Pro-Series/ Electromechanical Linear Actuator

Installation and Operation Manual

P-264-PROSERIES (01/07)

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.

DANAHER MOTION

*Helping you build a better machine, **faster.***

Item No.

Record of Revisions

Edition	Valid for	Description
08/01/2007	P-264-PROSERIES (01/07)	first printed edition

~~Trademark~~

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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 in not installed and operated in accordance with these instructions.

Warranty

Danaher 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 Danaher's prior consent.

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

Danaher Motion Assistance Center
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.

Danaher's obligation under this warranty is limited to the repair or replacement of the defective product and in no event shall Danaher be liable for consequential, indirect, or incidental damages of any kind incurred by reason of the manufacturer, sale, or use of any defective product. Danaher 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.

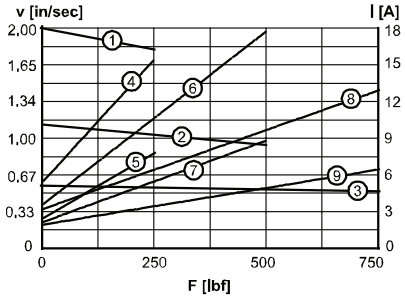
Application Notes

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.

Specifications

Performance Diagrams

Acme Screw Models
Speed and Current vs. Load

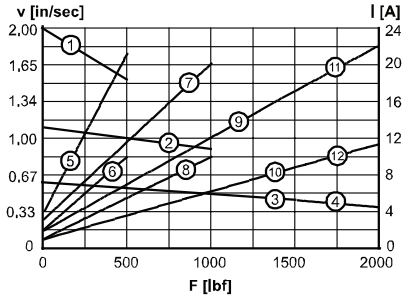


V: speed
I: current
F: load

1: speed 250 lbf
2: speed 500 lbf
3: speed 750 lbf

4. current 12 Vdc, 250 lbf
5: current 24 Vdc, 250 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
2: speed 1000 lbf
3: speed 1500 lbf
4: speed 2000 lbf

5. current 12 Vdc, 500 lbf
6: current 24 Vdc, 500 lbf
7: current 12 Vdc, 1000 lbf
8: current 24 Vdc, 1000 lbf
9: current 12 Vdc, 1500 lbf
10: current 24 Vdc, 1500lbf
11: current 12 Vdc, 2000 lbf
12: current 24 Vdc, 2000 lbf

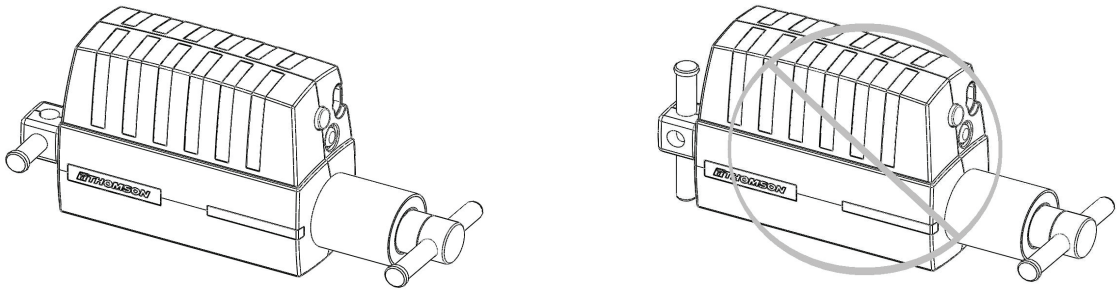
Standard stroke lengths (in)	4, 6, 8, 12
Operating temperature limits (°F)	-40 to +185
Maximum load duty cycle at 77°F (%)	25
Axial end play maximum (in)	0.04
Restraining torque maximum (lbf-in)	150
Protection class	IP66
Electrical Connector	Delphi Metri-Pack 280
Mating Connector	Delphi 12020599 connector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

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 **Wrong**

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.

