

Series 93 PULSAIR III

Digital Electronic Positioner

Installation, Operation and Maintenance Instructions

The *Pulsair III* is a digital positioner designed primarily for controlling adjustable valves. The positioner can be used with single or double action 39 series actuators.

The *Pulsair III* Watertight Positioner (L93W) can be equipped with modules for feedback, limit switches, sensors, and a pressure gauge block.

The *Pulsair III* Hazardous Location Positioner (4L93Z) does not allow for switch/sensor options. However, the feedback (4–20 mA output) option is included as standard.

For the L93W, modules can be factory assembled before delivery or fitted later.

The modules for feedback (4–20 mA output) and limit switches/sensors can contain the following:

Feedback (4–20 mA output) and/or one of the following functions:

- Two mechanical switches (code M2)
- Two proximity (reed) switches (code R2)
- Two Namur sensors (code P2)

Storage Instructions

PULSAIR III positioners are precision instruments which should be stored and handled accordingly to avoid problems or damage.

Electro-pneumatic positioners contain electronic components which can be damaged by exposure to excessive water. Appropriate precautions should be taken to protect units while in storage.

Warehouse Storage

Stored in original shipping containers, units should be stored in an environmentally controlled area, i.e., clean, cool (15–26°C, 60–80°F) and dry, out of direct sunlight or weather exposure.

Field Storage

NOTE: *Once the air supply to the positioner is connected and turned on, internal air bleed will prevent the ingress of moisture and protect the unit from corrosion. It is recommended that the air supply be left on at all times.*

- If units are installed immediately, turn, and leave on, the air supply.
- If positioners must be stored outdoors, tighten all covers which may have loosened in shipment and make sure all open enclosure points are sealed.

Positioners should be wrapped and sealed, air and watertight with desiccant inside the plastic, units should be securely covered with an opaque cover and not exposed to direct sunlight, rain or snow.

Units should have all ports sealed and be protected from direct exposure to weather. For long term storage (>1 month) or overseas shipment, units should be protected with plastic and desiccant.

Potential Damage to Mechanism

When units are stored in hot, humid climates, the daily heating/cooling cycle will cause air to expand/contract and be drawn in and out of the positioner housing. Dependent on the local temperature variations, humidity, dew points and time in storage, condensation could occur and accumulate inside causing erratic operation or failure due to water and corrosion. The potential for condensation damage is especially high in southern climates and aggravated if units are exposed to direct sunlight.

For further assistance, please contact your nearest Worcester distributor.

Installation

If Positioner is not already mounted to the 39 Series Actuator, mount per part 1:

1. Attaching the Positioner to the 39 Series Actuator (refer to Figure 1)

Remove positioner (1) from the box. Coupling (spindle adapter) (2), and failsafe block (3) (used with spring return only) are loose inside the box.

Insert the round end of the coupling (2) into the bottom of the positioner making sure that the spline seats properly, and that the coupling is firmly seated in the positioner shaft. There is a spring loaded ring on the coupling which must fit into a groove inside the positioner shaft.

Install the mounting bracket (4) onto the bottom of the positioner using four M6 X 12 mm screws (5) and lock washers (6) included in the bracket kit. Align the bracket with the positioner.

Rotate the coupling to align the coupling tang with the slot in the output shaft on top of the actuator. Attach the positioner/bracket/ coupling assembly to the actuator using four M5 x 12 mm screws (7) and lock washers (8). The air inlet porting on the positioner must be on the same end as the "A" endcap (air inlet end) of the actuator.

Using an indelible marker, mark the 39 actuator model number and output torque (as found on 39 actuator nameplate) on the white mylar label supplied with the positioner and attach it to the side of the actuator opposite the nameplate side.

2. If not already attached, attach the Failsafe Block to the Positioner (for spring return only)

Refer to figure 1.

Install three O-rings (for L93W only) into the failsafe block (3).

Mount the failsafe block (3) to the end of the positioner (1) with the 'C+' port to the right using the two screws provided with the L93W, or three each of fittings and bushings and six grommets with the 4L93Z.

3. Air Connections (Refer to Figures 1 and 2)

IMPORTANT: Use industrial air (or other non-flammable gas), Which must be dry and oil free. See PULSAIR III Technical Reference Manual (Part No. 19990) for other air supply requirements and technical data.

