USER INSTRUCTIONS

# 3400IQ Digital Positioner

FCD LGENIM3401-01 – 05/10

**Installation**
**Operation**
**Maintenance**


FOUNDATION

*Experience In Motion*

# Contents

# 1 Terms Concerning Safety

The safety terms DANGER, WARNING, CAUTION and NOTE are used in these instructions to highlight particular dangers and/or to provide additional information on aspects that may not be readily apparent.

b **DANGER:** Indicates that death, severe personal injury and/or substantial property damage will occur if proper precautions are not taken.

c **WARNING:** Indicates that death, severe personal injury and/or substantial property damage can occur if proper precautions are not taken.

a **CAUTION:** Indicates that minor personal injury and/or property damage can occur if proper precautions are not taken.

**NOTE:** indicates and provides additional technical information, which may not be very obvious even to qualified personnel. Compliance with other, not particularly emphasized notes, with regard to transport, assembly, operation and maintenance and with regard to technical documentation (e.g., in the operating instruction, product documentation or on the product itself) is essential, in order to avoid faults, which in themselves might directly or indirectly cause severe personal injury or property damage.

# 2 General Information

The following instructions are designed to assist in unpacking, installing and performing maintenance as required on Flowserve Valtek Logix® 3400IQ digital positioners. Series 3000 is the term used for all the positioners herein; however, specific numbers indicate features specific to model (i.e., Logix 3400 indicates that the positioner has Foundation Fieldbus protocol). See Logix 3400IQ Model Number table in this manual for a breakdown of specific model numbers. Product users and maintenance personnel should thoroughly review this bulletin prior to installing, operating, or performing any maintenance on the valve.

Separate Valtek Flow Control Products Installation, Operation, Maintenance instructions cover the valve (such as IOM 1 or IOM 27) and actuator (such as IOM 2 or IOM 31) portions of the system and other accessories. Refer to the appropriate instructions when this information is needed.

To avoid possible injury to personnel or damage to valve parts, WARNING and CAUTION notes must be strictly followed. Modifying this product, substituting non-factory parts or using maintenance procedures other than outlined could drastically affect performance and be hazardous to personnel and equipment, and may void existing warranties.



c **WARNING:** Standard industry safety practices must be adhered to when working on this or any process control product. Specifically, personal protective and lifting devices must be used as warranted.

# 3 Unpacking and Storage

## 3.1 Unpacking

1. While unpacking the Logix 3400IQ positioner, check the packing list against the materials received. Lists describing the system and accessories are included in each shipping container.

2. When lifting the system from the shipping container, position lifting straps to avoid damage to mounted accessories. Systems with valves up to six inches may be lifted by actuator lifting ring. On larger systems, lift unit using lifting straps or hooks through the yoke legs and outer end of body.

   C **WARNING:** When lifting a valve/actuator assembly with lifting straps, be aware the center of gravity may be above the lifting point. Therefore, support must be given to prevent the valve/actuator from rotating. Failure to do so can cause serious injury to personnel or damage to nearby equipment.

3. In the event of shipping damage, contact the shipper immediately.

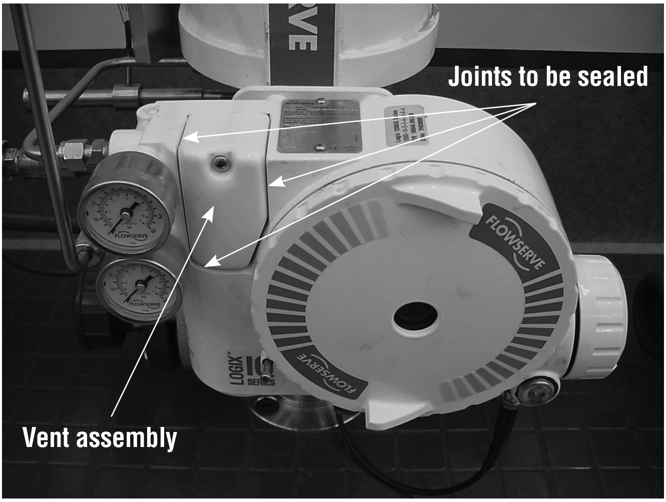
4. Should any problems arise, contact a Flowserve Flow Control representative.

## 3.2 Storage

Control valve packages (a control valve and its instrumentation) can be safely stored in an enclosed building that affords environmental protection; heating is not required. Control valve packages must be stored on suitable skids, not directly on the floor. The storage location must also be free from flooding, dust, dirt, etc.

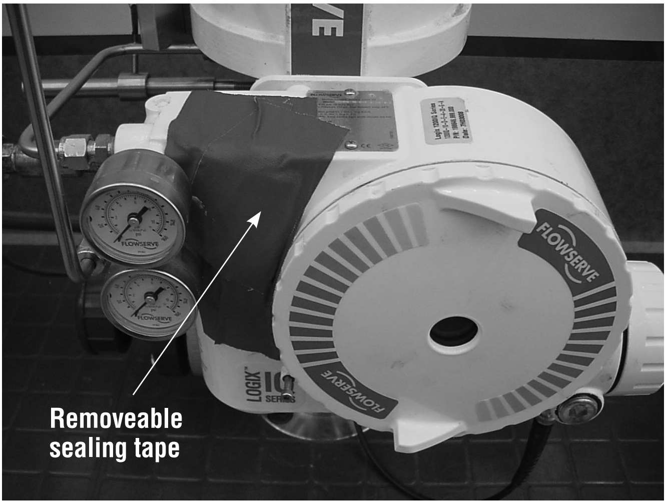
**Long Term Storage of Logix 3000 series Positioners in Humid Locations**
The Logix 3000 series positioners are designed to operate in humid environments when connected to a proper instrument air supply. There are some occasions when valves and positioners are stored at job sites or installed and commissioned and then left without instrument air for months. To make startup easier for units that are left without instrument air and insure that the positioners will be ready to operate, it is recommended that the vent assembly of the positioner be sealed preferably with a desiccant pouch sealed with the vent assembly.

The vent assembly is located in the upper left side of the positioner. The gaps around the assembly as noted by the arrows should be sealed for long term storage.




A small desiccant package as shown can be included under the sealing tape to insure proper protection.

All of the edges around the vend assembly should be sealed similar to the picture below.




The sealing tape and desiccant should be removed when instrument air is permanently applied to the positioner.

## 3.3 Pre-installation Inspection

If a valve control package has been stored for more than one year, inspect one actuator by disassembling it per the appropriate Installation, Operation, and Maintenance Instructions (IOM) prior to valve installation. If O-rings are out-of-round, deteriorated, or both, they must be replaced and the actuator rebuilt. All actuators must then be disassembled and inspected. If the actuator O-rings are replaced, complete the following steps:

1. Replace the pressure-balance plug O-rings.

2. Inspect the solenoid and positioner soft goods and replace as necessary.

# 4 Logix 3400IQ Positioner Overview

The Logix 3400IQ digital positioner is a two-wire FOUNDATION Fieldbus compliant digital valve positioner. The positioner is configurable through the local user interface. The Logix 3400IQ utilizes the FF protocol to allow two-way remote communications with the positioner. The Logix 3400IQ positioner can control both double- and single-acting actuators with linear or rotary mountings. The positioner is completely powered by the FF signal. Start up voltage must be from a FF power supply source.

*Figure 1: Logix 3400*IQ *Digital Positioner Schematic (air-to-open configuration)*

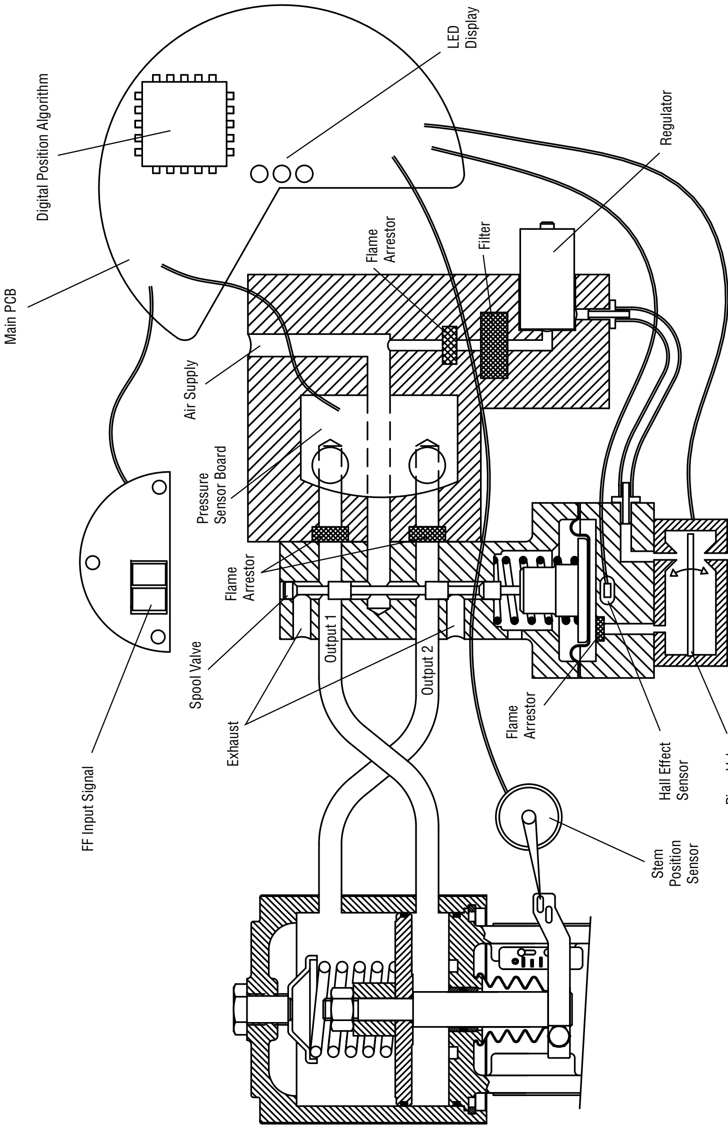
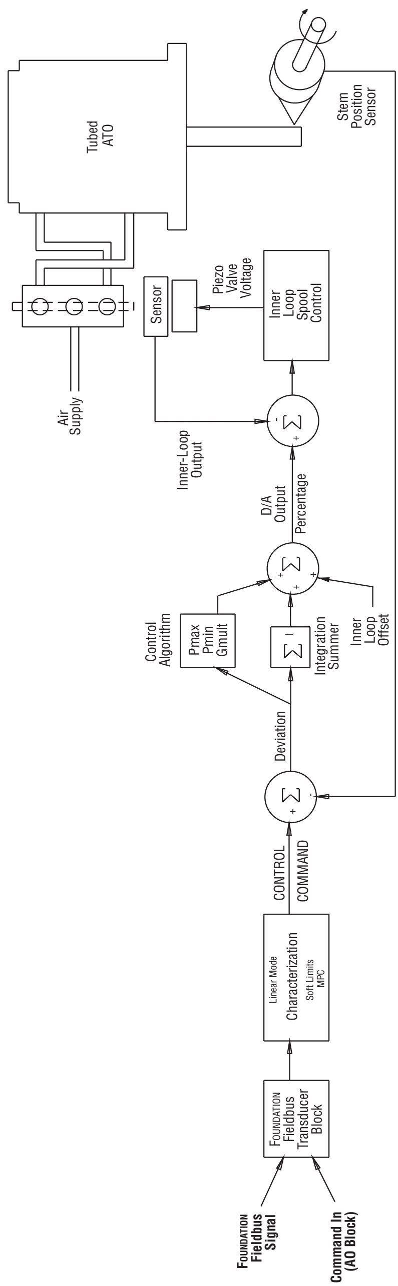


*Figure 2: System Positioning Algorithm*



## 4.1 Specifications

*Table I: Electrical Specifications*

| | |
|---|---|
| Power Supply | Two-wire, 9-32 VDC<br>FF compatible |
| IS | Fisco compliant |
| Communications | FF Protocol ITK 4.6x |
| Operating Current | 23 mA |
| Maximum Voltage | 36.0 VDC |

*Table II: Environmental Conditions*

| | | |
|---|---|---|
| Operating Temperature Range | Standard | -40° to 176°F<br>(-40° to 80°C) |
| Transport and Storage Temperature Range | -40° to 176°F (-40° to 80°C) | |
| Operating Humidity | 0 - 100% non-condensing | |

*Note: The air supply must conform to ISA Standard ISA 7.0.01 (a dew point at least 18 degrees Fahrenheit below ambient temperature, particle size below five microns—one micron recommended—and oil content not to exceed one part per million).*

*Table III: Physical Specifications*

| | |
|---|---|
| Housing Material | Cast, powder-painted aluminum, stainless steel |
| Soft Goods | Buna-N / Florosilicone |
| Weight | 8.3 pounds (3.9 kg) aluminum<br>20.5 pounds (9.3 kg) stainless steel |

*Table IV: Positioner Specifications*

| | |
|---|---|
| Deadband | <0.1% full scale |
| Repeatability | <0.05% full scale |
| Linearity | <0.5% (rotary), <0.8%, (sliding stem) full scale |
| Air Consumption | <0.3 SCFM (0.5 Nm$^3$/hr) @ 60 psi (4 bar) |
| Air Supply | 30-150 psig (ISA 7.0.0.1 compliant) |

