I&M No. V_10062 Rev. AC

Push-Type Linear Actuator Electronic Pressure Regulation

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⚠ WARNING To prevent the possibility of death, serious injury, or property damage, the actuator must be installed and serviced only by a qualified service technician avoiding the following hazards:

- **Electrical hazard: Turn off all electrical power to actuator.**
- **Risk of electric shock: More than one disconnect switch may be required to de-energize the device for servicing.**
- **Pressure hazard: Depressurize valve and vent hazardous or combustible fluid to a safe area before inspection or removal of the actuator or valve from service.**
- **Explosion, fire, or toxic gas hazards: Extinguish all open flames and avoid any type of sparking or ignition during leakage testing.**

NOTICE **See separate _158A Series Gas Safety Shut-off Valve Installation and Maintenance Instructions for information on: Operation, Positioning, Mounting, Piping, Strainer or Filter Requirements, Flow Controls, Preventive Maintenance and Cause of Improper Operation.**

Product Verification

Check nameplate for correct catalog number, and service. Check the catalog number against Figure 1 to ensure that the actuator meets the requirements of the application. Installation and valve maintenance to be performed by qualified personnel. Never apply incompatible fluids or exceed pressure rating of the valve. Contact ASCO through the website below or your supplier for more information about this actuator or other actuator options if this actuator is not suitable for your application.

Description

The P159A Series Hydraulic Actuator is a self-contained linear, push-type actuator which extends when powered and retracts by spring force upon power interruption.

The P159A Series Actuator is typically used for control of gas-fired heating equipment, commonly to open and close a valve or both a valve and damper.

The P159A Series Actuator positions _158A Series Gas Safety Shut-off Valves. This actuator is a Class A rated device per UL 60730-1 in a pressure regulation set-up and is CSA certified per CSA ANSI Z21.18/ CSA 6.3.

Operation

P159A3 - Electronic Pressure Regulation

Application of electrical power simultaneously drives an electric pump and closes a normally-open dump valve and control valve, resulting in up to 1100 N (250 lbf) of force on the actuator stem. This extends the actuator stem and attached valve poppet, to open the valve and/or damper.

Upon reaching the fully extended position, a travel limit switch interrupts power to the electric motor while maintaining power to the dump valve and control valves, thus stabilizing hydraulic pressure to hold shaft position.

Position indicators on both sides of the actuator show the actual position of the valve stem.

Upon power interruption, the dump valve opens, releasing hydraulic pressure and allowing the return spring to retract the stem and close the valve fully. Closing time is one second or less.

Optional Features

- **Proof-of-Closure Switch:** A single factory set, non-field adjustable, SPDT switch to be used in conjunction with _158A Series Gas Valves with overtravel seals (See ACTUATOR / VALVE COMPATIBILITY Table).
- **Auxiliary Switch:** Integral SPDT switch, field adjustable to actuate at any position of stroke. This is not a safety switch.

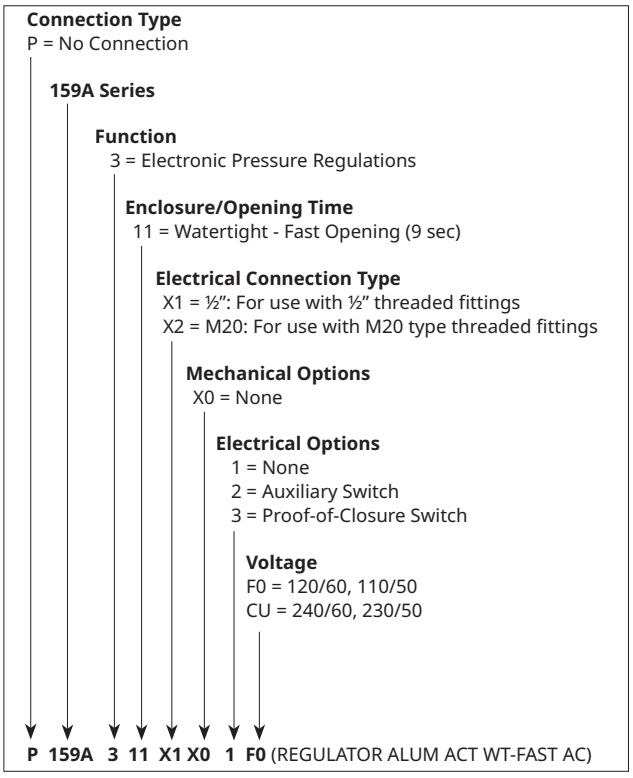


Figure 1. P159A3 Series Product Codification

Actuator / Valve Compatibility

The P159A Series Actuator is designed for use only with ASCO _158A Series Gas Valves (as shown below, check valve nameplate for catalog and date code details):