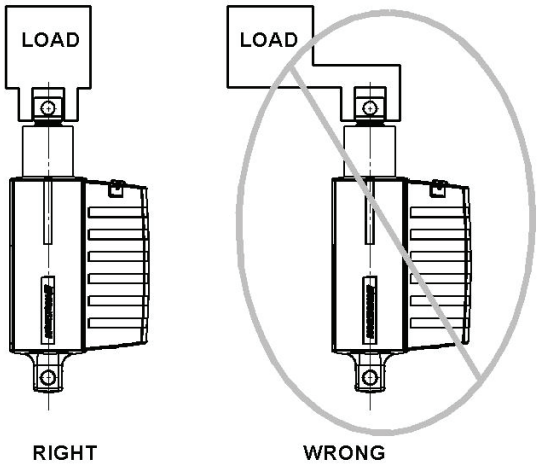
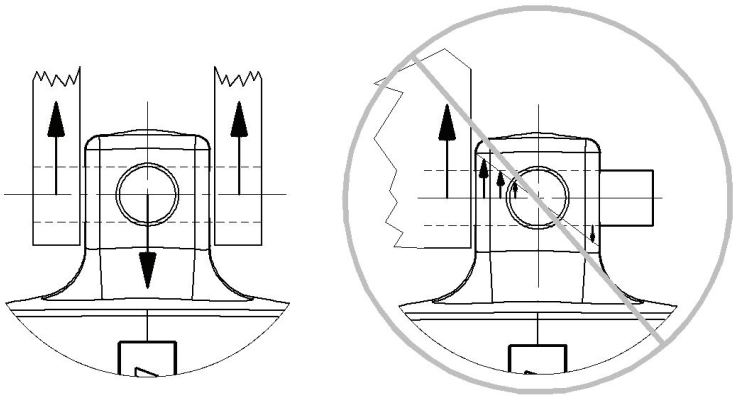


Figure 2.

Make sure that mounting pins are supported on both ends. Failure to do so could shorten the life of the actuator. See Figure 3. Cantilever mounts are unacceptable.



Right **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.

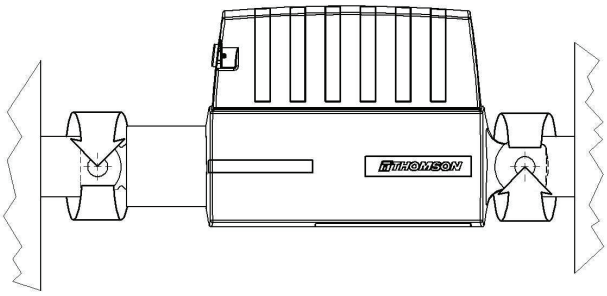


Figure 4.

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

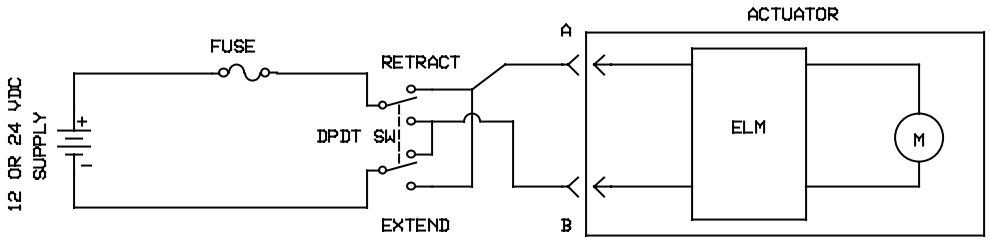
NOTE
Make sure power is off before attempting to wire the actuator.

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). Motor speed is calculated by the “on time” of the output of a Hall Effect sensor triggered by a multi-pole magnet secured to the motor shaft. 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 anytime power is cut, either by the input switch or by ELM activation. The ELM function requires the actuator to be at a complete stop prior to direction reversal (approximately 100 milli-seconds).

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.

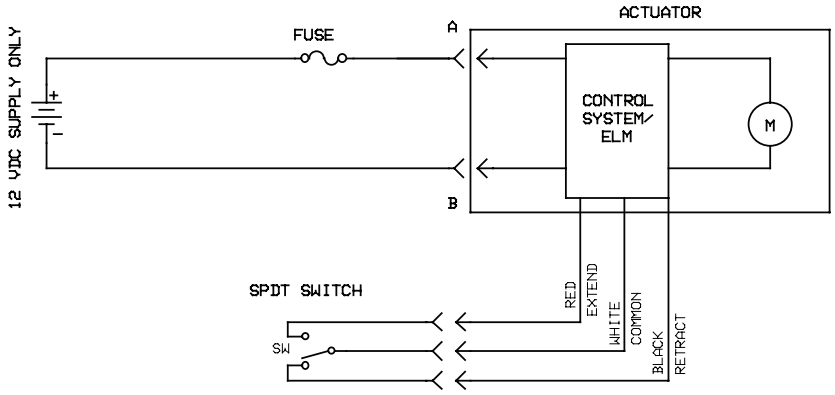


Electronic Load Monitoring with Low Level Switch Input (Option “T” 12 VDC Only)

