



# PROMATION ENGINEERING

*Precision Actuation for Industry*

## Installation & Operation Manual

This IOM is for the following  
ProMation Engineering Products:

**PL680-12PN4-AC/DC**

**PL680-24PN4-AC/DC**

**PL680-120PN4**

**PL680-230PN4**

**PL680-12PN7-AC/DC**

**PL680-24PN7-AC/DC**

**PL680-120PN7**

**PL680-230PN7**

# Field Manual PL680\_LV\_HV Proportional Control



PL-120PN4 shown  
with optional linkage  
assembly and valve  
stem coupler

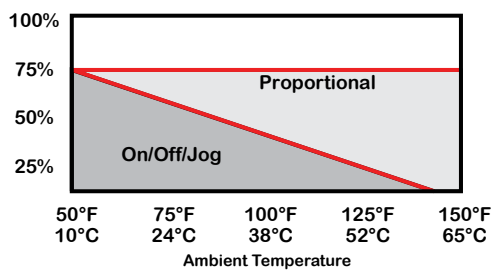
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# Product Specifications

Actuator Specifications	PL680	
Force	680”lbs/3kN	
Supply Voltage	12/24vac/dc	120/230
Max Inrush Current	2.0 / 1.1	0.6 / 0.4
Running Current	1.9 / 1.1	0.6 / 0.3
Motor	DC Brush Type / AC split capacitor	
Runtime	0.8mm/sec / 0.03in/sec	
Max Stroke	32mm / 1.25in	
Duty Cycle	75%	
Motor Starts	1200 per hour	
Weight	7lbs/4kg	
Mechanical Connections	ISO5211 F05/F07(F07 only N7) 8pt 17mm	
Electrical Entry	(2) 1/2” NPT	
Electrical Terminations	14-18ga	
Environmental Rating	NEMA 4/4X	
Manual Override	5mm Hex Drive	
Control	Modulating	
Actuator Enclosure	NEMA4X standard/NEMA7/9 optional	
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

The following procedure is to be followed for set-up, calibration, testing and use of the PL Series linear electric actuators. Each unit is shipped from the factory with initial calibration of cams and switches completed for full up and down travel and operation. However, these are general settings and serve as a starting point for proper calibration of the actuator in its real-world application. There are no mechanical stops on this model.

## Safety

Safety is a basic factor any time you maintain and operate mechanical equipment. Use of proper handling methods, tools and clothes can help prevent serious accidents -- 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 PL Series actuator.

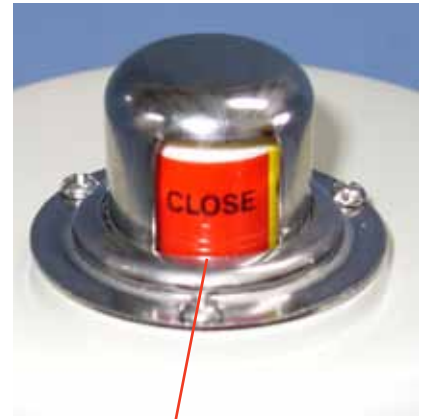
Only competent and trained personnel should install, maintain and repair ProMation Actuators. Any work related to this Actuator must be carried out in accordance with this manual and related codes and regulations. Local workplace health and safety rules should always be followed.

## 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; overusing an actuator typically results in motor overheating which can permanently damage it. Overheating also consumes more electricity. Generally speaking, the hotter a motor becomes, the longer 'rest' it needs to cool down so it runs efficiently.

## Shipping and Handling

1. This actuator is shipped in the FULLY Stem Down (position indicator shows “CLOSE”) position.
2. **NOTE, THIS ACTUATOR MUST HAVE WATER TIGHT EMT FITTINGS, WITH CONDUIT DRAINAGE INSTALLED AND POWER SUPPLIED TO UNIT TO KEEP THE HEATER WARM AT THE TIME OF INSTALLATION.**
3. **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.**
4. This actuator has been **factory calibrated to operate between the down position and maximum up position.** If any travel adjustment is necessary, please refer to pages 7 & 8 for instructions.
5. **The actuator CANNOT operate with the stem any further down.**



The actuator is shipped from the factory in its fully Closed position. The top illustration shows Red closed, Yellow open

## Product Mounting and Setup

1. Fully CLOSE the valve or damper to which the actuator is to be mounted.
  - In Direct Acting Mode, the stem connector travels DOWN. THIS UNIT IS CALIBRATED FOR ITS MAXIMUM CLOSED (DOWN) POSITION. DO NOT ADJUST FURTHER CLOSED!! DAMAGE WILL OCCUR!!
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 manual override (5mm hex key output drive on side of the actuator) to check for unobstructed manual operation and set the potentiometer from fully DOWN to fully OPEN positions BEFORE applying power to the unit.

