PSA SERIES ROTARY ACTUATOR INSTALLATION AND SERVICE MANUAL
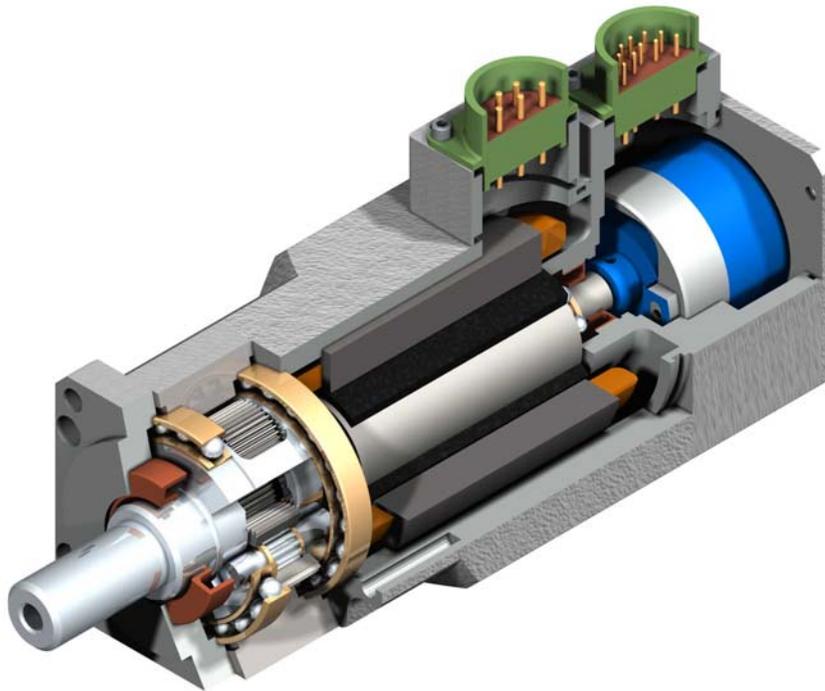
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952-500-6200

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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 Corporation's database tracked by individual product serial number.

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

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

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

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

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

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

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

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

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

1.2 Safety Considerations

As with any electro-mechanical device, safety should be considered during the installation and operation of your PSA 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 PSA Series Actuator System Configuration

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

This flexibility allows PSA 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 PSA Series of actuators show incredible performance and durability.

The close integration between the brushless servomotor and the planetary gear set provides an extremely compact package. By eliminating unneeded couplings and bearings, the overall system inertia and losses are reduced offering higher performance capability, or reduced RMS current draw.

Each brand of brushless motor amplifiers may have unique wiring requirements, parameter settings and operational principals that affect how the actuator operates. The drawing on the following page shows general connection principals 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 6.0**.

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.

2.2 Feedback Information

Most PSA 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 that the end user will use to operate the actuator. This amplifier is indicated in the model number of the PSA Series actuator as a 3 digit code consisting of 2 letters and 1 number.

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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 PSA 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 mis-aligned, 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. Mis-wiring the feedback cable can cause unstable operation, incorrect operation or no operation at all. In some cases, if the proper current limits are not set in the amplifier, mis-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 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.

PSA Series Feedback Devices

Standard PSA 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 6.0 for proper wiring, or contact Exlar for the correct wiring details.

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3.0 INSTALLATION AND OPERATION

3.1 Lubrication Requirements

PSA Series actuators require either grease or recirculating oil lubrication. Actuators that operate within their performance ratings may use grease. Oil lubrication is required for actuators that will be running above the rated torque of the motor. Recirculating oil provides lubrication and cools the actuators integral brushless motor, allowing it to operate at higher than rated continuous torque.

Determining if your application will require oil or grease lubrication should be determined prior to ordering the actuator. However, for users of the PSA 90, 115 and 142, all units are ported for oil lubrication should it be determined after installation that oil lubrication is required. Oil can be flowed through the actuator to flush out the grease. PSA 60 actuators can be ordered with a special configuration for oil ports.

3.2 Grease Lubrication and Maintenance

SLG Series gear motors are designed, when used within their standard ratings, 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 within which the unit should be re-lubricated.

Please refer to the table next page 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 952-368-3434.

Exlar recommends using Mobilith SHC220, a high performance extreme pressure gear grease. 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 degrees C to 177 degrees C (-40 degrees F to 350 degrees F).

RMS Rotational Speed (RPM)	Recommended Grease Renewal Period (Hours)		
RMS Rotational Speed (RPM)	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

3.3 Oil Lubrication for High Power / Low Maintenance Operation

Exlar PSA Series actuators can be lubricated with either grease or oil. They are shipped from the factory fully greased and are capable of functioning for many hundreds of hours between re-greasing. Greased lubrication makes them ideal for low speed or intermittent duty applications; simply mount the actuator, connect the servo amplifier and run.

However, PSA 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, PSA Series actuators, size 90 and larger are provided with porting and an internal circulation design that allows the use of externally supplied oil.

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 PSA Series, oil cooling allows the actuator to perform while maintaining a case temperature below the maximum of 85 °C.

To most 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 PSA 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. This is best achieved by using large line sizes as to not impede oil flow, and to use check valves to bypass the actuator in the case of rising oil pressures.

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.

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.

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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 85ºC[1]. Once it is determined that oil lubrication will be used, oil flow rates and case temperatures are determined via the following information:

<table>
<tr><td>

ACTUATOR LOAD CONSTANTS: K_L

K_L PSA60   =   40
K_L PSA90   =   70
K_L PSA115   =   95
K_L PSA142   =   125

</td><td>

APPLICATION LOAD FACTOR: F_L

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

Where:
Irms = actual application current
IG = Actuator current rating from specifications. (see Section 5.0)

</td></tr>
</table>

USE THE FOLLOWING RELATIONSHIP TO DETERMINE OIL FLOW REQUIREMENTS: W

GAL / HOUR $\qquad W = K_L \cdot \dfrac{F_L}{\Delta T}$ $\qquad\qquad\qquad \Delta T = \left(T_{case} - T_{oil}\right)$

CONSIDER THE FOLLOWING EXAMPLES:

CASE 1:
A PSA90 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.

$F_L = (4/2.3)^2 = 3.0$ W = [(3.0*70) / (85-45)] = 5.25 GAL / HOUR

CASE 2:
A PSA142 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.

$F_L = (12/8)^2 = 2.25$ W = [(2.25*125) / (85-45)] = 7.0 GAL / HOUR

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

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3.5 Mounting Configurations

The PSA 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 PSA Series actuators are:

PSA 60:   M5 or #10 SHCS
PSA 90:   M6 or 1/4" SHCS
PSA 115: M8 or 5/16 SHCS
PSA 142: M10 or 3/8 SHCS

3.6 Mounting Considerations

As with any actuator product, misalignment of the PSA 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. Therefore every effort should be made to minimize misalignment as much as is possible. Also, mounting of pulleys and similar devices on the output shaft of the PSA Series actuators imparts side load on the output shaft. The life of the gear stage of the actuator is dependant on side load. Refer to the product catalog for details.

