



**PROMATION
ENGINEERING**

Precision Actuation for Industry

Installation & Operation Manual

**This IOM is for the following
ProMation Engineering Products:**

P2-12N4+ACDC

P2-24N4+ACDC

P2-120N4

P2-230N4

P2S-12N4+ACDC

P2S-24N4+ACDC

P2S-120N4

P2S-230N4

P3-12N4+ACDC

P3-24N4+ACDC

P3-120N4

P3-230N4

P3S-12N4+ACDC

P3S-24N4+ACDC

P3S-120N4

P3S-230N4

Valid for the following Options

- TS - Torque Switch equipped**
- 68 - IP68 compatible enclosure**
- SS - Stainless Steel enclosure**

Field Manual

P2/3

12/24VDC 24/120/230VAC

On/Off/Jog Control

ISO5211 Mount F07 F10 8P22

Imperial Mount S 3.25in BHC, 0.75x0.5in DD
Imperial Mount L 3.25/5in BHC, 0.875x0.625in DD



Actuator Sizes and Voltage Options

	Product Family	Torque Output		Voltage Options				
		in lbs	Nm	12DC	24DC	24AC	120AC	230AC
Actuators In This IOM	P2	800	90	✓	✓	✓	✓	✓
	P3	1,335	150	✓	✓	✓	✓	✓
	P4	3,500	400	✓	✓	✓	✓	✓
	P5	4,400	500	✓	✓	✓	✓	✓
	P6	5,750	650	✓	✓	✓	✓	✓
	P7	8,900	1,000		✓	✓	✓	✓
	P8	13,250	1,500		✓	✓	✓	✓
	P9	17,500	2,000				✓	✓
	P10	22,000	2,500				✓	✓
	P11	26,500	3,000				✓	✓
	P12	31,000	3,500				✓	✓
	P13	40,000	4,500				✓	✓

FM_P2-8 ISO Imp HV LV N4 TS_Ver P 121522

Product Specifications

Actuator Specifications	P2				P3			
	800”lbs/90Nm				1335”lbs/150Nm			
Torque “lb/Nm								
Supply Voltage	12vdc	24vac/vdc	120vac	230vac	12vac/vdc	24vac/vdc	120vac	230vac
Max Inrush Current	5.2A	4.5A	1.8A	0.8A	4.9A	5.0A	1.8A	1.2A
Running Current	3.4A	2.2A	1.0A	0.5A	4.4A	2.4A	1.2A	0.5A
Motor	DC Brush Type		Split Phase Capacitor		DC Brush Type		Split Phase Capacitor	
Runtime (90°@60Hz/vdc)	15 sec				22 sec			
Runtime (90°@50Hz)	15 sec		17 sec		22 sec		26 sec	
Duty Cycle	75%		25%		75%		25%	
Motor Starts	1200 per hour							
Weight	26lbs/12kg (29lbs/13kg w/ -TS)							
Mechanical Connections	ISO5211 of Imperial							
Electrical Entry	(2) ISO5211 3/4” NPT Imperial 1/2” NPT							
Electrical Terminations	12-16ga							
Environmental Rating	NEMA 4/4X IP67							
Manual Override	5” Handwheel							
Control	On/Off/Jog							
Actuator Case Material	Aluminum Alloy, Powder coated							
Motor Protection	230°F/110°C Thermal F* Class *Totally Enclosed Non-Ventilated Motors							
Ambient Temperature	-22°F to +125°F							
Operating Range	-30°C to +52°C							

Introduction

This document provides necessary information for set-up, calibration, testing and use of the P Series quarter-turn electric actuators stated on the cover page. Each unit is shipped from the factory with initial calibration of mechanical stops, cams and switches completed for 0-90 degree operation. However, these are general settings and serve as a starting point for proper calibration of the actuator in its real-world application.

Safety

Safety is a basic factor any time you maintain and operate mechanical equipment. Appropriate handling methods and proper use of tools and personal protective equipment (PPE) can help prevent serious accidents which can cause injuries to you or a fellow worker. This manual was created to enable a trained user to install, adjust and troubleshoot your ProMation actuator.

Only competent and trained personnel should install, maintain and operate ProMation actuators. Any work related to this actuator must be carried out in accordance with this manual and related codes and regulations. Local workplace health and safety rules must always be followed.

Duty cycle

Duty cycle is the percent of time that an actuator spends running as a fraction of the total time. Duty Cycle is directly related to heat; excessively repositioning an actuator typically results in motor overheating which can cause permanent damage and/or reduced service life.

Duty cycle can be calculated as follows:

(example P2 series actuator running 3 seconds ON and 30 seconds OFF)

Runtime = 3s, Total time = 3s + 30s = 33s, therefore this duty cycle would be 9% (3/33)

Additionally, ProMation P series actuators are designed for a maximum of 1200 starts per hour (one start every 3 seconds maximum).



