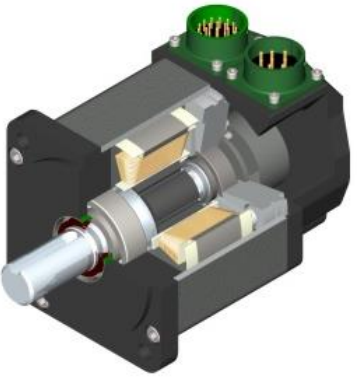
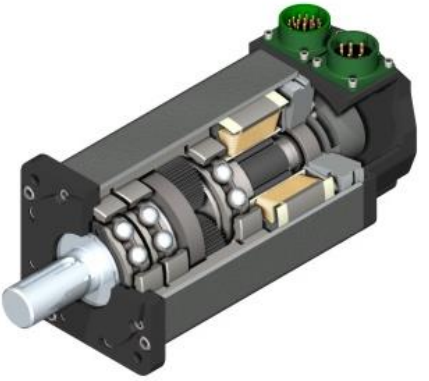
SLM and SLG Series
Brushless Servo Motors
Installation and Service Manual

SLM Series Brushless Servo Motor



SLG Series Brushless Servo Gearmotor



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1.0 INTRODUCTION

1.1 Warranty and Limitation of Liability

Products are warranted for two years from date of manufacture as determined by the serial number on the product label. Labels are generated and applied to the product at the time of shipment. The first and second digits are the year and the third and fourth digits represent the manufacturing week. Product repairs are warranted for 90 days from the date of the repair. The date of repair is recorded within Exlar's database tracked by individual product serial number.

Exlar Corporation warrants its product(s) to the original purchaser and in the case of original equipment manufacturers, to their original customer to be free from defects in material and workmanship and to be made only in accordance with Exlar's standard published catalog specifications for the product(s) as published at the time of purchase. Warranty or performance to any other specifications is not covered by this warranty unless otherwise agreed to in writing by Exlar and documented as part of any and all contracts, including but not limited to purchase orders, sales orders, order confirmations, purchase contracts and purchase agreements. In no event shall Exlar be liable or have any responsibility under such warranty if the product(s) has been improperly stored, installed, used or maintained, or if Buyer has permitted any unauthorized modifications, adjustments and/or repairs to such product(s). Seller's obligation hereunder is limited solely to repairing or replacing (at its opinion), at the factory any product(s), or parts thereof, which prove to Seller's satisfaction to be defective as a result of defective materials, or workmanship and within the period of time, in accordance with the Seller's stated product warranty (see Terms and Conditions above), provided, however, that written notice of claimed defects shall have been given to Exlar within thirty (30) days from the date of any such defect is first discovered. The product(s) claimed to be defective must be returned to Exlar, transportation prepaid by Buyer, with written specification of the claimed defect. Evidence acceptable to Exlar must be furnished that the claimed defects were not caused by misuse, abuse, or neglect by anyone other than Exlar.

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

The use of products or components under load such that they reach the end of their expected life is a normal characteristic of the application of mechanical products. Reaching the end of a product's expected life does not indicate any defect in material or workmanship and is not covered by this warranty.

Costs for shipment of units returned to the factory for warranty repairs are the responsibility of the owner of the product. Exlar will return ship all warranty repairs or replacements via UPS Ground at no cost to the customer.

For international customers, Exlar will return ship warranty repairs or replacements via UPS Expedited Service and cover the associated shipping costs. Any VAT or local country taxes are the responsibility of the owner of the product.

The foregoing warranty is in lieu of all other warranties (except as Title), whether expressed or implied, including without limitation, any warranty of merchantability, or of fitness for any particular purpose, other than as expressly set forth and to the extent specified herein, and is in lieu of all other obligations or liabilities on the part of Exlar.

Seller's maximum liability with respect to these terms and conditions and any resulting sale, arising from any cause whatsoever, including without limitation, breach of contract or negligence, shall not exceed the price specified herein of the product(s) giving rise to the claim, and in no event shall Exlar be liable under this warranty otherwise for special, incidental or consequential damages, whether similar or dissimilar, of any nature arising or resulting from the purchase, installation, removal, repair, operation, use or breakdown of the product(s) or any other cause whatsoever, including negligence.

The foregoing warranty shall also apply to products or parts which have been repaired or replaced pursuant to such warranty, and within the period of time, in accordance with Seller's stated warranty.