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

3.7 General Operation

The PSA Series rotary 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 through the planetary gear stage of the actuator to produce the final output rotary motion.

The relationships between the rotary motion of the motor and the rotary motion of the output shaft correspond to the following relationships:

Output shaft revolutions (revs) = (Motor Revolutions)*(Gear Ratio)
Output rotary speed (rev/min) = (Motor RPM / Ratio)
Output Torque (lbf*in) = (Motor Torque * Ratio * efficiency)

Motor RMS current must be maintained at a level below the continuous current rating of the PSA 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 PSA Series actuator or damage to the stator will result.

4.0 SPECIFICATIONS

4.1 Performance Specifications

PSA 60 Reduction Ratio	MAX Output RPM	Torque with Grease Lubrication					
		Short Stack		Medium Stack		Long Stack	
		In-lb	(Nm)	In-lb	(Nm)	In-lb	(Nm)
3	1666	15	(1.7)	28	(3.2)	36	(4.1)
5	1000	25	(2.8)	47	(5.3)	60	(6.8)
10	500	50	(5.6)	93	(10.5)	120	(13.6)

PSA 90 Reduction Ratio	MAX Output RPM	Torque with Grease Lubrication						Torque with Oil Cooling					
		Short Stack		Medium Stack		Long Stack		Short Stack		Medium Stack		Long Stack	
		In-lb	(Nm)	In-lb	(Nm)	In-lb	(Nm)	In-lb	(Nm)	In-lb	(Nm)	In-lb	(Nm)
3	1000	33	(3.7)	60	(6.8)	86	(9.7)	99	(11.2)	180	(20.3)	258	(29.2)
5	600	55	(6.2)	100	(11.3)	143	(16.2)	165	(18.6)	300	(33.9)	430	(48.6)
10	300	110	(12.4)	200	(22.6)	287	(32.4)	330	(37.3)	525	(59.3)	525	(59.3)

PSA 115 Reduction Ratio	MAX Output RPM	Torque with Grease Lubrication						Torque with Oil Cooling					
		Short Stack		Medium Stack		Long Stack		Short Stack		Medium Stack		Long Stack	
		In-lb	(Nm)	In-lb	(Nm)	In-lb	(Nm)	In-lb	(Nm)	In-lb	(Nm)	In-lb	(Nm)
3	1000	97	(11.0)	153	(17.3)	213	(24.1)	291	(32.9)	459	(51.9)	639	(72.2)
5	600	162	(18.3)	255	(28.8)	355	(40.1)	485	(54.8)	765	(86.4)	1010	(114.1)
10	300	323	(36.5)	510	(57.6)	710	(80.2)	970	(109.6)	970	(109.6)	970	(109.6)

PSA 142 Reduction Ratio	MAX Output RPM	Torque with Grease Lubrication						Torque with Oil Cooling					
		Short Stack		Medium Stack		Long Stack		Short Stack		Medium Stack		Long Stack	
		In-lb	(Nm)	In-lb	(Nm)	In-lb	(Nm)	In-lb	(Nm)	In-lb	(Nm)	In-lb	(Nm)
3	800	135	(15.2)	228	(25.7)	387	(43.7)	270	(30.5)	456	(51.5)	774	(87.5)
5	480	225	(25.4)	380	(42.9)	645	(72.8)	450	(50.8)	760	(85.9)	1290	(145.8)
10	240	450	(50.8)	760	(85.9)	1290	(145.8)	900	(101.7)	1520	(171.8)	2580	(291.5)

The values in this table are approximate. The type of commutation performed by the chosen servo amplifier will affect the continuous torque rating. Consult the detailed motor information to determine the torque for your amplifier. These are attainable steady state torques, and assume an ambient temperature of 25 degrees C. These torques may be exceeded momentarily, consult Exlar for details.

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4.2 Electrical Specifications

PSA 60 MOTOR STATOR	L6 medium	M6 short	M6 medium	M6 long	H6 Medium
Voltage Constant, Ke Vrms/Krpm(Vpk/Krpm)	19.6 (28.10)	40.1 (57.5)	40.8 (58.5)	39.5 (56.0)	81.6 (117.0)
Trapezoidal commutation stator data					
Continuous motor torque (Tc), Lbf-in (N-m)	9.7 (1.10)	5.1 (0.58)	9.3 (1.05)	12.3 (1.39)	8.7 (0.98)
Peak motor torque (Tpk), Lbf-in (N-m)	19.4 (2.19)	10.2 (1.15)	18.6 (2.10)	24.6 (2.78)	17. 4 (1.20)
Torque Constant (Kt), Lbf-in/A (N-m/A)	2.26 (0.26)	4.43 (0.50)	4.69 (0.53)	4.55 (0.51)	9.35 (1.06)
Continuous current rating (Ic), A	4.30	1.16	1.98	2.70	0.93
Peak current rating (Ipk), A	8.60	2.32	3.95	5.40	1.86
RMS Sinusoidal commutation stator data					
Continuous motor torque (Tc), Lbf-in (N-m)	10.2 (1.15)	5.4 (0.61)	9.7 (1.10)	12.9 (1.45)	9.1 (1.03)
Peak motor torque (Tpk), Lbf-in (N-m)	20.4 (2.31)	10.8 (1.22)	19.4 (2.19)	25.8 (2.92)	18.2 (2.06)
Torque Constant (Ktrms), Lbf-in/A (N-m/A)	2.90(0.33)	5.68 (0.64)	6.02 (0.68)	5.83 (0.66)	12.00 (1.36)
Continuous current rating (Icrms), A	3.51	0.95	1.61	2.20	0.76
Peak current rating (Ipkrms), A	7.02	1.89	3.23	4.41	1.52
Pole Configuration	6	6	6	6	6
Resistance (L-L), Ohms	1.72	23.66	8.11	4.35	36.52
Inductance (L-L), mH	1.08	9.26	4.69	2.87	18.76
Bus Voltage (VDC)	170	325	325	325	650
Speed at Bus Voltage (RPM)	5000	5000	5000	5000	5000
PSA 90 MOTOR STATOR	**L6 medium**	**M6 short**	**M6 medium**	**M6 long**	**H6 Medium**
Voltage Constant, Ke Vrms/Krpm(Vpk/Krpm)	31.2(45)	61.3(88.5)	62.4(90.0)	63.5(91.5)	124.8(180.0)
Trapezoidal commutation stator data					
Continuous motor torque (Tc), Lbf-in (N-m)	20.3(2.30)	11.0(1.24)	20.9(2.37)	29.3(3.30)	20.8)2.35)
Peak motor torque (Tpk), Lbf-in (N-m)	40.6(4.59)	22.0(2.71)	41.8(4.72)	58.6(6.62)	41.6(4.70)
Torque Constant (Kt), Lbf-in/A (N-m/A)	3.63(0.41)	6.85(0.77)	7.26(0.82)	7.48(0.84)	14.52(1.64)
Continuous current rating (Ic), A	5.61	1.61	2.88	3.91	1.44
Peak current rating (Ipk), A	11.21	3.21	5.77	7.82	2.87
RMS Sinusoidal commutation stator data					
Continuous motor torque (Tc), Lbf-in (N-m)	21.3(2.41)	11.5(1.30)	21.9(2.48)	30.6(3.46)	21.8(2.47)
Peak motor torque (Tpk), Lbf-in (N-m)	40.6(4.59)	22.0(2.71)	41.8(4.72)	58.6(6.62)	41.6(4.70)
Torque Constant (Ktrms), Lbf-in/A (N-m/A)	4.65(0.53)	8.79(0.99)	9.31(1.05)	9.59(1.08)	18.62(2.10)
Continuous current rating (Icrms), A	4.58	1.31	2.35	3.19	1.17
Peak current rating (Ipkrms), A	9.16	2.62	4.71	6.39	2.34
Pole Configuration	6	6	6	6	6
Resistance (L-L), Ohms	2.37	28.90	8.96	4.87	36.17
Inductance (L-L), mH	3.92	37.8	15.72	9.62	62.92
Bus Voltage (VDC)	170	325	325	325	650
Speed at Bus Voltage (RPM)	3000	3000	3000	3000	3000