*Table V: Hazardous Area Certifications*

| | |
|---|---|
| Intrinsically Safe<br>Class I,II,III, Div 1, Grp A,B,C,D,E,F,G<br>T4 Ta = -20$^0$C to +60$^0$C<br>Class 1, Zone 0, AEx ia IIC<br>NEMA/Type 4X<br>Entitiy Parameters:<br>Ui=24V, Ii=250mA, Pi=1.2W, Ci=3300pF, Li=10uH<br>Fisco Parameters:<br>Ui=17.5V, Ii=380mA, Pi=5.32W, Ci=3300pF, Li=10uH | Explosion Proof<br>Class I, Div. 1, Grp B,C,D<br>DIP Class II,III, Div. 1, Grp E,F,G<br>T6 Ta=60$^0$C<br>NEMA/ Type 4X<br>Class I, Div 1, Grp B,C,D<br>Class II, Grp E,F,G<br>Class III<br>Ex d IIB + H2 |
| Non Incendive: Class I,II,III, Div 2, Grp A,B,C,D,F,G T6 Ta= -20$^0$C to +60$^0$C | |

| | |
|---|---|
| II 1 G, Ex ia IIC T4 Ta=-20$^{0}$C to 60$^{0}$C<br>FM07ATEX0029X<br>Entity Parmeters<br>Ui=24V, Ii=250mA, Pi=1.2W, Ci=3300pF, Li=10uH<br>Fisco Parameters:<br>Ui=17.5V, Ii=380mA, Pi=5.32W, Ci=3300pF, Li=10uH<br>IP 65 | II 2 G, Ex d IIB+H2 T5 Ta=-40$^{0}$C to 80$^{0}$C<br>II 2 D, ExtD A21 T95$^{0}$C<br>Ta=-40$^{0}$ C to 55$^{0}$ C<br>IP65<br>FM07ATEX0005 |
| IECEx<br>Ex ia IIC T4 Ga<br>Ta = -40$^{0}$C to +60$^{0}$C<br>Entity Parmeters: Ui=24V, Ii=250mA, Pi=1.2W, Ci=3300pF, Li=10uH<br>Fisco Parameters: Ui=17.5V, Ii=380mA, Pi=5.32W, Ci=3300pF, Li=10uH<br>IP 65 | |
| Non Incendive<br>II 3 G, Ex nA nL IIC T6 Ta=-20$^{0}$ C to 60$^{0}$ C<br>IP65 FM07ATEX0035X | |
| CE Compliant | |
| FISCO Compliant | |

### *Special Conditions for Safe Use*

*1. **WARNING - Potential Sparking Hazard!** When used within a Zone 0 location, cast aluminum (when Enclosure Option b = 0,2,3,4, or 5) enclosures shall be installed in such a manner as to prevent the possibility of sparks resulting from friction or impact against the enclosure.*

*2. **WARNING - Potential Electrostatic Charging Hazard!** To prevent the risk of electrostatic sparking, the equipment's mechanical pressure gauges shall be cleaned only with a damp cloth.*

*3. Using the box provided on the nameplate, the user shall permanently mark the protection type chosen for the specific installation. Once the type of protection has been marked it shall not be changed.*

## 4.2 Positioner Operation

The Logix 3400IQ positioner is an electric feedback instrument. Figure 1 shows a Logix 3400IQ positioner installed on a double-acting linear actuator for air-to-open action.

The Logix 3400IQ receives power from the two-wire, FF input signal. This positioner utilizes FF communications for the command signal. The command source can be accessed with the Rosemount 375 communicator or other host software.

0% is always defined as the valve closed position and 100% is always defined as the valve open position. During stroke calibration, the signals corresponding to 0% and 100% are defined.

The input signal in percent passes through a characterization/limits modifier block. The positioner no longer uses CAMs or other mechanical means to characterize the output of the positioner. This function is done in software, which allows for in-the-field customer adjustment. The positioner has four basic modes: *Linear, Equal Percent (=%), Quick Open (QO)* and *Custom* characterization. In *Linear* mode, the input signal is passed straight through to the control algorithm in a 1:1 transfer. In *Equal Percent (=%)* mode, the input signal is mapped to a standard 30:1 rangeability =% curve. In

*Quick Open* the input signal is mapped to an industry standard quick-open curve. If *Custom* characterization is enabled, the input signal is mapped to either a default =% output curve or a custom, user-defined 21-point output curve. The custom user-defined 21-point output curve is defined using a handheld or the Host configuration tool software. In addition, two user-defined features, *Soft Limits* and Final Value Cutoff, may affect the final input signal. The actual command being used to position the stem, after any characterization or user limits have been evaluated, is called the *Control Command*.

The Logix 3400IQ uses a two-stage, stem-positioning algorithm. The two stages consist of an inner-loop, spool control and an outer-loop, stem position control. Referring again to Figure 1, a stem position sensor provides a measurement of the stem movement. The *Control Command* is compared against the *Stem Position*. If any deviation exists, the control algorithm sends a signal to the inner-loop control to move the spool up or down, depending upon the deviation. The inner-loop then quickly adjusts the spool position. The actuator pressures change and the stem begins to move. The stem movement reduces the deviation between *Control Command* and *Stem Position*. This process continues until the deviation goes to zero.

The inner-loop controls the position of the spool valve by means of a driver module. The driver module consists of a temperature-compensated hall effect sensor and a piezo valve pressure modulator. The piezo valve pressure modulator controls the air pressure under a diaphragm by means of a piezo beam bender. The piezo beam deflects in response to an applied voltage from the inner-loop electronics. As the voltage to the piezo valve increases, the piezo beam bends, closing off against a nozzle causing the pressure under the diaphragm to increase. As the pressure under the diaphragm increases or decreases, the spool valve moves up or down respectively. The hall effect sensor transmits the position of the spool back to the inner-loop electronics for control purposes.

## 4.3 Detailed Sequence of Positioner Operations

A more detailed example explains the control function. Assume the unit is configured as follows:

- Unit is in *OOS.*
- *Custom* characterization is disabled (therefore characterization is *Linear*).
- No soft limits enabled. No Final Value Cutoff set.
- Valve has zero deviation with a present input command of 50.
- Write to Final_Value to change command.
- Actuator is tubed and positioner is configured air-to-open.

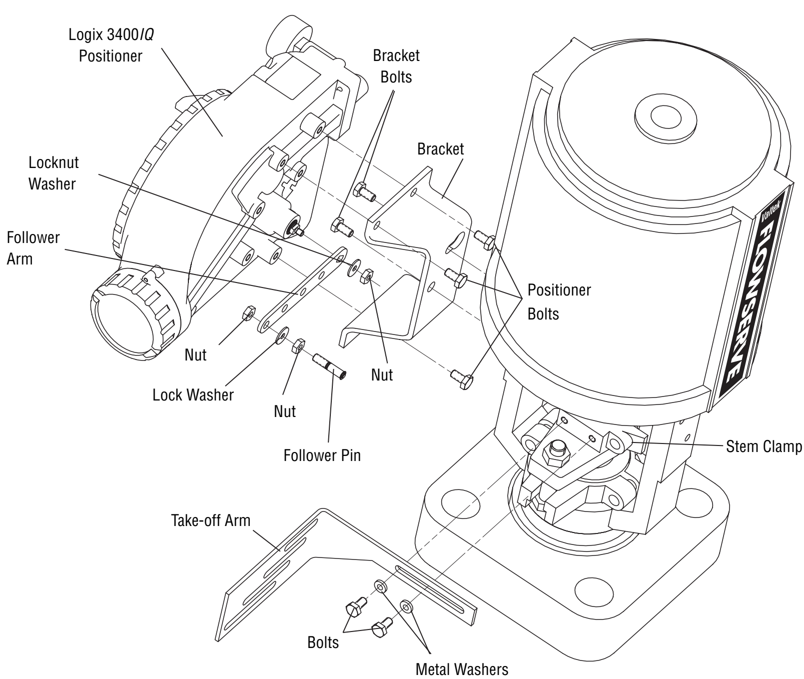
Given these conditions, 50 represents a *Command source* of 50 percent. *Custom characterization* is disabled so the *Command source* is passed 1:1 to the *Control Command*. Since zero deviation exists, the Stem Position is also at 50 percent. With the stem at the desired position, the spool valve will be at a middle position that balances the pressures above and below the piston in the actuator. This is commonly called the *null* or *balanced* spool position.



Assume the input signal changes from 50 to 75. The positioner sees this as a *Command source* of 75 percent. With *Linear characterization*, the *Control Command* becomes 75 percent. Deviation is the difference between *Control Command* and *Stem Position*: Deviation = 75% - 50% = +25%, where 50 percent is the present stem position. With this positive deviation, the control algorithm sends a signal to move the spool up from its present position. As the spool moves up, the supply air is applied to the bottom of the actuator and air is exhausted from the top of the actuator. This new pressure differential causes the stem to start moving towards the desired position of 75 percent. As the stem moves, the *Deviation* begins to decrease. The control algorithm begins to reduce the spool opening. This process continues until the *Deviation* goes to zero. At this point, the spool will be back in its null or balanced position. Stem movement will stop and the desired stem position is now achieved.

One important parameter has not been discussed to this point: Inner loop offset. Referring to Figure 2, a number called *Inner loop offset* is added to the output of the control algorithm. In order for the spool to remain in its null or balanced position, the control algorithm must output a non-zero spool command. This is the purpose of the *Inner loop offset*. The value of this number is equivalent to the signal that must be sent to the spool position control to bring it to a null position with zero deviation. This parameter is important for proper control and is optimized and set automatically during stroke calibration.

*Figure 3: Linear Mark One Control Valve Mounting*



# 5 Mounting and Installation

## 5.1 Mounting to Valtek Linear Mark One Valves

To mount a Logix 3400IQ positioner to a Valtek linear Mark One valve, refer to Figure 3 and proceed as outlined below. The following tools are required:

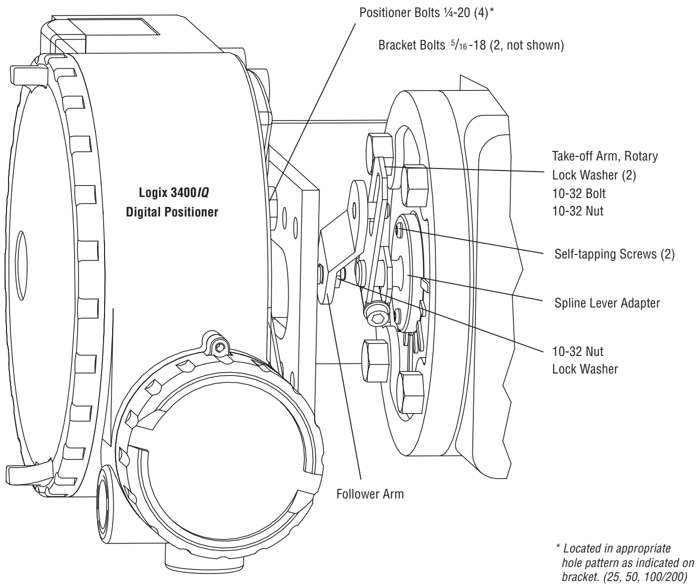
- 9⁄16" open-end wrench (or ½" for spud sizes 2.88 and smaller)
- 7⁄16" box wrench
- ⅜" open-end wrench

1. Remove washer and nut from follower pin assembly. Insert pin into the appropriate hole in follower arm, based on stroke length. The stroke lengths are stamped next to their corresponding holes in the follower arms. Make sure the unthreaded end of the pin is on the stamped side of the arm. Reinstall lock washer and tighten nut to complete follower arm assembly.
2. Slide the double-D slot in the follower arm assembly over the flats on the position feedback shaft in the back of the positioner. Make sure the arm is pointing toward the customer interface side of the positioner. Slide lock washer over the threads on the shaft and tighten down the nut.
3. Align the bracket with the three outer mounting holes on the positioner. Fasten with ¼" bolts.
4. Screw one mounting bolt into the hole on the yoke mounting pad nearest the cylinder. Stop when the bolt is approximately 3⁄16" from being flush with mounting pad.
5. Slip the large end of the teardrop shaped mounting hole in the back of the positioner/bracket assembly over the mounting bolt. Slide the small end of the teardrop under the mounting bolt and align the lower mounting hole.
6. Insert the lower mounting bolt and tighten the bolting.
7. Position the take-off arm mounting slot against the stem clamp mounting pad. Apply Loctite 222 to the take-off arm bolting and insert through washers into stem clamp. Leave bolts loose.
8. Slide the appropriate pin slot of the take-off arm, based on stroke length, over the follower arm pin. The appropriate stroke lengths are stamped by each pin slot.
9. Center the take-off arm on the rolling sleeve of the follower pin.
10. Align the take-off arm with the top plane of the stem clamp and tighten bolting. Torque to 120 in-lb.

    **NOTE:** If mounted properly, the follower arm should be horizontal when the valve is at 50% stroke and should move approximately ±30° from horizontal over the full stroke of the valve. If mounted incorrectly, a stroke calibration error will occur and the indicator lights will blink a YRYR or YRRY code indicating the position sensor has gone out of range on one end of travel. Reposition the feedback linkage or rotate the position sensor to correct the error.