Actuator	Actuator Electrical Options	Valve/Seal Type	Valve Catalog # (with the date code 2547 or higher)
P159A3	P159A3_ _X_X_1_ _ P159A3_ _X_X_2_ _	_158A Linear Trim	_158A3 OR _158A7*
	P159A3_ _X_X_3_ _	_158A Linear with Overtravel	_158A4 OR _158A8* OR _158AC*

*Actuator to be installed on downstream valve position (Closest to valve outlet port)

Specifications

Force Output: 1100 N (250 lbf)

Stroke: 28.6±1 mm (1-1/8±0.04 in)

Electrical Characteristics:

ACTUATOR	Operating Voltage/ Frequency	Current, in Amperes		
		Inrush	Opening	Holding
P159A3	120/60	11	1.5	0.1
	110/50	11.5	1.9	0.2
	240/60	5.0	0.6	0.1
	230/50	5.5	0.8	0.1

Opening Time:

Fast Opening:

- Typical time approximately 13 seconds.
- At temperatures below -30°C, actuator may take as long as 30 seconds.

Maximum Closing Time: One second

Ambient Temperature and Duty Cycle Limitations

The actuator may be operated in ambient temperature conditions from -40 °C to 66 °C (-40 °F to 150 °F). During normal operation, the P159A series Actuator can be cycled CLOSED to OPEN, up to 4 times per hour at maximum ambient temperature of 66 °C (150 °F). Higher cycle rates are possible with lower ambient temperatures. During commissioning at room temperature of 20 °C (68 °F), the actuator can be cycled up to 60 times per hour.

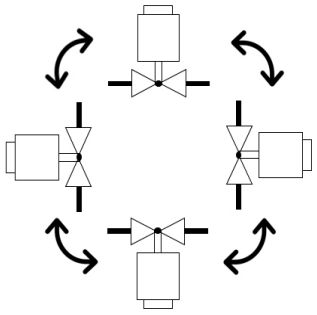
NOTICE

The P159A Series Actuator is fitted with a self-resetting thermal cutout device. If the recommended temperatures and duty cycles above are exceeded, the thermal cutout may trip causing the actuator to stop in its current position during valve opening. The valve closing time remains one second or less regardless of thermal cutout trip. Once the actuator cools, the cutout will self-reset and the actuator will resume operation. If the cutout trips repeatedly, verify that the application is within the ambient temperature and the duty cycle limits of the actuator. If the application is within the specified operating limits and the cutout continues to trip, replace actuator.

Positioning/Mounting

Follow the _158A Series Gas Valves manufacturer's instructions when installing the actuator.

1. The P159A Series Actuator can be installed to operate in any position.



2. Check to ensure that the mounting gasket is in the proper position, clean and without damage. Position the actuator to operate the valve. Secure actuator with the three mounting set screws. Tighten set screws to 9,0 ± 0,5 N-m (80 ± 5 in-lbs) using a 4 mm hex bit socket. Ensure actuator base is fully secured against valve body mounting surface for proper operation. (See Figure 2).

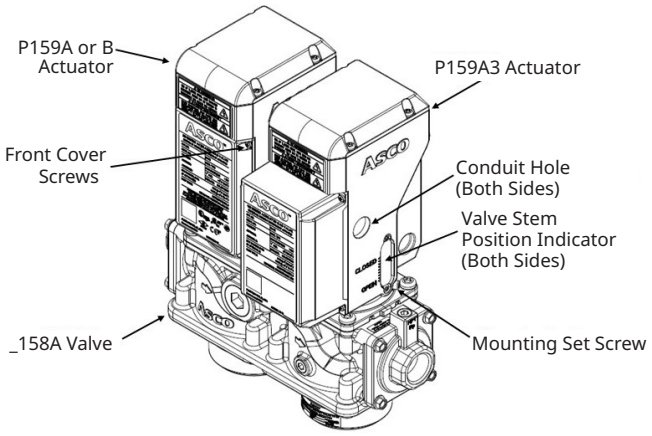


Figure 2. P159A (or B) & P159A3 Actuators on a 158A Gas Valve Assembly

Wiring: (Refer to Figure 3 for Wiring to Actuator)

⚠ WARNING Electrical hazard. To prevent the possibility of death, serious injury or property damage, open all circuits before inspection, service or disassembly.