**Warning: DO NOT operate manual override when power is present. Geartrain damage and personal injury may occur.**

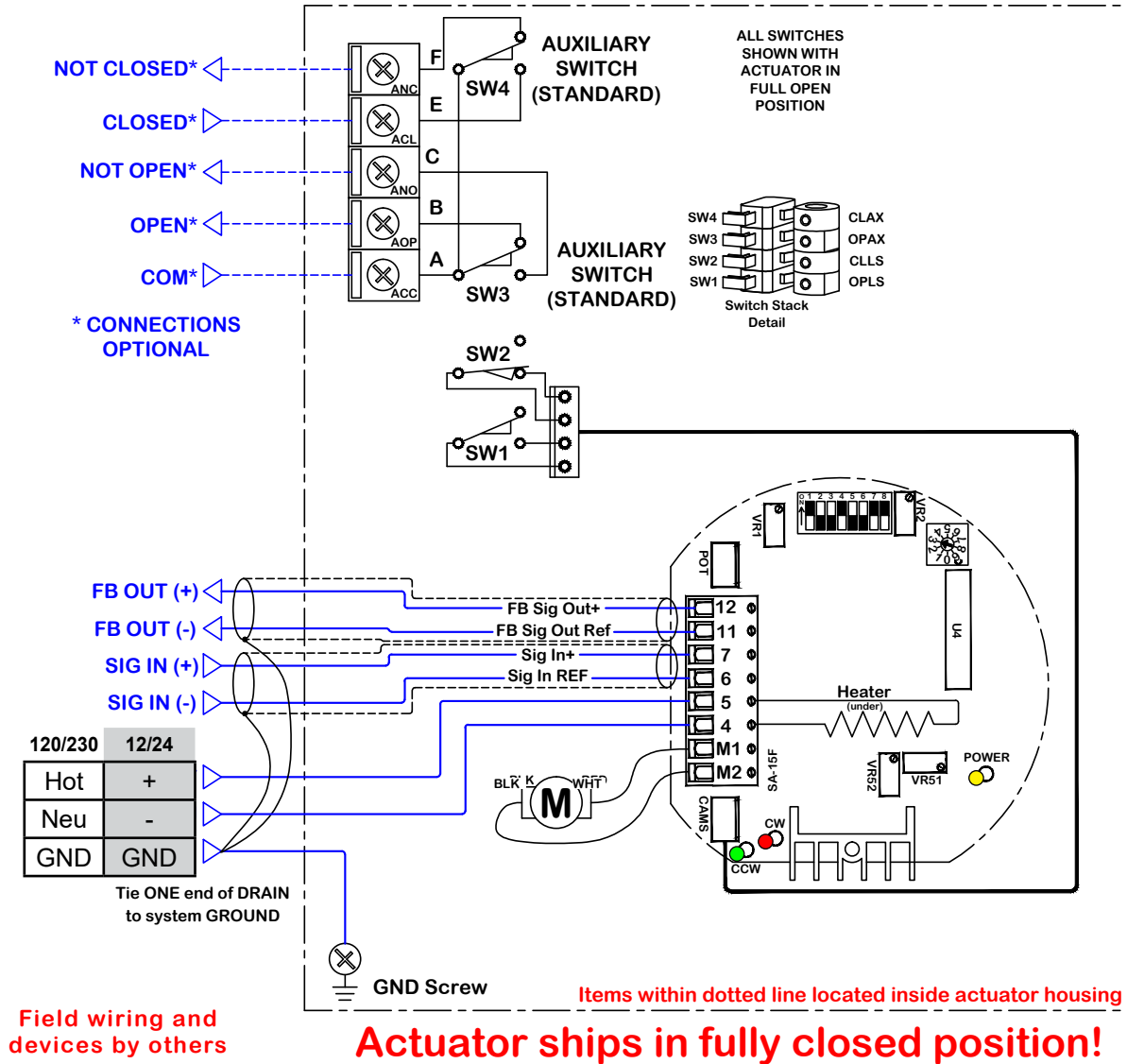
**Do not use powered tools to turn the manual override -- it will DAMAGE the gear train or motor and VOID the warranty.**

5. Make the electrical connections per wiring diagram on page 4.
  - Connect HOT and NEUTRAL to terminals marked 5 & 4 respectively.
  - Actuator accepts a 4-20mA (default), 2-10VDC, or 1-5VDC signal.
  - Connect control wires to the control card terminals marked 6 (COM) and 7 (+IN). The positive wire MUST connect to terminal 7 or the controller will not function.
  - Wires may be connected to terminals marked 11 (COM) and 12 (+OUT) for remote position indication.
  - Terminals A-F on the switch card are for the (adjustable) aux switches. They are dry type Form C rated 3A @ 250vac MAX.
  - The drain wire on the signal cables must be grounded at ONE END ONLY! (Preferably at the supply end).
6. Do NOT apply power at this time.

## Installation Notes

- There are no mechanical stops on this model.
- 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.
- Both NPT conduit ports MUST use proper equipment to protect the NEMA 4X/7/9 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 to prevent actuator failure (see chart on page 4 for proper wire sizing).
- All terminals accept 14-18AWG solid/stranded wire.