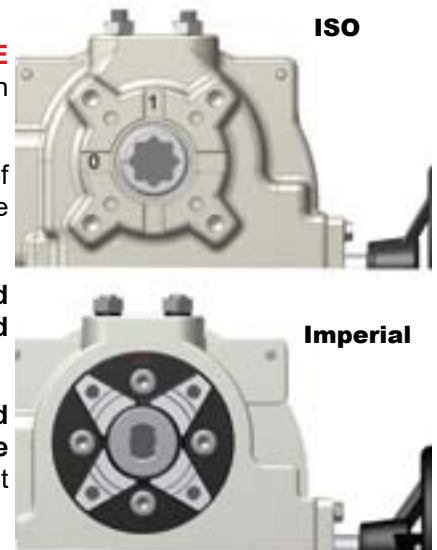
Shipping and Handling

1. This actuator is shipped in the FULLY **CW** position (2 color position indicator shows "**CLOSE**").

For ISO5211 Mount, a Reference Dimple aligns with "0" for **CW** position (**CLOSE** on the indicator) and the "1" mark is the **CCW** position (**OPEN** on the position indicator).

For Imperial Mount, the long axis of the Double D is perpendicular to the axis of the handwheel in the **CW** position. For shaft drives, the Keyways align toward the mechanical endstops and toward the handwheel in the **CW** position.

2. **Storage: This unit should NOT be stored outside unless it is powered up and has proper conduit terminations. When NOT powered up, it should be stored in a clean, dry environment at all times.**
3. This actuator has been **factory calibrated to operate between 0 degrees and 90 degrees. Most quarter-turn products will not require recalibration of these settings.** Check alignment of actuator and driven device. If any travel adjustment is necessary, please refer to pages 5-7 for instructions.



Product Mounting and Setup

1. Fully CLOSE the valve or damper to which the actuator is to be mounted.
 - Keep in mind this actuator rotates CW (as viewed from above the unit) when driving CLOSED.
2. Assemble necessary linkage components and attach the actuator to the driven device.
3. Tighten mounting bolts, making sure actuator is centered on the device drive shaft.
4. Utilize the handwheel to check for unobstructed manual operation from fully CCW to fully CW positions BEFORE applying power to the unit.
5. Torque Switches (2), if so equipped, are factory set and **are NOT adjustable**.
6. Make the electrical connections per wiring diagram on page 4, depending on your model.
 - Connect POWER AND CONTROL to terminals marked 1, 2, 4, and 6.
 - Terminals 7-12 on the switch card (430-10100) are for the (adjustable) aux switches. They are dry type Form C rated 15A @ 250vac MAX.
7. Follow all rules and regulations for installing electrical equipment per applicable electrical code.
8. Do NOT apply power at this time.