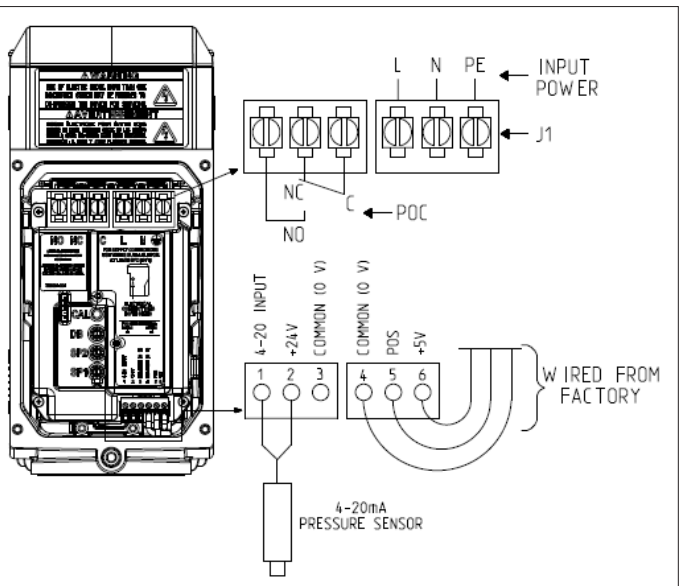


Figure 3. Wiring to Actuator

Wiring must comply with all local codes and NFPA 70 National Electric Code edition appropriate for installation. Installation should conform to all actuator ratings. All wiring must be an approved type suitable for 90 °C.

V_10062 Rev. AC

1. Check the nameplate and confirm that the appropriate power will be supplied to the unit. Turn off all power to the unit prior to servicing. Remove the front cover and set aside to access electrical connections, taking care not to damage the cover O-ring (if applicable). A diagram is located on the inside of the cover to aid in making electrical connections.
2. Upon removing the front cover, a temporary shipping plug will be installed on the conduit holes. This plug should be removed & discarded prior to actuator installation. Install appropriate electrical fittings in the desired conduit holes and ensure when installed, the connection is properly centered on conduit opening. Type 4 fittings must be used with watertight units. Route wiring through the installed electrical fitting(s) and take care not to scratch or otherwise damage the cover sealing surface when working on watertight enclosure.
3. Connect the power wires, stranded 12-14 AWG, to terminals 3 (Hot/ L1) and 2 (Neutral/L1) of J1 outlined in figure 3. Connect the stranded ground wire of matching gauge to terminal 1(Protective Earth) marked in figure 3.
4. Power Terminal Screw Torque: 1.02 N-m (9 in-lbs) Ensure all strands are securely fastened under terminal screw.
5. If a Proof-of-Closure or Auxiliary switch is being used make those electrical connections. Use the markings located on the wiring diagram to determine normally open and normally closed terminals. Use stranded 12-18 AWG wire. Torque terminal strip screws to 1.02 N-m (9 in-lbs). Proof-of-Closure switches are set at the factory. Do not adjust Proof-of-Closure switch.
6. Connect the pressure sensor wires to terminals 1 (4-20 INPUT) and 2(+24V) outlined in figure 3. Its recommended that the sensor can be installed 5 pipe diameters away from outlet of the 159 Series Pressure Regulator for maximum accuracy. However sensor can be installed right on 1/4" NPT/ISO port on the outlet of the pipe adapter when application allows (see figure 4). Pressure sensor terminal block should be torqued to 0.25Nm (2.21 in-lbs) max. Ensure all strands are securely fastened inside of the connector clamp.
7. It is recommended to route the power lines on one conduit opening and the sensor wires on the other conduit opening.
8. Install the front cover. Be certain that the O-ring (if applicable) and sealing surfaces are clean and there is no damage to the surfaces or O-ring. Snug down all screws before tightening. Torque screws to 1.4 to 1.8 N-m (12 to 16 in-lbs) evenly using crisscross pattern.

Proof-of-Closure and Auxiliary Switch Ratings

120 VAC: 7 Amps Resistive, 3 Amps Inductive
240 VAC: 7 Amps Resistive, 3 Amps Inductive

Total connected load of Proof-of-Closure switches not to exceed 1800 VA.