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

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 2 contact closures to indicate direction (contacts must be rated for 20 milli-amperes at 12 VDC).

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

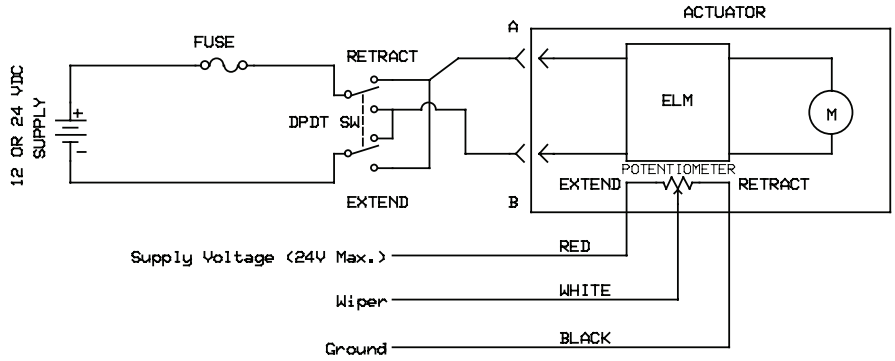


Electronic Load Monitoring with Analog Linear Potentiometer Feedback (Option “L”)

This design includes a 5k linear potentiometer for strokes equal to or less than 6 inches or 10k linear potentiometer for strokes greater than 6 inches, integral to the actuator that is powered and read by the customer’s control (1 watt maximum power dissipation). Total resistance is +/- 15% 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 anytime power is cut, either by the input switch or by ELM activation.

The analog feedback requires 3 signal level interconnections (one for each end of the resistance element and one for the wiper).

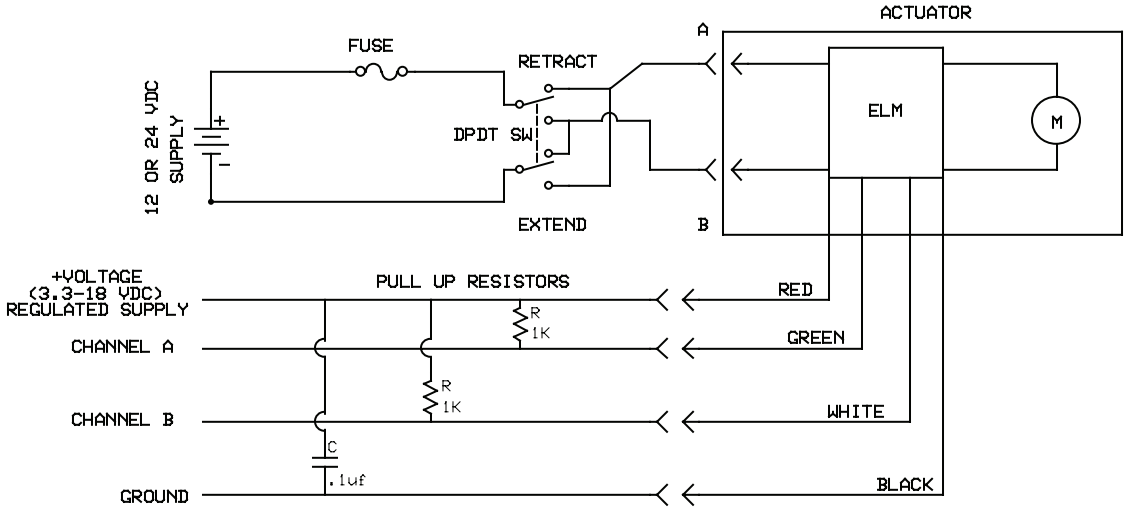


Digital Hall Effect Feedback (Option “D”)

This design utilizes two Hall Effects (in quadrature) triggered by the multi-pole magnet on the rotating motor shaft. The customer’s control must provide a 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 anytime the actuator is stopped, either when power is cut by the customer controlled input or 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).