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4.2 Electrical Specifications (cont'd)

PSA 115 MOTOR STATOR	L8 medium	M8 short	M8 medium	M8 long	H8 Medium
Voltage Constant, Ke Vrms/Krpm(Vpk/Krpm)	28.5(40.3)	56.9(80.5)	56.9(80.5)	56.9(80.5)	113.8(161)
Trapezoidal commutation stator data					
Continuous motor torque (Tc), Lbf-in (N-m)	54.2(6.12)	32.3(3.65)	52.0(5.88)	73.0(8.25)	50.8(5.74)
Peak motor torque (Tpk), Lbf-in (N-m)	108.4(12.25)	64.6(7.30)	104.0(11.75)	146.0(16.50)	101.6(11.48)
Torque Constant (Kt), Lbf-in/A (N-m/A)	3.28(0.37)	6.41(0.72)	6.55(0.74)	6.62(0.75)	13.09(1.48)
Continuous current rating (Ic), A	16.51	5.04	7.94	11.03	3.88
Peak current rating (Ipk), A	33.02	10.08	15.88	22.05	7.76
RMS Sinusoidal commutation stator data					
Continuous motor torque (Tc), Lbf-in (N-m)	56.7(6.41)	33.8(3.82)	54.5(6.15)	76.5(8.64)	53.2(6.01)
Peak motor torque (Tpk), Lbf-in (N-m)	113.4(12.81)	67.6(7.64)	109.0(12.32)	153.0(17.29)	106.4(12.02)
Torque Constant (Ktrms), Lbf-in/A (N-m/A)	4.21(0.48)	8.22(0.93)	8.40(0.95)	8.50(0.96)	16.79(1.90)
Continuous current rating (Icrms), A	13.48	4.12	6.48	9.00	3.17
Peak current rating (Ipkrms), A	26.96	8.23	12.96	18.01	6.34
Pole Configuration	8	8	8	8	8
Resistance (L-L), Ohms	0.30	3.19	1.29	0.67	5.38
Inductance (L-L), mH	0.47	3.75	2.49	1.25	7.50
Bus Voltage (VDC)	170	325	325	325	650
Speed at Bus Voltage (RPM)	3000	3000	3000	3000	3000
PSA 142 MOTOR STATOR	**L6 medium**	**M6 short**	**M6 medium**	**M6 long**	**H6 Medium**
Voltage Constant, Ke Vrms/Krpm(Vpk/Krpm)	41.0 (57.0)	82.0 (114.0)	82.0 (114.0)	85.0 (118.5)	160.0 (223.0)
Trapezoidal commutation stator data					
Continuous motor torque (Tc), Lbf-in (N-m)	75.4 (8.52)	43.5 (4.92)	76.5 (8.64)	132.3 (14.94)	74.1 (8.37)
Peak motor torque (Tpk), Lbf-in (N-m)	150.8 (17.04)	87.0 (9.83)	153.0 (17.3)	264.6 (29.9)	148.2 (16.75)
Torque Constant (Kt), Lbf-in/A (N-m/A)	4.58 (0.52)	8.83 (1.00)	9.16 (1.03)	9.72 (1.10)	17.88 (2.02)
Continuous current rating (Ic), A	16.47	4.93	8.35	13.6	4.14
Peak current rating (Ipk), A	32.95	9.87	16.71	27.21	8.28
RMS Sinusoidal commutation stator data					
Continuous motor torque (Tc), Lbf-in (N-m)	78.97 (8.92)	45.6 (5.15)	80.1 (9.05)	138.5 (15.65)	77.6 (8.76)
Peak motor torque (Tpk), Lbf-in (N-m)	157.8 (17.83)	91.2 (10.31)	160.20 (29.40)	277.0 (31.3)	155.2 (17.54)
Torque Constant (Ktrms), Lbf-in/A (N-m/A)	5.87 (0.66)	11.32 (1.28)	11.75 (1.33)	12.47 (1.41)	22.94 (2.59)
Continuous current rating (Icrms), A	13.45	4.03	6.82	11.11	3.38
Peak current rating (Ipkrms), A	26.9	8.05	13.64	22.21	6.76
Pole Configuration	6	6	6	6	6
Resistance (L-L), Ohms	0.45	5.02	1.75	0.66	7.12
Inductance (L-L), mH	1.71	16.43	6.93	3.12	27.54
Bus Voltage (VDC)	170	170	325	325	650
Speed at Bus Voltage (RPM)	2400	2400	2400	2400	2400

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4.3 PSA Series General Specifications

The following table contains the inertia values for the motor armature and gear set for the PSA actuators. The gear set inertia value is given as the reflected value seen by the motor. The total inertia is achieved by adding the proper armature inertia to the correct ratio gear set inertia. The values can be used separately as entries in motor sizing software packages.