NO PERSON, INCLUDING ANY AGENT OR REPRESENTATIVE OF EXLAR IS AUTHORIZED TO MAKE ANY REPRESENTATION OR WARRANTY ON BEHALF OF EXLAR CONCERNING ANY PRODUCTS MANUFACTURED BY EXLAR, EXCEPT TO REFER PURCHASERS TO THIS WARRANTY.

1.2 Safety Considerations

As with any electro-mechanical device, safety should be considered during the installation and operation of your SLM/SLG Series Brushless Servo Motor. 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 SLM/SLG Series Servo Motor System Configuration

The design of the SLM/SLG Series motor and selection of the proper feedback configuration allows it to be powered by nearly every brand of brushless motor amplifier on the market.

This flexibility allows SLM/SLG Series motors 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, these motors show incredible performance and durability.

Each brand of brushless motor amplifiers may have unique wiring requirements, parameter settings and operational principals that affect how the motor operates. Details on connections to specific brands of amplifiers can be obtained from www.exlar.com.

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

Never attempt to connect or disconnect the motor 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.

2.2 Feedback Information

Most SLM/SLG Series motors 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 that the end user will use to operate the motor.

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 an SLM or SLG Series motor, 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 motor with the selected amplifier. Wiring the feedback cable incorrectly can cause unstable operation, incorrect operation or no operation at all. In some cases, improper current limits set in the amplifier along with improper 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 2 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 with 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.

SLM/SLG Series Feedback Devices

Standard SLM/SLG Series motors 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. Refer to www.exlar.com or contact Exlar for the correct wiring details.

2.3 Internal Holding Brake

Many applications require the addition of the rear 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 shaft from moving.

Table 2-1 Brake Specifications

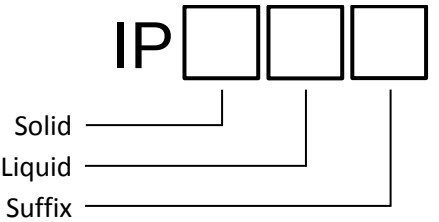
Motor	Brake Holding Torque (Lb-in / N)	Brake Voltage (VDC)	Brake Current (AMPS)
SLM/SLG 60	18/2.0	24	0.33
SLM/SLG 75	40/4.5	24	0.50
SLM/SLG 90	97/11.0	24	0.67
SLM/SLG 115	195/22.0	24	0.75
SLM 142	354/44.0	24	1.0
SLM 180	708/80.0	24	1.45

CAUTION: DO NOT attempt to operate the motor with the brake applied. Allowing the motor to operate with the brake applied may cause serious damage to the motor 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

2.4 Ingress Protection Rating

The standard IP rating for SLM/SLG Series actuators is ***IP65S***. Ingress protection is divided into two categories; solids and liquids. For example, in IP65 the three digits following "IP" represent different forms of environmental influence:

- The first digit represents protection against ingress of solid objects.
- The second digit represents protection against ingress of liquids.
- The suffix digit represents conditions of motion during the rating test.



Digit 1 – Solid Particle Protection

The IP rating system provides for 6 levels of protection against solids.

Table 2-2 Digit 1 – Solid Particle Protection

Level	Object Size Protected Against	Effective Against
0	-	No Protection
1	>50mm	Hands, large tools
2	>12.5mm	Fingers
3	>2.5mm	Wire, small tools
4	>1mm	Thin wires, screws
5	Dust Protected	Limited protection against dust ingress (no harmful deposit)
6	Dust Tight	Totally protected against dust ingress

Digit 2 – Liquid Ingress Protection

The IP rating system provides for 9 levels of protection against liquids.

Table 2-3 Digit 2 – Liquid Ingress Protection

Level	Protected Against	Effective Against
0	-	No Protection
1	Dripping Water	Protected against vertically falling drops of water or condensation
2	Dripping Water when tilted up to 15°	Protected against falling drops of water, if the case is disposed up to 15 degrees from vertical
3	Spraying Water	Protected against sprays of water from any direction, even if the case is disposed up to 60 degrees from vertical
4	Splashing Water	Protected against splashing water from any direction
5	Water Jets	Protected against low pressure water jets from any direction. Limited ingress permitted
6	Powerful Water Jets	Protected against high pressure water jets from any direction. Limited ingress permitted
7	Immersion up to 1m	Protected against short periods of immersion in water of 1m or less for 30 minutes or less
8	Immersion beyond 1m	Protected against long durations of immersion in water beyond 1m
9	Powerful High Temperature Water Jets	Protected for high pressure, high temperature wash-down applications

Suffix

Additional letters can be appended to provide more information.

