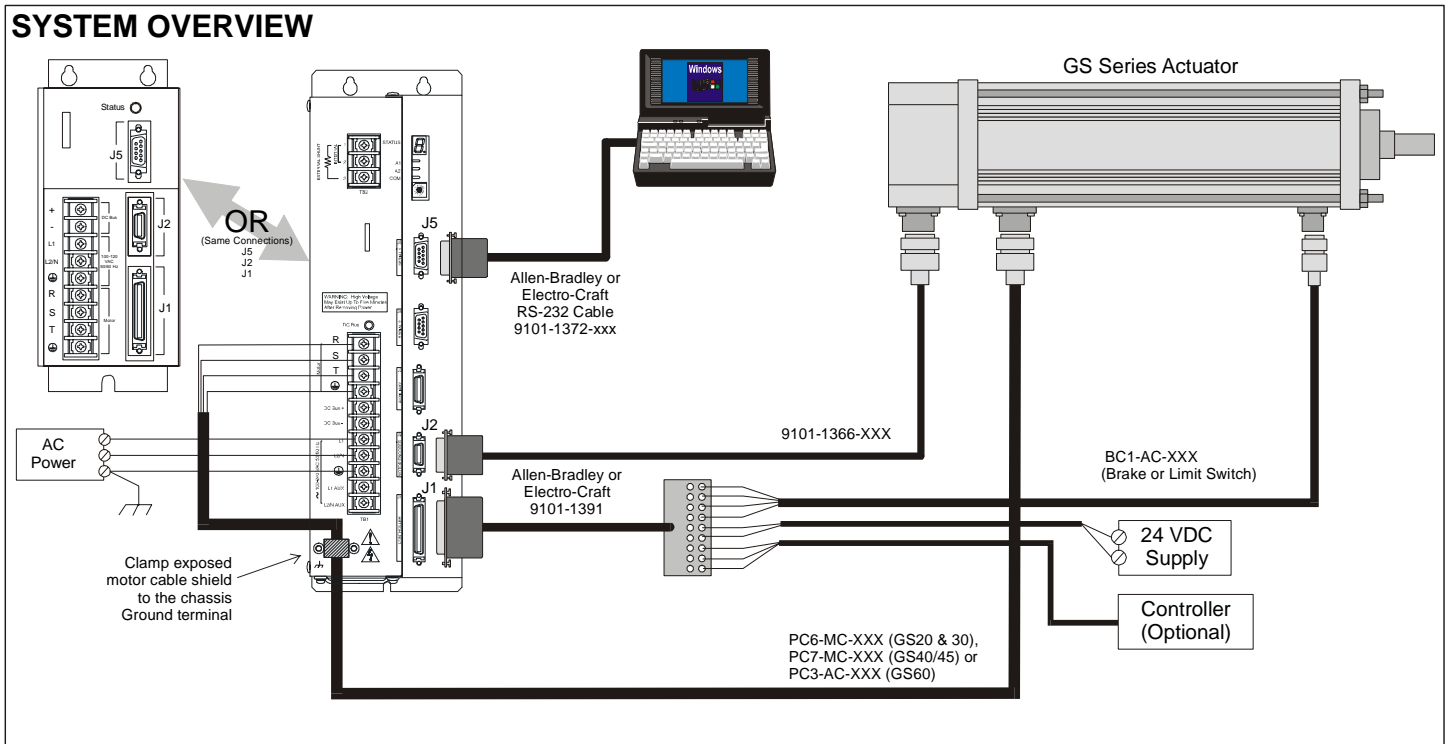
Refer to the diagram at the beginning of Section 7.2. The required cables are identified in the table below.

An Exlar cable must be used for the limit switch option on the GS/X actuators; Emerson Motion Control does not offer a version of this cable. An Exlar motor power cable is required for the GS60.

