

## LA-2900 SERIES LINEAR ACTUATORS

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*Due to wide variations in the terminal numbering of actuator products, actual wiring of this device should follow the print supplied with the unit.*

## I. Description

### A. General

The LA-2900 series actuators are electro-mechanical, bi-directional linear actuators. They may be ac or dc powered. The LA-2900 series have a totally enclosed, permanently lubricated gear train with an acme screw and nut output drive. The series can provide up to 12,000 pounds of thrust with stroke lengths from 6 to 30 inches (152.4 to 762 mm) at a speed of approximately .25 inches (6.35 mm) per second. These actuators feature a built-in thrust overload switch mechanism to de-energize the actuator when the thrust rating of the unit is exceeded, and a manual override mechanism to allow the unit to be positioned without electrical power. Two types of environmental ratings are available; NEMA Type 4 and Hazardous Dust- suitable for Class II, Division 1, Groups E,F and G Indoors or Outdoor location.

### B. Theory of Operation

The LA-2900 series actuators utilize a 3-phase ac or 180Vdc reversible motor to produce torque at the motor pinion gear. The motor torque is increased (with a corresponding decrease in speed) through three stages of bearing supported spur gearing. The final spur gear is mounted on a bearing supported shaft with an acme thread profile on one end. Rotation of this screw shaft causes a mating nut to be pulled or pushed axially. This axial nut movement is transmitted through a tube to a clevis end providing the final thrust output. Also, fine pitch spur gearing from the screw shaft allows the number of screw shaft revolutions necessary to produce the full linear stroke to be reduced (geared down) to an amount which can be used to rotate a ten turn potentiometer and activate position limit switches to sense end of travel. Another set of spur gearing is used to activate two intermediate positions (with four limit switch option). Possible damage to the actuator from running into an obstruction or exceeding the rated thrust capability is avoided by the thrust overload protection mechanism. The screw shaft incorporates a spring pack and a thrust limit switch assembly. If the actuator encounters an obstruction or is overloaded the spring pack deflects, absorbing the

overload. As the screw shaft deflects beyond rated load (-0%+20%), thrust limit switches are actuated (tripped) to remove power from the motor. A manual override is provided to allow the actuator to be manually positioned during installation, alignment, or power outage. When the motor is de-energized, the manual override plunger can be depressed until a latching sound is heard and plunger resistance is greatly decreased. This puts the unit in "manual" by declutching the motor and engaging the hex drive shaft located below the manual override plunger. At this time torque applied to the hex drive shaft will produce thrust and movement at the output shaft and will allow the actuator to be manually positioned. If, during manual handcranking, electrical power is applied to the motor, the hex drive will be instantly disengaged and the motor will drive the actuator. The hex drive can not be power driven, thereby protecting the operator. Following the completion of manual positioning, the motor is powered to disengage the hex drive and return the actuator to "auto". Care should be taken when manually driving a load, since the thrust overload switch mechanism is not operational when the unit is de-energized and excess output thrust can be developed through the hex drive shaft. **NOTE: For shaft extension, rotate hex drive CW.**

When the motor is de-energized, the acme screw helix angle and gear inefficiencies are sufficient to prevent the actuator from being backdriven by the load. Thus the unit maintains the last position upon loss of power. The screw shaft and gears are lubricated during manufacturing with a high quality grease which allows the actuator to be mounted in any position. Lubrication is not required under normal service conditions for the life of the unit.

A motor thermal overload is provided on Hazardous Locations rated actuators. It is required that it be used to stop the actuator in case of a stall or high modulating duty cycle. The thermal overload can be wired in series with the common lead of the limit switch circuitry, or wired to a device designed to shut down the actuator via the control circuitry.

## C. Storage

If the actuator will not be installed, it should be stored in a clean, dry area where the ambient temperature is not less than -20° F. The actuator should not be stored in a corrosive environment.

## II. Installation And Set up

### A. General

Refer to page 8 for Installation dimensions. Upon initial receipt of actuator, the actuator clevis is taped to the actuator ram tube at the factory to prevent the actuator ram clevis from turning. If the tape has been broken or if the actuator clevis is allowed to rotate during initial start-up, the limit switch settings will be affected. The feedback and limit switches are operated by secondary gearing and allowing the clevis to rotate under motor power will turn the feedback and limit switches but the ram will not extend or retract. Likewise, turning the clevis with the motor stopped will extend or retract the ram without turning the feedback or limit switches. DO NOT attempt to simply adjust the limit switches to correct the ram travel in case of the clevis being turned. The unit must be re-centered or damage to the feedback pot may result.