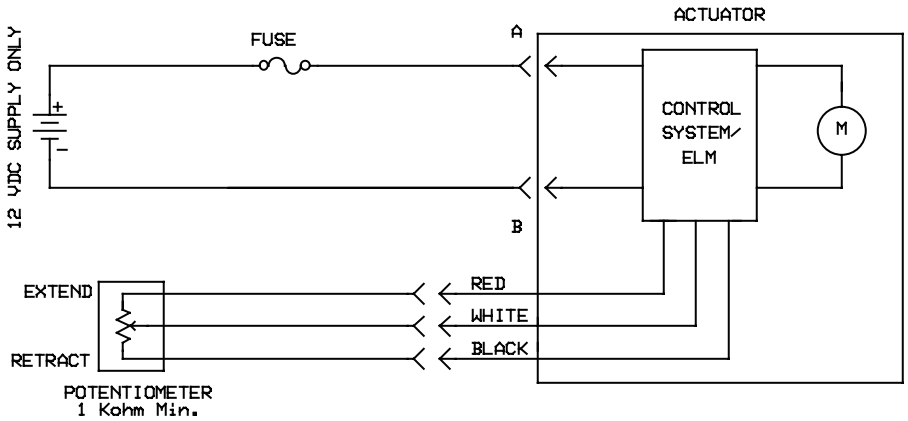


Electronic Load Monitoring with Signal Follower (Option “K”)

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 potentiometer is either 5k for strokes of 6 inches or less or 10k for strokes greater than 6 inches. The actuator control also 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 the “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 power is cut. The ELM circuit will still function as described above for mid-stroke overloads or when the duty cycle is exceeded.

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

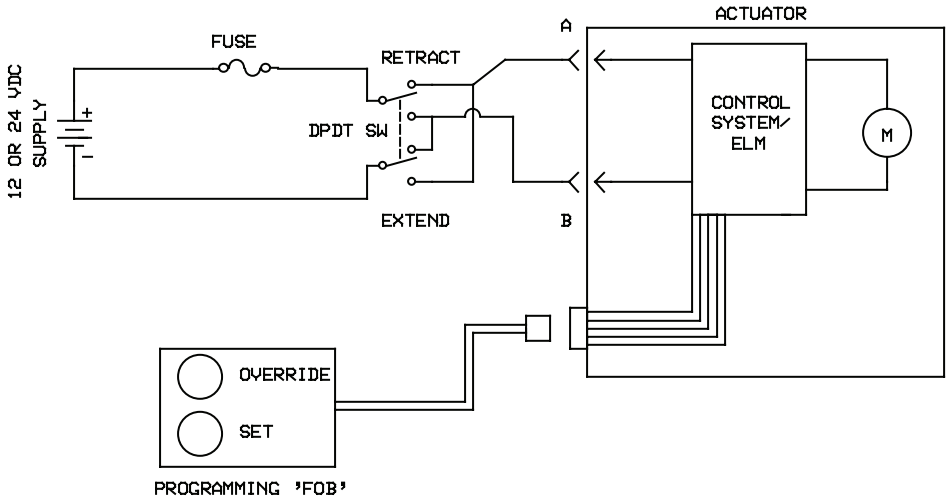
For more repeatable positioning, customers may want to consider a multi-position rotary switch with discreet resistance values.



Programmable Limit Switches (Option “P”)