Emerson EN Series Cable Part Numbers (-xxx denotes cable length)	
<b>GS/X20, GS/X30</b>	
Feedback	CFCS-XXX
Motor Power	CMDS-XXX
Brake/Limit Switch	BC1-AC-XXX (Exlar Cable)
<b>GS/X40, GSX50, GS45</b>	
Feedback	CFCS-XXX
Motor Power	CMMS-XXX
Brake/Limit Switch	BC1-AC-XXX
<b>GS60</b>	
Feedback	CFCS-XXX
Motor Power	PC3-AC-XXX (Exlar Cable)
Brake/Limit Switch	BC1-AC-XXX (Exlar Cable)



## 7.3 Allen-Bradley/Electro-Craft Drives with GS/X Actuator (M Connector Option)



**Dangerous voltages exist so use extreme caution when operating this equipment. Sufficient energy remains in the DDM-XXX to cause motion even with the power removed. To verify that the equipment is safe, insure that the voltage across the DC+ and DC- terminals is at 0VDC. At startup, reduce the positive and negative current to below the rated current, such that accelerating torque is limited, until proper control is verified.**

### SETTING UP THE DDM-XXX DRIVE TO RUN EXLAR GS/X SERIES ACTUATORS

In order to program the drive to run the Exlar actuators, the motor parameter files provided by Exlar must be loaded into the motor directory, which by default is named "c:\brudrive\motordir". Once the motor files are loaded, the following steps will set up the DDM-XXX drives to run the Exlar actuators:

1. Connect the serial cable from the PC to J5 of the DDM-XXX.
2. With the motor power cable disconnected from the motor, apply power to the DDM-XXX.
3. Double click on the Ultra Master or BRU Master icon to start the program.
4. Following the upload of drive information, click on the Drive Setup icon.
5. Click on the down arrow for the motor model and select the appropriate Exlar actuator model number.
6. The warnings generated after changing the motor are normal.
7. The motor parameters are now downloaded into the drive and configuration for the motor is complete.
8. Power down the drive and reconnect the motor cable.

Basic GS/X Series Parameter Settings for A-B/Electro-Craft DDM Drives (1)							
		GS/X20	GS/X30	GS/X40	GS45	GSX50	GS/X60
Integral Thermostat		Note 2	Note 2	Note 2	Note 2	Note 2	Note 2
Number of Poles		GS-6 GSX-8	GS-6 GSX-8	GS-8 GSX-8	GS-6	8	GS-6 GSX-8
Thermal Time Constant	Seconds	780	1320	2200	2880	3750	5400
Maximum Speed	RPM	5000	3000	3000	2400	2400	2400
J <sub>m</sub>	Kg-cm <sup>2</sup>	See Inertia Table in section 7.0					
Encoder Line Count	Lines	2048	2048	2048	2048	2048	2048
Index Offset	Degrees	0	0	0	0	0	0
Hall Offset	Degrees	240	240	240	240	240	240
Startup Commutation		Hall/ Hall	Hall/ Hall	Hall/ Hall	Hall/ Hall	Hall/Hall	Hall/Hall
Current Feed forward	Degrees/ KRPM	0	0	0	0	0	0

(1) Appropriate motor files may be obtained from Exlar and downloaded to DDM-XXX drives. Changes to motor parameters require the advanced option for BRU Master or Ultra Master. Add /a to the command line of shortcut for the BRU Master or Ultra Master software to enable the advanced option. These Parameters and others specific to each motor winding are included in the motor file listed in the table in section 7.0.

(2) Set to "yes" if TS+ and TS- from the motor cable are connected to J2 pins 19 and 20.

(3) Voltage is 0 – peak of sinusoid, measured phase-to-phase

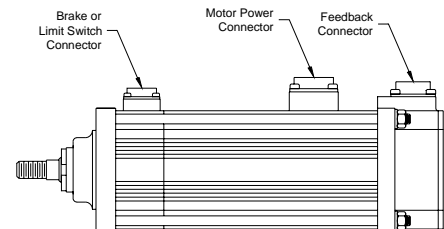
(4) Current is 0 – peak of sinusoid

#### CABLES FOR A-B / E-C DDM-XXX DRIVE AND GS/X SERIES ACTUATORS (M CONNECTOR OPTION)

Refer to the diagram at the beginning of Section 7.4. The required cables are identified in the table below.