# 5.2 Mounting to Standard Valtek Rotary Valves (See Figure 4)

*Figure 4: Standard Rotary Mounting*




The standard rotary mounting applies to Valtek valve/actuator assemblies that do not have mounted volume tanks or handwheels. The standard mounting uses a linkage directly coupled to the valve shaft. This linkage has been designed to allow for minimal misalignment between the positioner and the actuator. The tools required for the following procedure are:

- 5⁄32" Allen wrench
- ½" open-end wrench
- 7⁄16" open-end wrench
- 3⁄8" socket with extension
- 3⁄16" nutdriver

1. Fasten the spline lever adapter to the splined lever using two 6 x ½" self-tapping screws.
2. Slide the take-off arm assembly onto the spline lever adapter shaft. Insert the screw with star washer through the take-off arm and add the second star washer and nut. Tighten nut with socket so arm is lightly snug on the shaft but still able to rotate. This will be tightened after linkage is correctly oriented.
3. Attach follower arm to positioner feedback shaft using the star washer and 10-32 nut.

**NOTE:** The arm will point up when feedback shaft is in the free position.

4. Using four ¼-20 x ½" bolts, fasten positioner to universal bracket using appropriate hole pattern (stamped on bracket).

5. Using a ½" end wrench and two 5⁄16-18 x ½" bolts, attach bracket to actuator transfer case pad. Leave these bolts slightly loose until final adjustments are made.

6. Rotate take-off arm so the follower pin will slide into the slot on the take-off arm. Adjust the bracket position as needed noting the engagement of the follower pin and the take-off arm slot. The pin should extend approximately 1⁄16" past the take-off arm. When properly adjusted, securely tighten the bracketing bolts.

**Orienting the Take-off Arm for Final Lock Down**

1. Tube the Logix 3400IQ positioner to the actuator according to the instructions given in Section 5.5, "Tubing Positioner to Actuator."

2. **With supply pressure off**, rotate the follower arm in the same direction the shaft would rotate upon a loss of supply pressure. When the mechanical stop of the follower arm (positioner) is reached, rotate back approximately 15 degrees.

3. Hold the take-off arm in place; tighten the screw of the take-off arm.

   **NOTE:** The take-off arm should be snug enough to hold the follower arm in place but allow movement when pushed.

4. Connect regulated air supply to appropriate port in manifold.

5. Remove main cover and locate DIP switches and RE-CAL button.

6. Refer to sticker on main board cover and set DIP switches accordingly. (A more detailed explanation of the DIP switch settings is given in Section 7, "Startup.")

7. Press the RE-CAL button for three to four seconds or until the positioner begins to move. The positioner will now perform a stroke calibration.

8. If the calibration was successful the green LED will blink GGGG or GGGY and the valve will be in control mode. Continue with step 9. If calibration failed, as indicated by a YRYR or YRRY blink code, the A/D feedback values were exceeded and the arm must be adjusted away from the positioners limits. Return to step 2 and rotate the arm back approximately 10 degrees.

   **NOTE:** Remember to remove the air supply before re-adjusting take-off arm.

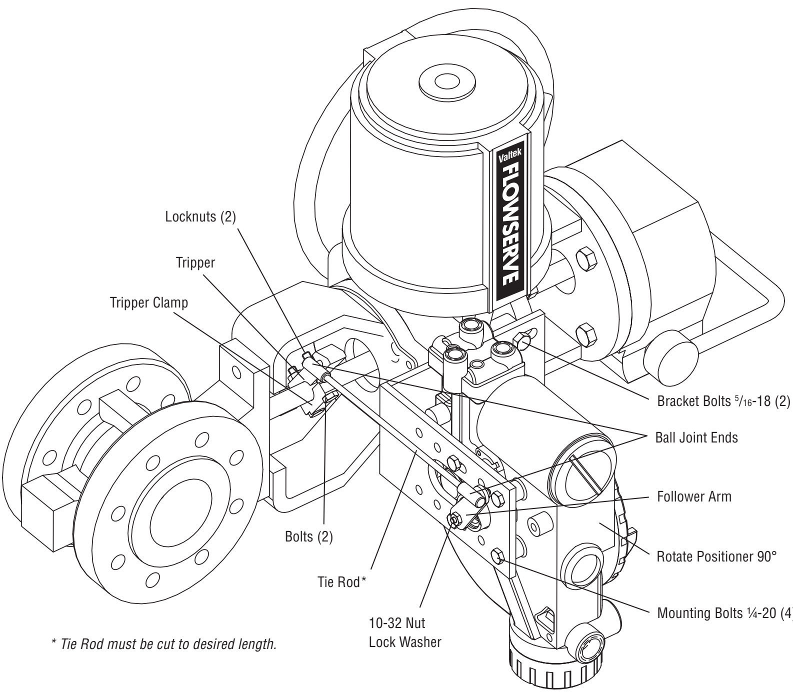
9. Tighten the nut on the take-off arm. The socket head screw of the take-off arm must be tight, about 40 in-lb.

   **NOTE:** If the take-off arm slips, the positioner must be recalibrated.

C **WARNING:** Failure to follow this procedure will result in positioner and/or linkage damage. Check air-action and stroke carefully before lockdown of take-off arm to spline lever adapter.

## 5.3 Optional Valtek Rotary Mounting Procedure (See Figure 5)

*Figure 5: Optional Rotary Mounting*




The optional rotary mounting applies to Valtek valve/actuator assemblies that are equipped with mounted volume tanks or handwheels. The optional mounting uses a four-bar linkage coupled to the valve shaft. The following tools are required:

- ⅜" open-end wrench
- 7⁄16" open-end wrench
- ½" open-end wrench

1. Using a ½" open-end wrench and two 5⁄16-18 x ½" bolts, attach bracket to actuator transfer case pads. Leave bracket loose to allow for adjustment.

2. Using four ¼-20 x ½" bolts and a 7⁄16" open-end wrench, fasten positioner to universal bracket, using the four-hole pattern that locates the positioner the farthest from the valve. Rotate positioner 90 degrees from normal so gauges are facing upward.

3. Attach follower arm to positioner feedback shaft, using the star washer and 10-32 nut.

4. Attach tripper and tripper clamp to valve shaft using two ¼-20 bolts and two ¼-20 locknuts. Leave tripper loose on shaft until final adjustment.

5. Thread ball joint linkage end to tripper and tighten (thread locking compound such as Loctite is recommended to prevent back threading). Adjust the length of tie rod so follower arm and tripper rotate parallel to each other (the rod must be cut to the desired length). Connect the other ball joint end to follower arm using a star washer and a 10-32 nut.

6. Tighten bracket and tripper bolting.

7. Check for proper operation, note direction of rotation.

   C **WARNING:** If rotating in wrong direction, serious damage will occur to the positioner and/or linkage. Check air action and stroke direction carefully before initiating operation.

## 5.4 NAMUR Mounting Option

Logix 3200IQ is available with a NAMUR output shaft and mounts on an actuator using the ISO F05 holes. Proper alignment of the positioner shaft to the actuator shaft is very important since improper alignment can cause excess wear and friction to the positioner.

## 5.5 Tubing Positioner to Actuator

The Logix 3400IQ digital positioner is insensitive to supply pressure changes and can handle supply pressures from 30 to 150 psig. A supply regulator is recommended if the customer will be using the diagnostic features of the Logix 3400IQ but is not required. In applications where the supply pressure is higher than the maximum actuator pressure rating a supply regulator is required to lower the pressure to the actuator’s maximum rating (not to be confused with operating range). An air filter is highly recommended for all applications where dirty air is a possibility.

**NOTE:** The air supply must conform to ISA Standard ISA 7.0.01 (a dew point at least 18°F below ambient temperature, particle size below five microns—one micron recommended—and oil content not to exceed one part per million).

Air-to-open and air-to-close are determined by the actuator tubing, not the software. When air action selection is made during configuration, that selection tells the control which way the actuator has been tubed. The top output port is called *Output 1*. It should be tubed to the side of the actuator that must receive air to begin the correct action on increasing signal. Verify that tubing is correct prior to a stroke calibration. Proper tubing orientation is critical for the positioner to function correctly and have the proper failure mode. Refer to Figure 1 and follow the instructions below:

**Linear Double-acting Actuators**

For a linear air-to-open actuator, the Output 1 port of the positioner manifold is tubed to the bottom side of the actuator. The Output 2 port of the positioner manifold is tubed to the top side of the actuator. For a linear air-to-close actuator the above configuration is reversed.

**Rotary Double-acting Actuators**

For a rotary actuator, the Output 1 port of the positioner manifold is tubed to the bottom side of the actuator. The Output 2 port of the positioner manifold is tubed to the top side of the actuator. This tubing convention is followed regardless of air action. On rotary actuators, the transfer case orientation determines the air action.

**Single-acting Actuators**

For single-acting actuators, the Output 1 port is always tubed to the pneumatic side of the actuator regardless of air action. The Output 2 port must be plugged.

# 6 Wiring and Grounding Guidelines (See Figure 6)

C **WARNING:** This product has electrical conduit connections in either thread sizes ½" NPT or M20 which appear identical but are not interchangeable. Housings with M20 threads are stamped with the letters M20 above the conduit opening. Forcing dissimilar threads together will damage equipment, cause personal injury and void hazardous location certifications. Conduit fittings must match equipment housing threads before installation. If threads do not match, obtain suitable adapters or contact a Flowserve representative.

## 6.1 FF Command Input Wiring

The Logix 3400IQ is non-polarity sensitive. Wire FF source to the input terminals (see Figure 6). Minimum operating voltage is 9 VDC.

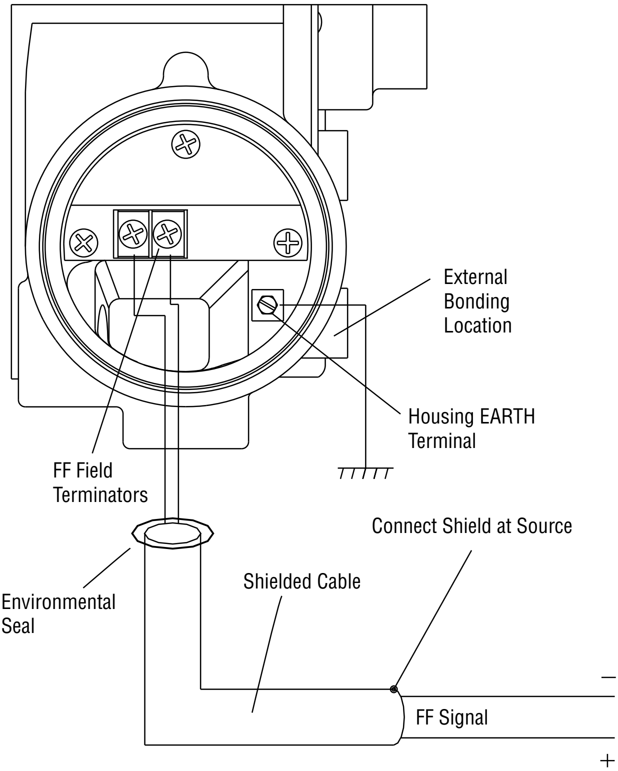
The FF signal to the Logix 3400IQ digital positioner should be in shielded cable. Shields must be tied to a ground at only one end of the cable to provide a place for environmental electrical noise to be removed from the cable. In general, shield wire should be connected at the source. Refer to guidelines in FF AG-181 for proper wiring methods.

**NOTE:** The Logix 3400IQ positioner carries an intrinsically safe barrier rating of 250 mA. Input currents should not exceed 250 mA, 5 watts.

## 6.2 Grounding Screw

The green grounding screw, located inside the termination cap, should be used to provide the unit with an adequate and reliable earth ground reference. This ground should be tied to the same ground as the electrical conduit. Additionally, the electrical conduit should be earth grounded at both ends of its run.

*Figure 6: Field Termination*




C **WARNING:** The green grounding screw must not be used to terminate signal shield wires.

## 6.3 Segment Compliance Voltage (See Figure 7)

Output compliance voltage refers to the voltage limit that can be provided by the FF source. A FF system consists of the FF source, wiring resistance, barrier resistance (if present), and the Logix 3400IQ positioner voltage. The Logix 3400IQ digital positioner requires that the system allows for a 9.0 VDC drop across the positioner at minimum segment voltage. The actual voltage at the terminals varies from 9.0 to 32.0 VDC depending on the FF signal and ambient temperature.

Determine if the segment will support the Logix 3400IQ digital positioner by performing the following calculation.



$$\text{Voltage} = \text{Compliance Voltage (@ 23 mA)} - 23\ \text{mA} \bullet (R_{barrier} + R_{wire})$$

Equation 1

The calculated voltage must be greater than 9 VDC in order to safely support the Logix 3400IQ digital positioner.

Example:

DCS Compliance Voltage = 19 VDC

$R_{barrier}$ = 300 Ω

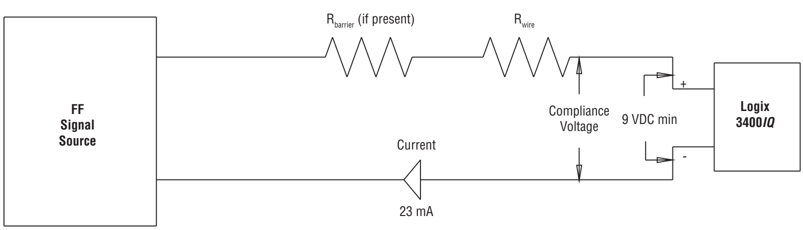
$R_{wire}$ = 25 Ω

$Current_{max}$ = 23 mA

Voltage = 19 VDC – 0.023 A • (300 Ω + 25 Ω) = 11.5 VDC

The voltage 11.5 VDC is greater than the required 9.0 VDC; therefore, this system will support the Logix 3400IQ digital positioner.