Table 2-4 Suffix – Additional Information

Letter	Meaning
S	Device stationary during test
M	Device moving during test

3.0 INSTALLATION AND OPERATION

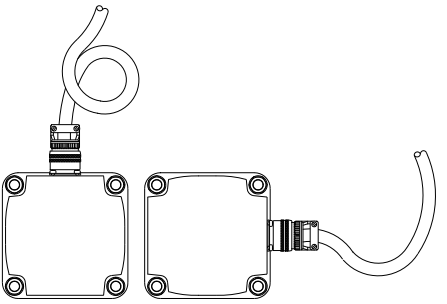
3.1 Mounting Configurations

The SLM/SLG Series standard mounting configurations and dimensions can be obtained from the product catalog or from our website, www.exlar.com.

The typical fasteners used to mount via the front through holes of the SLM/SLG Series actuators are:

Table 3-1 Mounting Fasteners

Motor	Fastener Size (SHCS)	
	Inch	Metric
SLM/SLG 60	#10	M5
SLM/SLG 75	1/4”	M6
SLM/SLG 90	1/4”	M6
SLM/SLG 115	5/16”	M8
SLM 142	3/8”	M10
SLM 180	1/2"	M12



Top Mount Side Mount

Figure 3-2 Drip Loop Examples

3.2 Cable Routing

Over time, liquid contaminants such as oil and cleaning solutions will run down the cables and into any exposed connectors. 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 in Figure 3-2, 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.

3.3 Mounting Considerations

Every effort should be made to minimize misalignment. Misalignment of the SLM/SLG Series motor with respect to the load the motor is moving is of great concern. Any misalignment will decrease the life of the components within the motor and also may create problems within the application associated with misalignment. Also, the mounting of pulleys and similar devices on the output shaft of the motor imparts side load on the output shaft. The life of the actuator is dependent on side load as shown in the tables below. Visit www.exlar.com for more details.

3.4 Radial Load Ratings

The following tables give the rated load for 10,000 hour life for Exlar servo motors. Side loading a motor's shaft in a given application (e.g., driving a pulley) as well as increasing the radial load distance, X will decrease a motor's service life.

X can be measured as the distance between the load's center to the motor's faceplate mounting surface.

Provided are the radial load ratings for 10,000 hour life at X=25mm, a standard load distance.

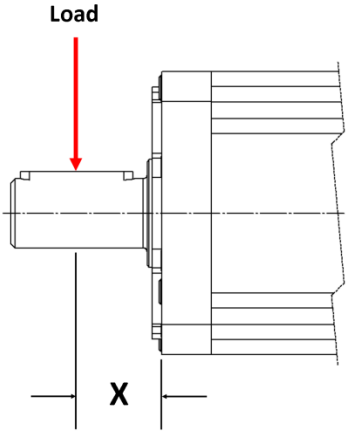


Figure 3-3 Radial Loading

Table 3-4 Radial Load Ratings for SLM Servo Motors

Maximum Radial Load for 10,000 Hour Life @X=25mm						
	RPM					
Motor	**50 (Lbf / N)**	**100 (Lbf / N)**	**250 (Lbf / N)**	**500 (Lbf / N)**	**1000 (Lbf / N)**	**3000 (Lbf / N)**
SLM 60	250/ 1112	198/ 881	148/ 658	116/ 516	92/ 409	64/ 285
SLM 75	278/ 1237	220/ 979	162/ 721	129/ 574	102/ 454	71/ 316
SLM 90	427/ 1899	340/ 1512	250/ 1112	198/ 881	158/ 703	109/ 485
SLM 115	579/ 2576	460/ 2046	339/ 1508	269/ 1197	214/ 952	148/ 658
SLM 142	1367/ 6081	1085/ 4826	800/ 3559	635/ 2825	504/ 2242	349/ 1552
SLM 180	2237/ 9951	1776/ 7900	1308/ 5818	1038/ 4617	824/ 3665	605/ 2691