#### To Re-Center Ram Travel

Turn clevis CCW until clevis is moved away from the tube. The clevis should be turned out several inches. Apply power to the actuator to cause ram to retract. Run the actuator until limit switch LS2 (actuator terminals 10 & 9) trips open. If properly wired, the motor will be prevented from further powering the actuator in this direction once the limit switch is open. Make sure that the clevis is not touching the tube as tripping the thrust limit TL2 will have the same effect. If the clevis contacts the tube before limit switch LS2 is tripped, remove power and turn clevis further CCW to move it away. When LS2 does trip, remove power. Turn clevis CW until it just touches the ram tube, and turn CCW to put the clevis hole in the proper plane. Apply power to energize the motor in the opposite direction. Prevent the clevis from turning and allow the ram to extend. The actuator should extend to its full

limit and limit switch LS1 should trip open and stop the unit. These are the full limits of travel as set by the factory. The limit switches may be set for an actuator travel which is less than these preset positions but not for more. To set a limit other than the factory limit, loosen locknut and adjust the setscrew on the traveling screw to trip the position limit switch. Limit switch LS1 operates at the extended end of travel and limit switch LS2 operates at the retracted end of travel (LS1 is at top of the Feedback Assembly and LS2 is at bottom nearest housing). Optional limit switches LS3 & LS4 are adjustable over the whole stroke distance (See "Metal Limit Switch Adjustment Procedure").

The actuator is mounted with pins (customer supplied) through the rear and front clevises. The rear clevis is normally the stationary end. The device to be positioned must be such that it will not allow the front clevis to rotate when positioning but only move in and out. Side loading must be avoided. Side loading can lead to excessive operating thrust requirements which could cause premature bearing failure. The device to be positioned must not require greater thrust than the thrust rating of the actuator or the thrust limit switches will be activated and positioning will cease.

***CAUTION: The actuator is supplied with eyebolts designed for lifting the actuator only. Never use the eyebolts for lifting the actuator with other equipment mounted to the actuator.***

Do not rotate or allow the front clevis to rotate during the installation of the actuator. Mount the rear clevis to the stationary actuator support device first, then move the traveling portion of the device to the front clevis and mount it or turn the manual hex drive shaft to move the front clevis to the device. If you elect to turn the hex drive be sure no electrical power is applied to the actuator. Hold the front clevis while turning the hex drive so the clevis will not rotate and will only extend or retract.

## B. Electrical Interconnect

The LA-2900 series is available with a 180Vdc PM motor (LA-2980) or a 230/460Vac three phase motor (LA-2910). Check the unit to be sure the proper motor is installed. Check the available power supply to insure that it does not vary by more than  $\pm 10\%$  of the motor voltage rating (ac motors only). Low ac line voltage can cause the motor to stall and high line voltage can overheat and reduce the life of the motor. Refer to page 7 for standard wiring diagrams.

**CAUTION:** *The thermal overload must be connected to the control system. Failure to do so could cause motor burnout under high duty cycle or high loads. If the actuator is to be installed in a Hazardous Location, the thermal overload must be installed to prevent the motor from exceeding the required motor shell temperature for Hazardous Dust locations.*

## C. Start up

### LA-2910

The three phase motor should be installed with two four-pole motor contactors, one for extend motor power and one for retract motor power. The fourth contact is used as an interlock to prevent both contactors from being energized at the same time. Checking for proper phasing requires two people, one to operate the controls and one to observe the actuator shaft travel and limit switches for proper operation. Apply power to the actuator and activate the extend contactor. If the actuator shaft extends, the motor phasing is correct. If the actuator shaft retracts, remove power immediately. Disconnect power to the actuator and reverse any two of the motor leads. Position the shaft to the mid-point of its travel by turning the manual

hex drive. Apply power and again activate the extend contactor. The actuator shaft should now extend. Repeat the procedure using the retract contactor. Actuate the extend contactor, with the shaft extending; trip the extend thrust limit switch by hand or by disconnecting the wire to the extend switch circuit. The actuator must stop. If the actuator does not stop, disconnect power immediately to prevent damage to the actuator. If necessary, rewire the limit switches and repeat the test procedure for both extend and retract operations. **NOTE:** *Extend thrust limit switch(TLE) is switch nearest housing. Retract(TLR) switch is located farthest from housing.*