Series 93 PULSAIR III mounting kits contain two elbow fittings for actuator, two elbow and two straight fittings for positioner, and one length of 1/4" O.D. tubing. The length of tubing will be cut to suit the assembly.

Note: Pipe thread sealant may be used on the threads of the fittings (do not allow thread sealant to contaminate the internal air passages of the positioner). Fluoropolymer tape thread sealant should not be used.

If not already plumbed, plumb the Positioner to the Actuator

Connect the elbow air fitting(s) (10) to the actuator "A" end cap.

| ACTUATOR SIZE | PORT THREAD (NPT) |
|---------------|-------------------|
| 10-20 | 1/8" |
| 25-42 | 1/4" |

Connect 1/4" NPT straight or elbow air fitting(s) (11) into the positioner.

For spring return, use 'C+' port on the failsafe block, and make sure that there is a plug in the unidentified port on the failsafe block (far left position).

For double acting actuator, use the 'C+' and 'C-' ports on the positioner. Note that no failsafe block is necessary.

Cut the tubing (12) provided to as short a length as possible that will still reach comfortably from the positioner to the actuator. Connect the tube(s) to their respective actuator and positioner port fittings.

4. Connect 80 psig Supply Air to Positioner (Refer to Figure 2)

Remove plastic plug from the positioner (or failsafe block) port 'S' and discard.

Connect an air supply line to the 1/4" NPT 'S' port.

5. Installation of M2, R2, or P2 Switch/Sensor and/or 4-20 mA Output Options (for L93W Positioner only)

1. If not already installed, install optional switches/sensors and/or 4-20 mA output into the positioner (if applicable):
2. The option kit includes a circuit board with switches mounted, two mounting screws, and a cam assembly with two mounting screws installed.
3. Refer to the PULSAIR III Technical Reference Manual (Part No. 19990) for assembly illustrations.
4. Remove the outside positioner cover.
5. Remove the plastic, yellow and black, position indicator. The indicator is a press fit and can be removed by prying up using fingers or small screwdrivers.
6. Remove the two inside cover attachment screws located at the terminal strip end of the inside positioner cover.
7. Carefully lift the inside cover to clear the yellow push button switches, and slide the inside cover towards the terminal strip to remove. The inside cover has a lip which is under the clear filter cover.
8. Install the circuit board over the positioning shaft, and align the board socket with the twelve pins on the positioner motherboard. Press firmly to seat the contacts.
9. Install the two mounting screws to hold the circuit board to the positioner motherboard.