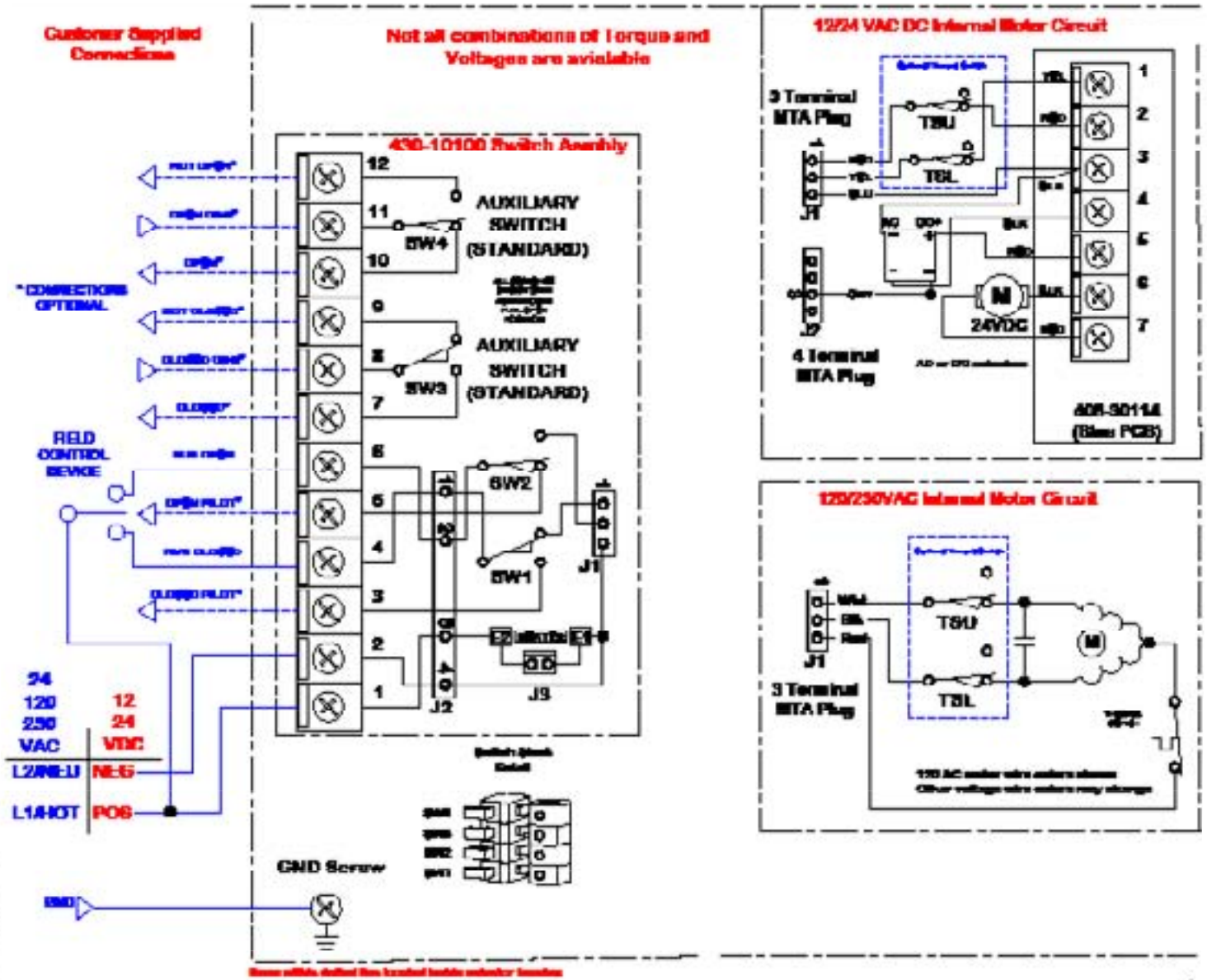
Installation Notes

- These actuators are designed to be used between a horizontal and upright position. Do NOT mount the assembly with the actuator top below a horizontal position.
- When installing conduit, use proper techniques for entry into the actuator. Use drip loops to prevent conduit condensate from entering the actuator.
- Mechanical travel stops are factory calibrated for 90 degree operation. These stops are NOT designed to adjust mechanical rotation by more than +/- 3 degrees, they are for positioning the handwheel only.
- Both NPT conduit ports MUST use proper equipment to protect the rated integrity of the housing.
- The internal heater is to be used in ALL applications.
- Do NOT install the actuator outdoors or in humid environments unless it is powered up and the heater is functioning.
- Use proper wire size and power supplies to prevent actuator failure.
- All terminals accept 12-16AWG solid/stranded wire.
- **Do NOT parallel wire multiple actuators together without utilizing isolation relays! Contact ProMation Engineering for a multiple actuator parallel wiring diagram.**
- **NE PAS mettre en parallèle des actionneurs multiples simultanément sans utiliser de relais d'isolement! Contactez ProMation Engineering pour un diagramme de câblage parallèle à plusieurs actionneurs.**



Identifying Torque Switch Units:

- -TS in Product Name
- Units with Torque Switches have additional switches mounted on the motor plate (see photo).



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Adjusting the actuator CW position

Serious Damage to the actuator will result if the motor is allowed to drive the gear train into the mechanical stop!! Remove power from this device BEFORE making any travel adjustments.

This actuator has been factory calibrated to operate between 0 degrees and 90 degrees. Most quarter-turn products will not require recalibration of these settings. Proceed **ONLY** if adjustments are required.