PSA60 Units lbf*in*sec^2 (kg*m^2)			
Stack Length	**Short**	**Medium**	**Long**
Armature Inertia	2.42×10^{-4} (2.74×10^{-5})	4.56×10^{-4} (5.17×10^{-5})	6.87×10^{-4} (7.76×10^{-5})
Reflected Inertia of Gear set			
3:1 Ratio	7.07×10^{-5} (7.98×10^{-6})		
5:1 Ratio	2.22×10^{-5} (2.51×10^{-6})		
10:1 Ratio	5.56×10^{-6} (6.29×10^{-7})		
PSA90 Units lbf*in*sec^2 (kg*m^2)			
Stack Length	**Short**	**Medium**	**Long**
Armature Inertia	5.50×10^{-4} (6.21×10^{-5})	8.99×10^{-4} (1.02×10^{-4})	$1.34 \times 10{\text -}3$ ($1.52 \times 10{\text -}4$)
Reflected Inertia of Gear set			
3:1 Ratio	4.54×10^{-4} (5.13×10^{-5})		
5:1 Ratio	1.90×10^{-4} (2.15×10^{-5})		
10:1 Ratio	4.79×10^{-5} (5.41×10^{-6})		
PSA115 Units lbf*in*sec^2 (kg*m^2)			
Stack Length	**Short**	**Medium**	**Long**
Armature Inertia	2.36×10^{-3} (2.66×10^{-4})	4.26×10^{-3} (4.82×10^{-4})	6.165×10^{-3} (6.97×10^{-4})
Reflected Inertia of Gear set			
3:1 Ratio	1.97×10^{-3} (2.23×10^{-4})		
5:1 Ratio	7.36×10^{-4} (8.32×10^{-5})		
10:1 Ratio	1.84×10^{-4} (2.08×10^{-5})		
PSA142 Units lbf*in*sec^2 (kg*m^2)			
Stack Length	**Short**	**Medium**	**Long**
Armature Inertia	4.85×10^{-3} (5.48×10^{-4})	8.81×10^{-3} (9.96×10^{-4})	1.76×10^{-2} (1.99×10^{-3})
Reflected Inertia of Gear set			
3:1 Ratio	5.49×10^{-3} (6.21×10^{-4})		
5:1 Ratio	1.83×10^{-3} (2.07×10^{-4})		
10:1 Ratio	4.53×10^{-4} (5.11×10^{-5})		
Standard Connection Receptacles			
Std. Motor Power Receptacle*	MS-3112-16-8P		
Std. Motor Feedback Receptacle*	MS-3112-14-18P		
Stator Wire Insulation	Class H		
Motor Stator Rating	Class F		

*Note: The "M"anufacturer's connector option may use different receptacles than the standards that are listed in this table. Contact Exlar for details.

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5.0 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 PSA Series actuator.

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

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5.1 Returning a Product for Repair

STANDARD REPAIR LEADTIME:

- Two weeks for written evaluation from Exlar

- Two weeks from receipt of approval (by fax or email) for repair where parts are available.

- An evaluation charge per unit after evaluation applies if customer chooses not to repair; or if product is found not in need of repair.

EXPEDITED REPAIR LEADTIME:

- An expedite charge per unit can be quoted.

- This provides one week for written evaluation from Exlar

- This provides one week from receipt of approval (by fax or email) for repair where parts are available.

PROCEDURE:

- Please discuss the return with Exlar Technical Support prior to requesting an RGA number to see if it is possible to resolve the issue prior to return.

- If it is determined that an RGA number is required, please do so by contacting the Returned Goods Administrator. Phone 952-500-6200 or email returns@exlar.com.

  - International Repairs: Closely follow instructions provided by the Exlar Returned Goods Administrator. Failure to comply with issued instructions may result in delays for repair and return.

- Exlar requires a purchase order at the time of RGA; $0 on warranty returns, or for the standard evaluation charge per unit on all non-warranty units for the evaluation fee.

- Following the evaluation, you will receive a quote from Exlar on the charges that will apply. If the actuator repair is approved, the evaluation fee will be waived and we will request an amended PO for the actual repair value.

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6.0 SYSTEM INSTALLATION

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

The "M" connector option on the PSA 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 PSA 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 form 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.**

The tables below outline the "O" and "M" connector options for Exlar actuators, the cable part numbers, manufacturer, and cable part numbers for each.

CABLE SELECTION FOR PSA SERIES ACTUATORS WITH "O" CONNECTORS

Exlar Actuator	Cable Type	Cable manufacturer	Cable part number
PSA60, PSA90	Power Cable	Exlar	PC1-AC-xxx
	Resolver Feedback cable	Exlar	RC1-AC-xxx
	Encoder cable	Exlar	EC1-AC-xxx
	Brake/Limit Switch cable	Exlar	BC1-AC-xxx
PSA115, PSA142	Power Cable	Exlar	PC1-AC-xxx
	Resolver Feedback cable	Exlar	RC1-AC-xxx
	Encoder cable	Exlar	EC1-AC-xxx
	Brake/Limit Switch cable	Exlar	BC1-AC-xxx

Each of the cables shown in the above table 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 PSA SERIES ACTUATORS WITH "M" CONNECTORS

Exlar Actuator	Amp Manufacturer and Model	Cable Type	Cable Manufacturer	Manufacturer Cable Part Number
PSA60, PSA90	Allen- Bradley Ultra Series	Encoder feedback	Allen Bradley	9101-1366-xxx
		Power	Exlar	PC6-MC-xxx
	Electro-Craft BRU-Series Advantage	Encoder feedback	Electro-Craft	9101-1366-xxx
		Power	Exlar	PC6-MC-xxx
	Emerson EN and Epsilon Series	Encoder feedback	Emerson	CFCS-xxx
		Power	Emerson	CMDS-xxx
	Emerson FX Series	Resolver feedback	Emerson	ECF-xxx
		Power	Emerson	ECM-xxx
	Emerson Epsilon Series	Encoder Feedback	Exlar	EC3-MC-xxx
		Power	Exlar	PC6-MC-xxx
	Kollmorgen Servo Star	Power	Kollmorgen	CS-SS-RHA1HE Set
		Resolver feedback	Kollmorgen	CS-SS-RHA1HE Set
PSA115, PSA142	Allen Bradley Ultra Series	Encoder feedback	Allen Bradley	9101-1366-xxx
		Power	Exlar	PC7-MC-xxx
	Electro-Craft BRU-Series Advantage	Encoder feedback	Electro-Craft	9101-1366-xxx
		Power	Exlar	PC7-MC-xxx
	Emerson EN and Epsilon Series	Encoder feedback	Emerson	CFCS-xxx
		Power	Emerson	CMMS-xxx
	Emerson FX Series	Resolver feedback	Emerson	ECF-xxx
		Power	Emerson	ECL-xxx
	Kollmorgen Servo Star	Resolver Feedback	Kollmorgen	CS-SS-RHA1HE Set
		Power	Kollmorgen	CS-SS-RHA1HE Set

Always look for more configurations of "M" connections to be published by Exlar. If you would like to use a configuration not yet published by Exlar, contact our applications engineering department and we can work together to develop what you require.

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DRIVE SET-UP WITH PSA 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 PSA 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.

Emerson EN and Epsilon Series   Use motor.ddf file found on **www.exlar.com**
Allen-Bradley Ultra Series or   Use motor dir files found on **www.exlar.com**
Electro-Craft BRU Advantage Line   Use motor dir files found on **www.exlar.com**
Kollmorgen Servo Star and   Use user.m03 file found on **www.exlar.com**
       Servo Star CD drives

The following table defines the motor file name structure for Exlar motors within the software of each of the brands of servo amplifier mentioned above. When the proper motor file is loaded into the drive manufacturer's software, these motor file names will be selectable. The proper file should be chosen from the list based on actuator size, voltage, stack length and ratio.