NOTICE **Proof-of-Closure Switch must only be used as per ACTUATOR / VALVE COMPATIBILITY Table on page 2 of 4.**

Proof-of-Closure Switch

The P159A Series Actuator with the optional Proof-of-Closure switch equipped, is to only be installed on _158A Series Gas Valves with over travel seals (See ACTUATOR / VALVE COMPATIBILITY Table on page 2). The Proof-of Closure switch is set at the factory to provide both a mechanical and electrical means of proving valve closed position interlock to the primary control. This switch is not to be field adjusted.

Maintenance

Before inspection or maintenance, review WARNING statements on page 1. Maintenance should include annual inspection and cleaning. Use a mild cleaning fluid, not aggressive solvents to remove dirt and oil. Organize a maintenance schedule based on environment and frequency of use. Check for loose electrical and mechanical connections. Do not remove the top cover for maintenance. There are no serviceable parts contained inside the actuator housing.

Calibration

The 159 Series Pressure Regulator is calibrated at the factory for a 158 Series Valve under ideal conditions. During Low-Fire operations, if the units experience oscillations or the diagnostic LEDs blinks RED 1 time, it is recommended that Calibration is performed while on the 158 Series valve with no pressure. To perform the Calibration,

1. The 159 Series Pressure Regulator must be calibrated once installed on 158 Series Valve to record OPEN/CLOSE position into memory.
2. First power the device while connected to the valve body.
3. Hold the push button down for at least 10 seconds until you see the green light flashing then, release the button.
4. The actuator will confirm its CLOSED then OPEN, pause, then CLOSE. Once calibration is done, the LED will go from blinking green to solid green.
5. Once calibration is completed, the unit will try to regulate with the factory default set-point. Proceed to Setpoint Setting to set to your application requirement.

Setpoint Setting

1. To change the setpoint, press and hold the Calibration button for about 5 seconds until the LED is flashing blue then release the button.
2. Rotate the rotary switches SP1 and SP2 until you have the desired setpoint.
3. On the PCB plastic cover there will be labels for SP1 and SP2 next to the rotary switches. SP1 will signify the larger digit while SP2 will signify the lower digit in the setpoint percentage.
4. For example if you want a setpoint of 52 then SP1 will be 5 and SP2 will be 2. If you want a setpoint of 25 then SP1 will be 2 and SP2 will be 5.
5. The setpoint will be a percentage of the pressure sensor full scale range installed.
6. For example if the setpoint is 50% and the sensor is 25 psi then the output of the regulator will regulate to 12.5 psi. IF the setpoint is 50% and the sensor is 2 psi then the output of the regulator will regulate to 1 psi.
7. Once the desired setpoint is made, press and hold the Calibration button for about 7 seconds and release. LED changes from blue to green.

Pressure Sensor Selection

The 159 Series Pressure Regulator is designed to work with a 4-20mA style pressure sensor. Qualified sensors that can be used are listed below available through ASCO or direct from the Manufacturer.

ASCO P/N	Wika (A-10 Series) P/N	Pressure Range
576901-001	76238587	0-1 psi
576901-002	76240624	0-2.3 psi
576901-003	76238667	0-5 psi
576901-004	76238668	0-10 psi
576901-005	76238669	0-15 psi
576901-006	76238670	0-25 psi

1. It is important to select a pressure sensor which can utilize the fullest range of resolution while also account for all pressures seen in the system.
2. We recommend using a sensor with pressure rating equal to the inlet pressure or slightly higher.
3. For example, if your inlet pressure is 1 psi then we recommend using a 2 psi sensor. If your inlet is 10 psi then we recommend using a 15 psi sensor.
4. If the sensor sees a pressure of 105% of the maximum rated pressure, the 159 Series actuator will go into Safety Shut-off mode and stay closed until the over-pressure condition disappears and inlet pressure is back to normal.