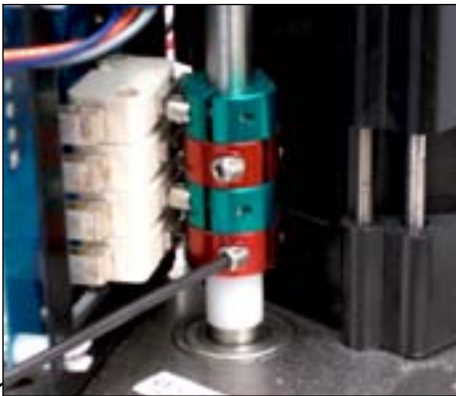
CW Mechanical Stop

Loosen Mechanical Stop

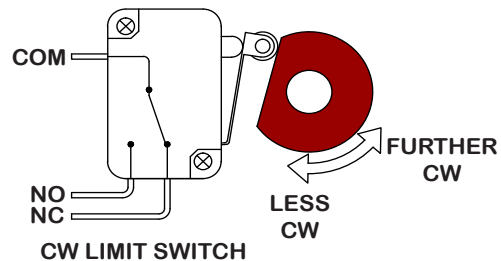
1. BEFORE power is applied, use a 17mm wrench and a 5mm hex key to loosen the RIGHT SIDE mechanical stop. This is the CW stop limit adjustment. Turn the stop screw 5-6 turns CCW to allow electrical cam stop adjustment without running into the mechanical stop screw.
2. Use the manual hand wheel to position the actuator to your required CW position. This must be within +/- 3 degrees of the factory setting.

Adjust Cam 1

3. The lower cam is Cam 1, the CW end-of-travel adjustment. Once the actuator is at its required CW position, with POWER OFF, use a 2.5mm hex key to free up the cam set screw. Once it is free, rotate the hex key to the RIGHT 10-15 degrees to reset the switch roller arm. Then snug the set screw up against the camshaft (CW) until slight pressure is felt. Then SLOWLY rotate the hex key pushing the cam to the LEFT until you hear the “click” on the bottom switch indicating that correct adjustment has been achieved. Tighten the set screw.



Cam 1



4. Apply power to the actuator and drive CCW at least 15-20 degrees. Then drive the actuator CW until the cam stops the electrical travel. Check to be sure this is the correct CW position you require. Repeat step 3 if further adjustment is needed.

Tighten Mechanical Stop

5. While holding the 17mm wrench on the RIGHT SIDE jam nut to prevent the jam nut from locking, turn the 5mm hex key CW until the end of the stop screw bottoms out against the internal stop boss. Then turn the hex key ONE FULL TURN CCW before locking that adjustment with the jam nut. This procedure assures that the actuator reaches its end of travel electrically before there is any interference from the mechanical stop.
6. This completes the CW position calibration.