An Exlar cable must be used for the brake/limit switch option and motor power on the GS/X Series actuators. Allen-Bradley / Electro-Craft does not offer a version of this cable.

A-B / Electro-Craft Cable Part Numbers (-XXX denotes cable length)	
<b>GS/X20, GS/X30</b>	
Feedback	9101-1366-XXX
Motor Power	PC6-MC-XXX (Exlar Cable)
Brake/Limit Switch	BC1-AC-XXX (Exlar Cable)
<b>GS/X40, GSX50, GS45</b>	
Feedback	9101-1366-XXX
Motor Power	PC7-MC-XXX (Exlar Cable)
Brake/Limit Switch	BC1-AC-XXX (Exlar Cable)
<b>GS60</b>	
Feedback	9101-1366-XXX
Motor Power	PC3-AC-XXX (Exlar Cable)
Brake/Limit Switch	BC1-AC-XXX (Exlar Cable)

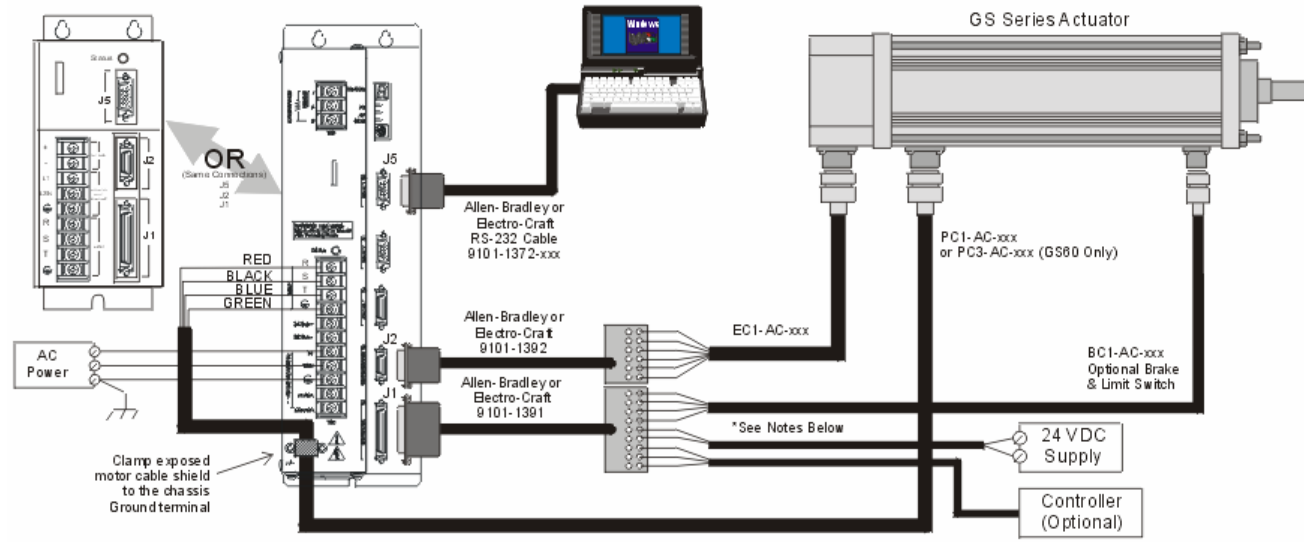


Motor Power Cable PC6-MC-XXX and PC7-MC-XXX for GSX20, 30, 40, and GS45		
Amplifier Connection	Motor Power Pin	Exlar PC6, PC7 Power Cable Color
R	A	Brown
S	B	Black
T	C	Blue
GND	D	Green/Yel + Shield