**NOTE: The PL main output drives up to down while the indicator rotates 180° over the full stroke of the actuator. Reducing the stroke will reduce the indicator rotation**



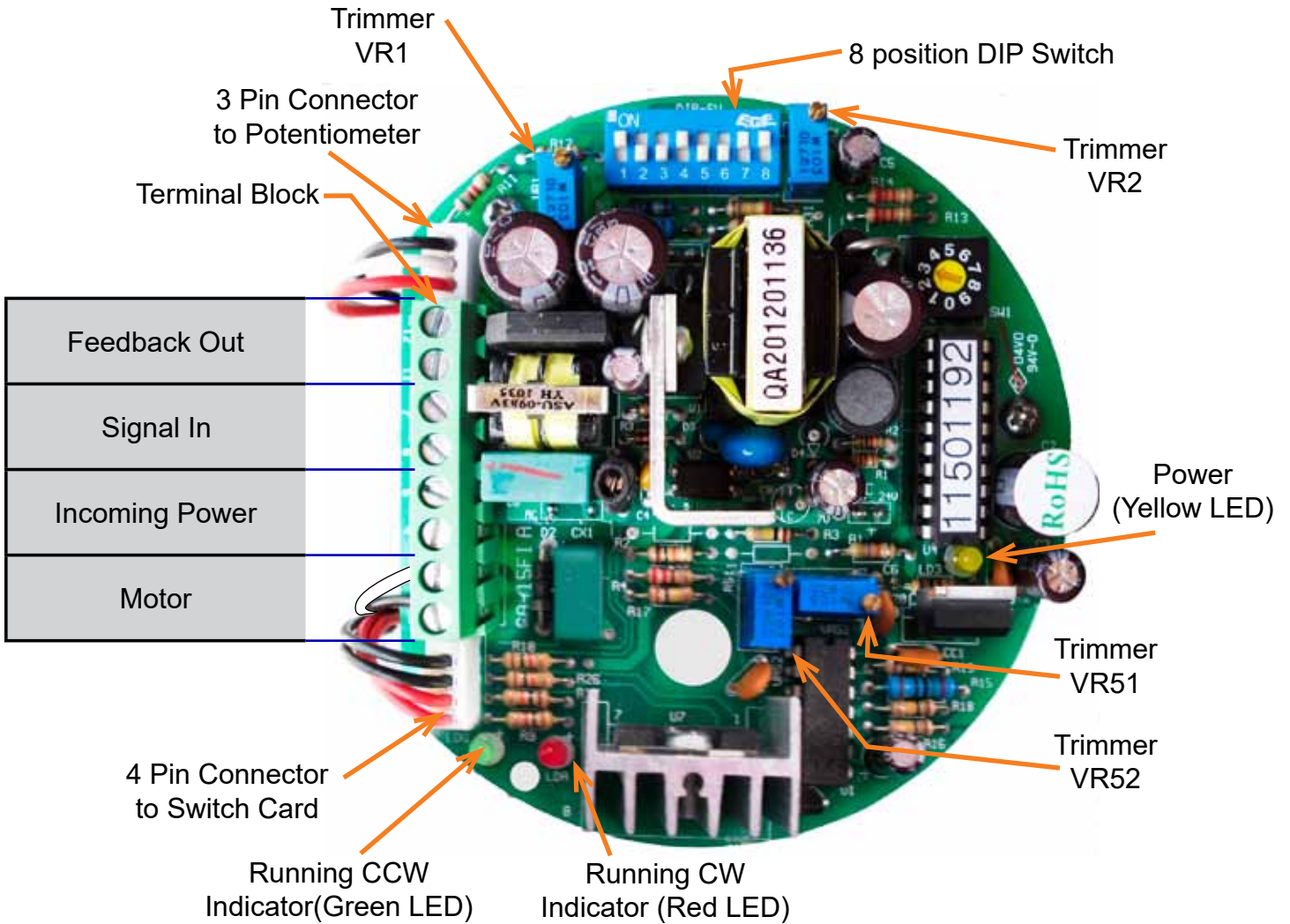
The default settings in the controller are as follows:

1. Input/Output Signal: 4-20mA (unless otherwise specified at time of Factory order)
2. Signal Response: Direct Acting (max signal = CCW)
3. Loss of Signal: Fail in Position