CW Mechanical Stop

The mechanical stop screw limits handwheel operation ONLY and is NOT to be used as an electrical travel limiting device.

Adjusting the actuator CCW position

Serious Damage to the actuator will result if the motor is allowed to drive the gear train into the mechanical stop!! Remove power from this device BEFORE making any travel adjustments.

This actuator has been factory calibrated to operate between 0 degrees and 90 degrees. Most quarter-turn products will not require recalibration of these settings. Proceed **ONLY** if adjustments are required.



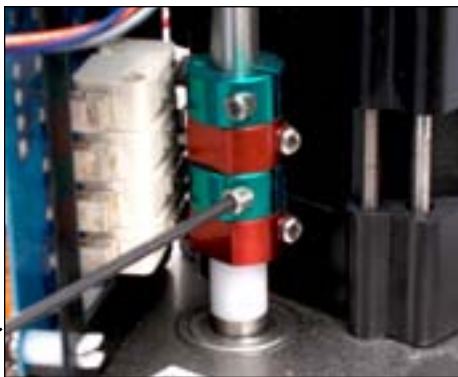
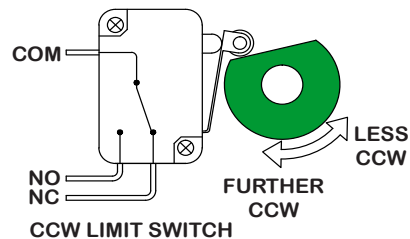
CCW Mechanical Stop

Loosen Mechanical Stop

1. BEFORE power is applied, use a 17mm wrench and a 5mm hex key to loosen the LEFT SIDE mechanical stop. This is the CCW stop limit adjustment. Turn the stop screw 5-6 turns CCW to allow electrical cam stop adjustment without running into the mechanical stop screw.
2. Use the manual hand wheel to position the actuator to your required CCW position. This must be within +/- 3 degrees of the factory setting.

Adjust Cam 2

3. The second cam is Cam 2, the CCW end-of-travel adjustment. Once the actuator is at its required CCW position, with POWER OFF, use a 2.5mm hex key to free up the cam set screw. Once it is free, rotate the hex key to the LEFT 10-15 degrees to reset the switch roller arm. Then snug the set screw up against the camshaft (CW) until slight pressure is felt. Then SLOWLY rotate the hex key pushing the cam to the RIGHT until you hear the "click" on the second switch indicating that correct adjustment has been achieved. Tighten the set screw.



Cam 2

4. Apply power to the actuator and drive CW at least 15-20 degrees. Then drive the actuator CCW until the cam stops the electrical travel. Check to be sure this is the correct CCW position you require. Repeat step 3 if further adjustment is needed.

Tighten Mechanical Stop

5. While holding the 17mm wrench on the LEFT SIDE jam nut to prevent the jam nut from locking, turn the 5mm hex key CW until the end of the stop screw bottoms out against the internal stop boss. Then turn the hex key ONE FULL TURN CCW before locking that adjustment with the jam nut. This procedure assures that the actuator reaches its end of travel electrically before there is any interference from the mechanical stop.



CCW Mechanical Stop

6. This completes the CCW position calibration.

The mechanical stop screw limits handwheel operation ONLY and is NOT to be used as an electrical travel limiting device.

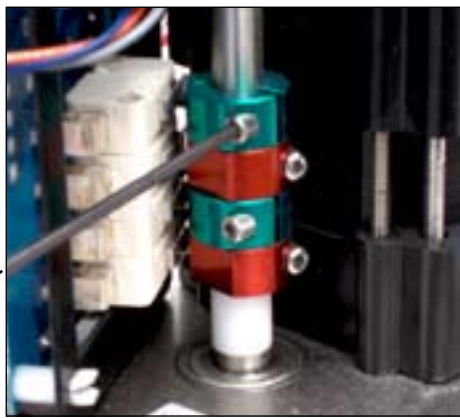
Adjusting the actuator Auxiliary Switches



Cam 3

Adjust Cam 3

1. The THIRD cam is Cam 3, the CW auxiliary switch adjustment. Drive the actuator to its CW position. Then use a 2.5mm hex key to free up the cam set screw. Once it is free, rotate the hex key to the RIGHT 10-15 degrees to reset the switch roller arm. Then snug the set screw up against the camshaft (CW) until slight pressure is felt. Then SLOWLY rotate the hex key and cam to the LEFT until you hear the “click” on the third switch. Continue to rotate the cam between 3 and 5 degrees to the LEFT to make sure the auxiliary cam switch changes state before the actuator reaches its end of travel electrically. Tighten the cam set screw.



Cam 4

Adjust Cam 4

1. The FOURTH cam is Cam 4, the CCW auxiliary switch adjustment. Drive the actuator to its CCW position. Then use a 2.5mm hex key to free up the cam set screw. Once it is free, rotate the hex key to the LEFT 10-15 degrees to reset the switch roller arm. Then snug the set screw up against the camshaft (CW) until slight pressure is felt. Then SLOWLY rotate the hex key to the RIGHT until you hear the “click” on the fourth switch. Continue to rotate the cam between 3 and 5 degrees to the RIGHT to make sure the auxiliary cam switch changes state before the actuator reaches its end of travel electrically. Tighten the cam set screw.