Motor Power Cable PC3-AC-XXX for GS60		
Amplifier Connection	Motor Power Pin	Exlar PC3 Power Cable Color
R	A	Red
S	B	Black
T	C	Blue
GND	D	Green + Shield

# 7.3a A-B/Electro-Craft Drive with Exlar GS/X Series Actuators (O Connector Option)

## SYSTEM OVERVIEW



Motor Cable PC1-AC-XXX			
Exlar Connector	Wire Color	Function	DDM-XXX Connector
A	Red	R Phase	R
B	Black	S Phase	S
C	Blue	T Phase	T
D	Green	GND	⊕

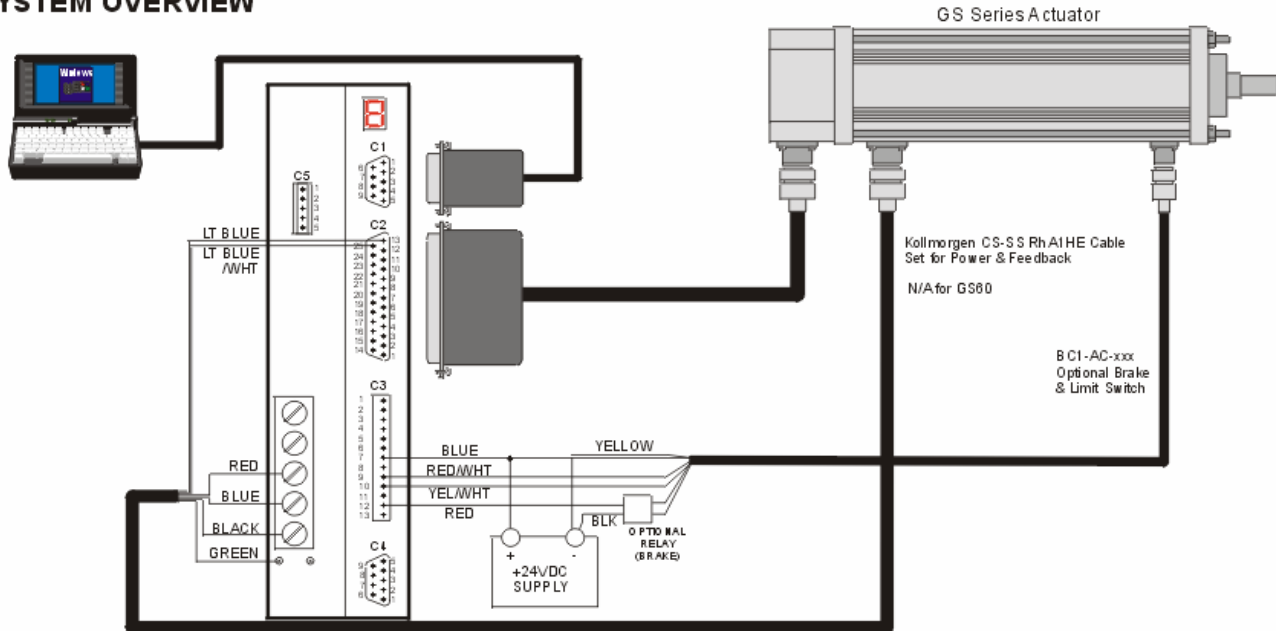
Brake and Limit Switch Cable BC1-AC-XXX			
Exlar Connector	Wire Color	Function	J1 Connector
A	Blue	+24 VDC	5
B	Yellow	24V GND	6
C	Red/White	Lim Sw +	32, 33 or 34
D	Yellow/White	Lim Sw -	32, 33 or 34
E			
F	Black	24V GND	6
G	Red	Brake -	50
		+ 24VDC	49

NOTES: (1) +24VDC supply is connected to J1, pin 5 and pin 50.  
 (2) 24V COM supply is connected to J1, pin 6.  
 (3) J1 pins 32, 33, and 34 are programmable by user.  
 (4) The GS travel limits are current sinking. Drive inputs are current sourcing requiring a 2.2k Ohm ¼ Watt pull-up resistor to the input power supply + for correct operation. The drives travel limits are set to "Active Off" for correct operation.