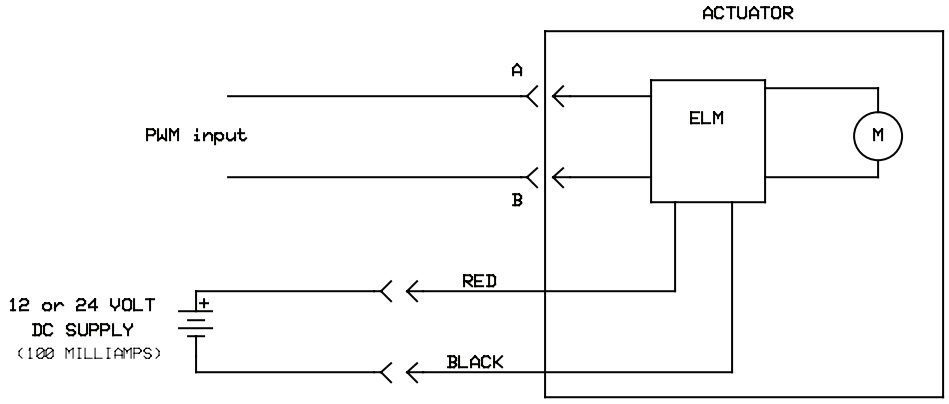
This feature will enable the customer to “program” end limit points in the application without requiring the end of stroke to be limited by either the actuator or the mechanism. These “programmed” points will trigger the ELM circuit to control ends of stroke. The ELM circuit will still function as described 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 plus a 5 wire custom cable connector. A 2-button “Programming FOB” with cable and mating connector is available for programming. With power applied to extend the actuator, the customer presses the O/R (override) button on the “FOB” to manually jog the actuator to the desired extend position and then presses the SET button on the “FOB” to input the position into the microprocessor. Similarly, with power applied to retract the actuator, the customer presses the O/R (override) button on the “FOB” to manually jog the actuator to the desired retract position and then presses the SET button on the “FOB” to input the position into the microprocessor. The microprocessor stores the last two positions programmed into its memory. When the voltage at the potentiometer equals the voltage of one of the “program” settings, the microprocessor will shut power to the actuator via the ELM circuitry. The control will dynamically brake the actuator anytime power is cut, either by the input switch or by ELM activation. The “FOB” can be removed from the actuator once the positions are stored.



Pulse Width Modulated (PWM) Input (Option “W”)

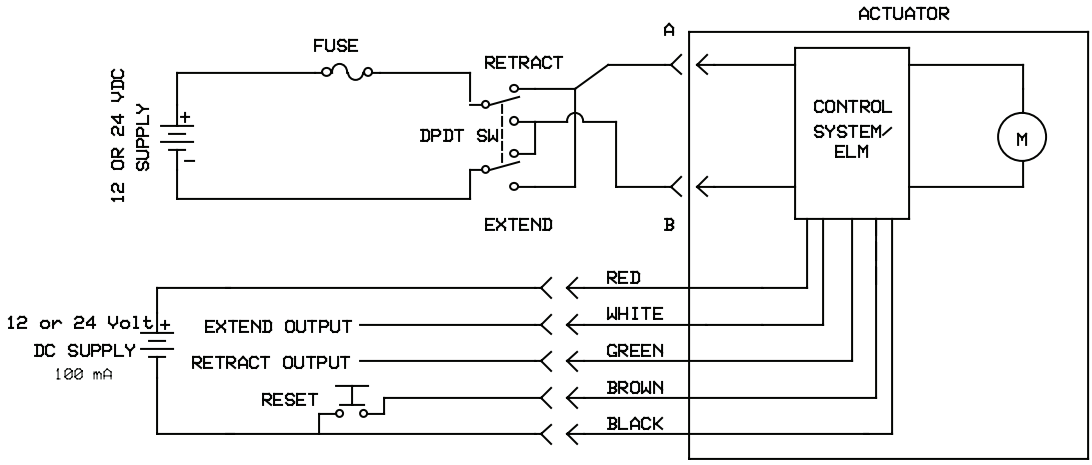
This option allows the customer to control actuator speed and direction through direct input of PWM power into the 2-way integral connector of the actuator. The control is compatible with typical PWM input signals operating between 15 kHz and 25 kHz with duty cycles between 50% and 100%. To power the ELM electronics, the customer must also input a low current (100 milli-amperes) power supply at the standard nominal input voltage (12, 24, or 36 VDC) through 2 secondary leads. In this design, the ELM also monitors the PWM frequency and “on-time” to adjust the minimum speed threshold for operation at lower actuator speeds. The control measures the frequency and duty cycle of the PWM signal and calculates the allowable speed including any temperature compensation. The ELM function still shuts off power to the motor anytime the actuator speed drops below the calculated threshold (either at ends of stroke, or during a mid-stroke overload), or by exceeding a temperature limit (excessive duty cycle).