SPECIAL NOTES FOR STAINLESS STEEL ENCLOSURES



Operation of Stainless Steel enclosure actuators is the same as standard aluminum enclosure actuators.

The internal components of actuators with stainless steel (SS316) enclosures are the same as those with aluminum enclosures.

There is no powder coating on the stainless enclosures. An anti-seize lubricant (Molykote P-37, Dow Corning) has been applied to the bolts and mating surfaces of the top and gear enclosures. Anti-seize material may be reapplied as needed.

Stainless Steel Special Notes

- CAUTION - Stainless steel actuators are heavier than actuators with aluminum enclosures.
- Do not use powered devices to remove or install enclosure bolts.
- Do not overtighten enclosure bolts.
- Apply anti-seize agent to bolts and mating surfaces as needed.

SPECIAL NOTES FOR IP-68 ENCLOSURES

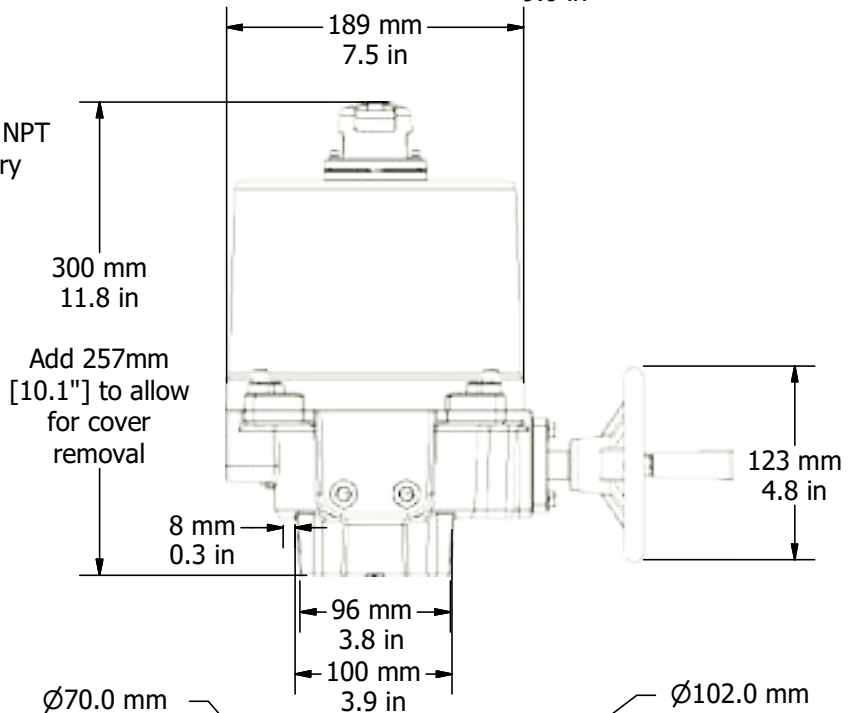
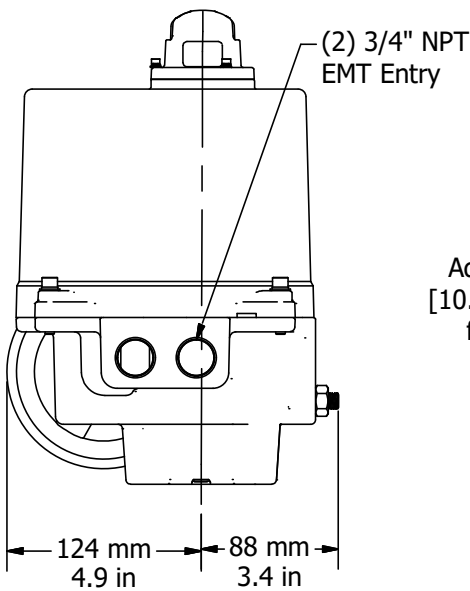
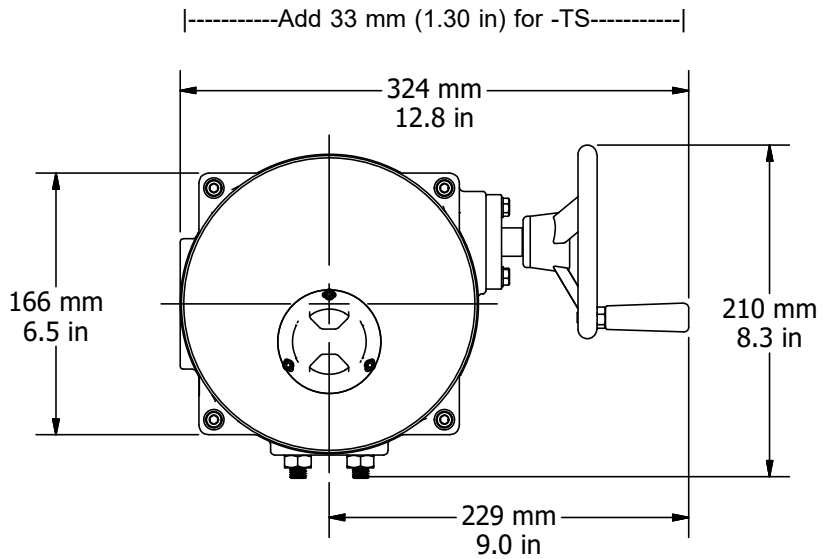
Standard ProMation Actuator enclosures are certified to IP67, immersion in 1m water for 30 minutes

Optional **-68** actuator enclosures are certified to IP68, immersion in 7m water for 72 hours. Both per ANSI/IEC 60529 -Degrees of protection provided by enclosures.