ACTUATOR SIZE	RATIO	MOTOR VOLTAGE AND STACK LENGTH								
		LOW VOLTAGE			MEDIUM VOLTAGE			HIGH VOLTAGE		
		SHORT	MEDIUM	LONG	SHORT	MEDIUM	LONG	SHORT	MEDIUM	LONG
PSA60	3	P60LS603	P60LM603	P60LL603	P60MS603	P60MM603	P60ML603	P60HS603	P60HM603	P60HL603
	5	P60LS605	P60LM605	P60LL605	P60MS605	P60MM605	P60ML605	P60HS605	P60HM605	P60HL605
	10	P60LS610	P60LM610	P60LL610	P60MS610	P60MM610	P60ML610	P60HS610	P60HM610	P60HL610
PSA90	3	P90LS603	P90LM603	P90LL603	P90MS603	P90MM603	P90ML603	P90HS603	P90HM603	P90HL603
	5	P90LS605	P90LM605	P90LL605	P90MS605	P90MM605	P90ML605	P90HS605	P90HM605	P90HL605
	10	P90LS610	P90LM610	P90LL610	P90MS610	P90MM610	P90ML610	P90HS610	P90HM610	P90HL610
PSA115	3	P11LS803	P11LM803	P11LL803	P11MS803	P11MM803	P11ML803	P11HS803	P11HM803	P11HL803
	5	P11LS805	P11LM805	P11LL805	P11MS805	P11MM805	P11ML805	P11HS805	P11HM805	P11HL805
	10	P11LS810	P11LM810	P11LL810	P11MS810	P11MM810	P11ML810	P11HS810	P11HM810	P11HL810
PSA142	3	P14LS603	P14LM603	N/A	P14MS603	P14MM603	N/A	P14HS603	P14HM603	N/A
	5	P14LS605	P14LM605	N/A	P14MS605	P14MM605	N/A	P14HS605	P14HM605	N/A
	10	P14LS610	P14LM610	N/A	P14MS610	P14MM610	N/A	P14HS610	P14HM610	N/A

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6.1 Emerson Epsilon Series Drive with PSA Series Actuator (M Connector Option)

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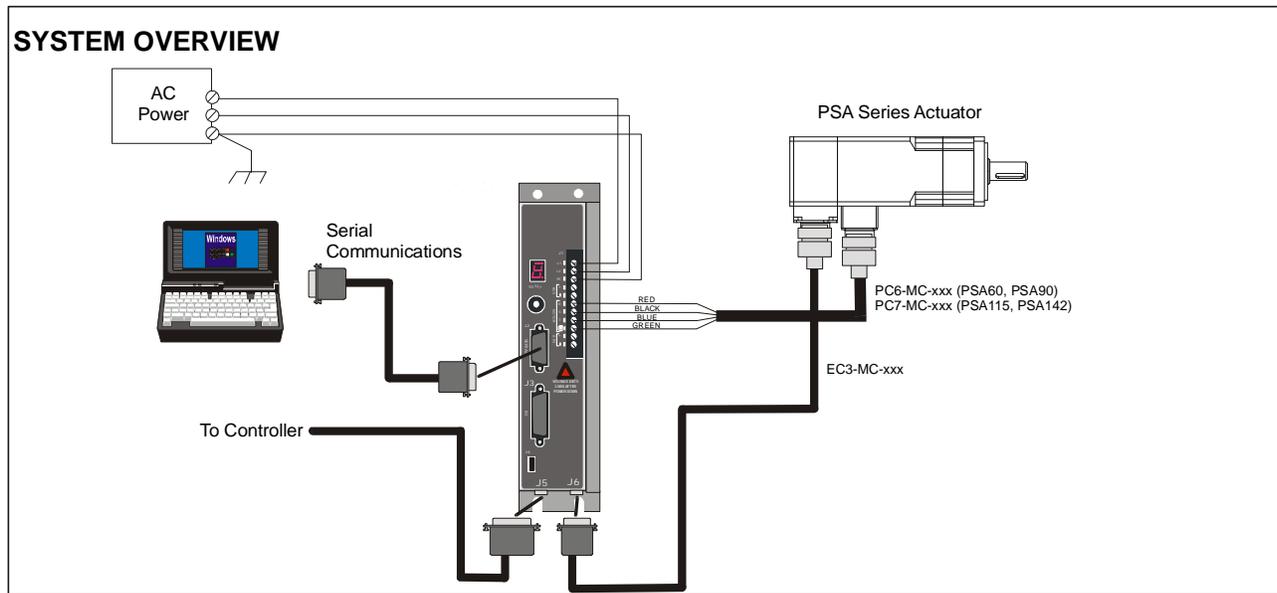
Note: Dangerous voltages exist, so use extreme caution when operating this equipment. Sufficient energy remains in the Epsilon Series drive to cause motion even with the power removed. Wait for the 7-segment display to dim to off when powering down the drive. At start-up, be sure to have the proper motor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

SETTING UP THE EPSILON SERIES DRIVE TO RUN PSA 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 PSA 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 PSA 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.

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Basic PSA Series Parameter Settings for Emerson Epsilon Drives		PSA60	PSA90	PSA115	PSA142
Number of Poles		6	6	8	6
Maximum Speed	RPM	5000	3000	3000	2400
J_m	Lb-in-s^2	See Inertia Table in section 6.0			
Encoder Size	Lines	2048	2048	2048	2048
Index Offset	Degrees	330	330	330	330
Hall Offset	Degrees	330	330	330	330

[1]   Appropriate motor files may be obtained from Exlar or www.exlar.com and downloaded to Epsilon-XXX drives.

CABLES FOR EPSILON SERIES DRIVE WITH PSA SERIES ACTUATOR (M CONNECTOR OPTION)

Encoder Cable EC3-MC-XXX

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

Motor Cable PC6-MC-XXX for PSA60, PSA90
PC7-MC-XXX for PSA115, and PSA142

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	⏚

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6.2 Emerson EN Series Drive with PSA Series Actuator (M Connector Option)

SYSTEM OVERVIEW

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 PSA 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 PSA 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 PSA 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.