Encoder Cable EC1-AC-XXX			
Exlar Connector	Wire Color	Function	J2 Connector
T	Red	EPWR	1
J	Black	ECOM	2
G	Green	A(+)	7
H	Green/Black	A(-)	8
S	Blue/Black	B(+)	9
F	Blue	B(-)	10
E	Orange	I(+)	11
R	Orange/Black	I(-)	12
U	Blue/White	Hall A	13
K	Black/White	Hall B	14
M	Red/White	Hall C	15
	No Connection	ABS	16
L	Black/Red	Therm Sw +	19
N	White/Red	Therm Sw -	20

## 7.4 Kollmorgen SERVOSTAR CD Drive with Exlar GS/X Series Actuators (M Connector Option)

### SYSTEM OVERVIEW



**Dangerous voltages exist so use extreme caution when operating this equipment. Sufficient energy remains in the SERVOSTAR to cause motion even with the power removed. To verify that the equipment is safe, insure that the voltage across the DC+ and DC- terminals is at 0VDC. At startup, reduce the current to below the rated current, such that accelerating torque is limited, until proper control is verified.**

### SETTING UP THE SERVOSTAR DRIVE TO RUN EXLAR GS/X SERIES ACTUATORS

In order to program the drive to run the Exlar actuators, the motor parameter file provided by Exlar must be loaded into the Servostar directory, which by default is named “c:\Program files\KMTG Motion Suite\user.m03”. Once the motor file is loaded, the following steps will enable the SERVOSTAR drive to run the Exlar actuators.

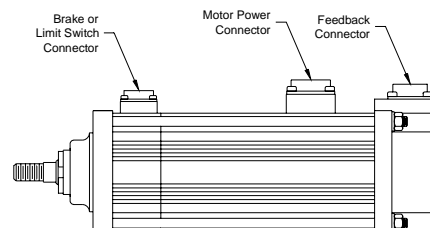
1. Connect the serial cable from the PC to C1 of the SERVOSTAR drive.
2. With the motor power cable disconnected from the motor, apply power to the drive.
3. Double click on the SERVOSTAR icon to start the program.
4. Click OK to continue from the About MotionLink page.
5. Click on Com Setup and enter the communication parameters for the computer and click on OK.
6. Click on the Scan For Drives button to initiate communication with the drive.
7. Click on Start to begin the drive initialization process.
8. From the New Amplifier Startup Screen, click Start.
9. Select the bus voltage and drive configuration switch settings, then click Exit.
10. Under Motor Description, select the appropriate Exlar actuator.
11. Click on the “To Drive” icon to download the motor data to the drive. Then click on Exit.
12. Continue on through the Startup process by running the “Opmode” “Tune”, and “Backup” steps.

Basic GS/X Series Parameter Settings for Kollmorgen SERVOSTAR CD Drives (1)							
		GS/X20	GS/X30	GS/X40	GS45	GSX50	GS60
Maximum Speed	RPM	5000	3000	3000	2400	2400	2400
Back EMF Compensation	%	50	50	50	50	50	50
Motor Inertia	Kg-m <sup>2</sup>	See Inertia Table in section 7.0					
Motor Poles		GS-6 GSX-8	GS-6 GSX-8	GS-8 GSX-8	GS-6	8	GS-6 GSX-8
AGain @ Peak Current	%	40	40	40	40	40	40
AGain @ Cont. Current	%	70	70	70	70	70	70
AGain@ Zero Current	%	100	100	100	100	100	100
Torque Advance P	Elec. Degrees	23	23	23	23	23	23
Torque Advance C	Elec. Degrees	10	10	10	10	10	10
Speed Advance V	Elec. Degrees	25	25	25	25	25	25
Speed Advance ½ V	Elec. Degrees	15	15	15	15	15	15