End of Stroke Indication (Option “R”)

This feature includes a limit switch assembly integral to the actuator that creates a contact closure at fixed end limits. The limits are established at 0.2 inches from the mechanical limit. The contacts have a maximum rating of 20 milli-amps and 24 VDC. The feature includes an anti-rotation feature and does not affect retracted length of the actuator. 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).

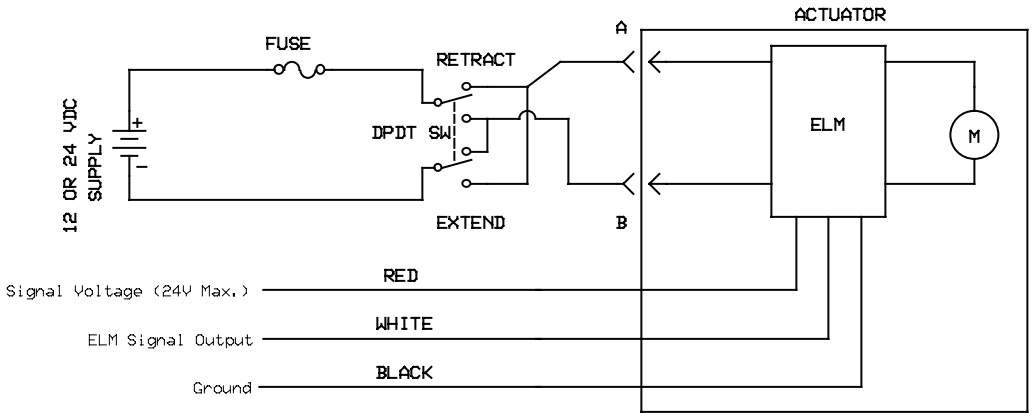
Interconnection is achieved by a 2 wire input to the integral actuator connector with directional control provided via a double-pole, double-throw switch (not provided) with a contact rating for actuator rated load current, and 3 connections to monitor the two end of stroke contact closures.



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 20 milli-amps and 24 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.

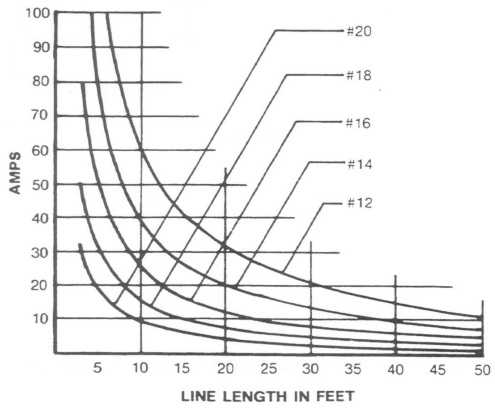


Figure 5. Wire Gauge Selection Chart

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.

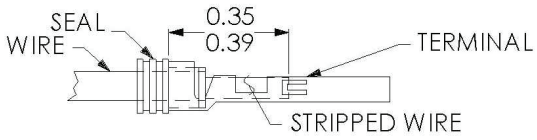


Figure 6. Terminal Assembly

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

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.

Switches

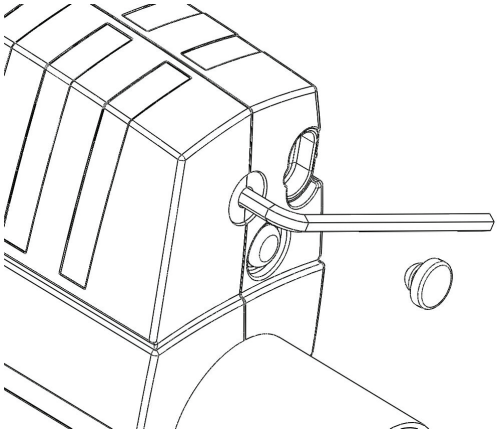
Pro-Series DC actuators require double-pole, double-throw switches. McGill 0121-004, Cutler Hammer 8835-K4, or equivalent are recommended and can usually be obtained locally. The required switch can also be purchased from Thomson under part number 830-8004-016.