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Basic PSA Series Parameter Settings for Exlar EN Series Amplifiers					
		PSA60	**PSA90**	**PSA115**	**PSA142**
Number of Poles		6	6	8	6
Maximum Speed	RPM	5000	3000	3000	2400
J_m	Lb-in-s^2	See Inertia Table in section 6.0			
Encoder Size	Lines	2048	2048	2048	2048
Index Offset	Degrees	330	330	330	330
Hall Offset	Degrees	330	330	330	330

6.3 Emerson FX Drive with Exlar PSA Actuator (M Option Connectors)
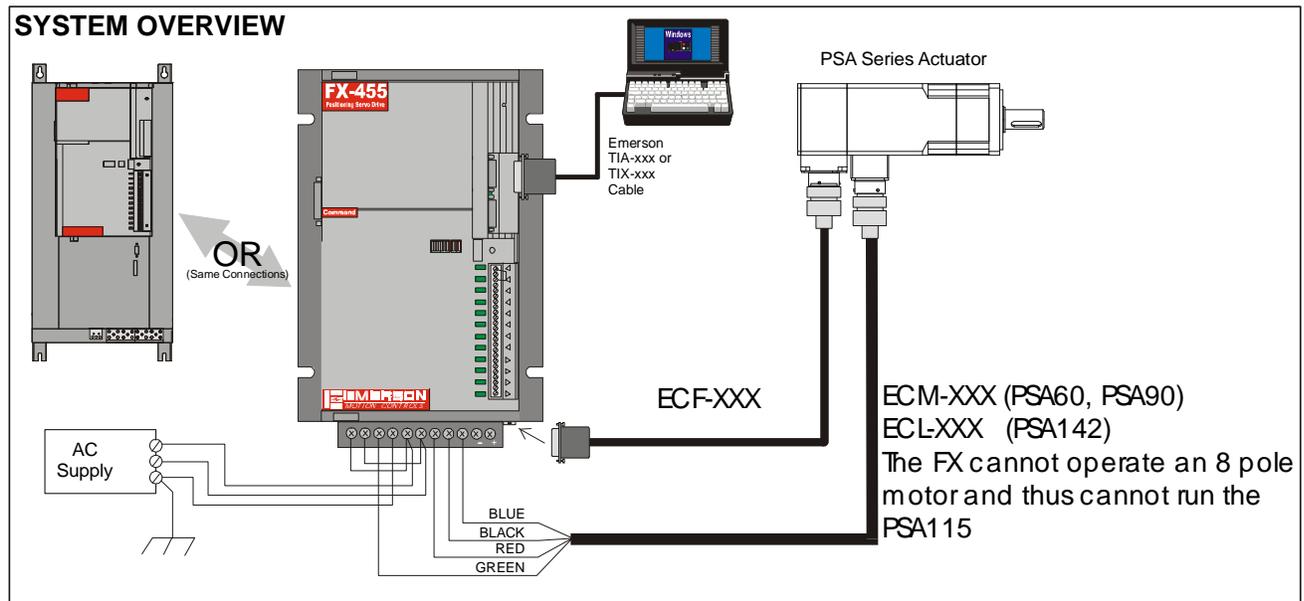
Note: Dangerous voltages exist, so use extreme caution when operating this equipment. Sufficient energy remains in the FX Series drive to cause motion even with the power removed.   At start-up, it is recommended to reduce current limits in order to lower maximum acceleration until the cables and control interface is verified.

SETTING UP THE EMERSON FX DRIVE TO RUN THE PSA SERIES ACTUATOR

The FX drive should be set up using the PCX software supplied by Emerson Motion Control. The steps for changing the maximum current are as follows:

1. Run the PCX software.
2. Select On-line operations for the appropriate COM port of the personal computer.
3. Select drive setup.
4. Select drive configuration.
5. Select limits.
6. Set maximum torque output to the value shown in the table below for the appropriate drive/actuator combination.

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**Maximum Current Limit Settings For FX Amplifiers With PSA Series Actuators**

Drive Model	Drive Cont. Current Rating	PSA60 Short	PSA60 Medium	PSA60 Long	PSA90 Short	PSA90 Medium	PSA90 Long	PSA142 Short	PSA142 Medium
FX-316	4	58	100	135	81	145	200	200	
FX-340	6.5	36	61	83	50	89	121	123	200
FX-455	8					72	100	100	200
FX-490	14								115

(1) Setting the maximum torque in the drive configuration does not protect the actuators from exceeding
the continuous ratings. The "Therm Sw" wires to the FX drive will help prevent overheating of the actuator, but do not guarantee that the drive will not damage
the motor. Proper care should be taken to insure that the operation of the application will not potentially damage the motor.
(2) FX drives do not operate with 8 pole motors such as PSA115.

6.3a Emerson FX Drive with Exlar PSA Series Actuator (O Option Connector)
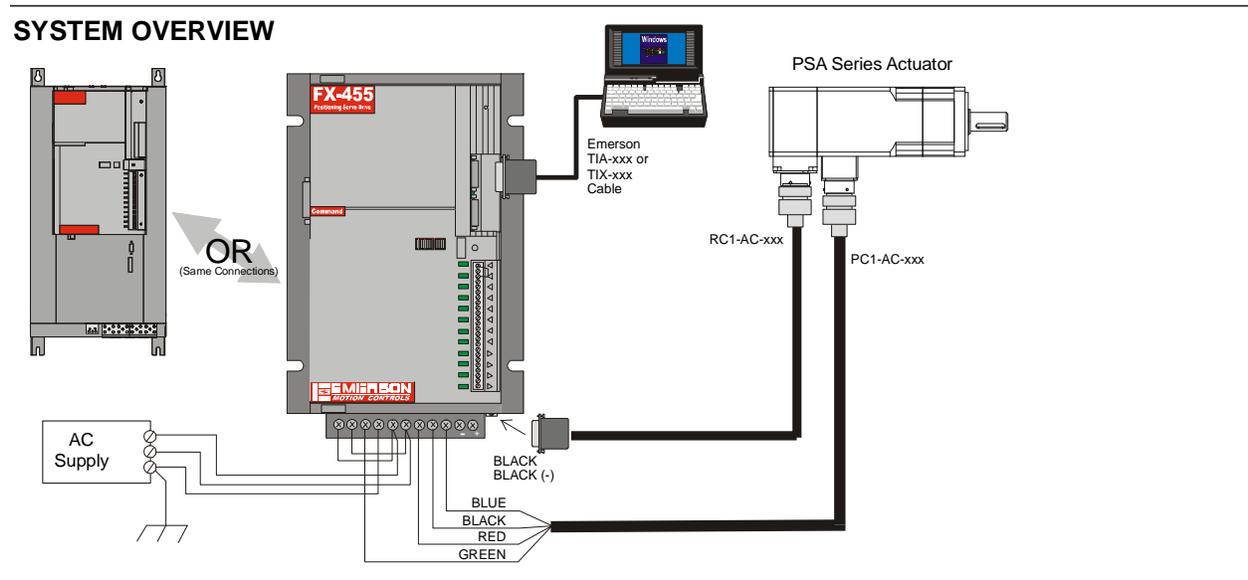
Motor Cable PC1-AC-XXX

Exlar Connector	Wire Color	Function	FX Connector
A	Red	R Phase	R
B	Black	S Phase	S
C	Blue	T Phase	T
D	Green	GND	⏚
E			

Resolver Cable RC1-AC-XXX

Exlar Connector	Wire Color	Function	FX Resolver Connector
R	Yellow/White	REF GND	1
G	Blue	COS GND	2
F	Black	SIN GND	4
E	Red/White	REF	6
S	Yellow	COS	7
H	Red	SIN	8
D	Bare	Shield	3
N	Black/White	Therm Sw +	5
U	Blue/White	Therm Sw -	9

