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# Pro-Series/ Electromechanical Linear Actuator

Installation and Operation Manual

P-264-PROSERIES (08/10)

Keep all product manuals as a product component during the life span of the product. Pass all product manuals to future users/owners of the product.

 **THOMSON**<sup>™</sup>  
*Linear Motion. Optimized.*



### Record of Revisions

Edition	Valid for	Description
0	P-264-PROSERIES 09/10	second printed edition

Technical changes to improve the performance of the equipment may be made without notice!

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## Introduction

Thomson has many years of experience designing and manufacturing linear actuators for a wide variety of applications on agricultural equipment, school buses, industrial sweepers, vans for the disabled, and other mobile applications. The Thomson linear actuator you have purchased is a well designed, high quality unit, which will provide consistent maintenance-free service throughout its life.

This manual provides complete information needed to install and troubleshoot Thomson **Pro-Series** 12 and 24 VDC linear actuators. All of these products are easy to install and require no maintenance.

Please follow the instructions provided in this manual carefully to ensure safe, reliable operation. The Application Notes found on page 4 are of paramount importance; be sure to read them thoroughly before proceeding with installation. All stated or implied manufacturer's warranties are voided if this product is not installed and operated in accordance with these instructions.

## Warranty

Thomson warrants that it will repair or replace (whichever it deems advisable) any product manufactured and sold by it which proves to be defective in material or workmanship within a period of one (1) year from the date of original purchase for consumer, commercial, or industrial use.

This warranty extends only to the original purchaser and is not transferable or assignable without Thomson's prior consent.

Warranty service can be obtained in the U.S.A. by returning any defective product, transportation charges prepaid, to the appropriate Thomson factory. Additional warranty information may be obtained by telephone at 540-633-3400 or by writing the Customer Service Department at:

Thomson Customer Service  
203A West Rock Road  
Radford, VA 24141

A purchase receipt or other proof of original purchase will be required before warranty service is rendered. If found defective under the terms of this warranty, repair or replacement will be made, without charge, together with a refund for transportation costs. If the product is found not to be defective, the sender will be notified and, without approved consent, the item will be repaired or replaced, and returned at the expense of the sender.

This warranty covers normal use and does not cover damage or defect which results from alteration, accident, neglect, or improper installation, operation, or maintenance. Some states do not allow limitation on how long an implied warrant last, so the above limitation may not apply to you.

Thomson's obligation under this warranty is limited to the repair or replacement of the defective product and in no event shall Thomson be liable for consequential, indirect, or incidental damages of any kind incurred by reason of the manufacturer, sale, or use of any defective product. Thomson neither assumes nor authorizes any other person to give any other warranty or to assume any other obligation or liability on its behalf.

**With respect to consumer use of the product, any implied warranties which the consumer may have are limited in duration to one year from the date of original consumer purchase.**

**With respect to commercial and industrial uses of the product, the foregoing warranty is in lieu of and excludes all other warranties, whether expressed or implied by operation of law or otherwise, including, but not limited to, any implied warranties of merchantability or fitness.**

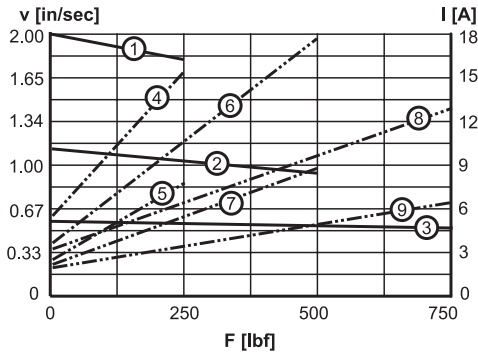
Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

## Application Notes

- 1 Always make sure power is off before attempting to work on or near the **Pro-Series** actuator and its electrical controls.
- 2 **Pro-Series** actuators include integral Electronic Load Monitoring (ELM) that shuts off power to the motor any time the speed drops below a factory set threshold either at ends of stroke or during a mid-stroke overload, or by exceeding a temperature limit due to excessive duty cycle.
- 3 **Pro-Series** actuators have an intermittent duty cycle with a maximum “on time” of 25% at rated load. For example, an actuator operating for 10 seconds at rated load must remain off for 30 seconds before it is operated again. Exceeding this maximum will cause excessive motor heat that will cause the ELM to shut off power to the motor until temperatures drop to acceptable levels.
- 4 **Pro-Series** actuators are weather protected for use in outdoor application, but they are not waterproof and should not be used in underwater conditions.
- 5 **Pro-Series** actuators are not explosion or dust ignition proof; do not apply them to those types of environments.
- 6 **Pro-Series** actuators are factory lubricated for life. No disassembly is ever required for routine maintenance purposes. Internal components of **Pro-Series** actuators are not to be serviced in the field and must be returned to the factory for service.
- 7 **Pro-Series** actuators may not be used with PWM circuits. PWM circuits will damage electronic components within the actuator.