*Figure 7: Compliance Voltage*




## 6.4 Cable Requirements

The Logix 3400IQ digital positioner utilizes the FF protocol. This communication signal is superimposed on the supply voltage.

FF rated cable should be used. Refer to H1 wiring specification.

## 6.5 Intrinsically Safe Barriers

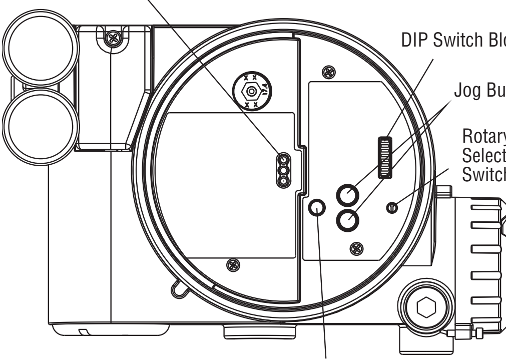
When selecting an intrinsically safe barrier, make sure the barrier is FF compatible. Although the barrier will pass the segment voltage and allow normal positioner operation, if not compatible, it may prevent FF communication.

## 6.6 DD Support

The DD for the Logix 3400IQ can be downloaded from either the flowserve website: www.flowserve.com or the FOUNDATION Fieldbus website: www.Fieldbus.org.

# 7 Startup

*Figure 8: Local User Interface*




## 7.1 Logix 3400IQ Local Interface Operation

The Logix 3400IQ local user interface (Figure 8) allows the user to configure the basic operation of the positioner, tune the response, and calibrate the positioner without additional tools or configurators. The local interface consists of a RE-CAL button for automatic zero and span setting, along with two jog buttons (▲ and ▼) for spanning valve/actuators with no fixed internal stop in the open position. There is also a DIP switch block containing eight switches. Six of the switches are for basic configuration settings and two are for FF options. There is also a rotary selector switch for adjusting the positioner gain settings. For indication of the operational status or alarm conditions there are three LEDs on the local user interface.

## 7.2 Initial DIP Switch Settings

Before placing the unit in service, set the DIP switches in the Configuration boxes to the desired control options. A detailed description of each DIP switch setting follows.

**NOTE:** The Logix 3400IQ positioner reads the DIP switch settings each time the RE-CAL button is pressed. If a FF handheld or Host software is used to configure and then calibrate the positioner, the DIP switches are not read. The auto-tune adjustment switch labeled "GAIN" is always live and can be adjusted at any time.



Transducer block settings will always override the DIP switch settings until the RE-CAL button is pressed.

## 7.3 Description of Configuration DIP Switch Settings

The first six DIP switches are for basic configuration. The function of each switch is described below.

**Air Action**
This must be set to match the configuration of the valve/actuator mechanical tubing connection and spring location since these determine the air action of the system.

**ATO (air-to-open)**
Selecting ATO if increasing output pressure from the positioner is tubed so it will cause the valve to open.

**ATC (air-to-close)**
Selecting ATC if increasing output pressure from the positioner is tubed so it will cause the valve to close.

**Pos. Characterization**
**Linear** Select *Linear* if the actuator position should be directly proportional to the input signal.

**Other** Select *Other* if another characteristic is desired, which is set in conjunction with the **Control_ Flags** parameter in the transducer block.

**Optional Pos. Characterization**
If the Pos. Characterization switch is set to Other then this parameter is active with the following options:

**=%** The =% option will characterize the actuator response to the input signal based on a standard 30:1 equal percent rangeability curve.

**QO** Quick open is based on a standard industry quick-open curve.

**Custom** If *Custom* is selected, the positioner will be characterized to a custom table that must be set-up using a properly configured 375 handheld or other host software. *Custom* characterization can be thought of as a "soft CAM." The user can define a characterization curve using 21 points. The control will linearly interpolate between points. Points do not have to be equally spaced in order to allow more definition at critical curve areas. The default values will linearize the output of a valve with an inherent =% characteristic (e.g. ball valves.)

*Figure 9: Default Custom Characterization*

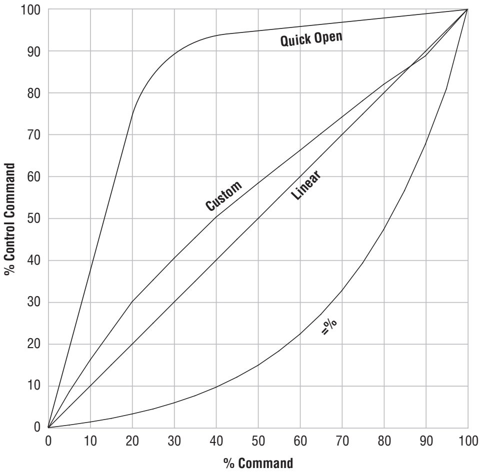


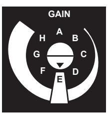

*Table VI : Characteristic Curve Data*

| % Command | % Control Command | | | |
|---|---|---|---|---|
| | =% | Linear | Custom | QO |
| 0 | 0 | 0 | 0 | 0 |
| 5 | 0.62 | 5 | 8.66 | 18.8 |
| 10 | 1.35 | 10 | 16.24 | 37.6 |
| 15 | 2.22 | 15 | 23.17 | 56.4 |
| 20 | 3.25 | 20 | 30.11 | 74.0 |
| 25 | 4.47 | 25 | 35.31 | 84.3 |
| 30 | 5.91 | 30 | 40.51 | 90.0 |
| 35 | 7.63 | 35 | 45.42 | 92.0 |
| 40 | 9.66 | 40 | 50.34 | 93.4 |
| 45 | 12.07 | 45 | 54.40 | 94.2 |
| 50 | 14.92 | 50 | 58.47 | 94.8 |
| 55 | 18.31 | 55 | 62.39 | 95.5 |
| 60 | 22.32 | 60 | 66.31 | 96.0 |
| 65 | 27.08 | 65 | 70.27 | 96.5 |
| 70 | 32.71 | 70 | 74.23 | 97.0 |
| 75 | 39.40 | 75 | 78.17 | 97.5 |
| 80 | 47.32 | 80 | 82.11 | 98.0 |
| 85 | 56.71 | 85 | 85.50 | 98.5 |
| 90 | 67.84 | 90 | 88.89 | 99.0 |
| 95 | 81.03 | 95 | 94.45 | 99.5 |
| 100 | 100.00 | 100 | 100.00 | 100.0 |

**Auto Tune**
This switch controls whether the positioner will auto tune itself every time the RE-CAL button is pressed or use preset tuning parameters.

**On** *On* enables an auto tune feature that will automatically determine the positioner gain settings based on the current position of the adjustable GAIN switch setting and response parameters measured during the last RE-CAL. The GAIN switch is live, meaning the settings can be adjusted at any time by changing the rotary switch position. (Note that there is a small black arrow indicating the selection. The slot in the switch is NOT the indicator.)

*Figure 10: Adjustable GAIN Switch*




If the adjustable GAIN selector switch is set to “E” with the auto tune switch on, a Flowserve standard response tuning set will be calculated and used based on response parameters measured during the last RE-CAL.

If the adjustable GAIN selector switch is set to “D”, “C”, “B”, or “A” with the auto tune switch on, progressively lower gain settings will be used based on response parameters measured during the last RE-CAL.

If the adjustable GAIN selector switch is set to “F”, “G”, or “H” with the auto tune switch on, progressively higher gain settings will be calculated and used based on response parameters measured during the last RE-CAL.

**Off** *Off* forces the positioner to use one of the factory preset tuning sets determined by the adjustable GAIN selector switch. Settings “A” through “H” are progressively higher gain predefined tuning sets. The GAIN selector switch is live and can be adjusted at any time to modify the tuning parameters.

> **NOTE:** “E” is the default adjustable GAIN selector switch setting for all actuator sizes. Raising or lowering the gain setting is a function of the positioner/valve response to the control signal, and is not actuator size dependent.

**Stability Switch**
This switch adjusts the position control algorithm of the positioner for use with low-friction control valves or high-friction automated valves.

**Low-Friction Valves** Placing the switch to the left optimizes the response for low-friction, high-performance control valves. This setting provides for optimum response times when used with most low-friction control valves.

**High-Friction Valves** Placing the switch to the right optimizes the response for valves and actuators with high friction levels. This setting slightly slows the response and will normally stop limit cycling that can occur on high-friction valves.

## 7.4 Description of Cal DIP Switch Settings

The sixth DIP switch selects between two calibration options. The function of the Cal DIP switch is described below.

**NOTE:** The unit must be in OOS mode before a calibration sequence can begin.

**Auto** Select *Auto* if the valve/actuator assembly has an internal stop in the open position. In *Auto* mode the positioner will fully *close* the valve and register the 0% position and then *open* the valve to the stop to register the 100% position when performing a self-calibration. See detailed instructions in the next section on how to perform an auto positioner calibration.

**Jog** Select *Jog* if the valve/actuator assembly has no physical calibration stop in the open position. In the *Jog* mode the positioner will fully close the valve for the 0% position and then wait for the user to set the open position using the Jog buttons labeled with the up and down arrows. See the detailed instructions in Section 7.6 on how to perform a manual calibration using the Jog buttons.

C **WARNING:** During the RE-CAL operation the valve may stroke unexpectedly. Notify proper personnel that the valve will stroke, and make sure the valve is properly isolated.

## 7.5 RE-CAL Operation

**NOTE:** The unit must be in OOS mode before a calibration sequence can begin.

The RE-CAL button is used to locally initiate a calibration of the positioner. Pressing and holding the RE-CAL button for approximately three seconds will initiate the calibration. If the Config-Switches option is enabled, the settings of all the configuration switches are read and the operation of the positioner adjusted accordingly. A RE-CAL can be aborted at any time by briefly pressing the RE-CAL button and the previous settings will be retained.

If the Quick Calibration switch (be careful not to confuse this with the RE-CAL button) is set to Auto and the valve/actuator assembly has the necessary internal stops the calibration will complete automatically. While the calibration is in progress you will notice a series of different lights flashing indicating the calibration progress. When the lights return to a sequence that starts with a green light the calibration is complete. An explanation of the various light sequences follows. The initial calibration of extremely large or small actuators may require several calibration attempts. The positioner adapts to the actuator performance and begins each calibration where the last attempt ended. On an initial installation it is recommended that after the first successful calibration that one more calibration be completed for optimum performance.

C **WARNING:** When operating using RE-CAL or local control, the valve will not respond to external commands. Notify proper personnel that the valve will not respond to remote command changes, and make sure the valve is properly isolated.

## 7.6 Manual Jog Calibration Operation

If the Quick Calibration switch is set to Jog, the calibration will initially close the valve then cause a small jump in the valve position. The jog calibration process will only allow the user to manually set the span; zero position is automatically always set at the seat. If an elevated zero is needed a handheld or other PC-based configuration software is required. When performing a jog calibration, the LEDs will flash in a sequence of Y-R-R-G (yellow-red-red-green) which indicates that the user must use the Jog buttons (▲ and ▼) to manually position the valve to the 100% position. When the stem is properly positioned press both the Jog buttons (▲ and ▼) simultaneously again to register the 100% position and proceed. No more user actions are required while the calibration process is completed. When the lights return to a sequence that starts with a green light the calibration is complete. An explanation of the various light sequences follows.

## 7.7 Local Control of Valve Position

Local control of valve position can be achieved from the user interface by holding down both Jog buttons and the RE-CAL button simultaneously for three seconds. While in this mode the LEDs will flash a YGRR (yellow-green-red-red) sequence. Use the two Jog buttons (▲ and ▼) to manually control the position of the valve. To exit the local control mode and return to normal operation, briefly press the RE-CAL button.

## 7.8 Factory Reset

To perform a factory reset, disconnect power, hold the RE-CAL button down, and reconnect power. Performing a factory reset will cause all of the internal variables, including calibration, to be reset to factory defaults. The positioner must be recalibrated after a factory reset. User configured limits, alarm settings, and valve information will also need to be restored.

C **WARNING:** Performing a factory reset may result in the inability to operate the valve until reconfigured properly. Notify proper personnel that the valve may stroke, and make sure the valve is properly isolated.

## 7.9 Logix 3400IQ Status Condition

The blink codes used to convey the status of the Logix 3400IQ digital positioner are described in the table below. In general, any sequence starting with a green light flashing first is a normal operating mode and indicates that there are no internal problems. Any sequence starting with a yellow light flashing indicates that the unit is in a special calibration or test mode, or that there was a calibration problem. Any sequence starting with a red light flashing indicates that there is an operational problem with the unit.