**Note 1** Appropriate motor files may be obtained from Exlar and downloaded to SERVOSTAR CD drives. Use user.m03 file found on [www.exlar.com](http://www.exlar.com)

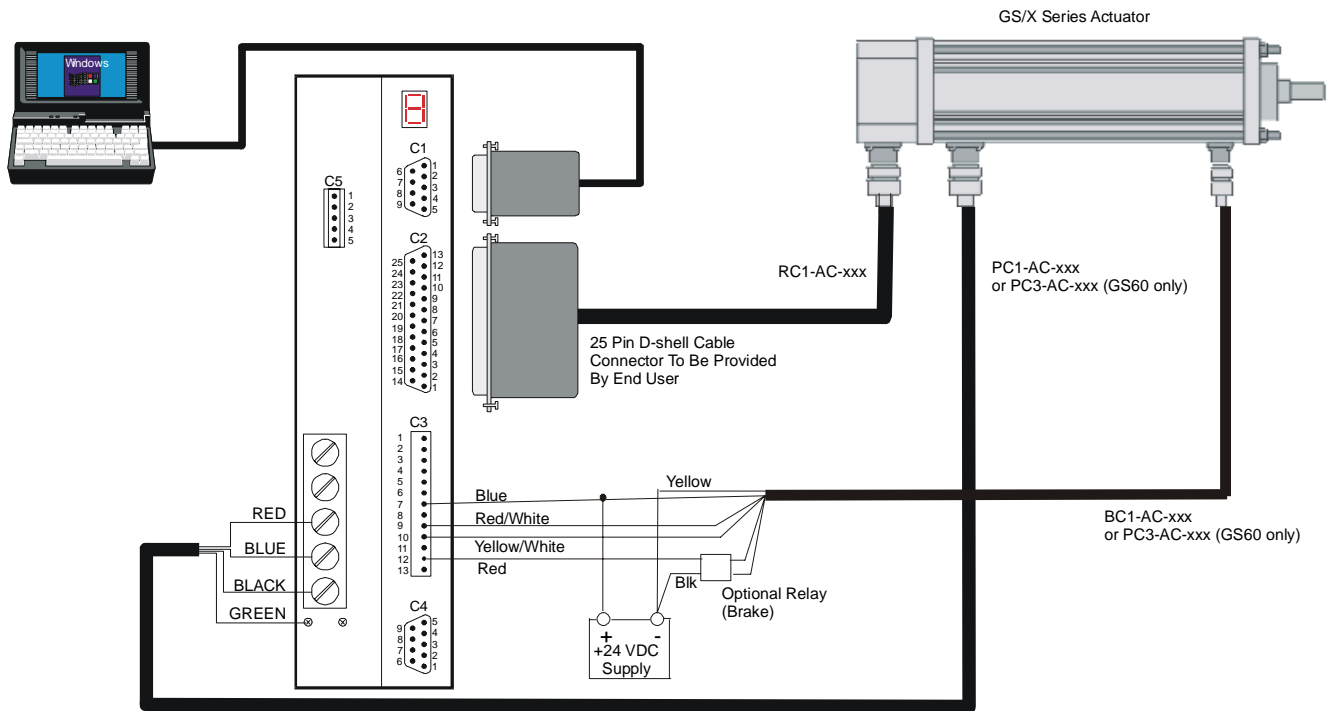
### CABLES FOR KOLLMORGEN SERVOSTAR CD DRIVE AND GS/X SERIES ACTUATORS (M CONNECTOR OPTION)