# Layout of Controller

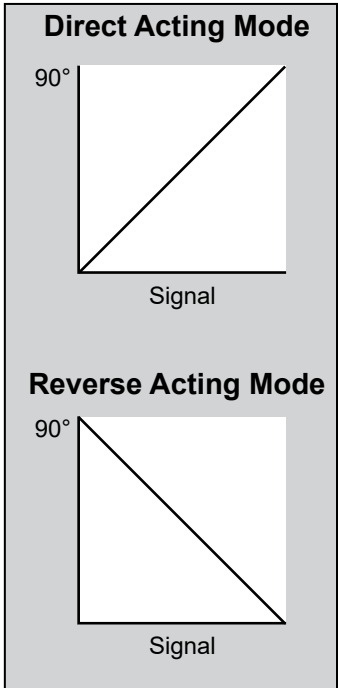
## Proportional Control



### Input, Feedback, Direct Acting, and Loss of Signal Table

DIP Switch Setting	DIP Switch Setting	DIP Switch Setting	Functions
<b>DIP 1 On</b>	<b>DIP 2 Off</b>		4-20mA Signal Input
DIP 1 Off	DIP 2 Off		1-5V Signal Input
DIP 1 Off	DIP 2 On		2-10V Signal Input
<b>DIP 3 Off</b>	<b>DIP 4 On</b>	<b>Dip 5 Off</b>	4-20mA Signal Output
DIP 3 On	DIP 4 Off	Dip 5 On	2-10V Signal Output
<b>DIP 6 Off</b>			Direct Acting Mode
	<b>DIP 7 On</b>	<b>DIP 8 On</b>	Stay in Place on LOSS of Input Signal
	DIP 7 Off	DIP 8 On	CW on LOSS of Input Signal
	DIP 7 On	DIP 8 Off	CCW on LOSS of Input Signal
DIP 6 On			Reverse Acting Mode
	DIP 7 On	DIP 8 On	Stay in Place on LOSS of Input Signal
	DIP 7 Off	DIP 8 On	CCW on LOSS of Input Signal
	DIP 7 On	DIP 8 Off	CW on LOSS of Input Signal

**Default Settings**



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## **Check End of Travel Settings**

The actuators are tested, calibrated and shipped in the Full DOWN or CLOSED position in the Direct Acting mode. End of Travel cams are set at maximum travel distance for the actuator.

- A. Set the control device (valve or damper) to the closed position.
- B. Mount the actuator to the device to be controlled (valve or damper).
- C. Insure that the UP End of Travel cam trips the UP End of Travel switch at the correct UP point.
  - C.1. If the switch does not change state at the correct UP position, adjust CAM 1 per instructions on page 7.
- D. Manually move (using the manual override) the actuator so the valve or damper is in the fully DOWN position.
- E. Insure that the DOWN End of Travel cam trips the DOWN End of Travel switch at the correct DOWN point.
  - E.1. If the switch does not change state at the correct DOWN position, adjust CAM 2 per instructions on page 7.

***If the End of Travel cams are adjusted at all, the actuator must be recalibrated.***

- F. Test actuator and device with a control input signal to insure that control signal corresponds to correct actuator and device position.



**Manual Override**

***Warning: DO NOT operate manual override when power is present. Geartrain damage and personal injury may occur.***

***Do not use powered tools to turn the manual override -- it will DAMAGE the gear train or motor and VOID the warranty.***

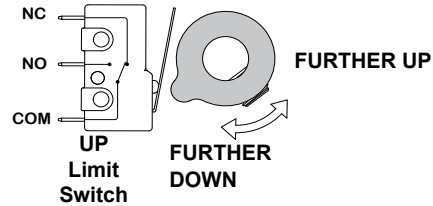
**Remove power from this device BEFORE making any End of Travel cam adjustments.**

### Cam 1 Adjustment



Cam 1  
 Indicator/  
 Camshaft  
 movement  
 Output Drive  
 movement

1. The lower cam is Cam 1, the UP end-of-travel adjustment. Once the actuator is at its required UP 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 cam.



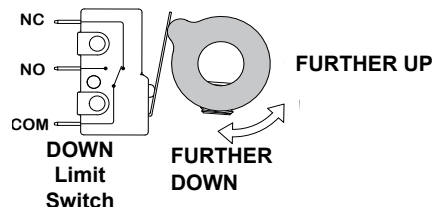
2. Apply power to the actuator and drive Down at least .25 in (6mm). Then drive the actuator Up until the cam stops the electrical travel. Check to be sure this is the correct Up position you require. Repeat step 1 if further adjustment is needed.
3. If using the Auxiliary Switches, adjust Cam 3 per instructions on page 8.

### Cam 2 Adjustment



Cam 2

1. The second cam is Cam 2, the DOWN end of travel adjustment. This cam is set for the maximum down position. Use the Manual Override to move the actuator UP only.
2. Once the actuator is at its required Down 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 to the RIGHT until you hear the “click” on the second switch indicating that correct adjustment has been achieved. Tighten the cam set screw.
3. Apply power to the actuator and drive UP at least .25 in (6mm). 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 1 if further adjustment is needed. Remove power from the actuator.
4. If using the Auxiliary Switches, adjust Cam 4 per instructions on page 8.



**If the End of Travel cams are adjusted at all, the actuator must be recalibrated.**



## Adjusting Auxiliary Switches

**Remove power from this device *BEFORE* making any *End of Travel* cam adjustments.**

### Cam 3 Adjustment



Cam 3

1. The third cam is Cam 3, the UP auxiliary switch adjustment. Drive the actuator to its UP 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.

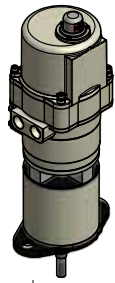


Cam 4

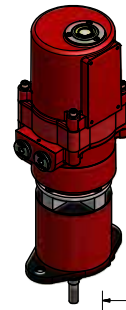
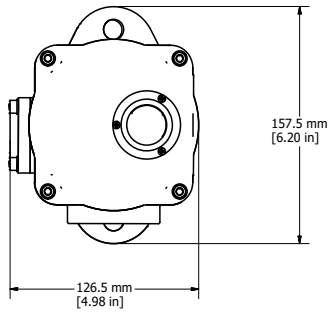
### Cam 4 Adjustment

1. The fourth cam is Cam 4, the Down 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 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.