Figure 1

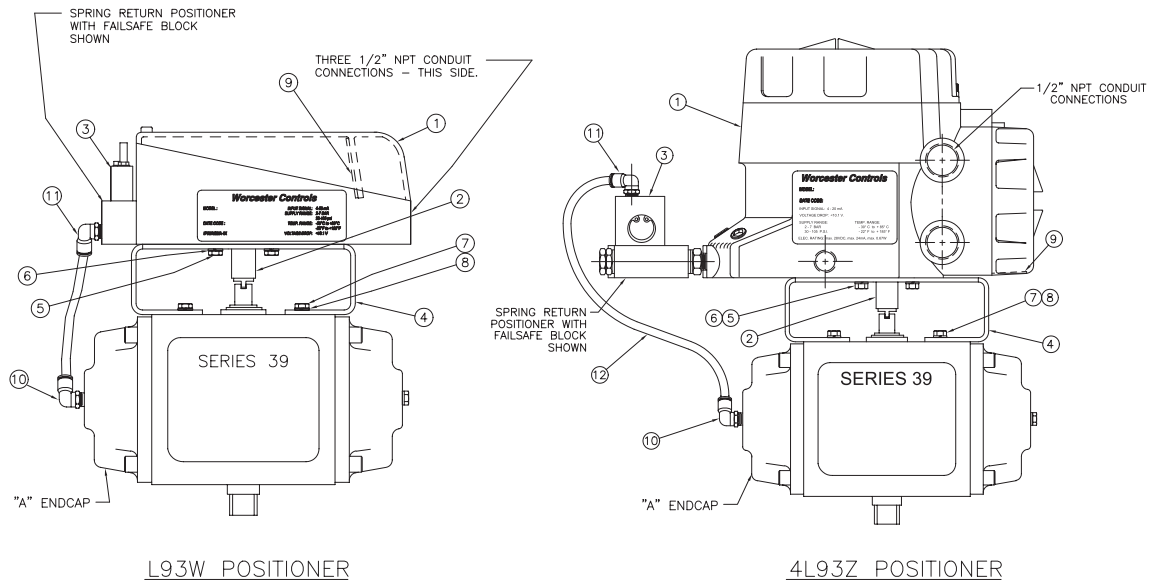
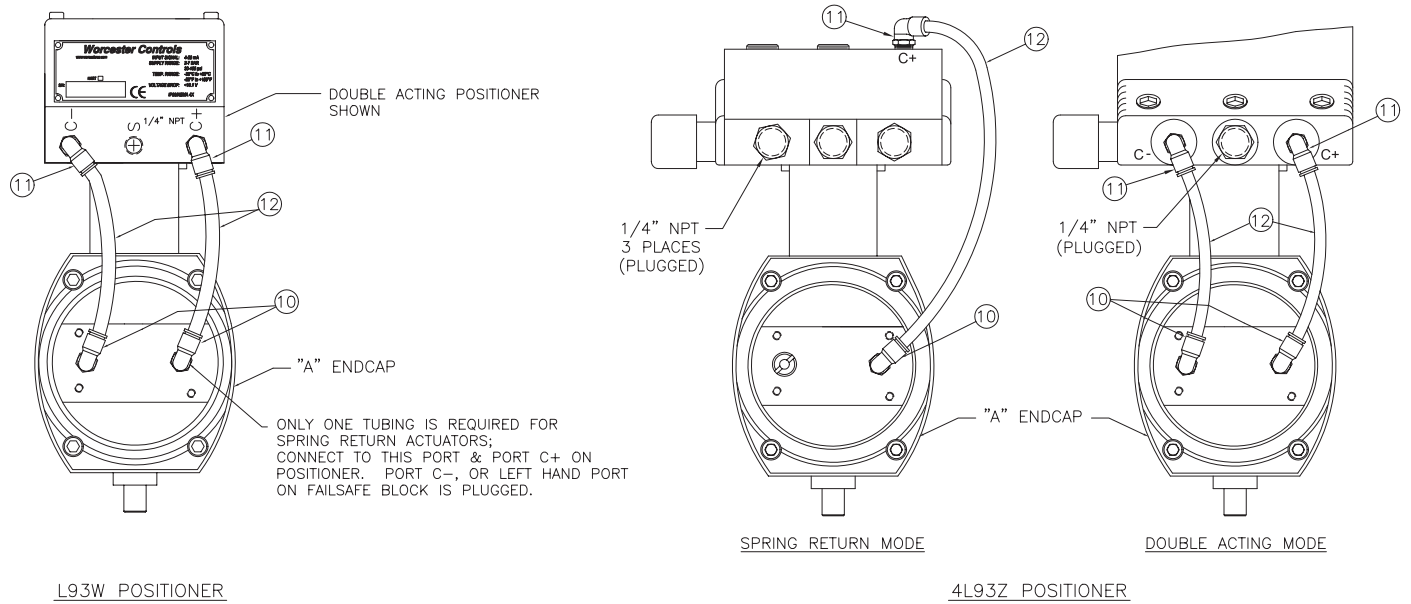


Figure 2



10. Install the cam assembly with the lobes oriented towards the terminal strip end of the positioner, over the positioner shaft. Move the switch contact arms (M2 mechanical switches only) aside so that the cam assembly can sit all the way down on the shaft.

NOTE: Cam assembly does not have to be installed, if switches are not going to be used and only the 4–20 mA output is to be utilized.

CAUTION: For m2 mechanical switches, Do not force the CAM assembly down without moving the contact arms, as damage to the limit switch may result.

11. Rotate the cam assembly to line up the cam assembly attachment screws and tighten the screws finger tight. You should still be able to move the cams for alignment before final tightening of the attachment screws.

6. Electrical Connections

See wiring diagram (9) on inside of cover (refer to Figure 1 for wiring label location) or Figure 3 below.

▲ WARNING: In a hazardous environment where there is a risk of explosion, electrical connections must comply with the relevant regulations.