Table 3-5 Radial Load Ratings for SLG Servo Gear Motors

Maximum Radial Load for 10,000 Hour Life @X=25mm						
	RPM					
Motor	50 (Lbf / N)	100 (Lbf / N)	250 (Lbf / N)	500 (Lbf / N)	1000 (Lbf / N)	3000 (Lbf / N)
SLG 60	189/ 841	150/ 667	110/ 489	88/ 391	70/ 311	48/ 214
SLG 75	343/ 1526	272/ 1210	200/ 890	159/ 707	126/ 560	88/ 391
SLG 90	350/ 1557	278/ 1237	205/ 912	163/ 725	129/ 574	89/ 396
SLG 115	858/ 3817	681/ 3029	502/ 2233	398/ 1770	316/ 1406	218/ 970

CAUTION: Excessive side load on the output shaft of the motor will dramatically reduce the life of the motor and should be avoided. Side load can be caused from mis-alignment, loading from devices such as pulleys mounted directly to the output shaft, and from the motor's use in the application.

3.5 Output Torque Ratings

SLG Series gearmotors are equivalent to SLM Series motors with integrated planetary gearing. Consult SLM Series electrical and speed torque data for use with SLG ratios. The life of the actuator is dependent on the output torque. It is the user's responsibility to not exceed the acceptable output torque of the SLG Series gearmotor. Visit www.exlar.com for more details.

3.6 Lubrication Maintenance

When used within their standard ratings, SLG Series gear motors are designed to operate for thousands of hours with the initial grease lubrication provided from the factory. Variables such as operating temperature and RMS rotational speed will affect the life of the grease lubrication and determine the period in which the unit should be re-lubricated.

Please refer to the table below to determine the hours of operation after which the unit should be re-lubricated, based on operating speed and operating temperature.

Due to the integrated nature of the gear motor product, it is recommended that the unit be sent to Exlar for cleaning, inspection and re-lubrication at the end of the recommended grease renewal period. This can be coordinated by contacting Exlar's RGA Coordinator at *(855)-620-6200*.

Exlar recommends using **Mobilith SHC220**, a high performance extreme pressure gear grease (standard grease option for Exlar). The unique physical properties of the synthetic base oil provide outstanding protection against wear, rust, corrosion and high or low temperature degradation. Its operating range is -40° C to 177°C (-40°F to 350°F).

Table 3-6 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

4.0 TROUBLESHOOTING PROCEDURES

This section provides the guidelines and hints for troubleshooting various problems that may be encountered during installation and operation of your Exlar SLM/SLG Series motor.

Table 4-1 Troubleshooting Procedures

Symptom / Trouble	Possible Cause / Troubleshooting Procedure
No response from motor	1. Check amplifier for faults that may indicate a problem 2. Ensure that the amplifier is enabled 3. Check for proper wiring
Motor seems to be enabled (drawing current) but is not operating, or is operating erratically	1. Amplifier may be improperly tuned – check all gain settings. *If a motor file or parameters specific to your amplifier/motor combination have been supplied by Exlar, be sure that they are entered or downloaded properly.* *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. *3.* Feedback wiring may be incorrect *4.* Feedback conductors may be touching or feedback cable damaged *5.* Motor phases are wired incorrectly or in incorrect order (R,S,T) *6.* Feedback (resolver or encoder) is improperly aligned – contact Exlar
Motor cannot move load	1. Load is too large for the capacity of the motor or too much friction is present 2. Excessive side load 3. Misalignment of output shaft to load 4. Amplifier has too low of current capacity or is limited to too low of current capacity
Motor housing moves or vibrates when shaft is in motion	1. Check motor mounting – ensure that the motor is securely mounted 2. Amplifier is improperly tuned (wrong gain settings) – tune amplifier
Motor is overheating	1. Insufficient cooling for application requirements – contact Exlar engineering 2. Motor is being operated outside of continuous ratings 3. Amplifier is poorly tuned causing excessive unnecessary current to be applied to motor – check Gain settings.

4.1 Returning a Product for Repair

STANDARD EVALUATION AND REPAIR LEADTIME:

- Lead-time is dependent upon production capacity and level of demand. Please contact the factory for current lead-time.