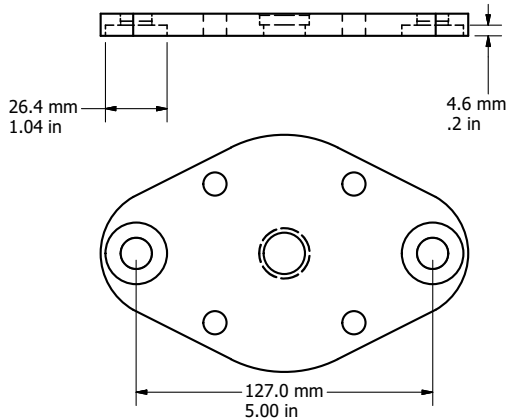
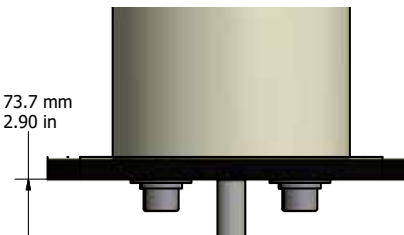
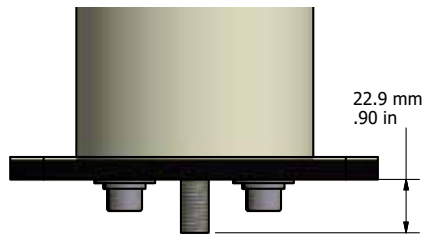
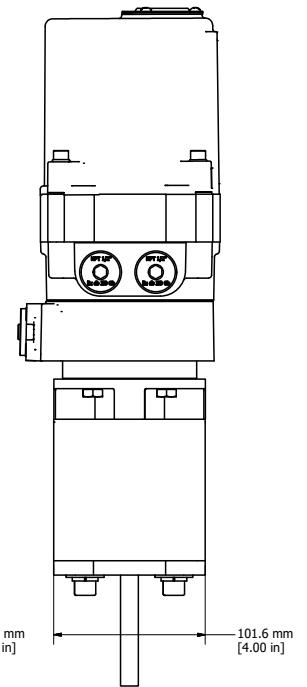
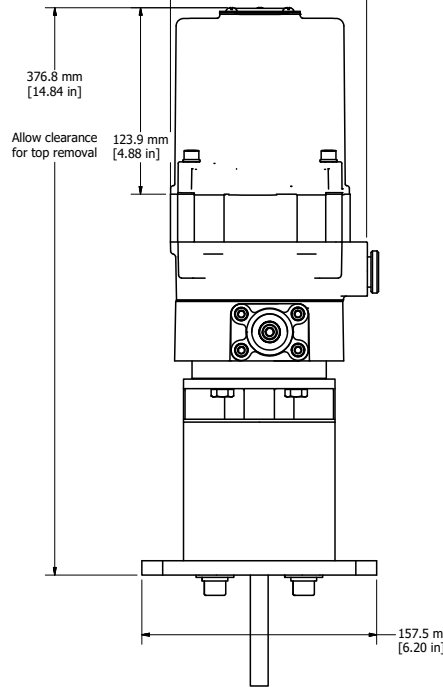
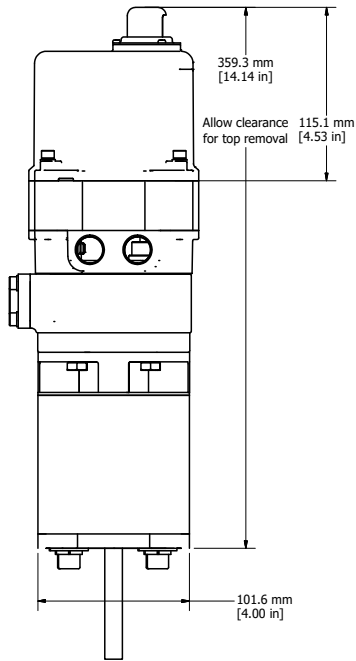
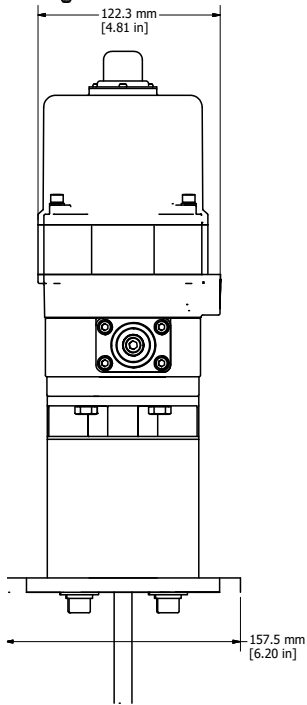
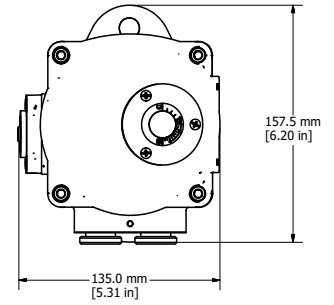
# Mechanical Data