Kollmorgen Cable Part Numbers (Goldline XT cables)	
<b>GS/X20, GS/X30</b>	
Feedback	CS-SS-RHA1HE
Motor Power	CS-SS-RHA1HE
Brake/Limit Switch	BC1-AC-XXX (Exlar Cable)
<b>GS/X40, GSX50, GS45</b>	
Feedback	CS-SS-RHA1HE
Motor Power	CS-SS-RHA1HE
Brake/Limit Switch	BC1-AC-XXX (Exlar Cable)
<b>GS60</b>	
Feedback	CS-SS-RHA1HE
Motor Power	PC3-AC-XXX (Exlar Cable)
Brake/Limit Switch	BC1-AC-XXX (Exlar Cable)



# 7.4a Kollmorgen SERVOSTAR Drive with GS/X Series Actuator (O Connector Option)

## SYSTEM OVERVIEW

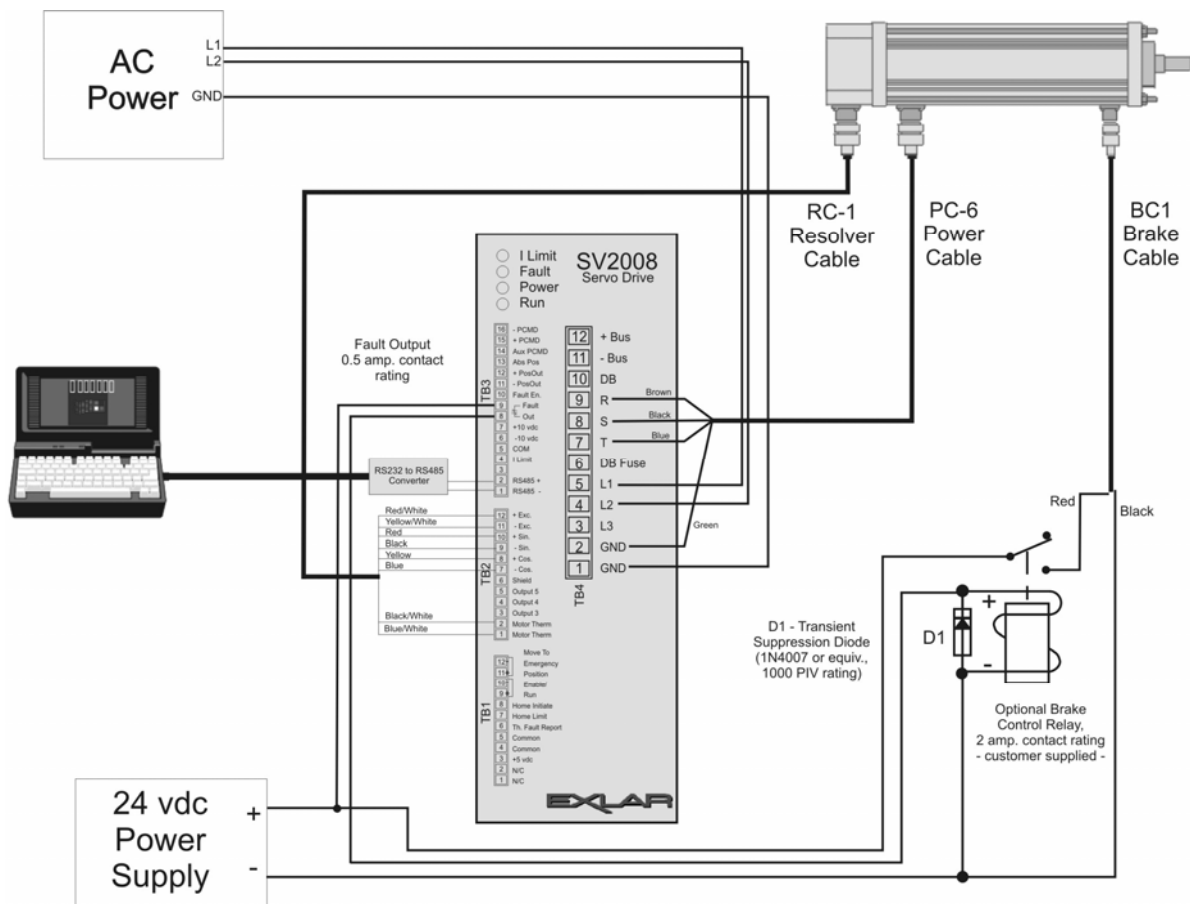


Motor Cable PC1-AC-XXX			
Exlar Connector	Wire Color	Function	SERVOSTAR Connector
A	Red	Phase A	Ma
B	Black	Phase C	Mc
C	Blue	Phase B	Mb
D	Green	GND	⊕
E			

Resolver Cable RC1-AC-XXX			
Exlar Connector	Wire Color	Function	C2 Connector
A	-	-	-
B	-	-	-
C	-	-	-
D	Bare	Shield	3, 6, 14
E	Red/White	Ref Hi (R1)	16
F	Black	Cos Lo (S4)	5
G	Blue	Sine Lo (S3)	1
H	Red	Cos Hi (S2)	4
J	-	-	-
K	-	-	-
L	-	-	-
M	-	-	-
N	Blue/White	Thermostat	13
P	-	-	-
R	Yellow/White	Ref Lo (R2)	15
S	Yellow	Sine Hi (S1)	2
T	-	-	-
U	Black/White	Thermostat	25
Case	-	Shield	-

Brake and Limit Switch Cable BC1-AC-XXX			
Exlar Connector	Wire Color	Function	C3 Connector
A	Blue	+24 VDC	7
B	Yellow	24V GND	
C	Red/White	Lim Sw +	9
D	Yellow/White	Lim Sw -	10
E			
F	Black	24V GND	
G	Red	Brake +	12