Remove the positioner cover (if not already done) for connecting signal source and for optional board wiring. NOTE: For 4L93Z units there are separate covers for programming and electrical connections.

Connect a 4–20 mA signal source to terminal locations 1 (positive lead) and 2 (negative lead).

Adjust the signal source to between 8 and 20 mA.

For 4–20 mA output module option (for L93W & 4L93Z Positioners)

Connect a 10-28 volt DC source to terminal locations 11 (positive) and 12 (negative return from load).

For M2 Limit or R2 proximity switch option (for L93W Positioner only)

M2- Connect 125 VAC- 3 amp maximum, or 30 VDC - 2 amp maximum wiring to terminal locations as follows:

R2 - Connect 125 VAC or 30 VDC - 250 mA maximum wiring to terminal locations as follows:

Terminal Locations:

- 3 Clockwise switch, normally open - Switch #1
- 4 Clockwise switch, normally closed - Switch #1
- 5 Clockwise switch, common - Switch #1
- 6 Counter-Clockwise switch, normally open - Switch #2
- 7 Counter-Clockwise switch, normally closed - Switch #2
- 8 Counter-Clockwise switch, common - Switch #2

For P2 Namur Sensor Option (for L93W Positioner only)

Connect appropriate Namur amplifier (rated for 5–25 VDC output) wiring to terminal locations as follows:

Terminal Locations:

- 3 Clockwise Sensor, negative - Sensor #1
- 4 Clockwise Sensor, positive - Sensor #1
- 6 Counter-Clockwise Sensor, negative - Sensor #2
- 7 Counter-Clockwise Sensor, positive - Sensor #2

For open collector alarm output

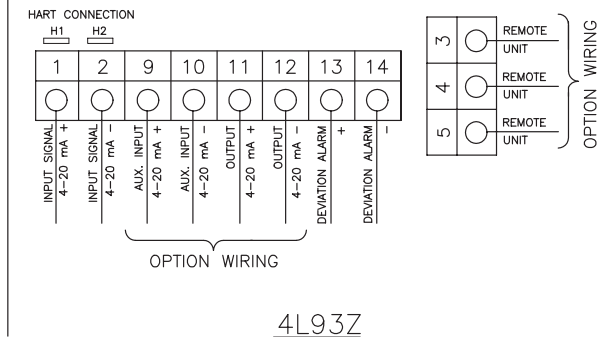
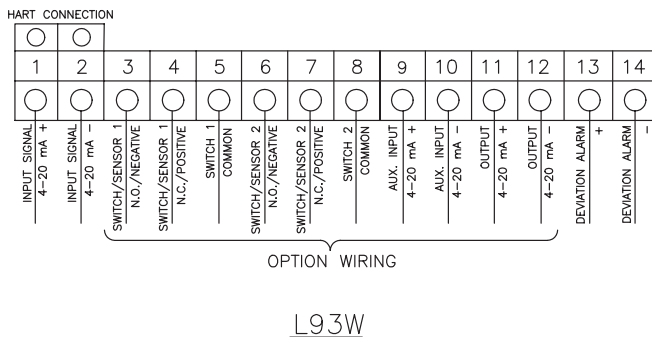
Connect 8–28 VDC wiring to terminal location 13 (positive) and 14 (negative).

Menus and Pushbuttons

The positioner is controlled using the five pushbuttons and the display, which are accessible when the positioner cover is removed. For normal functioning, the display shows the current position value.

Press the ESC button for two seconds to display the main menu.

Figure 3



Use the UP and DOWN pushbuttons to browse through the main menu and the sub-menus.

The main menu is divided up into a basic menu, and a full menu.

Other functions:

ESC - Exit the menu without making any changes (as long as any changes have not been confirmed with OK).

FUNC - To select function and change parameters.

OK - To confirm selection or change of parameters.

MENU INDICATOR - Displays the location of the current menu row in the menu.

IN SERVICE - The positioner is following the input signal. This is the normal status when the positioner is working.

OUT OF SERVICE - The positioner is not following the input signal. Critical parameters can be changed.

MANUAL- The positioner can be adjusted manually using the push buttons.