Standard Location  
NEMA 4x



Hazardous Location  
NEMA 7,9



M12 x 1.75

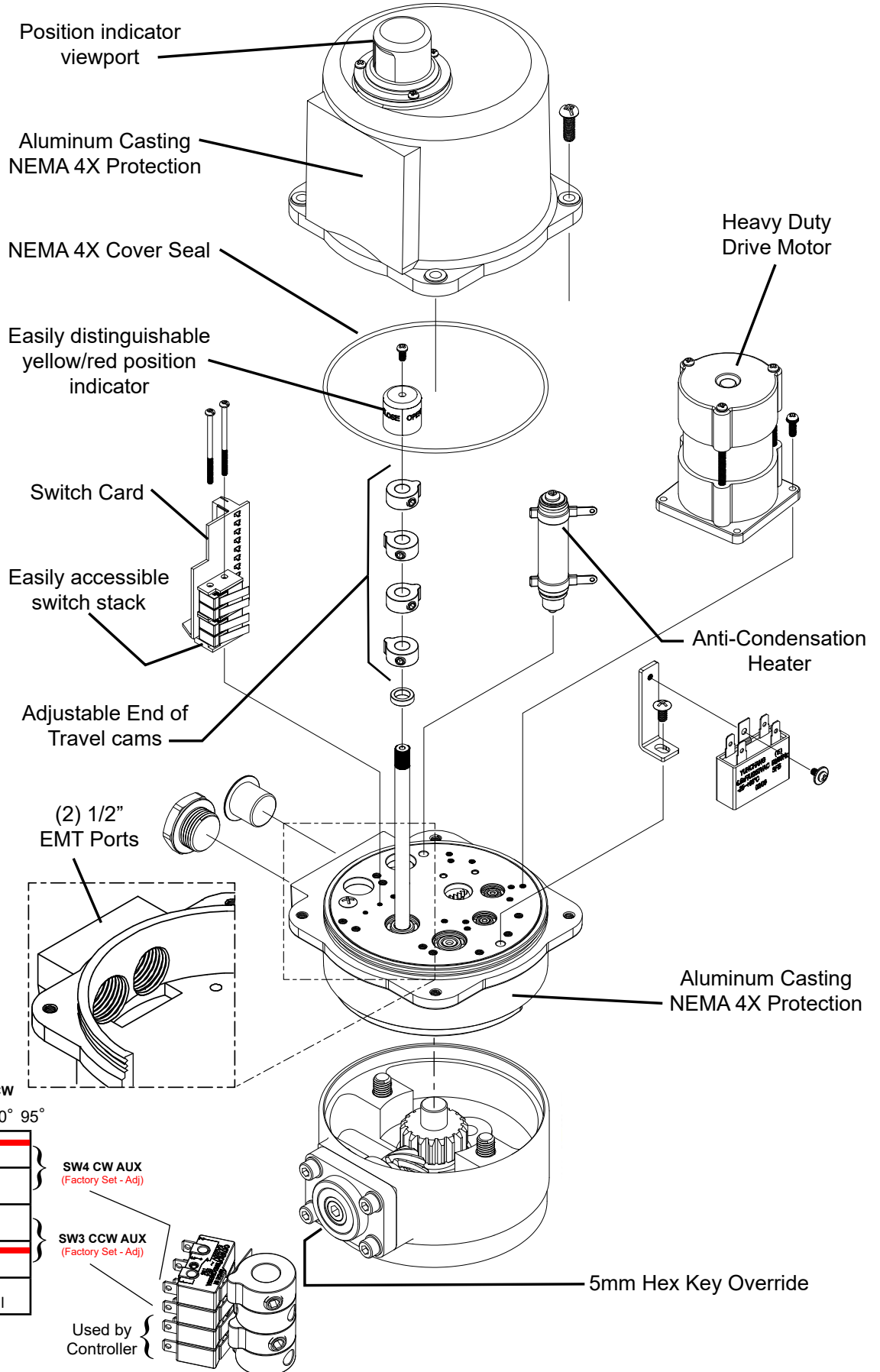
Optional Link Set  
PL 680/1200/2000

The PL Actuator base is designed to receive two 1 in steel support rods. The support leg length is determined by bonnet, stem and travel length. Customer Machines lower plate to fit valve

An Optional Valve Stem Connector Assembly is available

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# Mechanical Data



## 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 Up to Down 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.