EXPEDITED EVALUATION LEADTIME:

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

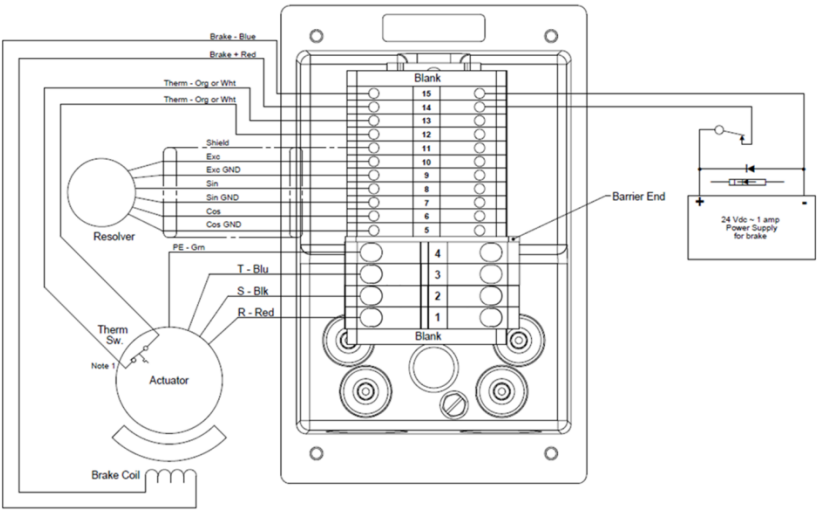
PROCEDURE:

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

5.0 CLASS I, DIVISION 2 OPTION

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

5.1 Terminal Box Wiring Diagram



Note 1: Thermal switch normally closed; opens when stator temp exceeds 130 deg. C.

Figure 5-1 Class 1 Division 2 Terminal Box Wiring Diagram

5.2 Class I Division 2 Terminal Box Terminations

Exlar uses spring clamp terminals for maximum vibration resistance and ease of connection.

- Tin-plated terminals and stainless steel spring clamps for resistance to corrosion and vibration
- Spring clamp design to minimize stress relaxation and maintain contact force, even under vibration

To use spring clamp terminals

1. Strip the wire to 0.5 in (12-13 mm). Longer is better than shorter since you can always trim to fit.
2. Open the terminal by inserting a flat blade screwdriver into the spring release and slide wire in until it stops.
   (See Figure 5-2)

Figure 5-2 Screwdriver to Open the Terminal

3. Make sure exposed wire is in the clamp, not insulated wire.
   (see Figure 5-3)

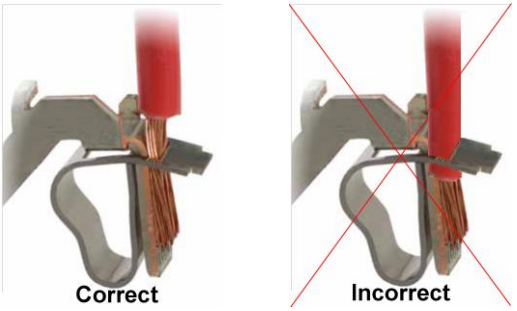


Figure 5-3 Correct and Incorrect Wire Insertion

4. Remove the screwdriver. The clamp pressure will keep the wire in place. No exposed wire should protrude past the cage opening. (See Figure 5-4)

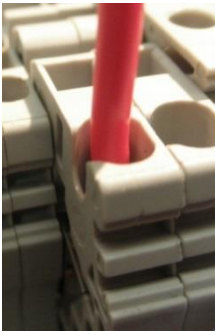
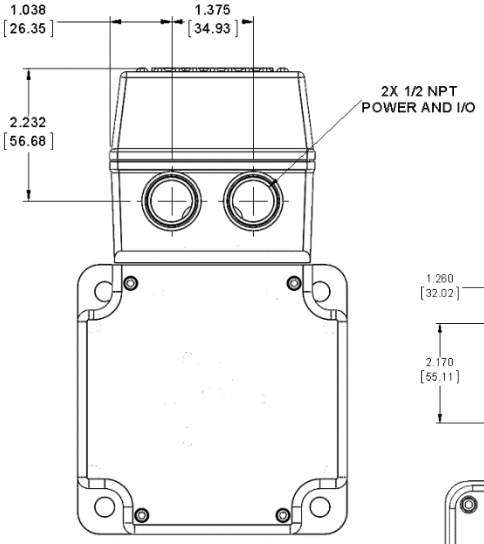
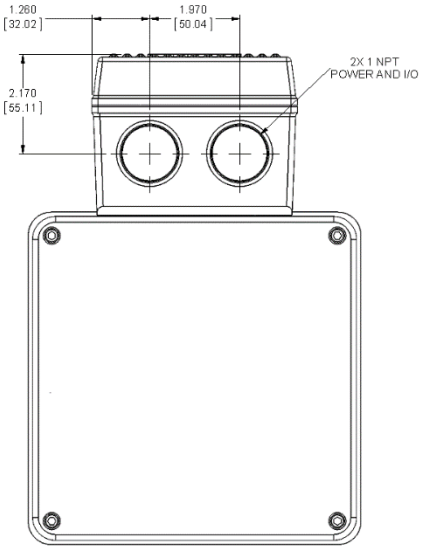