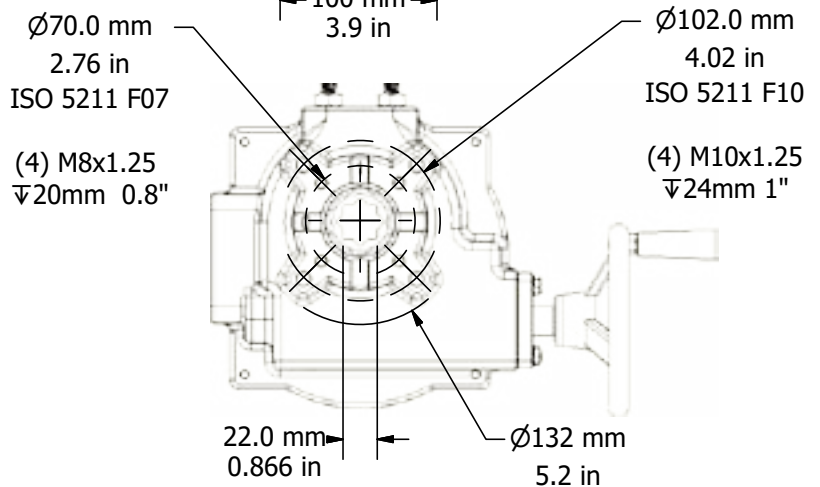
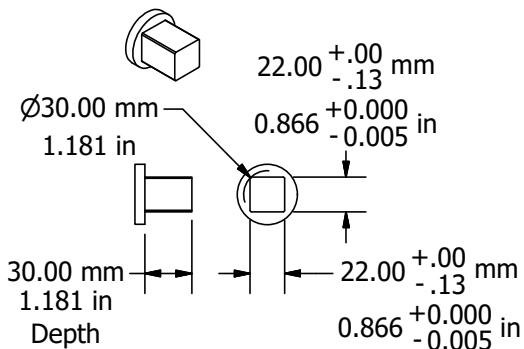
Mechanical Data

P2/3 Series Dimensional Data

ISO 5211 Mount



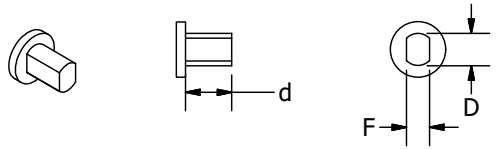
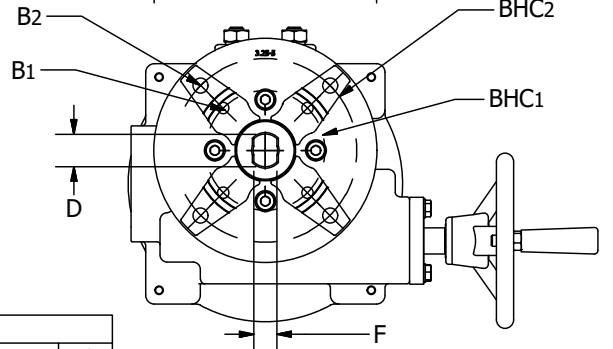
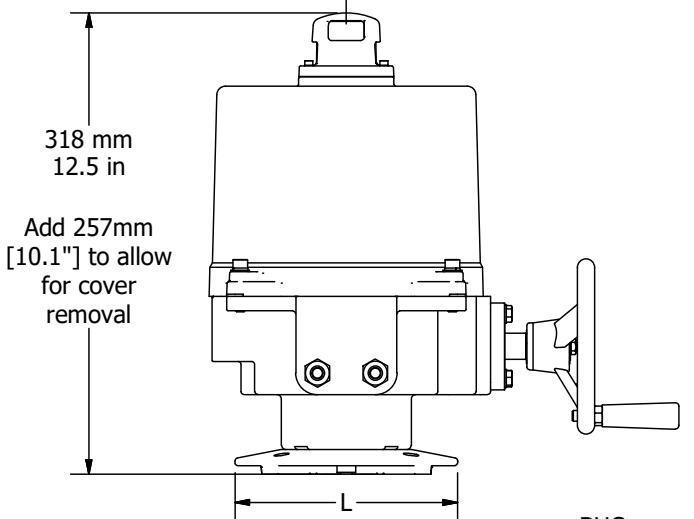
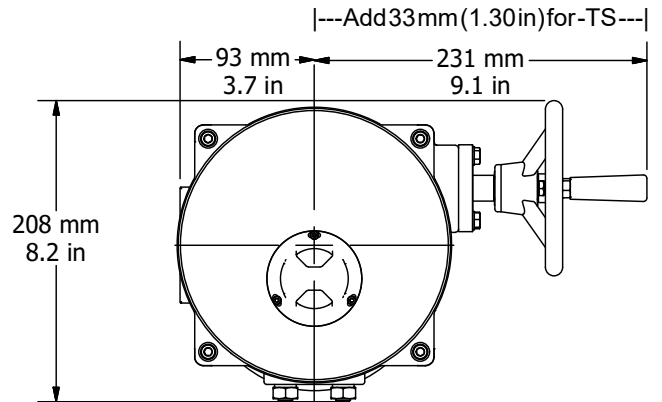
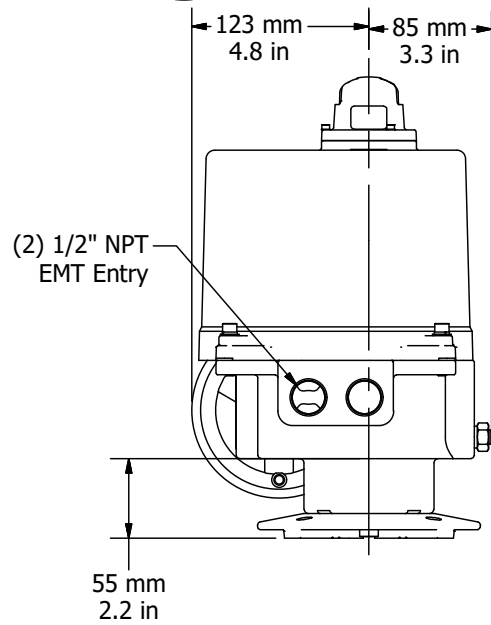
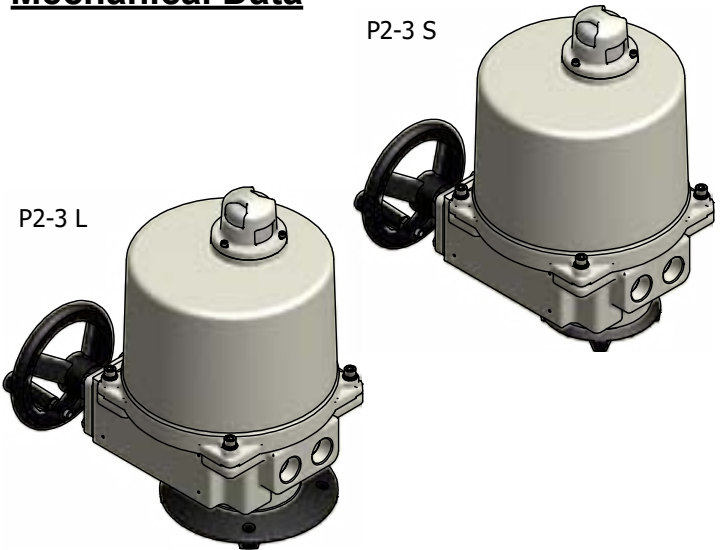
Drive Coupling Fabrication Data