Specifications

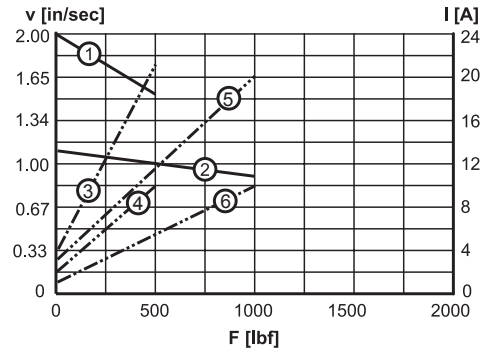
Acme Screw Models  
Speed and Current vs. Load



V: speed  
I: current  
F: load

1: speed 250 lbf	4: current 12 Vdc, 250 lbf
2: speed 500 lbf	5: current 24 Vdc, 250 lbf
3: speed 750 lbf	6: current 12 Vdc, 500 lbf
	7: current 24 Vdc, 500 lbf
	8: current 12 Vdc, 750 lbf
	9: current 24 Vdc, 750 lbf

Ball Screw Models  
Speed and Current vs. Load



V: speed  
I: current  
F: load

1: speed 500 lbf	3: current 12 Vdc, 500 lbf
2: speed 1000 lbf	4: current 24 Vdc, 500 lbf
	5: current 12 Vdc, 1000 lbf
	6: current 24 Vdc, 1000 lbf

- Standard stroke lengths (in) ..... 4, 6, 8, 12
- Operating temperature limits (°F)..... -40 to +185
- Maximum load duty cycle at 77°F (%)..... 25
- Axial end play maximum (in) ..... 0.04
- Restraining torque maximum (lbf-in) ..... 150
- Protection class..... IP66
- Electrical Connector ..... Delphi Metri-Pack 280
- Mating Connector..... Delphi 12020599 connector

12077411 terminals 15324980 seals 12089754 secondary lock

## Mounting

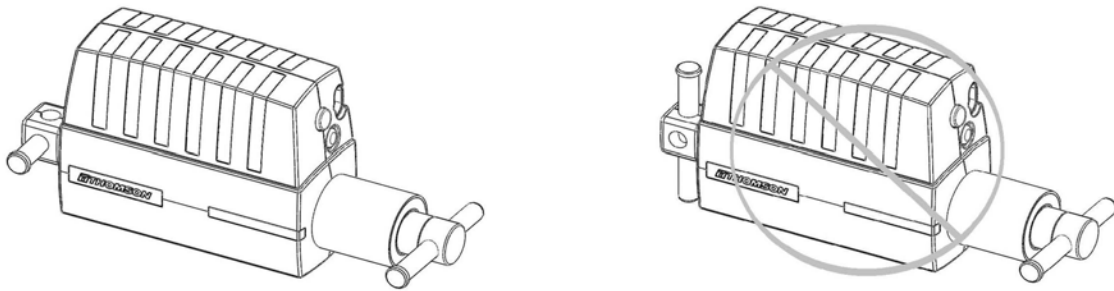
Thomson **Pro-Series** linear actuators are quickly and easily mounted by installing pins through the holes on each end of the unit and into customer mounting brackets on the machine frame.

### NOTE

Do not attempt to mount the **Pro-Series** actuator from its cover tube. The cover tube is not designed to support the forces required for mounting the actuator. Actuator damage or personal injury may result.

Do not attempt to mount the **Pro-Series** actuator from its cover tube. The cover tube is not designed to support the forces required for mounting the actuator. Actuator damage or personal injury may result.

Half inch (0.50) diameter solid pins provide maximum holding strength and a retaining or cotter pin on each end will prevent the solid pin from falling out of its mounting bracket. Roll or spring type mounting pins should be avoided. The mounting pins must be parallel to each other as shown in Figure 1. Pins that are not parallel to each other may cause the actuator to bind and lead to premature failure.



Right and Wrong way Figure 1.



The load should act along the stroke axis of the actuator since off center loads may cause binding and lead to premature failure. See Figure 2.

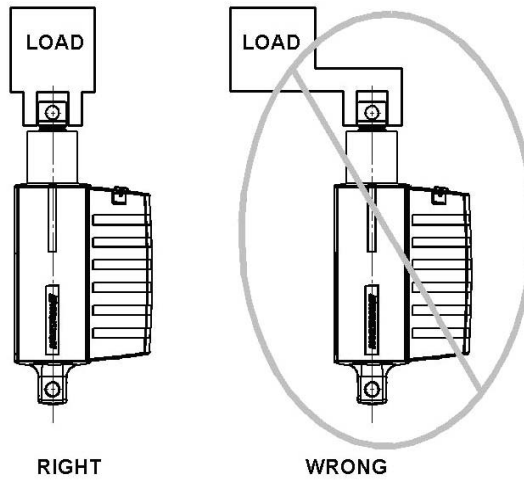
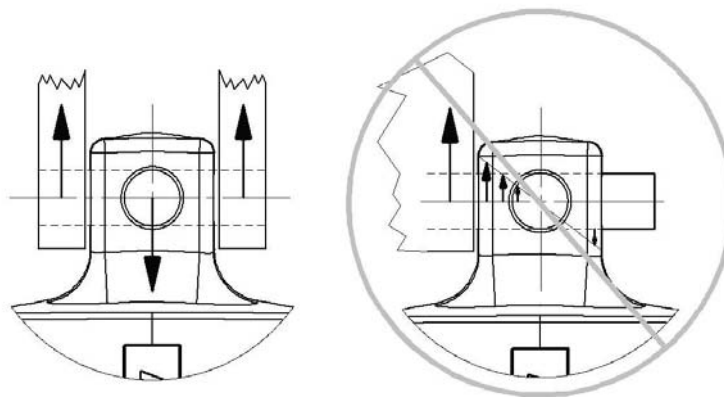


Figure 2.



Right and Wrong  
Figure 3.

The actuator mounting brackets must be able to withstand the torque that is developed when the unit extends or retracts. See Figure 4. Restraining torque varies with the model being used; see the chart below for the required value for the **Pro-Series** actuator used.