### LA-2980

With dc voltage applied to terminals 1(+) and 2(-), the actuator should extend. **NOTE:** *Limit and thrust switches must be wired to the controlling device so as to cause end of travel or thrust limit shut down. Phasing of switches must also be checked to ensure that correct switch be opened upon overload conditions. Refer to LA-2910 start-up for sequence.*

## D. Maintenance

Under normal service conditions the motor, gearing, bearings, and parts do not require periodic maintenance. If for any reason the unit is disassembled in the field, all Oilite bushings should be saturated with a S.A.E. 30 oil and all gearing heavily coated with an Amoco-Amolith all weather grease or equal. Care should be taken to ensure that no foreign material is in the grease, which will cause premature failure. The screw shaft must be lubricated with Allex C-P-115/RS-1306 grease. DO NOT SUBSTITUTE.

### III. Troubleshooting Guide

TROUBLE	POSSIBLE CAUSE	REMEDY
1. The motor does not operate	<ul style="list-style-type: none"> <li>a. No power to the motor.</li> <li>b. The actuator is at full extend or retract position and opposite thrust limit switch is actuated, cutting off power to the motor.</li> <li>c. Thrust limit switch activated from over-loaded condition.</li> <li>d. Motor is wired incorrectly.</li> <li>e. Motor in thermal overload(thermal overload tripped).</li> <li>f. Defective motor or thermal overload.</li> </ul>	<ul style="list-style-type: none"> <li>a. Restore Power</li> <li>b. Remove cause of thrust overload.</li> <li>c. Operate actuator in opposite direction to reset thrust limit switch. Locate and remove overload.</li> <li>d. Correct wiring per wiring diagram.</li> <li>e. Let motor cool. Reduce load and/or duty cycle.</li> <li>f. Replace motor</li> </ul>
2. The Motor operates but screw shaft does not move	<ul style="list-style-type: none"> <li>a. Damaged power gearing</li> <li>b. Screw drive nut stripped or pulled out of tube.</li> <li>c. Clutch remaining in manual.</li> </ul>	<ul style="list-style-type: none"> <li>a. Replace damaged gears.</li> <li>b. Repair or replace screw drive nut.</li> <li>c. Replace clutch release assy (on motor) or repair clutch.</li> </ul>
3. Position limit switch does not stop motor operation	<ul style="list-style-type: none"> <li>a. Position limit switch not properly wired to control circuit.</li> <li>b. Defective position limit switch.</li> <li>c. Switches not aligned</li> </ul>	<ul style="list-style-type: none"> <li>a. Correct wiring per wiring diagram</li> <li>b. Replace switch</li> <li>c. Re-align switches</li> </ul>
4. Thrust limit switch does not stop motor operation.	<ul style="list-style-type: none"> <li>a. Thrust limit switch not properly wired to control circuit.</li> <li>b. Thrust limit switch collars loose or not properly adjusted.</li> <li>c. Thrust limit switch defective</li> <li>d. Thrust limit switch shaft bend and binding.</li> <li>e. Thrust limit switch mounting or bushing is bent or damaged.</li> <li>f. Thrust limit switch mounting block not aligned or secured.</li> </ul>	<ul style="list-style-type: none"> <li>a. Correct wiring per wiring diagram.</li> <li>b. Adjust and tighten collars as required.</li> <li>c. Replace.</li> <li>d. Replace shaft.</li> <li>e. Replace as required.</li> <li>f. Align and secure block as required</li> </ul>
5. The retract thrust limit switch is always activated.	<ul style="list-style-type: none"> <li>a. The actuator is over-loaded in a retract operation.</li> <li>b. The switch collar is loose or out of adjustment.</li> <li>c. The switch actuator does not pivot on its retaining rivet.</li> <li>d. The switch is defective.</li> <li>e. Screw shaft main bearings are frozen to screw shaft or housing.</li> </ul>	<ul style="list-style-type: none"> <li>a. Operate the actuator in the opposite direction to reset the thrust limit switch. Locate and remove overload condition.</li> <li>b. Adjust and secure.</li> <li>c. Remove and replace rivet.</li> <li>d. Replace the switch.</li> <li>e. Repair and replace as required.</li> </ul>