*Table VII: Status and Conditions*

| Colors | Identifier | Indication and Resolution |
|---|---|---|
| G - - - | | **Any sequence starting with a green light flashing first is a normal operating mode and indicates that there are no internal problems.** |
| GGGG | 1 | **Normal operation** No errors, alerts, or warnings. |
| GGGY | 2 | **Final Value cutoff active** The command is below or above the user-set limits for tight shutoff feature. This is a normal condition for a closed valve. The factory default setting is 1% and 110% command. To clear the condition use handheld or Host software to reset the tight shutoff if the range is incorrect or adjust the command signal above the specified Final Value cutoff. |
| GGYR | 4 | **Initializing** This sequence should only be visible for three sequences when powering up the unit. |
| GGRG | 5 | **Cycle limit exceeded (user-set)** The cycle limit set by the user has been exceeded. To clear use handheld or Host software to reset. |
| GGRY | 6 | **Travel limit exceeded (user-set)** The total accumulated travel limit set by the user has been exceeded. To clear use handheld or Host software to reset. |
| GYYR | 7 | **Soft Stop Low (user-set)** The unit is being commanded to exceed a user-defined lower position limit and the internal software is holding the position at the limit. The function is similar to a mechanical limit stop except it is not active if the unit is un-powered. To clear the condition use handheld or Host software to reset the limit if more travel is needed or adjust the command signal back in the specified range. |
| GYRY | 8 | **Soft Stop High (user-set)** The unit is being commanded to exceed a user-defined upper position limit and the internal software is holding the position at the limit. The function is similar to a mechanical limit stop except it is not active if the unit is un-powered. To clear the condition use handheld or Host software to reset the limit if more travel is needed or adjust the command signal back in the specified range. |
| GRYR | 9 | **Posalert Low (user-set)** The position has reached or is exceeding a user-defined lower position indicator similar to a limit switch indicator. To clear the condition use handheld or Host software to reset the indicator if more travel is needed or adjust the command signal back in the specified range. |
| GRRY | 10 | **Posalert High (user-set)** The position has reached or is exceeding a user-defined upper position indicator similar to a limit switch indicator. To clear the condition use handheld or Host software to reset the indicator if more travel is needed or adjust the command signal back in the specified range. |
| Y - - - | | **Any sequence starting with a yellow light indicates that the unit is in a special calibration or test mode, or that there was a calibration problem.** |
| YGYG | 11 | **Signature test in progress** This is a test initiated by Host software that can only be cancelled by that software. |
| YRGG | 13 | **Stroke calibration in progress** Calibration sequence started either using the local RE-CAL button or by a handheld or Host software. It may be cancelled by briefly pushing the RE-CAL button. |

*Continued on page 29*

*Table VII: Status and Conditions (continued)*

| Colors | Identifier | Indication and Resolution |
|---|---|---|
| YGRR | 14 | **Local jog control mode** The unit has been placed in a local override mode where the valve can only be stroked using the two local jog buttons. It may be cancelled by briefly pushing the RE-CAL button. |
| YYGR | 15 | **Pressure calibration in progress** Calibration sequence controlled by a handheld or Host software that can only be cancelled by that software. |
| YYYY | 16 | **Local user interface disabled** Host software has been used to disable the local interface. If local control is desired then the local interface must be re-enabled from the remote software. This code is only present for a short time when the RE-CAL button is pressed. |
| YRRG | 17 | **Waiting** Adjust to full open position setting from User—only used during Jog calibration see explanation in Section 7.5, "RE-CAL," for operation. |
| YRYG | 18 | **Setting IL offset while calibrating** An automatic step in the calibration process that is done with the valve at 50% position. This must be completed for proper calibration. |
| YRYY | 19 | **No feedback motion while calibrating** Indicates that there was no motion of the actuator based on the current stroke time configuration. Check linkages and air supply to make sure the system is properly connected. If the time out occurred because the actuator is very large then simply retry the RE-CAL and the positioner will automatically adjust for a larger actuator by doubling the time allowed for movement. This error may be cleared by briefly pushing the RE-CAL button, which will force the positioner to use the parameters from the last good calibration. |
| YRYR | 20 | **Feedback 0% out of range** Calibration error indicating that the position sensor was out of range during the calibration of the closed position. To correct the condition, adjust the positioner mounting, linkage or feedback potentiometer to move the position sensor back into range then restart the calibration. This error may be cleared by briefly pushing the RE-CAL button, which will force the positioner to use the parameters from the last good calibration. |
| YRRY | 21 | **Feedback 100% out of range** Calibration error indicating that the position sensor was out of range during the calibration of the open position. To correct the condition, adjust the positioner mounting, linkage or feedback potentiometer to move the position sensor back into range then restart the calibration. This error may be cleared by briefly pushing the RE-CAL button, which will force the positioner to use the parameters from the last good calibration. |
| YRRR | 22 | **Feedback span too small** The range of motion of the position feedback arm was too small for optimum performance. Check for loose linkages and/or adjust the feedback pin to a position closer to the follower arm pivot to create a larger angle of rotation and recalibrate. Briefly pushing the RE-CAL button acknowledges this condition and the positioner will operate using the current short stroke calibration if otherwise a good calibration. |
| YRGR | 23 | **Feedback unstable while calibrating** Check for loose linkages or loose positioner sensor. This error may be cleared by briefly pushing the RE-CAL button, which will force the positioner to use the parameters from the last good calibration. This error may appear on some very small actuators during the initial calibration. Redoing the calibration may clear the problem. |
| R - - - | | **Any sequence starting with a red light indicates that there is an operational problem with the unit.** |
| RGRR | 24 | **Position deviation (user-set)** The position has exceeded user-defined error band between command and position. |
| RGYY | 25 | **Pressure reading out of range** The internal pressure sensors are either saturated with a pressure over 150 psi or the sensor has failed. Check supply pressure and if OK check the pressure sensor board connections and replace pressure sensor board if necessary. |

*Continued on page 30*

*Table VII: Status and Conditions (continued)*

| Colors | Identifier | Indication and Resolution |
|---|---|---|
| RGYR | 26 | **Loss of supply pressure** The Positioner has determined that the supply pressure is below 15 psi. Check the supply pressure and if OK check the pressure sensor board connections and replace pressure sensor board if necessary. Minimum recommended supply pressure is 30 psi for proper operation. |
| RYGG | | **Factory reset condition** Recalibrate. |
| RYYY | 27 | **Pilot relay non-motion alert** Check to make sure the air supply is connected. Also check the internal wiring harnesses for good connections. This error may be cleared by briefly pushing the RE-CAL button, which will force the positioner to use the parameters from the last good calibration. If the positioner still does not operate replace the pneumatic relay assembly. |
| RRGG | 30 | **Watchdog timer timeout (also listed as internal voltage reference)** This is often caused when intermittent operation occurs when connecting power. Remove power and then reconnect to clear. If problem persists it is a bad electronic assembly, replace. |
| RRYG | 31 | **Internal temperature alert** The internal positioner temperature is currently exceeding operational limits of -40ºF (-40ºC) or 185ºF (85ºC). |
| RRYY | 32 | **Piezo voltage error** Bad electronic assembly, replace. |
| RRYR | 33 | **Internal voltage reference error** Indicates that the circuit board is drawing too much power. Check internal wiring and connectors for electrical shorts—if no shorts are present, replace the electronic assembly. |
| RRRG | | **Loss of Inter-PCB Communications** Cycle power to restart. |
| RRRY | 34 | **NV RAM checksum error** The checksum of the internal data was not updated correctly. Cycle power and complete a RE-CAL if error persists. Check internal data to verify correct settings. If the error still occurs, replace the electronic assembly. |

## 7.10 Version Number Checking

The version number of the embedded code may be checked at any time except during a calibration by holding down the up arrow Jog button (▲). This will not alter the operation of the unit other than to change the blink sequence to three blinks indicating the major version number. Holding the down arrow Jog button (▼) will give the minor version number without affecting operation. The version codes are interpreted by adding up the numbers assigned according to the following table:

| Color | First blink value | Second blink value | Third blink value |
|---|---|---|---|
| Green | 0 | 0 | 0 |
| Yellow | 9 | 3 | 1 |
| Red | 18 | 6 | 2 |

For example if holding the up arrow Jog button (▲ ) gave a G-G-R code, and holding the down arrow Jog button (▼) gave a Y-Y-G code then the resulting version number would be (0+0+2).(9+3+0) or version 2.12.

## 7.11 375 Handheld Communicator

The Logix 3400IQ Quick Start Guide is available from a Flowserve representative.

The Logix 3400IQ digital positioner supports and is supported by the 375 Handheld Communicator. The Device Description (DD) files and the manuals listed below can be obtained from the FF Foundation or from your Flowserve representative. For more information please see the following guides:

- Product Manual for the 375 Communicator.
- Logix 3400IQ Digital Positioner Reference Manual.

Diagnostic features such as the signature tests and ramp tests are performed internally. Certain calibration features such as actuator pressure sensor calibrations are performed using the 375 Handheld Communicator or using the Host software.

## 7.12 Device Description (DD) Files

The DD files for the Logix 3400 can be downloaded from the Flowserve website, http://fcd.flowserve.com/valves/softwareDownload.jsp, or the Foundation Fieldbus website, www.fieldbus.org.

## 7.13 Calibration

### 7.13.1 CALIBRATE_FLAGS

**Position 0% Calibration Flag in CALIBRATE_FLAGS**
During stroke calibration, the Logix 3400 digital positioner checks to see if the linkage is placing the stem position sensor in range. If the valve stroke causes stem position measurement to go out of range in the closed position, a Position 0% Flag will be generated. The valve stem will stop in the closed position and the red LED will blink. Linkage must be adjusted to bring the sensor in range. Special LED indication: If the linkage is out of range, the LEDs can be used as an adjustment guide. The LED will change from a red to yellow when the linkage is brought into range.

**Position 100% Calibration Flag in CALIBRATE_FLAGS**
During stroke calibration, the Logix 3400IQ digital positioner checks to see if the linkage is placing the stem position sensor in range. If the valve stroke causes stem position measurement to go out of range in the open position, a Position 100% Flag will be generated. The valve stem will stop in the open position and the red LED will blink. Linkage must be adjusted to bring the sensor in range. Special LED indication: If the linkage is out of range, the LEDs can be used as an adjustment guide. The LED will change from a red to yellow when the linkage is brought into range.

**Position Span Flag in CALIBRATE_FLAGS**
Position span is a check during stroke calibration to verify that the valve stem moved. The algorithm waits to see if no movement is detected when the valve is automatically stroked open. Anything that could prevent the valve from stroking will generate a Position Span error (no supply pressure, malfunctioning spool valve).

### 7.13.2 Control and Tuning

**Setting P + I Parameters**
Using the Host configurator, you can set individual tuning parameters. A few key points are mentioned below. (See Figure 11.)

**GAIN_UPPER, GAIN_LOWER, and GAIN_MULT**: These three parameters are related by the following formula.

Proportional Gain =

Maximum Gain - | deviation | x Gain Multiplier

If Proportional Gain < Minimum Gain, then Proportional Gain = Minimum Gain

This algorithm allows for quicker response to smaller steps yet stable control for large steps. Setting the gain multiplier to zero and max gain = min gain results in a typical fixed proportional gain.

The higher the gain multiplier, the larger the required deviation before the gain increases. Default values upon initiating a RESET to factory defaults (under LOAD_EE_DEFAULTS) are maximum gain = 2.0, minimum gain= 1.0, and gain multiplier= 0.05. These values will allow stable control on all Valtek control product actuator sizes.

**Integral Gain (IGAIN)**: The integral gain is primarily for deviations due to temperature drift within the inner loop spool control. The factory default value is 10. Although higher numbers can speed the time it takes to reach zero deviation, it can add overshoot if too large. It is recommended that maximum and minimum gains be adjusted while leaving integral gain fixed at 10. Integration is disabled below a stem position of 3 percent and above a stem position of 97 percent. This is to prevent integration windup from calibration shifts due to lower pressure or a damaged seat that may prevent fully closing the valve.

**Integration Summer**: The integral summer within the Logix 3400IQ digital positioner is clamped at +20 percent and -20 percent. If the integration summer is fixed at +20 percent or -20 percent, it usually indicates a control problem. Some reasons for a clamped integration summer are listed below:

- Stroke calibration incorrect.
- Any failure which prevents stem position movement: stuck spool, handwheel override, low pressure.
- Incorrect inner loop offset.
- Loss of air supply on a fail in place actuator.

Writing a zero to integral gain (IGAIN) will clear the integral summer. The integral gain can then be returned to its original value.

**Inner loop offset (IL_OFFSET)**: Three control numbers are summed to drive the inner loop spool position control: proportional gain, integral summer, and inner-loop offset.

Inner-loop offset is the parameter that holds the spool in the 'null' or 'balance' position with a control deviation of zero. This value is written by the positioner during stroke calibration and is a function of the mechanical and electrical spool sensing tolerances. However, if it becomes necessary to replace the driver module assembly or the software RESET calibration constants has been performed, it may be necessary to adjust this value. The method below should be used to adjust inner-loop offset.

Or simply perform a new stroke calibration.