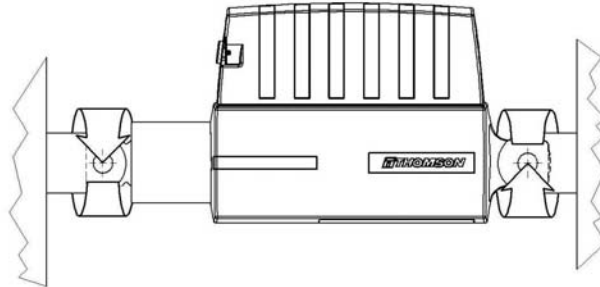


Figure 4.

PRXX-02-2A65.....	25 lbf-in
PRXX-05-4A65.....	50 lbf-in
PRXX-07-8A65.....	75 lbf-in
PRXX-05-2B65.....	25 lbf-in
PRXX-10-4B65.....	50 lbf-in
PRXX-15-8B65.....	100 lbf-in
PRXX-20-8B65.....	150 lbf-in

## Electrical Installation

**NOTE**

Make sure power is off before attempting to wire the actuator.

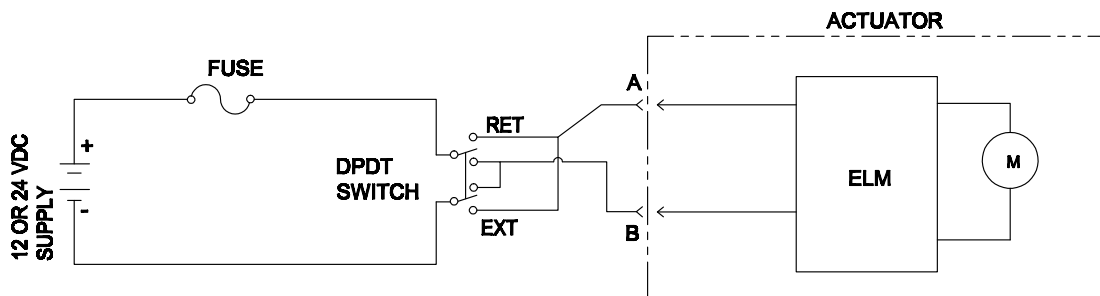
**Pro-Series** actuators are offered with many control options to suit specific customer needs. Recommended wiring diagrams are shown below for each option.

### Electronic Load Monitoring (Option “S”)

The integral Electronic Load Monitoring (ELM) shuts off power to the motor any time the actuator speed drops below a factory-set threshold due to motor speed variation (either at ends of stroke, or during a mid-stroke overload), or by exceeding a temperature limit (excessive duty cycle). The threshold value is scaled based upon available input voltage and ambient temperatures less than 32 degrees F (0 degrees C). The control will dynamically brake the actuator on ELM activation.

Interconnection is achieved by the integral 2-wire input to the actuator with directional control provided via a double-pole, double-throw switch (not included) with a contact rating for actuator rated load current.

#### S OPTION: ELECTRONIC LOAD MONITORING (ELM) STANDARD



## Electronic Load Monitoring with Low level Switch input (Option “T”)

This design allows microprocessor outputs to extend or retract the actuator. Polarity changes to the motor are controlled internal to the actuator.

Interconnection requires 5 wire inputs to the actuator, 2 power leads directly from battery to the integral connector and 3 signal input leads through an auxiliary harness. The customer control must supply power to indicate direction.

The control will dynamically brake the actuator anytime the actuator stops, either by the input switch or by ELM activation.

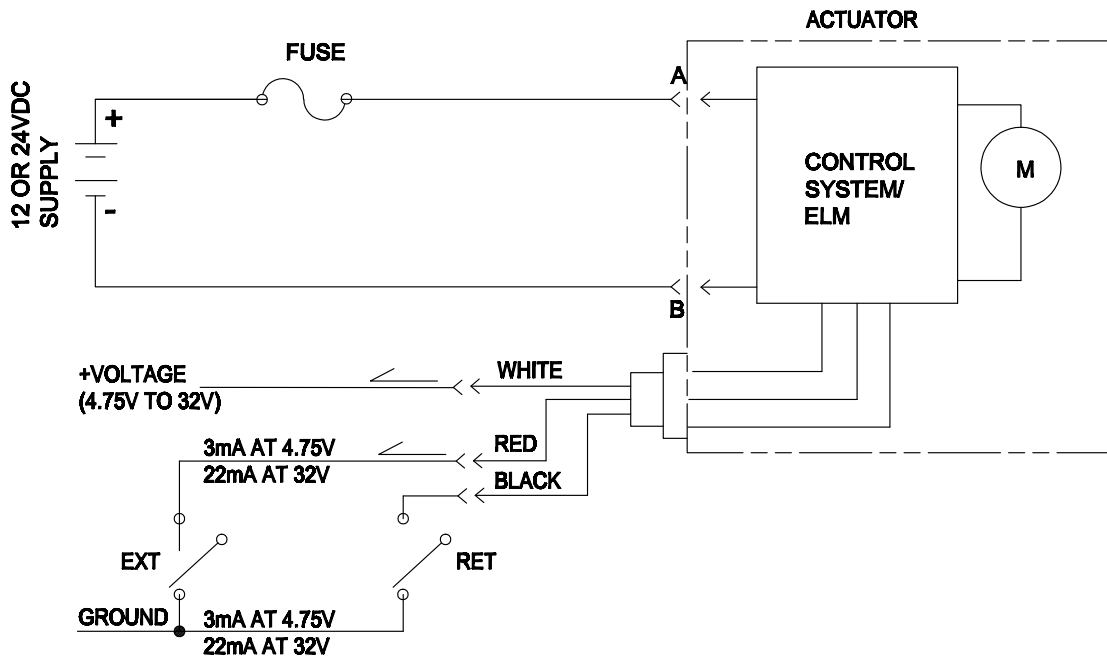
### T: ELM PLUS LOW LEVEL POWER SWITCHING

CAN BE OPERATED USING A SINGLE POLE-DOUBLE THROW SWITCH WITH APPROPRIATE ELECTRICAL RATING

TO EXTEND THE ACTUATOR, APPLY VOLTAGE TO WHITE AND RED WIRES.