Figure 5-4 A Properly Terminated Wire

5.3 Terminal Box Dimensions



SLM/SLG 075
SLM/SLG 090
SLM/SLG 115



SLM 142
SLM 180

Note: Applications with 20A rms or greater will require the larger terminal box.

6.0 CONFORMANCE CERTIFICATIONS

EU Declaration of Conformity

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

The undersigned, representing the	*and the authorized representative*
Manufacturer	*established within the community*
Exlar Corporation	*Exlar GmbH*
18400 West 77th Street	*Frankfurter Str: 107*
Chanhassen, MN 55317 USA	*65479 Raunheim, Germany*

Declares, that the Exlar Brand Products:
GSX, GSM, SR, SLM, SLG Linear and Rotary Actuators

(Complete Model Listing Below)
Model identification:
GSX20, GSX30, GSX40, GSX50, GSX60,
GSX90, GSX115, SR21, SR31, SR41
SLM060, SLM075, SLM090, SLM115, SLM142, SLM180
SLG060, SLG075, SLG090, SLG115, GSM20, GSM30, GSM40

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

Per directives listed below:
EU EMC Directive 2004/108/EC (until April 19th, 2016)
EU EMC Directive 2014/30/EU (from April 20th, 2016)
EU Low Voltage Directive 2006/95/EC (until April 19th, 2016)
EU Low Voltage Directive 2014/35/EU (from April 20th, 2016)

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

EMC: EN 55014-1:2006+A1:2009+A2:2011
EN 55014-2:1997+A1:2001+A2:2008

Safety: IEC/EN 60034-1:2010

Year of CE Marking: 2004

Signature: 

Name: Bill Zerull
Position: Chief Technology Officer
Date of Issue: 20-April-2016

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

The requirements for importers include:

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

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

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

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

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

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

The requirements for distributor include:

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

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

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

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

CERTIFICATE OF COMPLIANCE

Certificate Number	20130104-E225288
Report Reference	E225288-20020530
Issue Date	2013-JANUARY-04
Issued to:	EXLAR CORP 18400 W 77TH ST CHANHASSEN MN 55317
This is to certify that representative samples of	COMPONENT - SERVO AND STEPPER MOTORS See Addendum Page
	Have been investigated by UL in accordance with the Standard(s) indicated on this Certificate.
Standard(s) for Safety:	UL 1004-1, Standard for Rotating Electrical Machines – General Requirements; UL 1004-6, Standard for Servo and Stepper Motors; CSA C22.2 No. 100, Standard for Motors and Generators
Additional Information:	See the UL Online Certifications Directory at www.ul.com/database for additional information

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

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

Recognized components are incomplete in certain constructional features or restricted in performance capabilities and are intended for use as components of complete equipment submitted for investigation rather than for direct separate installation in the field. The final acceptance of the component is dependent upon its installation and use in complete equipment submitted to UL LLC.

Look for the UL Recognized Component Mark on the product.

William R. Carney

William R. Carney, Director, North American Certification Programs

UL LLC

Any information and documentation involving UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL. For questions, please contact a local UL Customer Service Representative at www.ul.com/contactus

CERTIFICATE OF COMPLIANCE

Certificate Number	20130104-E225288
Report Reference	E225288-20020530
Issue Date	2013-JANUARY-04

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

Permanent Magnet servo motors, SLG or SLM Series, Model SLG or SLM;
followed by 060, 075, 090, 115, 142, or 180;
followed by 04, 05, 10, 16, 20, 25, 40, 50, 100 or X;
followed by K, R or X;
followed by A, B, C, D, E, I, J, M, P, T or X;
followed by E, F, G or X;
followed by B or S;
followed by three letters or numbers;
followed by 1, 2, 3 or X;
followed by A, B, C, 1, 3, 5, 6 or X;
followed by 6 or 8;
may be followed by 01 through 99, HC, HW, MW, NI, RD, SD, SS, XF, XH, XM, N4, XT or XL;
may be followed by 00000 through 99999.