From the fieldbus configurator:

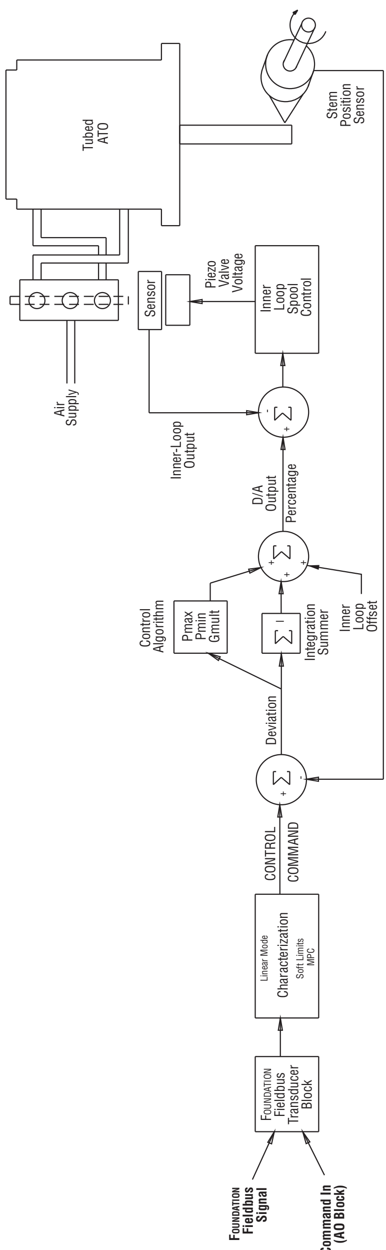
- Set transducer block to OOS
- Enable Diagnostic Variable access in TEST_MODE
- Send a 50 percent command.
- Set integral to zero.
- Locate the DAC_PERCENT
- Write this percentage value to IL_OFFSET
- Write original value to Integral

These tuning sets can be used to obtain initial values for Flowserve products and comparable actuator sizes. The user may need to adjust this tuning to achieve optimal performance for a particular application.

*Table VIII: Factory Tuning Sets*

| Mfg. | Tuning Set | GAIN_ LOWER | GAIN_ UPPER | GAIN_ MULT | Igain | Comparable Size (in$^2$) |
|---|---|---|---|---|---|---|
| Valtek | VFactory_A | 1.0 | 2.0 | 0.05 | 10 | 25 |
| | VFactory_B | 1.0 | 2.5 | 0.05 | 10 | 50 |
| | VFactory_C | 2.0 | 3.0 | 0.05 | 10 | 100 |
| | VFactory_D | 4.0 | 5.0 | 0.05 | 10 | 200 |
| | VFactory_E | 4.0 | 7.0 | 0.05 | 10 | 300 |
| | Trooper 48 | 0.4 | 0.5 | 0.05 | 25 | 31 |
| | Trooper 49 | 3.0 | 4.0 | 0.05 | 10 | 77.5 |
| Kammer | Trooper 48 | 0.4 | 0.5 | 0.05 | 25 | 31 |
| | Trooper 49 | 3.0 | 4.0 | 0.05 | 10 | 77.5 |
| Automax | R1 | 0.3 | 0.5 | 0.05 | 10 | 3 to 5 |
| | R2 | 1.0 | 1.5 | 0.05 | 10 | 9 to 12 |
| | R3 | 1.3 | 2.0 | 0.05 | 10 | 16 to 19 |
| | R4 | 2.0 | 2.5 | 0.05 | 10 | 27 to 37 |
| | R5 | 2.5 | 3.6 | 0.05 | 10 | 48 to 75 |
| | R6 | 4.0 | 5.0 | 0.05 | 10 | 109 |

*Figure 11: Logix 3400 Block Diagram*



# 7.14 Alerts

## 7.14.1 FINAL_VALUE_CUTOFF

The FINAL_VALUE_CUTOFF or tight shutoff feature of the Logix 3400IQ digital positioner allows the user to control the level at which the command signal causes full actuator saturation in the closed or open position.

This feature can be used to guarantee actuator saturation in the closed or open position or prevent throttling around the seat at small command signal levels. To enable, use configuration to apply the desired FINAL_VALUE_CUTOFF threshold.

**NOTE:** The positioner automatically adds a 1 percent hysteresis value to the FINAL_VALUE_CUTOFF_LO setting to prevent jumping in and out of saturation when the command is close to the setting.

## 7.14.2 Effects of FINAL_VALUE_CUTOFF on Operation

With the FINAL_VALUE_CUTOFF_LO set at 5 percent the positioner will operate as follows: Assume that the present command signal is at 50 percent. If the command signal is decreased, the positioner will follow the command until it reaches 5 percent.

At 5 percent, full actuator saturation will occur. The actuator will maintain full saturation below 5 percent command signal. Now, as the command increases, the positioner will remain saturated until the command reaches 6 percent (remember the 1 percent hysteresis value added by the positioner). At this point, the stem position will follow the command signal.

If the FINAL_VALUE_CUTOFF_LO is set to 3 percent but the valve will not go below 10 percent, SOFTSTOP_LOW may be enabled. The lower soft limit must be less than or equal to 0 percent in order for the FINAL_VALUE_CUTOFF_LO to become active.

If soft stops are active (ie: SOFTSTOP_LOW = 0 or SOFTSTOP_HIGH = 100) FINAL_VALUE_CUTOFF is disabled.

## 7.14.3 Soft Limits

Unlike position alerts, soft limits prevent the stem position from going below or above the configured limits. If the command signal is trying to drive the position past one of the limits, the yellow LED will blink but the stem position will remain at the set limit.

## 7.14.4 Travel Accumulator

The travel accumulator is equivalent to a car odometer and sums the total valve movement. Using the user defined stroke length and travel dead-band, the Logix 3400IQ digital positioner keeps a running total of valve movement. When the positioner first powers up, high and low dead-band limits are calculated around the present position. When the stem position exceeds the travel dead-band, the movement from the center of the deadband region to the new position is calculated and added to the travel accumulator. From this new position, deadband high and low limits are again calculated.

**EXAMPLE:** The Logix 3400IQ digital positioner has a default dead-band configuration of 20 percent. The valve has a 4 inch linear stroke. When the valve first powers up, the command signal is 50 percent. The unit will calculate a high travel threshold of 70 percent (50 percent present position plus 20 percent dead-band) and a low travel threshold of 30 percent (50 percent present position minus 20 percent dead-band). As long as the stem position remains greater than 30 percent and less than 70 percent, no additions are made to the travel accumulator. Now, assume the stem position moves to 80 percent that is outside the present dead-band. The Logix 3400IQ digital positioner calculates the stem movement and adds this number to the travel accumulator.

80 percent (present position) - 50 percent (previous) =
30 percent movement x 4-inch stroke = 1.2 inches

So, 1.2 inches is added to the travel accumulator. New dead-band thresholds of 100 percent (80 percent present position plus 20 percent dead-band) and 60 percent (80 percent present position minus 20 percent dead-band) are calculated. This process continues as the stem position moves throughout its stroke range.

### 7.14.5 Cycle Counter

The cycle counter is another means of monitoring valve travel. Unlike the travel accumulator, the stem position must do two things to count as a cycle: exceed the cycle counter dead-band and change direction. A cycle counter limit can also be written into the positioner. If this limit is exceeded, the yellow LED will blink.

### 7.14.6 Position Deviation

If the stem position differs from the control command by a certain amount for a given length of time, the yellow LED will blink to signify excess deviation. The trip point and settling times are set from the transducer function block.

### 7.14.7 Advanced Features

**NOTE:** These features are contained in the transducer function block. Refer to the Reference Manual for a more detailed explanation.

### 7.14.8 Standard vs. Advanced Diagnostics

Advanced diagnostics models add top, bottom, and supply pressure sensors. This allows for more diagnostic calculations such as loss of pressure, advanced signatures, and troubleshooting.

### 7.14.9 Temperature and Pressure Units

The desired temperature and pressure units can be set during configuration. Once set, all readings will be displayed in the desired units.

## 7.14.10 Stroke Length

Stroke length is used by the travel accumulator. When the stroke length and units are set, the length is used to determine the total travel accumulated. The travel accumulator will have the units associated with stroke.

**EXAMPLE:** Stroke length is set to four inches. If the valve is moved from 0 percent to 100 percent, four inches will be added to the travel accumulator. The travel accumulator units will be inches. If Stroke length is 90 degrees for a rotary, the travel accumulator will now have units of degree. A 0 percent to 100 percent stroke will add 90 to the travel accumulator.

**NOTE:** Stroke length is for information only and is not used during calibration.

*Table IX: Transducer Block Characterization Parameters*

| Parameter | Description | Value - Meaning | Comments |
|---|---|---|---|
| MODE_BLK | The operating mode of the transducer block | Auto - Auto (target mode) | The transducer block must be out of service before characterization can be edited or changed |
| | | OOS - Out of Service | |
| CONTROL_ FLAGS | Byte values which select positioner operation features | 1 - Quick Opening Curve* | Loads factory-defined QO curve as custom curve. |
| | | 2 - Equal Percent Curve* | Loads factory-defined equal percent curve as custom curve. |
| | | 3 - Actuator Type | |
| | | 4 - Advanced Model | |
| | | 5 - Rotary Actuator Gain | |
| | | 6 - Custom Characterization Active | Activates custom curve. If Off, response is Linear. |
| | | 7 - Fail Position TBD | |
| | | 8 - Air Action | |
| CURVEX | Numeric X value array for custom point. (1 x 21 array points) | X-axis value for custom stroke characterization point. Range –10 to 110 | Pair each X-value with corresponding Y-value to define the desired point. Values must be in ascending (or equal) order. |
| CURVEY | Numeric Y value array for custom point. (1 x 21 array points) | Y-axis value for custom stroke characterization point. Range –10 to 110 | |

**NOTE: Must not be selected if a custom curve is to be created or edited.*

## 7.15 Characterization Retention

Once a custom curve has been loaded into the Logix 3400IQ digital positioner's memory it is retained in the EPROM until it is either edited or replaced. Turning Custom Characterization Active on or off now selects between a linear response (off), or the new custom curve (on). If either of the other two factory curves is selected it will overwrite the custom curve in RAM only. The custom user-defined curve will automatically be activated again when the factory curve is deselected.

### 7.15.1 Initiating a Valve Signature

A feature of the Logix 3400 positioner is the ability to capture and store a valve diagnostic signature. A signature is the collected data response of the valve to a predefined set of operating conditions. This stored data can later be uploaded to the host system for analysis of potential problems. By comparing a baseline signature, when the valve is new, to subsequent signatures at later times, a rate of change can be tracked which can help predict possible faults in the valve before they happen. This is called 'predictive maintenance'. It is important to note that the purpose of the positioner is to act as the data acquisition device for the signature. Analysis of the data is not done on the device, but in the supervisory system.

**NOTE:** Signature data is lost if the positioner is reset or if the power is cycled

### 7.15.2 System Preparation

C **WARNING:** By definition, the collection of the signature requires the unmanaged operation of the positioner. Therefore, the process must be in a safe operating mode where unexpected movement of the valve will not cause a hazardous condition.

Before a valve signature can be run, the Transducer Block must Out-of-Service (OOS).

### 7.15.3 Signature Procedure

The following steps are an example of how to initiate a ramp signature capture.

1. Make sure the process is in safe condition and notify the control room that the valve will temporarily be taken off-line.
2. Verify preparedness to proceed.
3. Put the Transducer block MODE_BLK OOS
4. Set SIG_START to desired value.
5. Set SIG_STOP to desired value.
6. Set SAMPLE_TIME to desired value (typically 0.3).
7. In SIG_FLAGS, select; STEP_RAMP, PRESS_MEAS.
8. Write values to the Logix 3400IQ digital positioner.

9. Set RAMP_RATE to desired value (typically 100).
10. Write value to the Logix 3400IQ digital positioner.
11. In SIG_FLAGS, select BEGIN_SIG.
12. Write value to the Logix 3400IQ digital positioner.
13. The valve will stroke to the beginning position, as defined by SIG_START and will begin ramping to the desired ending position, as defined by SIG_STOP.

    Notice that SIG_COUNTER will increment while this takes place. (Typically approximately 670 data sets will be collected with the above settings and full stroke of the valve. Exact numbers will vary.)
14. SIG_FLAGS indicates SIG COMPLETE.
15. Return the MODE_BLK to auto.
16. Notify control room the valve is back on-line. The stored signature will remain in the Logix 3400IQ digital positioner RAM until the either the unit is powered down, or another signature is taken which overwrites the previous one.

## 7.16 Step Signature

If a step signature was desired, simply do not select STEP_RAMP in SIG_FLAGS, and then set the STEP_TIME prior to selecting BEGIN_SIG.

### 7.16.1 Collection of Stored Signature

The collection of the stored signature is accomplished by the host system. It is not part of the device. See host system programming. A simple utility using National Instruments NI-FBUS is available from Flowserve for retrieving a signature file.

The retrieved file is stored in a text format that can be imported into other programs for plotting and analysis. Contact Flowserve for more details.

## 7.17 Glossary

**A/D** Also called ADC. Analog-to-digital converter. An A/D converts an analog signal into an integer count. This integer count is then used by the microcontroller to process sensor information such as position, pressure, and temperature.

**D/A** Also called DAC. Digital-to-analog converter. A D/A converts an integer count into an analog output signal. The D/A is used to take a number from the microcontroller and command an external device such as a pressure modulator.

**EEPROM (Electrically Erasable Programmable Read Only Memory)** A device that retains data even when power is lost. Electrically erasable means that data can be changed. EEPROM have a limited number of times data can be rewritten (typically 100,000 to 1,000,000 writes).

**Micro-controller** In addition to an integral CPU (microprocessor), the micro-controller has built in memory and I/O functions such as A/D and D/A.

**Microprocessor** Semiconductor device capable of performing calculations, data transfer, and logic decisions. Also referred to as CPU (Central Processing Unit).

**Protocol** A set of rules governing how communications messages are sent and received.

**Resolution** Resolution is a number which indicates the smallest measurement which can be made. You will often see analog-to-digital (A/D) converters referred to as a 10-bit A/D or a 12-bit A/D. 10-bit and 12-bit are terms which indicate the total number of integer counts which can be used to measure a sensor or other input. To determine the total integer count, raise 2 to the power of the number of bits.