TO RETRACT THE ACTUATOR, APPLY VOLTAGE TO WHITE AND BLACK WIRES.

ACTUATOR MUST HAVE CONSTANT POWER WITHOUT CHANGE IN POLARITY



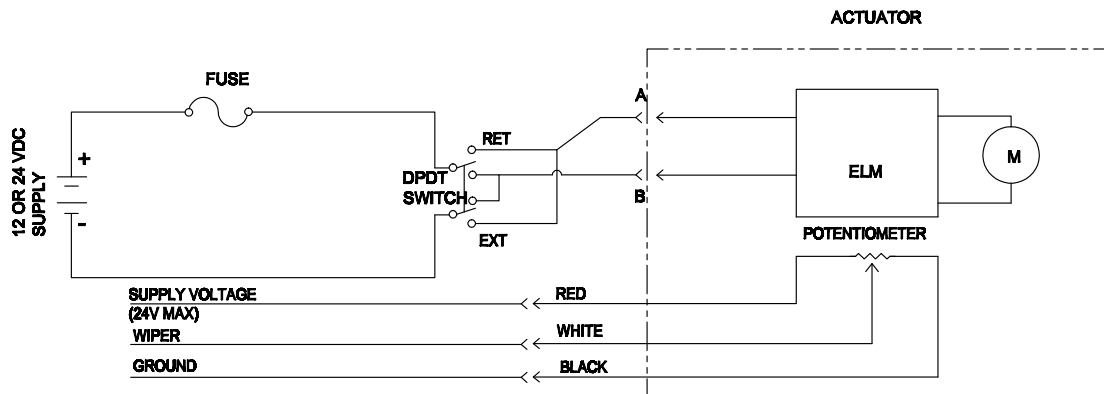
## Electronic Load Monitoring with Analog Linear Potentiometer Feedback (option “L”)

This design includes a 5k integral linear potentiometer for strokes equal to or less than 6 inches or 10k linear potentiometer for strokes greater than 6 inches, that is powered and read by the customer’s control. Total resistance is +/- 20% with essentially infinite linear resolution. The application should apply control voltage to one end of the potentiometer, ground the other end of the potentiometer, and compare the wiper to ground voltage to the input control voltage to determine position.

The integral Electronic Load Monitoring (ELM) will shut off power to the motor anytime the actuator speed drops below a pre-set threshold (either at ends of stroke or during a mid-stroke overload), or by exceeding a temperature limit (excessive duty cycle). The control will dynamically brake the actuator or upon ELM activation.

The analog feedback requires 3 signal level interconnections (one for each end of the resistance element and one for the wiper). This option includes an anti-rotation feature (standard on ball nut units, optional on acme units) that does not affect the retracted length of the ball nut actuator, but will add approximately 0.25" to the acme.

L OPTION: ELM PLUS LINEAR POTENTIOMETER

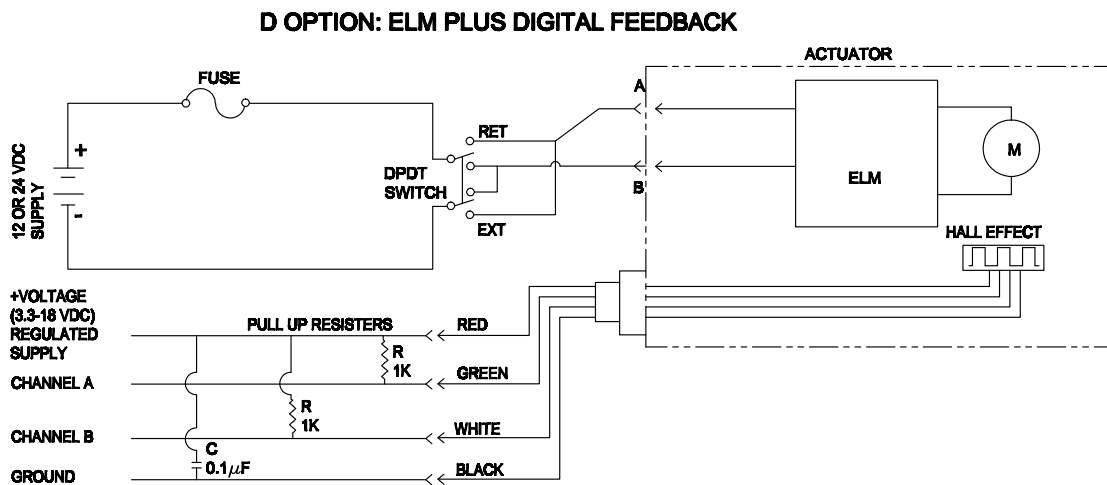


## Digital feed back (Option “D”)

This design utilizes two Hall Effects (in quadrature) triggered by a multi-pole magnet on the rotating motor shaft. The customer’s control must provide 3.3 to 18 VDC input power for the Hall Effects, count the pulses, interpret the actuator position, and control the start/stop of the actuator; the customer control must also provide an initialization process when power is re-started. Linear resolution is 0.0012 inches (0.03 mm) for the lowest gear reduction; 0.0006 inches (0.015 mm) for the middle gear reduction; and 0.0003 inches (0.008 mm) for the highest gear reduction. Protection for the Hall Effect is integral to the actuator. Because the feedback is generated from the motor, the actuator extension tube must be restrained from rotating to ensure accurate positioning under all applications. Optional anti-rotation feature is available.