UNPROTECTED- Most of the parameters can be changed when the positioner is in the 'Unprotected' mode. However, critical parameters are locked when the positioner is in the 'In Service' mode.

MENU STATUS INDICATORS - On the left side of the display there are indicators that mean the following:

Top Left (on and flashing) - OUT OF SERVICE

Middle Left (on and flashing) - MANUAL MODE

Bottom Left (on) - UNPROTECTED MODE

Calibration

The following steps are used to calibrate the unit for verification of installation. Specific programming and advanced features are explained in the Technical Reference Manual (Part No. 19990).

1. Apply 80 psig air to the supply 'S' port of the positioner.
2. Set the input signal source to 10–12 milliamps.
3. Look at the display- it should read "BASIC MENU" over "CALIBRATE"
4. Momentarily depress the pushbuttons in the following sequence to begin the auto-calibration routine.
FUNC, FUNC, OK, OK, OK, OK, OK
5. At this point, the positioner will begin its auto-calibration routine.

Note: If the display reads 'increase C+ damper', there is too much air volume flowing to the actuator (speed is too high). Adjust the damper by turning the C+ damper screw clockwise ½ turn and press the 'ok' button. Refer to the inside electrical cover for location of the C+ damper screw. Adjust until the unit performs the auto-calibration routine without getting the 'increase C+ damper' message.

6. For double acting actuators, both the 'C+' and 'C-' damper screws may need adjusting. Follow the display instructions accordingly.
7. At the end of the auto-calibration routine, press and hold the OK pushbutton for three seconds to place the unit back to 'IN SERVICE'.
8. If an internal leak is detected during the auto-calibration routine, the display will show 'AIR LEAK DETECTED'. The next screen will show 'ESC=ABORT' and 'OK=GO ON'. Press the ESC to stop the calibration routine or OK to allow you to continue the calibration and ignore the leak.
9. When the unit is back 'IN SERVICE', the positioner should respond to the 4–20 mA input signal with 4 mA= Full CW and 20 mA=Full CCW positions.

4–20 mA Output Option Calibration

Attach a current meter (4–20 mA range) in line with the positive meter lead connected to terminal strip position 12, the negative meter lead connects to the negative power supply (10–28 volts DC) lead, and the positive power supply lead connects to terminal strip position 11.

1. Turn on the ammeter and power supply.
2. Press and hold the ESC pushbutton for three seconds to get the display back to the root menu. Display should show 'BASIC MENU' over 'MAN/AUTO'.
3. Press the DOWN button twice and display should read 'BASIC MENU' over 'SHIFT MENU'.
4. Press the FUNC button once and display should read 'Full menu' over 'no'.
5. Press the DOWN button and display should read 'Full menu' over 'yes'.
6. Press the OK button and display should read 'FULL MENU' over 'SHIFT MENU'.
7. Press the DOWN button four (4) times and display should read 'FULL MENU' over 'TUNING'.
8. Press the FUNC button and the display should read 'TUNING' over 'Close time'.
9. Press the DOWN button three (3) times and display should read 'TUNING' over 'Expert'.
10. Press the FUNC button once and the display should read 'Expert' over 'togglestep'.
11. Press the DOWN button three (3) times and the display should read 'Expert' over 'Ref Cal'.
12. Press the FUNC button once and the display should read 'Ref Cal' over 'Set point'.
13. Press the DOWN button four (4) times and the display should read 'Ref Cal' over 'Transm'.

14. Press the FUNC button once and the display should read 'Transm' over 'Transm low'.
15. Press the FUNC button once and display should read 'Transm low' over 'LO=4.0 mA'.
16. Press the UP or DOWN button as necessary to adjust the output signal to read 4.0 mA, or as close to 4.0 as is possible.
17. Press the OK button to accept the setting. The display should read 'Transm low' over 'UPDATED' for a brief moment.
18. Press ESC and display should read 'Transm' over 'Transm low'.
19. Press DOWN once and display should read 'transm' over 'Transm hi'.
20. Press FUNC button once and the display should read 'Transm hi' over 'HI=20.0 mA'.
21. Press the UP or DOWN button as necessary to adjust the output signal to read 20.0 mA, or as close to 20.0 as is possible.
22. Press the OK button to accept the setting. The display should read 'Transm hi' over 'UPDATED' for a brief moment.
23. Press the ESC button for 2-3 seconds and the display will return to the 'FULL MENU' over 'MAN/AUTO' screen.
24. Disconnect the calibration ammeter from terminal positions 11 and 12, and attach your readout leads to terminal position 11 (positive) and 12 (negative).