TROUBLE	POSSIBLE CAUSE	REMEDY
6. The extend thrust limit switch is always activated.	a. The actuator is overloaded in the extended direction. b. Switch collar is loose or out of adjustment. c. Switch shaft is bent. d. Switch shaft spring is weak or broken. e. Switch block bent or bushing bent in main housing.	a. Operate the actuator in the opposite direction to reset the limit switch. Locate and remove overload condition. b. Adjust and secure as required. c. Replace switch shaft. d. Replace spring. e. Repair or replace switch block and bushing.
7. Position feedback device not operating.	a. Broken potentiometer(s). b. Loose or broken feedback gear(s).	a. Replace potentiometer(s). b. Tighten or replace gear(s).

#### IV. Subassembly Alignments

##### A. Metal Position Limit Switch Adjustment Procedure( 4 Switch Option)

The metal limit switch assembly features two independent auxiliary position limit switches. The setting of one switch does not affect the settings of the others. The outermost switch is designated LS3, the next LS4. Each limit switch is cam activated with switch activation occurring on the high side of the cam. To change the end of travel position switch settings follow the procedure below.

- 1) Run the actuator from mid-travel to the position required. Observe if the limit switch assembly is rotating CW or CCW.
- 2) With the actuator at the desired position, disconnect all electrical power and insert a long shaft, 1/8" Allen wrench into the appropriately numbered hole on the front face of the limit switch assembly.
- 3) Loosen the set screw located at the bottom of the hole to relieve cam clamping pressure - about 1/4 turn. Leave wrench in place.
- 4) With the cam in the dwell area ("low point") manually rotate the cam in the same direction as the noted limit switch assembly rotation (cam should rotate easily by hand) until the "high" part of the cam just activates the limit switch (signified by a "click"). Hold the cam at this position.
- 5) Tighten the set screw with moderate force to lock the cam in position. *NOTE: Excessive force on the set screw is not required and can cause damage to the assembly.*

- 6) Run actuator to mid-travel and back to confirm new setting. If not correct, readjust.
- 7) Repeat procedure on remaining switch.

##### B. Position Feedback Alignment( feedback option)

Position feedback is provided through the use of a potentiometer attached to the multiturn screw shaft. As the shaft is driven by the actuator gearing, the potentiometer is simultaneously driven to provide position feedback. The end of travel limit switches, LS1 and LS2, also use the multiturn screw shaft.

1. Establish if full extend or full retract is to be used for zero indication. On slide gate installations, zero indication is normally used when the actuator is fully extended and the gate closed.
2. Make sure end of travel limit switches are correctly set for the proper stroke length. **NOTE: LS1(Extend) limit switch is at top of feedback assy and LS2(Retract) limit switch is closest to housing.**
3. Use an ohmmeter to monitor the position of the feedback potentiometer wiper to determine which end of the pot gives a low ohm resistance indication.
4. If the reading is greater than 50 ohms, loosen the potentiometer's mounting nut and slowly rotate body until approximately 50 ohms is reached. Tighten mounting nut. **NOTE: On tandem potentiometer assembly, try to set the bottom potentiometer to approximately 50 ohms, especially if the 4 to 20mA transmitter is being used.**

**CAUTION: End-of-travel limit switches are factory preset. Do not rotate the front clevis as this will alter the switch settings.**