The integral Electronic Load Monitoring (ELM) will shut off power to the motor anytime the actuator speed drops below the pre-set threshold (either at ends of stroke or during a mid-stroke overload), or by exceeding a temperature limit (excessive duty cycle). Dynamic braking is provided, by ELM activation.

The digital feedback interconnection requires 4 signal level leads (2 for hall-effect power input of 3.3 to 18 VDC and 2 ground-referenced signal outputs).



## Electronic Load Monitoring with Signal Follower (Option “K”)

This feature will enable the actuator to “follow” an analog input “signal”. The customer must provide the “signal” potentiometer; a second potentiometer integral to the actuator will provide the “follow” signal. The actuator control provides a 5 VDC power supply for the customer’s matching 5k or 10k “signal” potentiometer. The actuator microprocessor continuously compares the “signal” voltage from the customer potentiometer to “follow” voltage from the actuator potentiometer. Any differences cause the control to drive the actuator until the signals match. The control will dynamically brake the actuator anytime the actuator is stopped. The ELM circuit will function as described above for mid-stroke overloads or when the duty cycle is exceeded. This option includes an anti-rotation feature (standard on ball nut units, optional on acme units) that does not affect the retracted length of the ball nut actuator, but will add approximately 0.25" to the acme.

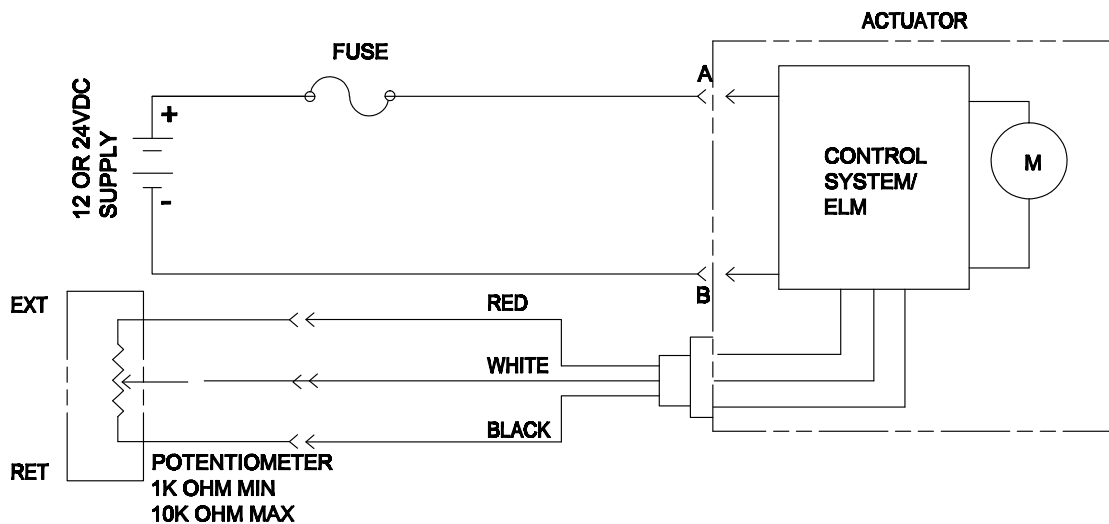
Interconnection requires 3 signal-level leads for the customer potentiometer (one for each end of resistance element and one for the wiper), and 2 power-leads directly from the battery to the integral actuator connector.

For most repeatable positioning, customers may want to consider a multi-position rotary switch with discreet resistance values.

### K: ELM PLUS SIGNAL FOLLOWER INPUT

**SIGNAL WIRE (WHITE) ACCEPTS VOLTAGES BETWEEN 0.5 VDC AND 4.5VDC TO EXTEND THE ACTUATOR, INCREASE VOLTAGE ON THE SIGNAL WIRE. TO RETRACT ACTUATOR, DECREASE VOLTAGE ON THE SIGNAL WIRE**

**ACTUATOR MUST HAVE CONSTANT POWER WITHOUT CHANGE IN POLARITY**

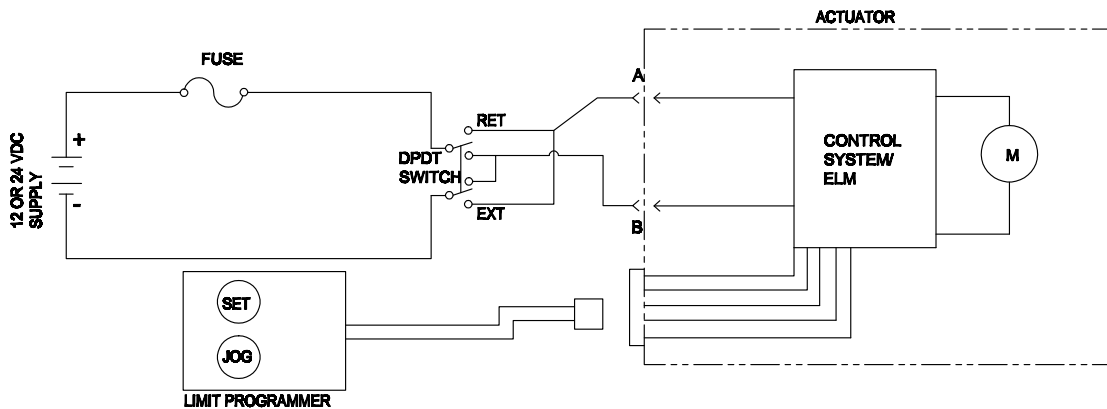


## Programmable Limit Switches (Option “P”)

This feature will enable the customer to “program” end limit points in the application without requiring the end of stroke to be limited by either the actuator or the mechanism. These “programmed” points will trigger the ELM circuit to control ends of stroke. The ELM circuit will still function as described above for mid-stroke overloads or when the duty cycle is exceeded.