Example: 12-bit A/D

Total integer number = 2

Number of Bits = $2^{12}$= 4096

Resolution is the measurement range divided by the maximum integer number.

Example: A valve has a 2-inch stroke and a 12-bit A/D is used to measure position.

Resolution = Stroke/(Maximum Integer for 12-bit) = 2 inch/4096 = 0.000488 inches

**Sampling** Taking readings at periodic time intervals.

**Serial Channel** Channel that carries serial transmission. Serial transmission is a method of sending information from one device to another. One bit is sent after another in a single stream.

## 7.18 Transducer Block Parameters

*Table X: Transducer Block Parameters*

| Variable No. | Variable | Logix Positioner | | Fieldbus Datatypes | R/W | Low Limits | Up Limits | Description |
|---|---|---|---|---|---|---|---|---|
| | | Type | Fix Pt Rd | | | | | |
| **CONTROL** | | | | | | | | |
| 1 | AD_RAW_FB | signed int | No | Integer 16 | R | 0 | 4095 | 12-bit A/D Feedback counts |
| 2 | FINAL_VALUE | signed int | /100 | DS-65 | R/W* | -10% | 110% | Digital Command signal in % |
| 3 | FINAL_POSITION_VALUE | signed int | /100 | DS-65 | R | | | Actual Feedback position in % |
| 4 | ERROR | signed int | /100 | float | R | | | Position deviation in % |
| 5 | DAC_PERCENT | signed int | /100 | float | R | 0% | 100% | 12-bit DAC output in % |
| 6 | CONTROL_FLAGS | unsigned char | No | Bit String | R/W* | | | Valve parameters, ATO,ATC,etc. |
| 7 | PGAIN | signed int | /100 | float | R | | | Present proportional gain |
| 8 | GAIN_UPPER | signed int | /100 | float | R/W* | | | Upper gain limit |
| 9 | GAIN_LOWER | signed int | /100 | float | R/W* | | | Lower gain limit |
| 10 | GAIN_MULT | signed int | /1000 | float | R/W* | | | Gain multiplier |
| 11 | IGAIN | signed int | No | Integer 16 | R/W* | 1 | | Integral Gain |
| 12 | INTEGRAL_SUM | signed int | /100 | float | R | -20% | 20% | Integration summer in % |
| 13 | IL_OFFSET | signed int | /100 | float | R/W* | | | Inner-loop offset |
| 14 | ALPHA_FILT | signed int | /1000 | float | R/W* | | | Recursive filter “ alpha” coefficient |
| 15 | STATUS_FLAGS | unsigned char | No | Bit String | R/W* | | | Status flag variable for Fieldbus |
| 16 | CMD_USED | signed int | /100 | float | R | -10% | 110% | Command after characterization |

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*Table X: Continued from Page 41*

| Variable No. | Variable | Logix Positioner | | Fieldbus Datatypes | R/W | Low Limits | Up Limits | Description |
|---|---|---|---|---|---|---|---|---|
| | | Type | Fix Pt Rd | | | | | |
| 17 | FAIL_MODE | unsigned char | No | Unsigned 8 | R/W* | | | Failure of Internal Communications on loss, set defined operation |
| 18 | PRESS_WINDOW | signed int | /100 | float | R/W* | 0% | 100% | Window size to lock in pressure control |
| 19 | PRESS_HYST | signed int | /100 | float | R/W* | 0% | 100% | Hyst. added to prevent window from unlocking |
| 20 | PRESS_GAIN | unsigned int | /100 | float | R/W* | 0 | 100 | Gain value for pressure control |
| 21 | StrokeRate open | unsigned | /100 | float | R/W | 0 | | Opening rate limitor |
| 22 | StrokeRate close | unsigned | /100 | float | R/W | 0 | | Closing rate limitor |
| **CALIBRATION** | | | | | | | | |
| 28 | CAL_FullScale | unsigned | /100 | float | R/W | 0 | 4094 | Calibration full scale<br>ADC counts minimum |
| 29 | Auto_Tune | unsigned | /100 | float | R/W | 0 | | Tuning multiplier |
| 30 | TP_ZERO | signed int | No | Integer 16 | R/W* | 1 | 4094 | Top actuator 0 pressure 10-bit A/D counts |
| 31 | TP_SPAN | signed int | No | Integer 16 | R/W* | 1 | 4094 | Top actuator cal. pressure 10-bit A/D counts |
| 32 | TP_FULL_SCALE | signed int | No | Integer 16 | R/W* | 1 | 4093 | Top actuator span 10-bit A/D counts |
| 33 | BP_ZERO | signed int | No | Integer 16 | R/W* | 1 | 4094 | Bot actuator 0 pressure 10-bit A/ counts |
| 34 | BP_SPAN | signed int | No | Integer 16 | R/W* | 1 | 4094 | Bot actuator cal. pressure 10-bit A/D counts |
| 35 | BP_FULL_SCALE | signed int | No | Integer 16 | R/W* | 1 | 4093 | Bot actuator span 10-bit A/D counts |
| 36 | CALIBRATE | unsigned char | No | Integer 8 | R/W* | | | Calibration Mode setting |
| 37 | DAC_VALUE | unsigned int | No | Integer 16 | R/W* | 0 | 4095 | Binary value written to 12-bit D/A |

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Table X: Continued from Page 42

| Variable No. | Variable | Logix Positioner | | Fieldbus Datatypes | R/W | Low Limits | Up Limits | Description |
|---|---|---|---|---|---|---|---|---|
| | | Type | Fix Pt Rd | | | | | |
| 38 | SP_ZERO | signed int | No | Integer 16 | R/W* | 1 | 4094 | Supply act. 0 press. 10-bit A/D counts |
| 39 | SP_SPAN | signed int | No | Integer 16 | R/W* | 1 | 4094 | Sup. actuator cal. press. 10-bit A/D counts |
| 40 | SP_FULL_SCALE | signed int | No | Integer 16 | R/W* | 1 | 4093 | Supply actuator span 10-bit A/D counts |
| 41 | FB_ZERO | signed int | No | Integer 16 | R/W* | 1 | 4094 | Feedback 0% 12-bit A/D counts |
| 42 | FB_SPAN | signed int | No | Integer 16 | R/W* | 1 | 4094 | Feedback 100% 12-bit A/D counts |
| 43 | FB_SCOUNT | signed int | No | Integer 16 | R/W* | 1 | 4093 | Feedback full scale counts |
| 44 | PRESS_CAL | unsigned long | /100 | float | R/W | | | Pressure applied when calibrating sensors |
| 45 | CALIBRATE_FLAGS | unsigned char | No | Bit String | R | | | Error flags related to stroke calibration |
| 46 | HALL_NULL | unsigned int | No | Unsigned 16 | R/W | 0 | 1024 | Hall counts when spool is in its null position |
| 47 | HALL_DOWN | unsigned int | No | Unsigned 16 | R/W | 0 | 1024 | A/D Hall counts when spool is down |
| 48 | HALL_UP | unsigned int | No | Unsigned 16 | R/W | 0 | 1024 | A/D Hall counts when spool is up |
| **USER SPECIFIED DATA & TRAVEL DIAGNOSTICS** | | | | | | | | |
| 49 | FINAL_VALUE_CUTOFF_HI | signed int | /100 | float | R/W* | -15% | 110% | Maximum Position Cutoff in % |
| 50 | FINAL_VALUE_CUTOFF_LO | signed int | /100 | float | R/W* | -15% | 110% | Minimum Position Cutoff in % |
| 51 | SOFTSTOP_HIGH | signed int | /100 | float | R/W* | -10% | 110% | Soft Stop High Limit in % |
| 52 | SOFTSTOP_LOW | signed int | /100 | float | R/W* | -10% | 110% | Soft Stop Low Limit in % |
| 53 | CYCLE_COUNTER | unsigned long | No | Unsigned 32 | R/W | 0 | $4.29x10^9$ | Stroke cycle counter |
| 54 | CYCLE_DEADBAND | signed int | /100 | float | R/W | 0 | 100% | Cycle counter deadband in % |
| 55 | CYCLE_LIMIT | unsigned long | No | Unsigned 32 | R/W | 0 | $4.29x10^9$ | Cycle counter alert limit |

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*Table X: Continued from Page 43*

| Variable No. | Variable | Logix Positioner | | Fieldbus Datatypes | R/W | Low Limits | Up Limits | Description |
|---|---|---|---|---|---|---|---|---|
| | | Type | Fix Pt Rd | | | | | |
| 56 | TRAVEL_ENG | float | No | float | R/W | 0 | $4.29x10^9$ | Valve travel accumulator in eng units |
| 57 | TRAVEL_DEADBAND | signed int | /100 | float | R/W | 0 | 100% | Travel accumulator deadband in % |
| 58 | TRAVEL_ALERT | float | No | float | R/W | 0 | $4.29x10^9$ | Travel accumulator alert limit |
| 59 | STROKE_ENG | float | No | float | R/W | 0 | $4.29x10^9$ | Valve stroke in eng units(inches or deg) |
| 60 | TRAVEL_UNITS | unsigned char | No | Unsigned 8 | R/W | 0 | $4.29x10^9$ | Code for present engineering units |
| 61 | POSALERT_HIGH | signed int | /100 | float | R/W | -10% | 110% | Position Alert High Limit in % |
| 62 | POSALERT_LOW | signed int | /100 | float | R/W | -10% | 110% | Position Alert Low Limit in % |
| 63 -68 200 -214 | CURVEX (21 points) | signed int | /100 | float [21] | R/W* | -10% | 110% | Custom Characterization x-axis |
| 69 -74 215 -229 | CURVEY (21 points) | signed int | /100 | float [21] | R/W* | -10% | 110% | Custom Characterization y-axis |
| 75 | TRAVEL_FLAGS | unsigned char | No | Bit Strings | R | -10% | 110% | Travel alarm flags |
| 76 | POSDEV_DEADBAND | signed int | /100 | float | R/W | 100% | 0.10% | Position Deviation Deadband |
| 77 | POSDEV_TIME | unsigned int | /10 | float | R/W | | | Position Deviation Time in seconds |
| 78 | SIG_START | signed int | /100 | float | R/W | -10% | 110% | Signature Starting Command in % |
| 79 | SIG_STOP | signed int | /100 | float | R/W | -10% | 110% | Signature Stopping Command in % |
| 80 | RAMP_RATE | unsigned char | 300/ | float | R/W | >1 | | Ramping time in %/minute |
| 81 | STEP_TIME | unsigned int | /100 | float | R/W | 0 sec. | 650 sec. | Settling time after step in seconds |
| 82 | SIG_FLAGS | unsigned char | No | Unsigned 8 | R/W | | | Signature Flags |
| 83 | SAMPLE_TIME | unsigned char | /100 | float | R/W | 0.1 sec | | Sampling time in seconds |

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*Table X: Continued from Page 44*

| Variable No. | Variable | Logix Positioner | | Fieldbus Datatypes | R/W | Low Limits | Up Limits | Description |
|---|---|---|---|---|---|---|---|---|
| | | Type | Fix Pt Rd | | | | | |
| 84 | SIG_COUNTER | unsigned int | No | Unsigned 16 | R/W | | | Number of collected sample points |
| **INTERNAL DIAGNOSTICS** | | | | | | | | |
| 90 | INTAD_RAW1 | unsigned int | No | Unsigned 16 | R | 0 | 4095 | 10-bit A/D temperature counts |
| 91 | INTAD_RAWTP | unsigned int | No | Unsigned 16 | R | 0 | 4095 | 10-bit A/D counts,top actuator pres |
| 92 | INTAD_RAWBP | unsigned int | No | Unsigned 16 | R | 0 | 4095 | 10-bit A/D counts,bot actuator pres |
| 93 | INTAD_RAWSP | unsigned int | No | Unsigned 16 | R | 0 | 4095 | 10-bit A/D counts,supply pressure |
| 94 | INTAD_RAW3 | unsigned int | No | Unsigned 16 | R | 0 | 4095 | 10-bit A/D 2.5VDC Ref counts |
| 95 | INTAD_RAW4 | unsigned int | No | Unsigned 16 | R | 0 | 4095 | 10-bit A/D IL hall sensor counts |
| 96 | INTAD_RAW5 | unsigned int | No | Unsigned 16 | R | 0 | 4095 | 10-bit A/D 12-bit DAC output |
| 97 | INTAD_RAW6 | unsigned int | No | Unsigned 16 | R | 0 | 4095 | 10-bit A/D modulator current counts |
| 98 | INTAD_RAW8 | unsigned int | No | Unsigned 16 | R | 0 | 4095 | 10-bit A/D zero ref. counts |
| 99 | TEMPERATURE | signed int | No | Integer 16 | R | | | Temperature, reported in TEMPunit |
| 100 | Port_1 (Port 1) | signed long int | /100 | float | R | | | Port 1 pressure in PRESSunit |
| 101 | Port_2 (Port 2) | signed long int | /100 | float | R | | | Port 2 pressure in PRESSunit |
| 112 | TEST_MODE | unsigned char | No | Unsigned 8 | R/W* | | | Off line tests and enable diagnostic update |
| **MISCELLANEOUS FIELDBUS FUNCTIONS** | | | | | | | | |
| NA | SIG_INDEX | NA | NA | Unsigned 16 | R/W* | | | Pointer used for data transition |
| NA | SIG_DATA | NA | NA | float [4] | R | | | Array of signature data. Order of data is: Command, position, port 2 / 1port 1 pressure |