	CW			CCW		
	-5°	0°	5°	85°	90°	95°
F	Not Closed					
E	Closed					
C	Not Open					
B	Open					
A	Common Switch Terminal					

SW4 CW AUX  
(Factory Set - Adj)

SW3 CCW AUX  
(Factory Set - Adj)

Used by Controller

FM\_PL660\_HVLPN47 VerA

## Commissioning

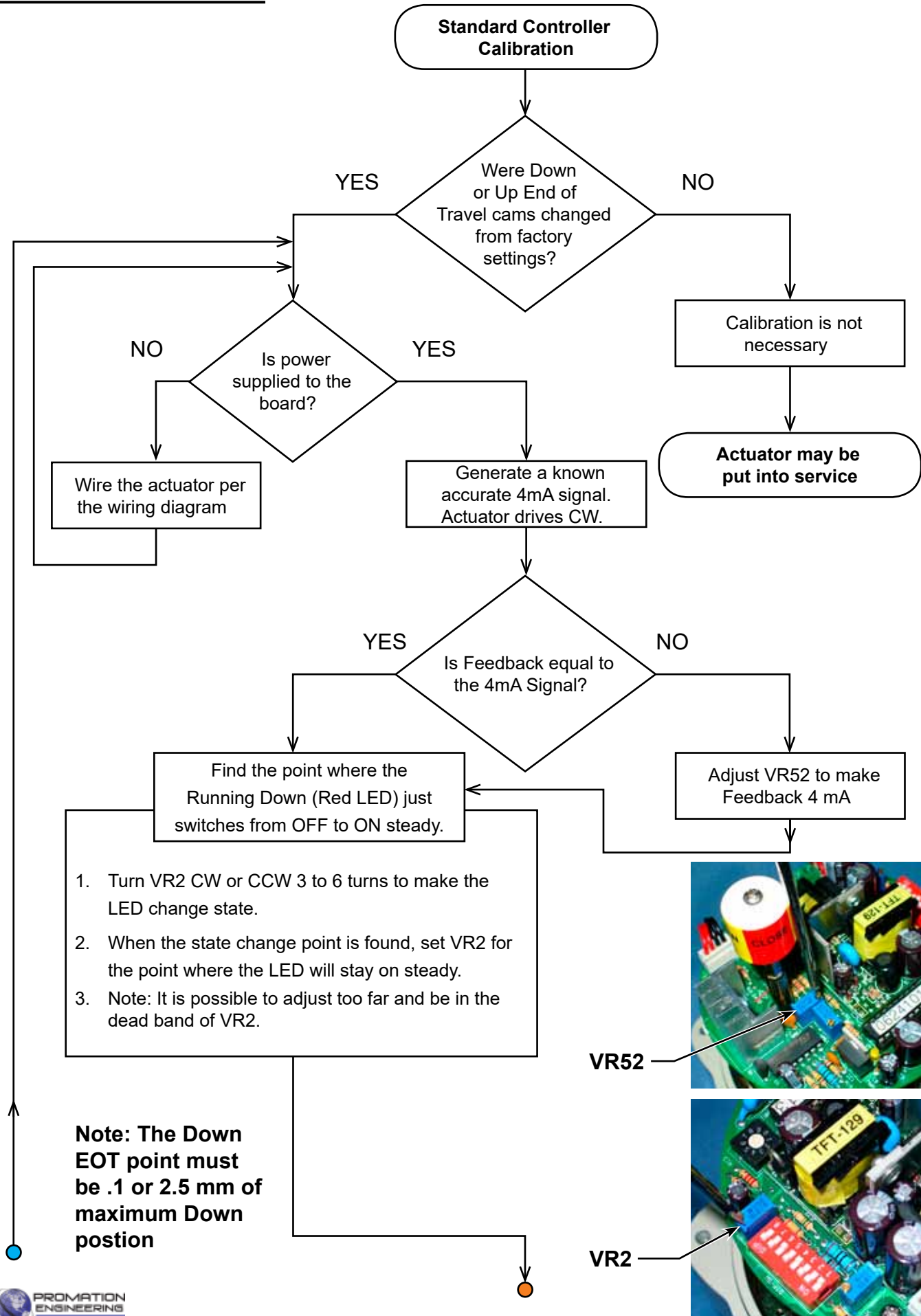
This procedure will assume that the actuator is installed correctly both mechanically and electrically with correct power at terminals marked 4 & 5 and control signal at terminals marked 6 & 7.

1. Apply the correct supply power to the actuator
  - NOTE - Power is measured at terminals marked 4 & 5 on the actuator.
  - The POWER (Yellow) LED will illuminate whenever power is on.
2. Test Full Down (CLOSE) and UP (OPEN) Positions for **Direct Acting Mode** (DIP 6 set to OFF)
  - 2.A Generate a MAXIMUM control signal at the PLC or signal generator.
    - I. The actuator OUTPUT shaft will drive to the **full UP (OPEN)** position while the INDICATOR/cam shaft rotates CW position (as viewed from ABOVE the actuator) to show Open.
    - II. If this is NOT the correct stop position, refer to Adjusting the actuator Up position instructions for CAM 1 on Page 7 in this document.
  - 2.B Generate a MINIMUM control signal at the PLC or signal generator.
    - I. The actuator OUTPUT shaft will drive to the **full DOWN (CLOSE)** position while the INDICATOR/cam shaft rotates CCW position (as viewed from ABOVE the actuator) to show Close.
    - II. If this is NOT the correct stop position, refer to Adjusting the actuator Down position instructions for CAM 2 on Page 7 in this document.
3. Test Full Down and UP Positions for **Reverse Acting Mode** (DIP 6 set to ON)
  - 3.A Generate a MAXIMUM control signal at the PLC or signal generator.
    - I. The actuator OUTPUT shaft will drive to the **full DOWN (OPEN)** position while the INDICATOR/cam shaft rotates to the full CCW position (as viewed from ABOVE the actuator).
    - II. If this is NOT the correct stop position, refer to Adjusting the actuator Down position instructions for CAM 2 on Page 7 in this document.
  - 3.B Generate a MINIMUM control signal at the PLC or signal generator.
    - I. The actuator OUTPUT shaft will drive to the **full UP (CLOSE)** position while the INDICATOR/cam shaft rotates to the full CW position (as viewed from ABOVE the actuator).
    - II. If this is NOT the correct stop position, refer to Adjusting the actuator Close position instructions for CAM 1 on Page 7 in this document.