The design requires 2 wire input power switching to the actuator integral connector. A 2-button “End of Stroke Programming Pendant” with cable and mating connector is available for programming. With power applied to extend the actuator, the customer presses the “Jog” button on the “End of Stroke Programming Pendant” to manually jog the actuator to the desired extend position and then presses the SET button on the “End of Stroke Programming Pendant” to input the position into the microprocessor. Similarly, with power applied to retract the actuator, the customer presses the “Jog” button on the “End of Stroke Programming Pendant” to manually jog the actuator to the desired retract position and then presses the “Jog” button on the “End of Stroke Programming Pendant” to input the position into the microprocessor. The microprocessor stores the last two positions programmed into its memory. The control will dynamically brake the actuator at programmed set points or by ELM activation. The “End of Stroke Programming Pendant” can be removed from the actuator once the ends of stroke positions are stored. This option includes an anti-rotation feature (standard on ball nut units, optional on acme units) that does not affect the retracted length of the ball nut actuator, but will add approximately 0.25" to the acme.

**P OPTION: ELM PLUS PROGRAMMABLE LIMIT SWITCHES**





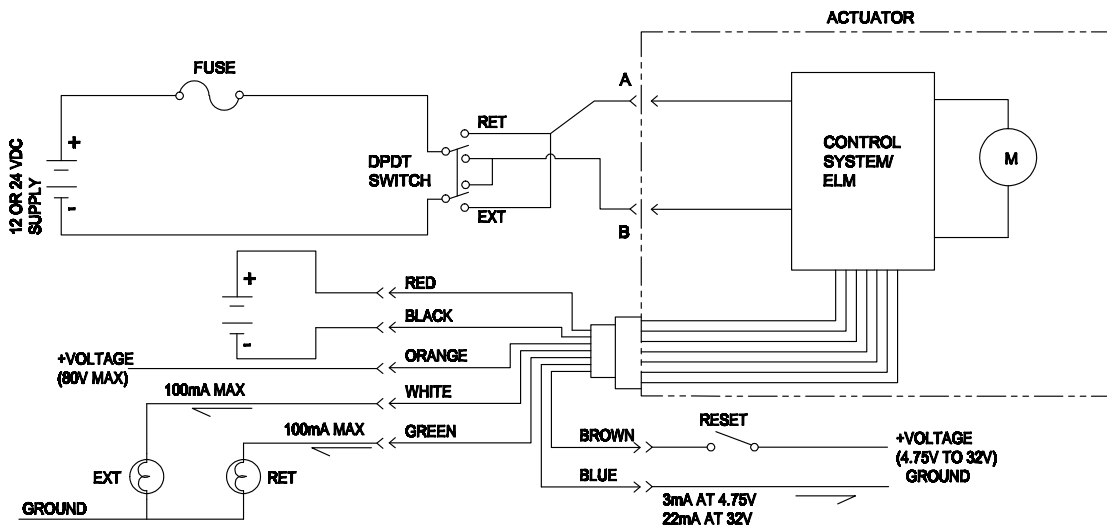
## End of Stroke Indication (Option “R”)

This feature uses a continuously powered control system to monitor the self programmed end of stroke locations. This allows an output indication even if the actuator is not running. The limits are established approximately 3% of stroke length from the mechanical end of stroke. This option includes an anti-rotation feature (standard on ball nut units, optional on acme units) that does not affect the retracted length of the ball nut actuator, but will add approximately 0.25" to the acme. The ELM function shuts off power to the motor anytime the actuator speed drops below a preset threshold (either at ends of stroke, or during a mid-stroke overload), or by exceeding a temperature limit (excessive duty cycle).

Interconnection is achieved by a 2 wire motor control input to the actuator’s integral connector with a directional control provided via a double-pole, double-throw switch (not provided) with a contact rating for actuator rated load current. Also, a 7 wire system includes the 12 or 24 VDC control supply voltage input (continuous), end of stroke outputs, and an end of stroke reset.

End of Stroke set points are self programmed by running actuator to full extend, then full retract.