Limit (M2) and Proximity (R2) Switch Cam Adjustment (for L93W Positioner only)

1. Connect an ohmmeter to terminal position 3 (switch 1 - normally open) and terminal position 5 (switch 1 - common).
2. Input a 4.2 mA signal so that the positioner is in the clockwise position.
3. Using a screwdriver or similar tool, use the notch on the lower cam and rotate the cam counter-clockwise away from the switch and then clockwise until switch 1 closes. The ohmmeter indication changes from infinite to a low reading that indicates continuity through the switch.
4. Input a 19.8 mA signal so that the positioner is in the counter-clockwise position.
5. Connect the ohmmeter leads to terminal position 6 (switch 2 - normally open), and terminal position 8 (switch 2 - common).
6. Using a screwdriver or similar tool, use the notch on the upper cam and rotate the cam clockwise away from the switch, and

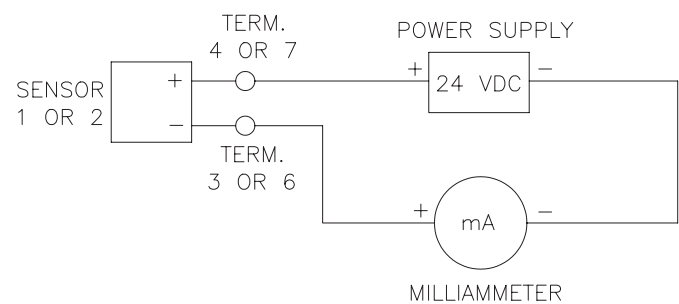
then counter-clockwise as necessary until switch 2 closes. The ohmmeter indication changes from infinite to a low reading that indicates continuity through the switch.

7. Tighten the 2 mounting screws on the cam assembly to lock the cam positions in place.
8. Adjust the input signal to 15 mA, and return to 20 mA to verify that the cam contacts or trips the switch, and the ohm reading changes from infinite to a low reading.
9. Remove the ohmmeter leads from terminal positions 6 and 8, and attach them to terminal positions 3 and 5.
10. Adjust the input signal to 4 mA and verify that the cam contacts or trips the switch and the ohm reading changes from infinite to a low reading.
11. If the ohm reading does not change, and continues to show an infinite reading, loosen the cam assembly mounting screws and adjust the cam as necessary.
12. Repeat the adjustment and set procedure until you can supply a 4 mA and a 20 mA signal and have the switches close.

Namur Sensor (P2) Cam Adjustment (for L93W Positioner only)

Refer to diagram below:

1. Connect a milliammeter positive lead to terminal position 3 (sensor 1 - negative), and a 24 VDC power supply positive lead to terminal position 4 (sensor 1 - positive). Connect the milliammeter negative lead to the 24 VDC power supply negative terminal.



2. Input a 4.2 mA signal so that the positioner is in the clockwise position.
3. Using a screwdriver or similar tool, use the notch on the lower cam and rotate the cam counter-clockwise away from the sensor

and then clockwise until sensor 1 trips. The milliammeter indication changes from ≥ 3 mA to a ≤ 1 mA reading.

4. Tighten the two mounting screws to 15 mA, and return to 20 mA to verify that the cam trips the sensor, and the milliammeter reading changes from a ≥ 3 mA to a ≤ 1 mA.
5. Remove the milliammeter and power supply leads from terminal positions 6 and 7, and attach them to terminal positions 3 and 4.
6. Adjust the input signal to 4 mA and verify that the cam trips the sensor and the milliammeter reading changes from a ≥ 3 mA to a ≤ 1 mA reading.
7. If the milliammeter reading does not change, and continues to show an ≥ 3 mA reading, loosen the cam assembly mounting screws and adjust the cam as necessary.
8. Repeat the adjustment and set procedure until you can supply a 4 mA or a 20 mA signal and have the appropriate sensor trip.

Operation and Maintenance

Refer to Technical Reference Manual (Part No. 19990) for detailed operation and maintenance information.

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