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6.4 Allen-Bradley/Electro-Craft Drives with PSA Actuator (M Connector Option)
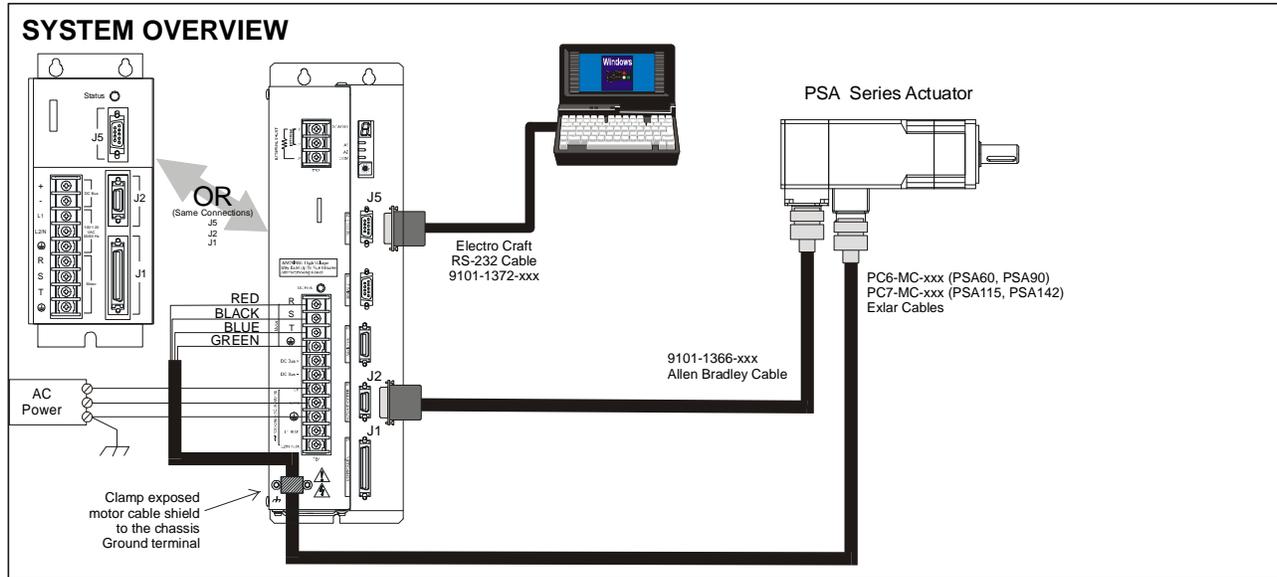
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Dangerous voltages exist so use extreme caution when operating this equipment. Sufficient energy remains in the DDM-XXX to cause motion even with the power removed. To verify that the equipment is safe, insure that the voltage across the DC+ and DC- 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 PSA 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.

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Basic PSA Series Parameter Settings for A-B/Electro-Craft DDM Drives (1)					
		PSA60	PSA90	PSA115	PSA142
Integral Thermostat		Note 2	Note 2	Note 2	Note 2
Number of Poles		6	6	8	6
Thermal Time Constant	Seconds	780	1320	2200	2880
Maximum Speed	RPM	5000	3000	3000	2400
J_m	Kg-cm^2	See Inertia Table in section 6.0			
Encoder Line Count	Lines	2048	2048	2048	2048
Index Offset	Degrees	0	0	0	0
Hall Offset	Degrees	240	240	240	240
Startup Commutation		Hall/Hall	Hall/Hall	Hall/Hall	Hall/Hall
Current Feed forward	Degrees/ KRPM	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

Motor Cable PC6-MC-XXX for PSA60, PSA90 PC7-MC-XXX for PSA115, and PSA142			
Exlar Connector	Wire Color	Function	DDM-XXX Connection
A	Red	R Phase	R
B	Black	S Phase	S
C	Blue	T Phase	T
D	Green/Yellow & Shield	GND	⏚

6.4a A-B/Electro-Craft Drive with Exlar PSA Series Actuators (O Connector Option)

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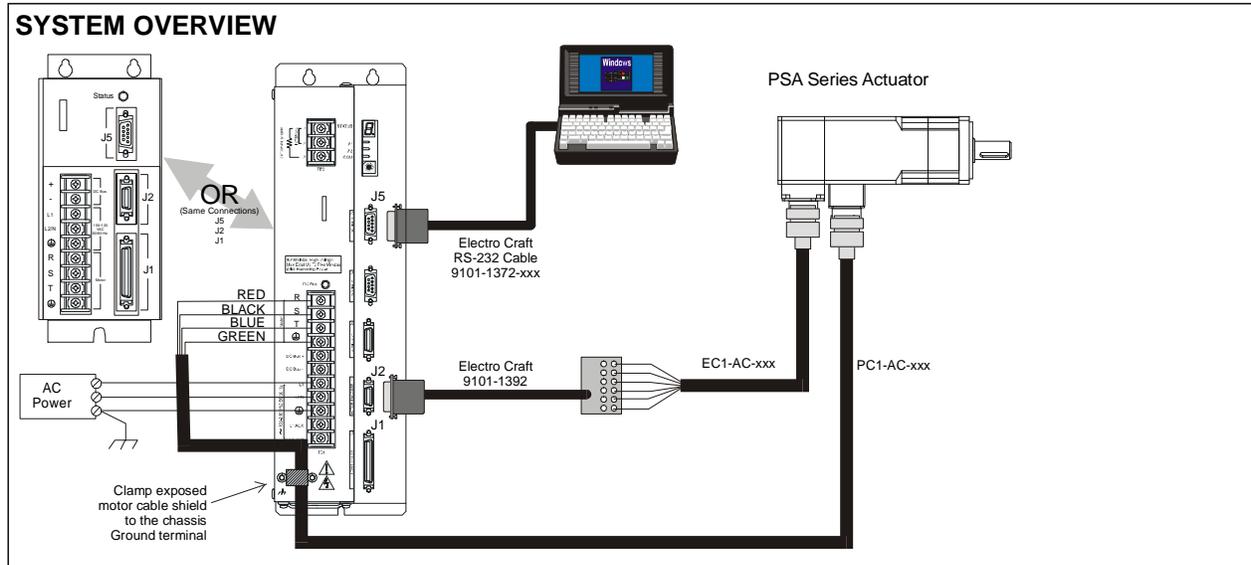
Encoder Cable EC1-AC-XXX			
Exlar Connector	Wire Color	Function	J2 Connector
T	Red	EPWR	1
J	Black	ECOM	2
G	Green	A(+)	7
H	Green/Black	A(-)	8
S	Blue/Black	B(+)	9
F	Blue	B(-)	10
E	Orange	I(+)	11
R	Orange/Black	I(-)	12
U	Blue/White	Hall A	13
K	Black/White	Hall B	14
M	Red/White	Hall C	15
	No Connection	ABS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