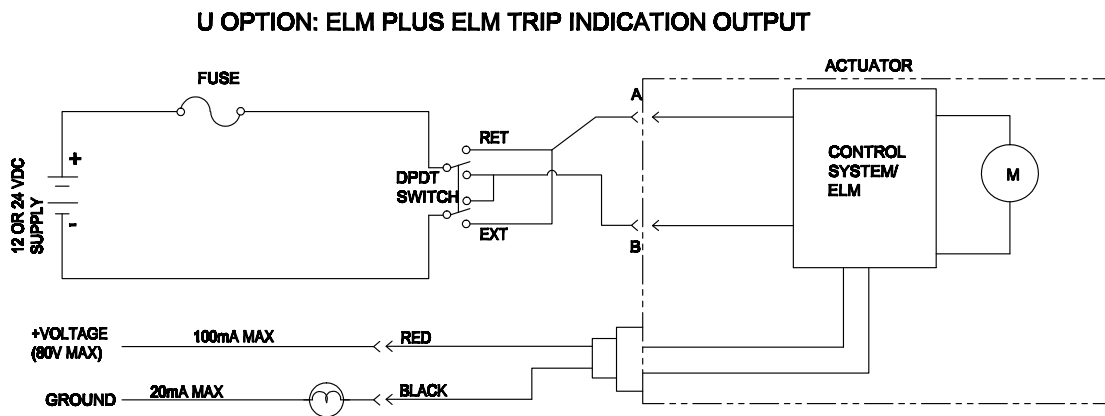
R OPTION: ELM PLUS END OF STROKE INDICATION OUTPUTS



## Load Monitoring Indication (Option “U”)

This feature provides an output signal from the actuator microprocessor anytime the ELM feature is activated. The ELM function shuts off power to the motor anytime the actuator speed drops below a pre-set threshold (either at ends of stroke, or during a mid-stroke overload), or by exceeding a temperature limit (excessive duty cycle).

Interconnection is achieved by a 2 wire input to the actuator integral connector with directional control provided via a double-pole, double-throw switch (not provided) with a contact rating for actuator rated load current; and 2 low level connections to monitor a contact closure whenever the ELM is activated with a maximum contact rating of 100 milliamps and 80 VDC.



## Wire Gauge Selection

Long lead wires between the power source and the actuator will result in a voltage drop. This voltage drop can be minimized by sizing the wires in accordance with the following Wire Gauge Selection Chart which is based on DC power sources.

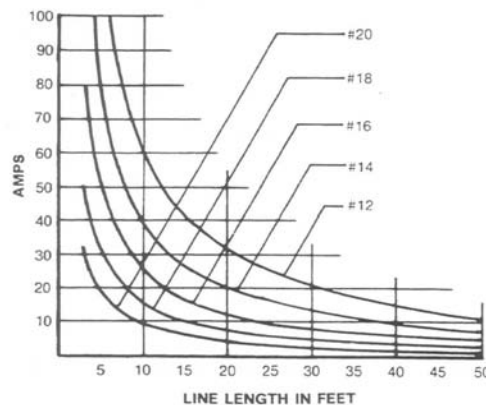


Figure 5. Wire Gauge Selection Chart

To use this chart, find the point of intersection of the amperage and distance and read the required wire gauge from the curves on the chart. Example: A **Pro-Series** actuator draws 14 amperes current at load and is located 22 feet from the power supply (44 feet total). The intersection of 14 amperes and 44 feet indicates the need for #12 AWG wire.

## Connectors

**Pro-Series** actuators include a mating connector kit that can be assembled to lead wires for the power input. The kit consists of Delphi Metri-Pack 280 12020599 connector, (2) 12077411 terminals, (2) 15324980 seals, and 12089754 secondary lock. Terminals and seals are to be assembled to the lead wires per the drawing and notes below.

- 1 Strip insulation to 0.22 +/- 0.02 inches.
- 2 Assemble seal to lead as shown.
- 3 Crimp terminal to lead and seal as shown. Crimp to hold 10 pounds pull.
- 4 Assemble terminals and seals into connector body in correct orientation.

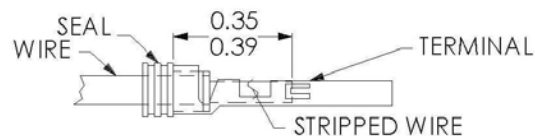


Figure 6. Terminal Assembly

Auxiliary signal wires are provided through a jacketed cable with 2, 3, or 4 conductors of 22 AWG stranded copper 36 inches long; terminals and connectors must be provided by the customer.

## Actuation For all except “T” and “K” options

To extend the **Pro-Series** actuator, connect Position “B” of the electrical connector to positive voltage and Position “A” of the electrical connector to negative voltage. To retract the **Pro-Series** actuator, connect Position “B” of the electrical connector to negative voltage and Position “A” of the electrical connector to positive voltage.

Polarity reversal is not required with “T” & “K”

## Switches

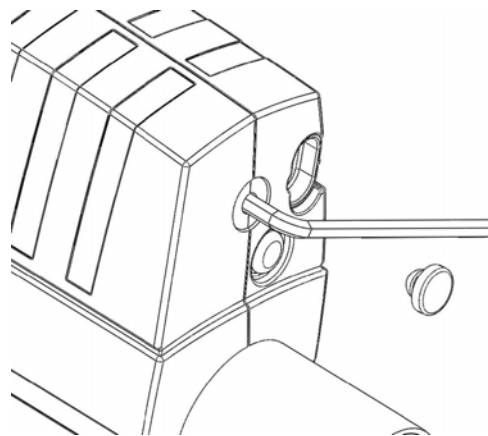
**Pro-Series** DC actuators require double-pole, double-throw switches. McGill 0121-004, Cutler Hammer 8835-K4, or equivalent are recommended and can usually be obtained locally. The required switch can also be purchased from Thomson under part number 830-8004-016.

Recommended Switch Specifications include:

- Double-pole, double-throw
- Momentary contacts with center off position
- Rated for 20 amperes at 28 VDC

## Manual Operation

If power is lost, the actuator can be manually extended or retracted by operating the manual override. Remove the rubber plug from the front of the actuator housing (see diagram below). Insert a 5 mm or 3/16” hex key (allen wrench) into the slot and rotate it to extend or retract the actuator. You may want to use a hand drill to drive the hex key for faster and easier extension / retraction. Replace the rubber plug when not using the manual override.