William R. Carney

William R. Carney, Director, North American Certification Programs

UL LLC

Any information and documentation involving UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL. For questions, please contact a local UL Customer Service Representative at www.ul.com/contactus

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Certificate of Compliance

Certificate: 2257566 (109156_0_000) **Master Contract:** 163694

Project: 70105667 **Date Issued:** 2017-03-10

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

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

C US

Issued by: Sorin Tat
Sorin Tat

PRODUCTS
CLASS - C322882 - VALVES-Actuators - For Hazardous Locations-Certified to U.S. Standards
CLASS - C322802 - VALVES-Actuators - For Hazardous Locations

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

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

Model Code Information:

GSX/GSMxx-xx xx-Txx-aaa-xbx-xx-(xx..c..NL..xx)

aaa – resolver feedback

b - Voltage Rating
A = 24Vdc
B = 48Vdc
C = 120Vdc
1 = 115Vrms

3 = 230Vrms
5 = 400Vrms
6 = 460Vrms
X = Special Voltage Rating - Not to Exceed 460Vrms

c – Optional Mechanical and Speed Designations
HW = Hand-Wheel Switch
xx = denotes other options not affecting safety

x – denotes options not affecting safety

SLM/SLGxxx-xxx-x'xx-aaa-xbx-xx-(xx..c..NI..xx)

aaa – Resolver Feedback

b - Voltage Rating
A = 24Vdc
B = 48Vdc
C = 120Vdc
1 = 115Vrms
3 = 230Vrms
5 = 400Vrms
6 = 460Vrms
X = Special Voltage Rating - Not to Exceed 460Vrms

c – Optional Mechanical and Speed Designations
HW = Hand-Wheel Switch
xx = denotes other options not affecting safety

x – denotes options not affecting safety

Conditions of Certifications

1. This Certification covers the actuator only. The end use suitability of the combination of the associated electronic controller and the actuator is to be determined by the local inspection authority having jurisdiction.
2. The actuators may include a hand-wheel switch (denoted by HW in Model Code). In such cases, the hand-wheel switch conduit must be sealed within 18 inches. When the handwheel option is included the maximum ambient temperature rating is -20°C ≤ Ta ≤ +40°C.
3. The actuators may include a holding brake. The thermal effects of the brake pad have not been evaluated and are to be considered by the authority having jurisdiction.

APPLICABLE REQUIREMENTS

CAN/CSA Standard C22.2 No. 0-10
(Tenth Edition September 2010)

- General Requirements - Canadian Electrical Code, Part II

Certificate: 2257566 **Master Contract:** 163694
Project: 70105667 **Date Issued:** 2017-03-10

CSA Standard C22.2 No. 0.4-04 *(October 2008 including updates No. 1 & 2)*	• Bonding of Electrical Equipment
CSA Standard C22.2 No. 139-2013	• Electrically Operated Valves
CSA Standard C22.2 No. 213-M1987 *(Reaffirmed 2008)*	• Non-incendive Electrical Equipment for Use in Class I, Division 2 Hazardous Locations
UL Standard 429 - 7th Edition	• Electrically Operated Valves
ANSI/ISA-12.12.01-2007	• Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Division 1 and 2 Hazardous (Classified) Locations

Supplement to Certificate of Compliance

Certificate: 2257566 (109156_0_000) **Master Contract:** 163694

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

Product Certification History

Project	Date	Description
70105667	2017-03-10	To update the 2257566 report to CSA 139-13 and UL 427 7th Edition as per CSA Signal Sensing and Controls No.12.
2631418	2013-06-19	Update of Report 2257566 to include minor alterations to the models within said report.
2530873	2012-08-09	Update to report 2399789 to include revised controlled drawings as per "project Instructions" and add alternate Resolvers and Holding Brakes.
2399789	2011-02-18	Update to Report 2293203 to cover error corrections, drawing updates and substitution of potting material.
2293203	2010-04-01	Update to report 2257566 to correct model mask information.
2257566	2010-02-12	Evaluation of GSX/GSM and SLM/SLG for hazardous locations

CSA Certified Product

The SLM/SLG Brushless Servo Motors are marked as shown after passing a rigorous set of design and testing criteria developed by CSA International (C22.2 No. 139). This label indicates that CSA certifies this product to be safe when installed according to the installation guidelines and used with the scope of the product specifications.

- Maximum Rated Torque: Rated up to 612 lbf-in (69.1 Nm)