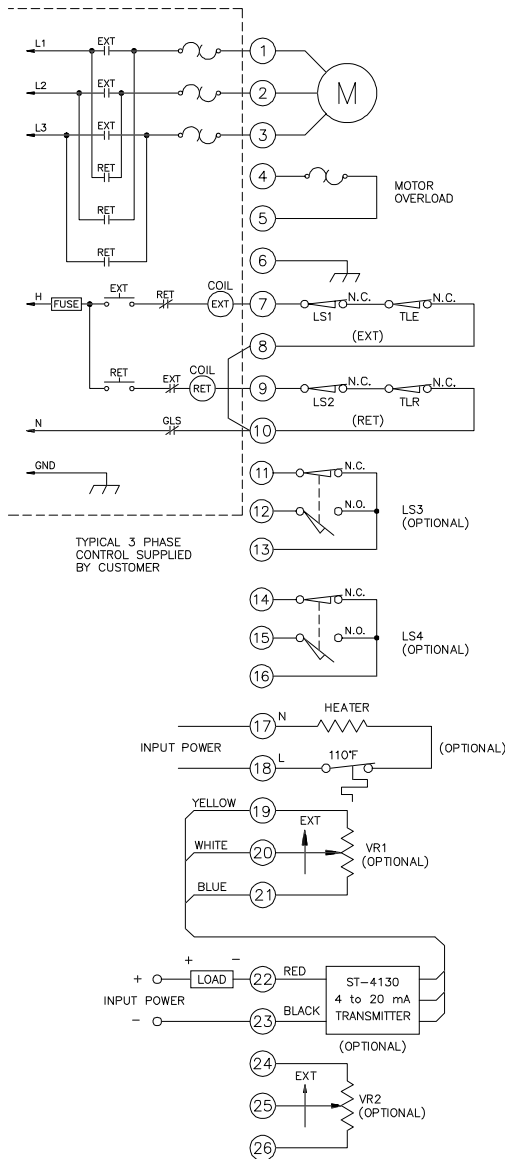
**CAUTION: Multiturn feedback potentiometer(s) has(have) internal mechanical stops. If potentiometer is not properly set up, damage could occur to potentiometer.**

**C. 4 to 20 mA Transmitter Alignment(option)**

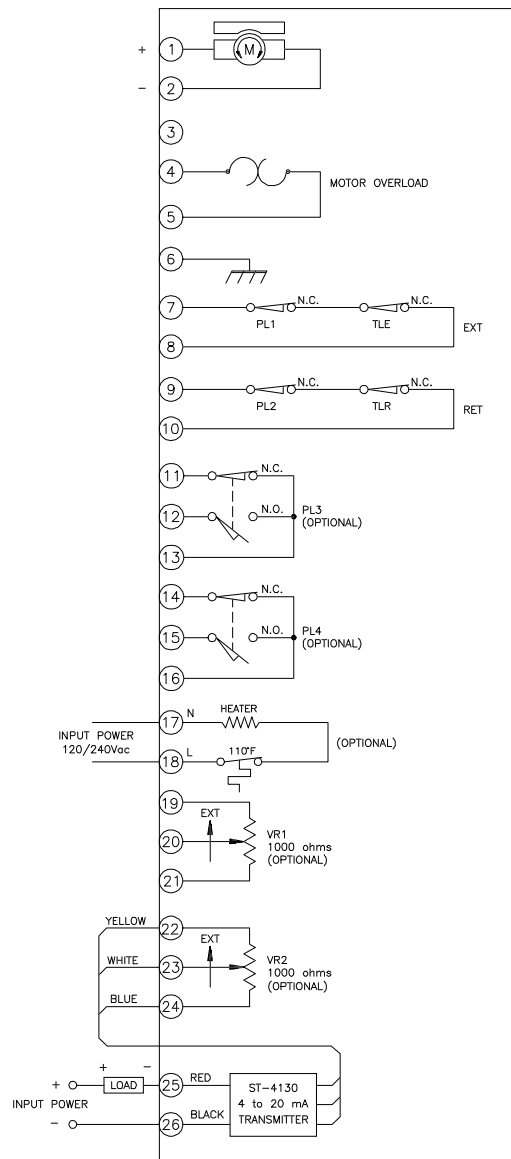
Before adjusting output of transmitter, refer to section IV-B. After stroke and potentiometer are properly set, and power supply and load are wired per Installation

wiring print, move actuator to fully retracted position. Adjust the "Elevation" trim pot to get 4.0mA output. Run actuator to full extend position. Adjust the "Range" trim pot on transmitter to get 20.0mA output. Repeat until interaction no longer occurs. For an increasing feedback signal with the actuator shaft retracting, interchange blue and yellow leads on terminals 19 and 21. Recalibration and realignment of pot and transmitter may be necessary.

**LA-2910**



**LA-2980**



# Major Dimensions

INCHES
(MILLIMETERS)