## Troubleshooting

The chart below may be helpful in isolating malfunctions in the control system, countering difficulties with system start-up, and in troubleshooting for worn or broken components in units that have been operating for some time. For proper diagnosis, it is important to do all tests prior to returning the actuator.

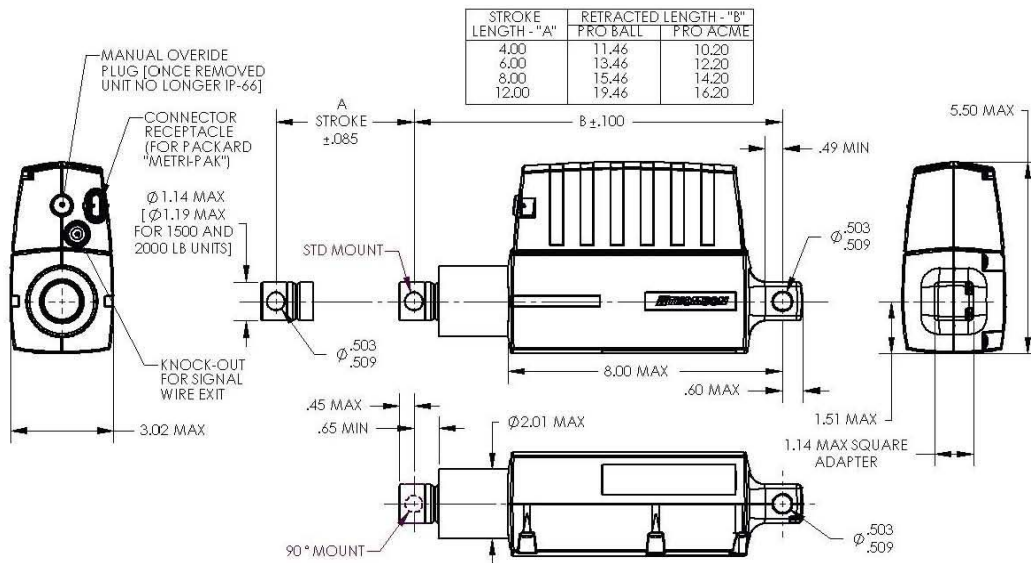
<b>Symptoms: Actuator will not extend or retract</b>		
<b>Checkpoint</b>	<b>Probable Cause</b>	<b>Possible Solution</b>
No voltage or current draw	Actuator not receiving power	Check power supply, fuse, and wiring
Proper voltage, no current draw	Motor “open”	Return for service
	ELM (control) “open”	
	Direction reversed too rapidly	Allow 100 milli-seconds off time prior to reversing
Proper voltage, current present	Mechanical overload	Check load
	Thermal overload	Cool and check duty cycle
<b>Symptom: Actuator Stops mid-stroke</b>		
<b>Checkpoint</b>	<b>Probable Cause</b>	<b>Possible Solution</b>
Proper voltage, current present initially but then drops to zero	Mechanical overload	Check load
	Thermal overload	Cool and check duty cycle
Current present but voltage is low	Power supply inadequate	Check power supply
	Wiring inadequate	Check wiring

## Dimensions

The outline drawings shown below describe the **Pro-Series** ball screw and acme screw actuators. The table shows the stroke and retracted lengths for the various models.

**NOTE**

Specifications, part numbers, dimensions, etc., may be changed without notification.



### Electrak Pro

1	2	3	4	5	6	7
PR24	20-8B65	-	04	R	C	S
<p><b>1. Model and input voltage</b>                      PR12 = Electrak Pro, 12 Vdc                      PR24 = Electrak Pro, 24 Vdc</p> <p><b>2. Dynamic load capacity and screw type</b>                      02-2A65 = 250 lbf, acme                      05-4A65 = 500 lbf, acme                      07-8A65 = 750 lbf, acme                      05-2B65 = 500 lbf, ball                      10-4B65 = 1000 lbf, ball                      15-8B65 = 1500 lbf, ball                      20-8B65 = 2000 lbf, ball</p> <p><b>3. Protection class</b>                      - = IP66 (standard)                      E = IP67</p>	<p><b>4. Stroke (S)</b>                      04 = 4 inch                      06 = 6 inch                      08 = 8 inch                      12 = 12 inch</p> <p><b>5. Control PCB options</b>                      S = electronic load monitoring, ELM (standard)                      D = ELM + encoder                      L = ELM + linear potentiometer<sup>1</sup>                      P = ELM + programmable limit switches<sup>1</sup>                      T = ELM + low level power switching<sup>1</sup>                      R = ELM + end of stroke indication outputs<sup>1</sup>                      U = ELM + ELM trip indication output                      K = ELM + signal follower input<sup>1,2</sup></p>		<p><b>6. Front adapter and anti-rotation options</b>                      C = freely rotatable cross hole, no anti-rotation                      S = cross hole in standard position, anti-rotation<sup>3</sup>                      M = cross hole rotated 90°, anti-rotation<sup>3</sup></p> <p><b>7. Finish</b>                      S = no paint (standard)                      B = actuator painted black</p> <p><sup>1</sup>Requires anti-rotation mechanism.  <sup>2</sup>Only possible on 12 Vdc input voltage models.  <sup>3</sup>Definition of cross hole positions.</p>			



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200707-06 TPS 9/2010 USA  
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