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

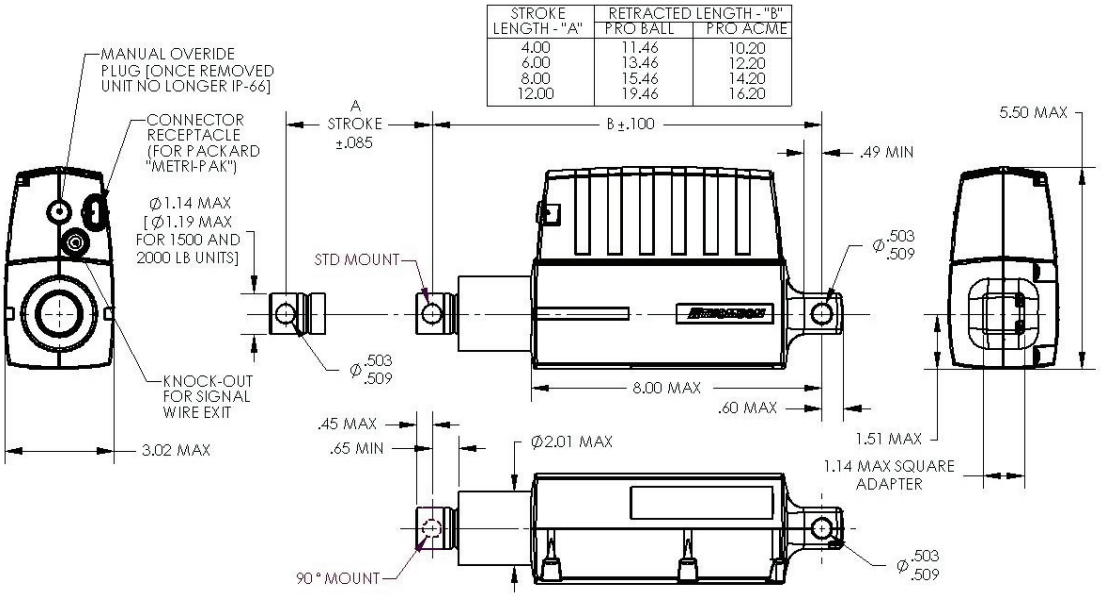
The chart below may be helpful in isolating malfunctions in the control system, countering difficulties with system start-up, and in troubleshooting for worn or broken components in units that have been operating for some time. For proper diagnosis, it is important to do all tests prior to returning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

Symptoms: Actuator will not extend or retract		
Checkpoint	**Probable Cause**	**Possible Solution**
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
Symptom: Actuator Stops mid-stroke		
Checkpoint	**Probable Cause**	**Possible Solution**
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.



STROKE LENGTH - "A"	RETRACTED LENGTH - "B" PRO BALL	PRO ACME
4.00	11.46	10.20
6.00	13.46	12.20
8.00	15.46	14.20
12.00	19.46	16.20

Electrak Pro

1	2	3	4	5	6	7
PR24	20-8B65	-	04	R	C	S

1. Model and input voltage
PR12 = Electrak Pro, 12 Vdc
PR24 = Electrak Pro, 24 Vdc

2. Dynamic load capacity and screw type
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

3. Protection class
- = IP66 (standard)
E = IP67

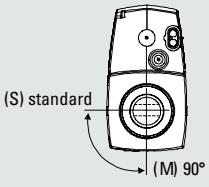
4. Stroke (S)
04 = 4 inch
06 = 6 inch
08 = 8 inch
12 = 12 inch

5. Control PCB options
S = electronic load monitoring, ELM (standard)
D = ELM + encoder
L = ELM + linear potentiometer[1]
P = ELM + programmable limit switches[1]
T = ELM + low level power switching[2]
R = ELM + end of stroke indication outputs[1]
U = ELM + ELM trip indication output
W = ELM + PWM speed control monitoring
K = ELM + signal follower input[1/2]

6. Front adapter and anti-rotation options
C = freely rotatable cross hole, no anti-rotation
S = cross hole in standard position, anti-rotation[3]
M = cross hole rotated 90°, anti-rotation[3]

7. Finish
S = no paint (standard)
B = actuator painted black

[1] Requires anti-rotation mechanism.
[2] Only possible on 12 Vdc input voltage models.
[3] Definition of cross hole positions.



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