## 7.5 Exlar SV Series Drive with GS/X Series Actuator



**FOR DETAILED INSTRUCTIONS ON SETTING UP THE SV SERIES DRIVE SEE EXLAR'S SV SERIES INSTALLATION AND CONFIGURATION MANUAL.**

Motor Cable PC6-AC-XXX			
Exlar Connector	Wire Color	Function	SV2000 terminal
A	Brown	R Phase	TB4-9
B	Black	S Phase	TB4-8
C	Blue	T Phase	TB4-7
D	Green/Yellow	GND	TB4-2

## 7.5 Exlar SV Series Drive with GS/X Series Actuator (cont'd)

Resolver Cable RC1-AC-XXX			
Exlar Connector	Wire Color	Function	SV2000 Terminal
E	Red/White	Exc+	TB2-12
R	Yellow/White	Exc-	TB2-11
H	Red	Sin+	TB2-10
F	Black	Sin-	TB2-9
S	Yellow	Cos+	TB2-8
G	Blue	Cos-	TB2-7
N	Black/White	Motor Therm	TB2-2
U	Blue/White	Motor Therm	TB2-1

Brake and Limit Switch Cable BC1-AC-XXX			
Exlar Connector	Wire Color	Function	SV2000 terminal
A	Blue	+24 vdc	n/a *
B	Yellow	24 v GND	n/a *
C	Red/White	Lim Sw +	n/a *
D	Yellow/White	Lim Sw -	n/a *
E			
F	Black	24V GND	24 VDC Brake Supply Ground
G	Red	Brake+	Brake Control Relay contact
H			

n/a \* - SV2000 has no limit switch inputs.

EX4 Resolver Feedback (17308) with Brake				
Actuator	Connector	P/N	Cables	Cable Desc.
GSX30/30	O/M	10221	PC6/PC1	Stator
		10220	RC1	Feedback
		11028	BC1	Brake
GSX40	O/M	14480	PC7	Stator
		10220	RC1	Feedback
		11028	BC1	Brake
GSX50	O/M	14480	PC7	Stator
		10220	RC1	Feedback
		11028	BC1	Brake
GSX60	O/M	12328	PC3	Stator
		10220	RC1	Feedback
		11028	BC1	Brake