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Mechanical Data

P2/3 Series Dimensional Data Imperial Mount



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Dimensions											
Model	Unit	D	F	d	L	BHC1	B1	B1 Depth	BHC2	B2	B2 Depth
P2-3 S	in	0.75	0.5	1.26	4.1	3.25	3/8-16 UNC	0.56			
	mm	19.05	12.7	32	105	82.6		14.2			
P2-3 L	in	0.875	0.625	2	6.1	3.25	3/8-16 UNC	0.56	5	1/2-13 UNC	0.63
	mm	22.23	15.88	50.8	154	82.6		14.2	127		16

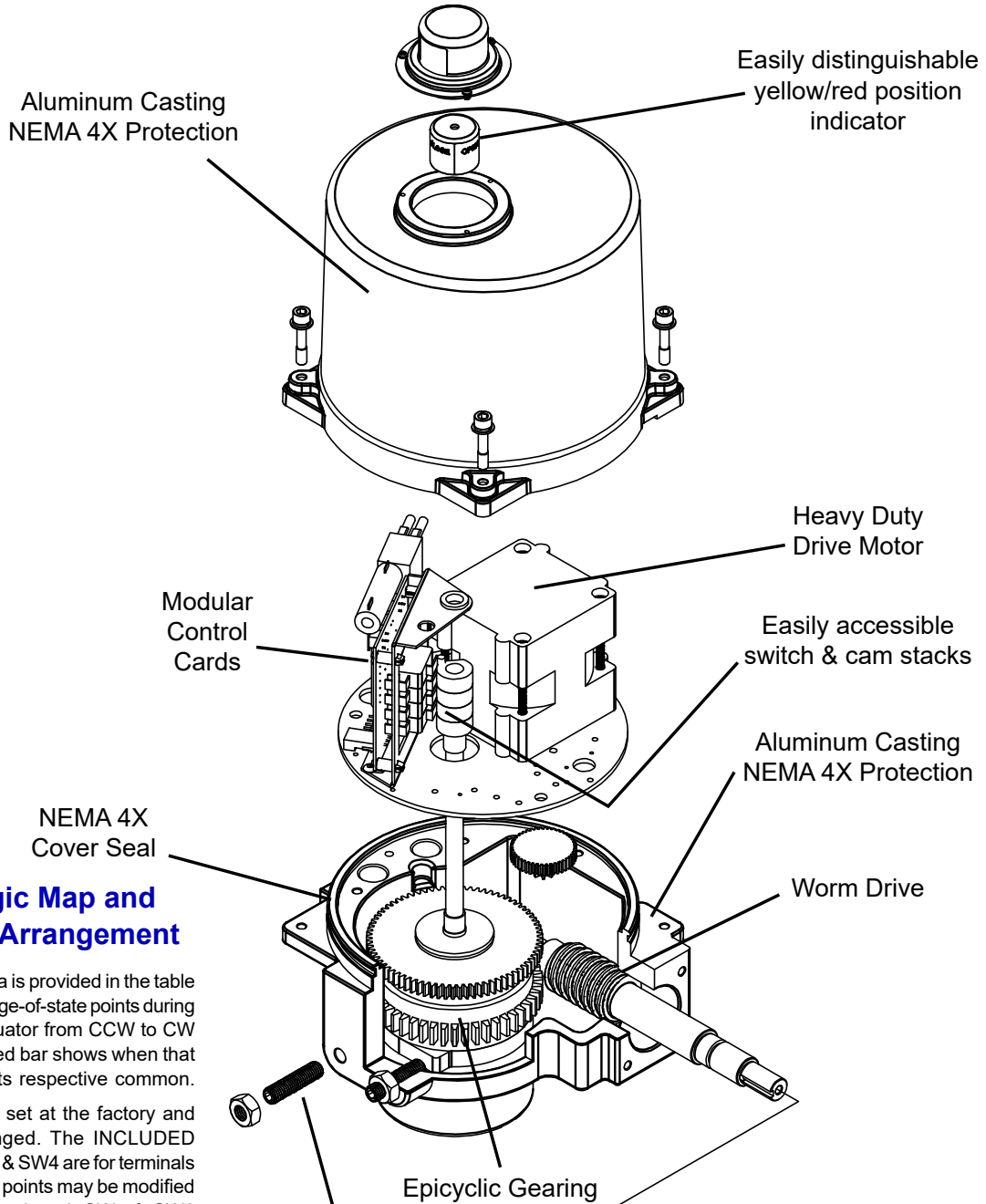
Single Mount Only



Mechanical Data

P Series Exploded View

(P2/3-120N4 unit is shown)



Switch Logic Map and Switch/Cam Arrangement

Switch sequencing data is provided in the table below to show the change-of-state points during the rotation of the actuator from CCW to CW and back again. The red bar shows when that terminal makes with its respective common.

Switches 1 and 2 are set at the factory and should NOT be changed. The INCLUDED auxiliary switches SW3 & SW4 are for terminals 7 thru 12 and those set points may be modified if need be. When so optioned, SW5 & SW6 auxiliary switches are initially set to function the same as auxiliary switches SW3 & SW4.

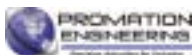
	cw			ccw		
	-5°	0°	5°	85°	90°	95°
12	Not Open					
11	Open Switch Common					
10	Open					
9	Not Closed					
8	Closed Switch Common					
7	Closed					

SW4 CCW AUX
(Factory Set - Adj)

SW3 CW AUX
(Factory Set - Adj)

Used by
Controller

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Commissioning

After completing all mounting and wiring procedures and main power is available, it is now possible to commission the actuator.

1. Utilize the handwheel to rotate the actuator and damper, valve or other connected device through its full travel from fully CW to fully CCW and back again to check for any possible interference.
 - Do NOT utilize any mechanical advantage devices to rotate the handwheel (pipes, wrenches, extension bars, etc.).
2. Manually position the actuator to its mid-stroke position.
3. Make certain the 3 wire orange plug is fully seated on the 3-pin receptacle on the switch board.
4. Apply correct power to the unit.
 - 4.A Measure correct power on terminals 1 (Hot / L1) & 2 (Neu / L2) on the switch board.
 - 4.B Measure correct power on the two heater terminals on the switch board.
5. Command the field device to generate a CCW signal. The actuator rotates in a CCW direction (as viewed from above).
 - Measure terminals 2 and 6 for correct voltage (matching that measured in step 4.A).
 - Actuator will stop when it reaches it's fully CCW position.
6. Command the field device to generate a CW signal. The actuator rotates in a CW direction (as viewed from above).
 - Measure terminals 2 and 4 for correct voltage (matching that measured in step 4.A).
 - Actuator will stop when it reaches it's fully CW position.
7. Generate a mid-position signal at the field device to move the actuator off its full CW trip position.
8. Actuator is now commissioned and operational.

Commissioning for TS units

TS units incorporate a torque overload protection system. In NORMAL operating mode, the torque switch drive cam is in this position:

WARNING! Do NOT adjust the torque switch cam settings. This will VOID the warranty.

High Torque Switch (top) for CW Output Drive Rotation

High Torque Switch (bottom) for CCW Output Drive Rotation



Torque Switch cams shown in the NORMAL operating position (No high torque situations)

Testing Torque Switch Electrical Operation



Test Torque Switch functions

1. **Generate a 4mA or 20mA control signal and let the actuator drive towards that CW or CCW position.**
2. **As the motor is running, simulate a torque switch event: Depress the top or bottom torque switch and hold it (one will immediately stop the motor).**
3. **Release the torque switch.**
4. **Test recovery from the torque switch event.**
 - Move the handwheel 2° in either direction
 - Signal the motor to drive.
5. **Repeat steps 5.A through 5.D in the opposite direction (20mA or 4mA) to test the opposing direction torque switch functionality.**



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