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	⏚

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6.5 Kollmorgen SERVOSTAR Drive with PSA Series Actuators (M Connector Option)
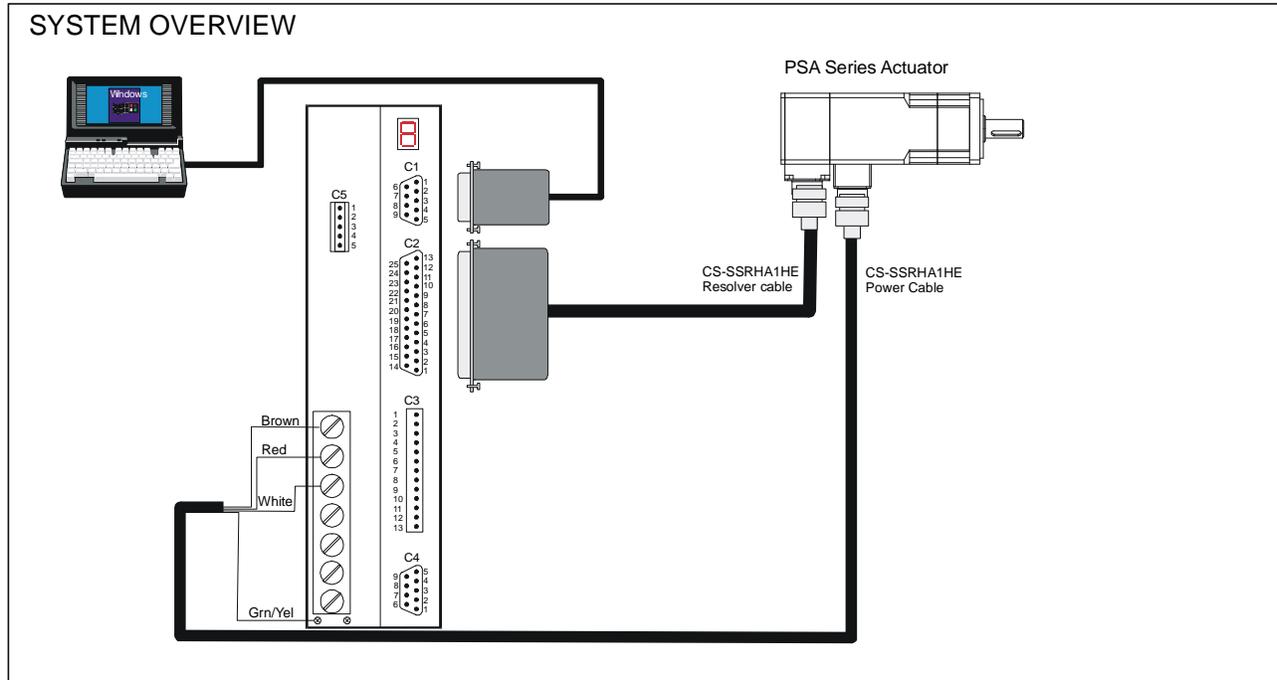
SYSTEM OVERVIEW

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 PSA 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.

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Basic PSA Series Parameter Settings for Kollmorgen SERVOSTAR CD Drives (1)		PSA60	PSA90	PSA115	PSA142
Maximum Speed	RPM	5000	3000	3000	2400
Back EMF Compensation	%	50	50	50	50
Motor Inertia	Kg-m^2	See Inertia Table in section 6.0			
Motor Poles		6	6	8	6
AGain @ Peak Current	%	40	40	40	40
AGain @ Cont. Current	%	70	70	70	70
AGain@ Zero Current	%	100	100	100	100
Torque Advance P	Elec. Degrees	23	23	23	23
Torque Advance C	Elec. Degrees	10	10	10	10
Speed Advance V	Elec. Degrees	25	25	25	25
Speed Advance ½ V	Elec. Degrees	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

6.5a Kollmorgen SERVOSTAR Drive with PSA Series Actuator (O Connector Option)

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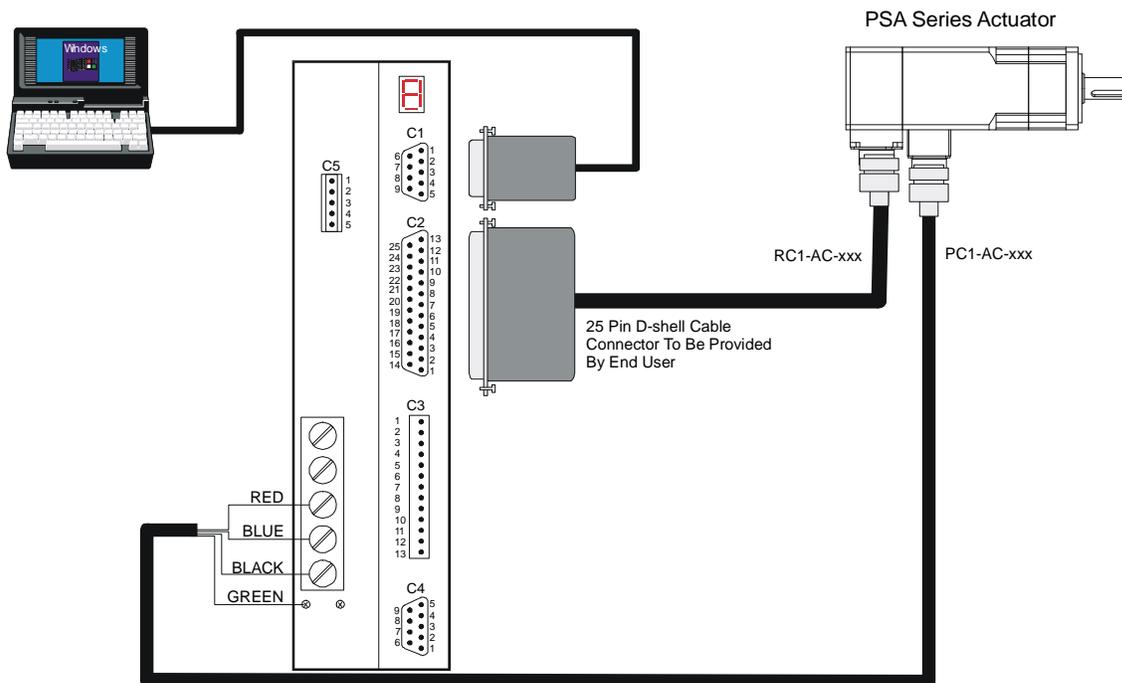
Motor Cable PC1-AC-XXX			
Exlar Connector	Wire Color	Function	SERVOSTAR Connector
A	Red	Phase A	Ma
B	Black	Phase C	Mc
C	Blue	Phase B	Mb
D	Green	GND	⏚
E			

Resolver Cable RC1-AC-XXX			
Exlar Connector	Wire Color	Function	C2 Connector
G	Black	Sine Hi (S3)	1
S	Red	Sine Lo (S1)	2
D	Bare	Shield	3
H	Yellow	Cos Hi (S2)	4
F	Blue	Cos Lo (S4)	5
D	Bare	Shield	6
D	Bare	Shield	14
R	Yellow/White	Ref Hi Out (R2)	15
E	Red/White	Ref Lo Out (R1)	16
N	Black/White	Therm Hi	13
U	Blue/White	Therm Lo	25