NOTE- The feedback signal generator shows the 4-20mA or 2-10vdc position output at terminals marked 11 (-) & 12 (+).

**IF THE END OF TRAVEL CAMS ARE ADJUSTED, THEN THE ACTUATOR MUST BE RECALIBRATED. REFER TO CALIBRATION PROCEDURE ON PAGE 12.**

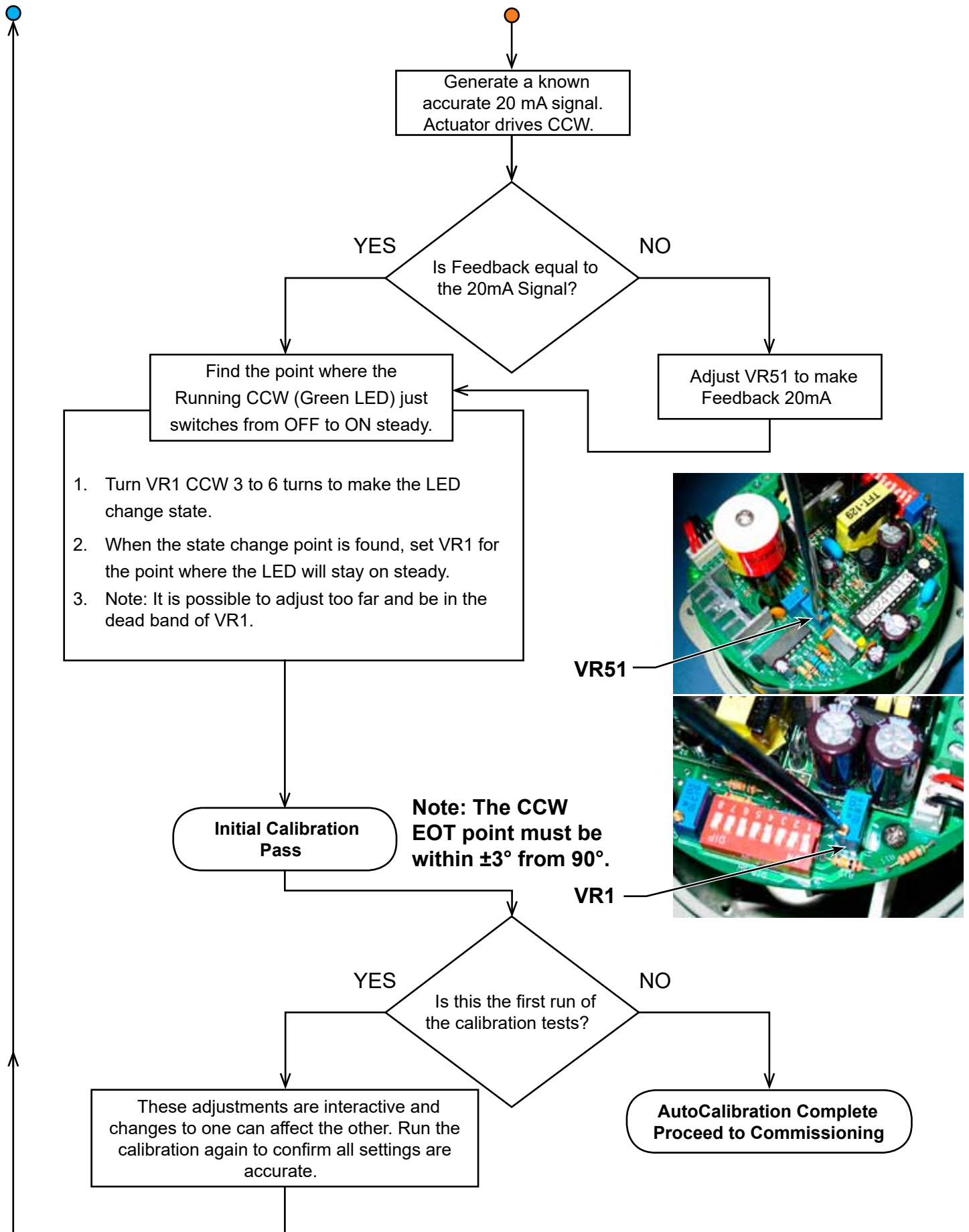
# Calibration Procedure



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# Calibration Procedure (continued)



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