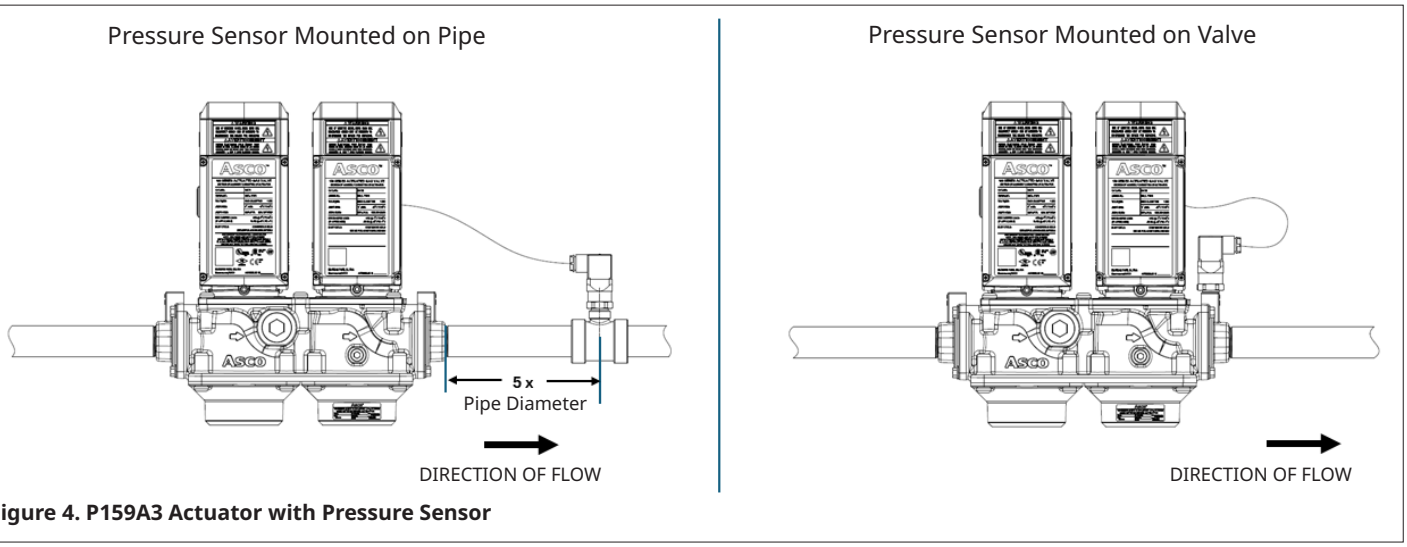


Figure 4. P159A3 Actuator with Pressure Sensor

Troubleshooting Guide

If device is not operating as expected, take note of Status LED & follow User Recommended Action.

LED Status	Description	Actuator Response	User Recommended Action
Solid Red	Calibration Failed	Actuator moved to safe position - CLOSED	Re-Calibrate
Blinking Red (1 time, 0.5 second ON/OFF)	Device not Calibrated	Actuator moved to safe position - CLOSED	Perform Calibration Procedure
Blinking Red (2 times, 0.5 second ON/OFF)	Pressure Sensor Failed / Out of Range	Actuator moved to safe position - CLOSED	Check sensor connection. Ensure sensor used is correct – see Pressure Sensor Selection section of I&M.
Blinking Red (3 times, 0.5 second ON/OFF)	Position Sensor Failed / Out of Range	Actuator moved to safe position - CLOSED	Verify actuator is connected to valve
Blinking Red (4 times, 0.5 second ON/OFF)	AC Cross Input Failed / Out of Range	Actuator moved to safe position - CLOSED	Replace unit
Blinking Red (5 times, 0.5 second ON/OFF)	Pressure Setpoint not Configured	Actuator moved to safe position - CLOSED	See Setpoint Setting section of I&M Sheet
Blinking Red (6 times, 0.5 second ON/OFF)	Rotary Switch Failed	Actuator moved to safe position - CLOSED	Replace unit
Solid White	Internal Fault	Actuator moved to safe position - CLOSED	Power Cycle unit
Blinking Blue – 0.5 seconds ON/OFF	Device is in setting mode to configure Pressure Setpoint	Factory setpoint (OPEN) or previous setpoint	Follow Setpoint Setting section of I&M Sheet
Blinking Blue – 3 seconds ON/OFF	Rotary Setpoint does not match EEPROM settings	Operates to setpoint stored in memory	Rotary dials move and not saved to memory. Verify correct setpoint – see Setpoint Setting section of I&M
Blinking Blue (1 time, 0.5 second ON/OFF)	Push button fail to short	Operates to setpoint stored in memory	Replace unit
Blinking Green – 0.5 seconds ON/OFF	In Calibration Mode	Actuator moving OPEN/ CLOSE	Wait for Calibration to finish and LED turn solid green
Blinking Green – 3 seconds ON/OFF	Moving to desired pressure setpoint	Normal	No Action
Solid Green	At desired pressure setpoint	Normal	No Action

Availability, design and specifications are subject to change without notice.
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