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*Table X: Continued from Page 45*

| Variable No. | Variable | Logix Positioner | | Fieldbus Datatypes | R/W | Low Limits | Up Limits | Description |
|---|---|---|---|---|---|---|---|---|
| | | Type | Fix Pt Rd | | | | | |
| NA | MFG_PHONE | NA | NA | Visible String | R/W | | | Manufacture's phone number field |
| NA | PUR_ORDER_NUM | NA | NA | Visible String | R/W | | | Purchase order number field |
| NA | GENERIC_PARM_NUM | NA | NA | DS-66 | R/W | | | Input point for desired Logix variable |
| NA | GENERIC_PARM_VAL | NA | NA | Unsigned 32 | R/W | | | Data for selected Logix variable |
| NA | BLOCK_TEST | NA | NA | Unsigne0d 8 [8] | R/W | | | Special diagnostics array |
| 102 | SUPPLY_PRESSURE | signed long int | /100 | float | R | | | Air supply pressure in PRESSunits |
| 103 | VOLT_REFERENCE | signed int | /1000 | float | R | | | 12-bit A/D, 2.5VDC reference (Volts) |
| 104 | HALL_SENSOR | signed int | /1000 | float | R | | | Inner-loop hall sensor output (Volts) |
| 105 | DAC_CHECK | signed int | /1000 | float | R | | | 12-bit D/A output (Volts) |
| 106 | MOD_CURRENT | signed int | /100 | float | R | | | Modulator piezo voltage (VDC) |
| 107 | IL_CHK | signed int | R | Interger 16 | | | | Inner-loop check |
| 108 | INTERNAL_FLAGS | unsigned char | No | Bit String | R | | | internal errors related to electronics |
| 109 | PRESS_FLAGS | unsigned char | No | Bit String | R | | | error flags related to the pressure sensors |
| 110 | PRESS_UNITS | unsigned char | No | Unsigned 8 | R/W | | | Units user wants reported for press |
| 111 | TEMP_UNITS | unsigned char | No | Unsigned 8 | R/W | | | Units user wants reported for temperature |
| **VALVE, ACTUATOR, AND POSITIONER INFORMATION** | | | | | | | | |
| 130 | VALVE_MAN_ID | unsigned char | No | Unsigned 32 | R/W | | | Valve manufacturer |
| 131 | VALVE_TYPE | unsigned char | No | Unsigned 8 | R/W | | | Valve type |
| 132 | VALVE_SIZE | unsigned char | No | Unsigned 8 | R/W | | | Valve size in inches |

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*Table X: Continued from Page 46*

| Variable No. | Variable | Logix Positioner | | Fieldbus Datatypes | R/W | Low Limits | Up Limits | Description |
|---|---|---|---|---|---|---|---|---|
| | | Type | Fix Pt Rd | | | | | |
| 133 | VALVE_CLASS | unsigned char | No | Unsigned 8 | R/W | | | Pressure class rating |
| 134 | VALVE_ENDCON | unsigned char | No | Unsigned 8 | R/W | | | Valve end connections |
| 135 | VALVE_BODYMA | unsigned char | No | Unsigned 8 | R/W | | | Valve body material |
| 136 | VALVE_TRIMMAT | unsigned char | No | Unsigned 8 | R/W | | | Valve trim material |
| 137 | VALVE_TRIMCHAR | unsigned char | No | Unsigned 8 | R/W | | | Valve trim characteristic |
| 138 | VALVE_TRIMTYPE | unsigned char | No | Unsigned 8 | R/W | | | Valve trim type |
| 139 | VALVE_TRIMNO | unsigned char | No | Unsigned 8 | R/W | | | Valve trim diameter |
| 140 | VALVE_PACKTYPE | unsigned char | No | Unsigned 8 | R/W | | | Valve packing type |
| 141 | STROKE_OPENTIM | unsigned int | /100 | float | R/W | | | Stroke open time in seconds |
| 142 | STROKE_CLOSEDTIM | unsigned int | /100 | float | R/W | | | Stroke closed time in seconds |
| 143 | STROKE_TSTPSI | signed int | /100 | float | R | | | Pressure |
| 144 | STEM_DIAM | float | No | float | R/W | | | Stem/shaft diameter |
| 145 | LEAK_CLASS | unsigned char | No | Unsigned 8 | R/W | | | Shutoff leakage class |
| 146 | INLET_PRESS | float | No | float | R/W | | | Upstream pressure of valve |
| 147 | OUTLET_PRESS | float | No | float | R/W | | | Downstream pressure of valve |
| 148 | VALVE_FLAGS | unsigned char | No | Unsigned 8 | R/W | | | Valve information (Ex. Flow direction) |
| 149 | RATED_TRAV | float | No | float | R/W | | | Rated valve travel before needs service |
| 150 | ACT_MAN_ID | unsigned char | No | Unsigned 32 | R/W | | | Actuator manufacturer |
| 151 | ACT_TYPE | unsigned char | No | Unsigned 8 | R/W | | | Actuator type |

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*Table X: Continued from Page 47*

| Variable No. | Variable | Logix Positioner | | Fieldbus Datatypes | R/W | Low Limits | Up Limits | Description |
|---|---|---|---|---|---|---|---|---|
| | | Type | Fix Pt Rd | | | | | |
| 152 | ACT_SIZE | unsigned char | No | Unsigned 8 | R/W | | | Actuator size |
| 153 | SPRING_TYPE | unsigned char | No | Unsigned 8 | R/W | | | Spring type: single, dual, etc. |
| 154 | SPOOL_ID | unsigned char | No | Unsigned 8 | R/W | | | Spool identification |
| 155 | ELECTRONICS_SN | unsigned char | No | Visible String | R/W* | | | Electronics serial number |
| 156 | SOFTWARE_VER | unsigned int | No | Unsigned 16 | R/W | | | Positioner embedded code version |
| 157 | VALVE_SN | unsigned char | No | Visible String | R/W | | | Valve serial number |
| 158 | PO_DATE | unsigned char | No | Visible String | R/W | | | PO date |

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Table X: Continued from Page 48

| Variable No. | Variable | Logix Positioner | | Fieldbus Datatypes | R/W | Low Limits | Up Limits | Description |
|---|---|---|---|---|---|---|---|---|
| | | Type | Fix Pt Rd | | | | | |
| 158 | INSTALL_DATE | unsigned char | No | Visible String | R/W | | | Installation date |
| **MISCELLANEOUS COMMANDS** | | | | | | | | |
| 171 | LOAD_EE_DEFAULTS | unsigned char | No | Unsigned 8 | R/W* | | | EEPROM write mode |
| 172 | ENG_RELEASE_NUM | unsigned int | No | Unsigned 8 | R | | | Embedded engineering release number |
| 173 | MISC_FLAGS | unsigned char | No | Unsigned 8 | R/W* | | | Miscellaneous Flags, Quick-Cal Enable/ Disable, Large actuator |
| **DATA FORMAT** | | | | | | | | |
| signed/unsigned characters | | 1 byte | Available on both Standard and Advanced | | | | | |
| signed/unsigned intergers | | 2 bytes | Advanced models only | | | | | |
| signed/unsigned long intergers | | 4 bytes | | | | | | |
| float (4 bytes) | | IEEE-754 | | | | | | |
| **READ/WRITE** | | | | | | | | |
| R= Read only | | | | | | | | |
| R/W= Read/Write access | | | | | | | | |
| R/W*= Transducer block must be out of service to write | | | | | | | | |

# 8 Maintenance and Repair

## 8.1 Driver Module Assembly

The driver module assembly moves the spool valve by means of a differential pressure across its diaphragm. Air is routed to the driver module from the regulator through a flexible hose. A barbed fitting connects the flexible hose to the driver module assembly. Wires from the driver module assembly connect the hall effect sensor and the piezo valve modulator to the main PCB assembly.

**Driver Module Assembly Replacement**

To replace the driver module assembly, refer to Figures 12-16 and 22 and proceed as outlined below. The following tools are required:

- Flat plate or bar about ⅛" thick
- Phillips screwdriver
- ¼" nutdriver

C **WARNING:** Observe precautions for handling electrostatically sensitive devices.

*Figure 12: Driver Module Assembly*

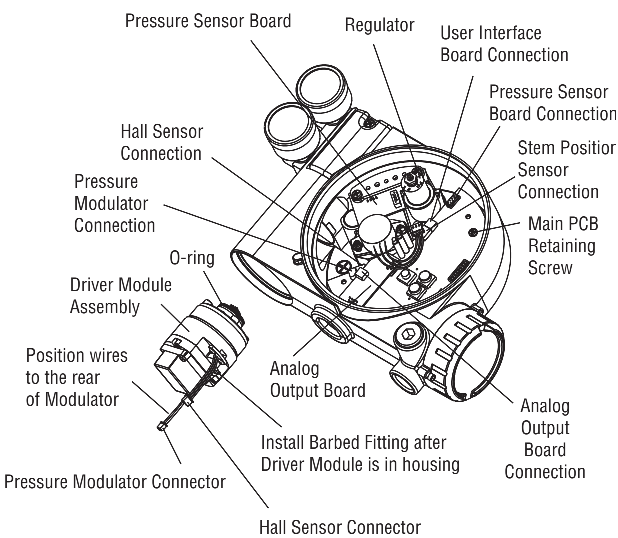
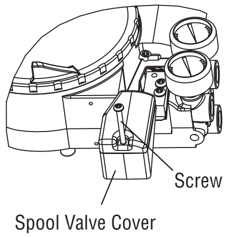
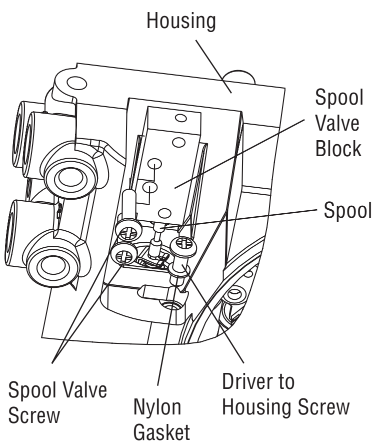


*Figure 13: Spool Valve Cover Assembly*



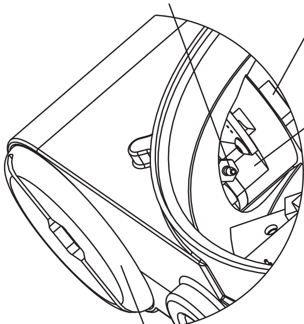

1. Make sure the valve is bypassed or in a safe condition.
2. Disconnect the power and air supply to the unit.
3. Remove the driver module cover (Figure 15), using a flat bar or plate in the slot to turn the cover.
4. Remove the spool valve cover by removing the screw and sliding the cover assembly backwards until the tab is clear of the slot (Figure 13). The sheet metal cap, hydrophobic filter, and O-ring should be removed with the spool valve cover. It is not necessary to take these parts out of the spool valve cover.
5. Being careful not to lose the nylon washer, remove the Phillips-head screw that attaches the driver module to the main housing (Figure 14).

*Figure 14: Spool and Block*



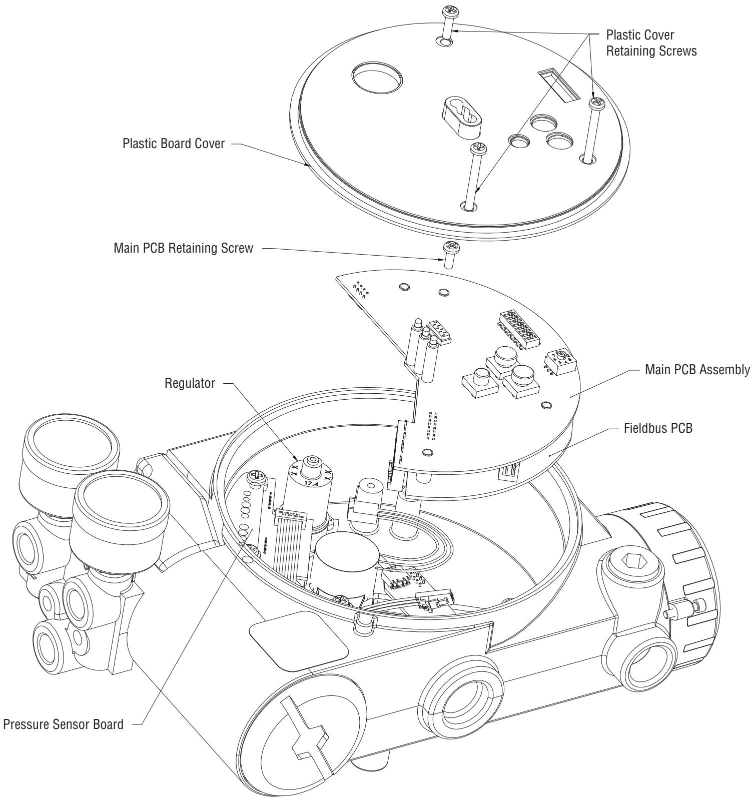
C **WARNING:** Spool (extending from the driver module assembly) is easily damaged. Use extreme caution when handling spool and spool valve block. Do not handle the spool by the machined portions of spool. The tolerances between the block and spool are extremely tight. Contamination in the block or on the spool may cause the spool to hang.

*Figure 15: Driver Module Barbed Fitting*




6. Remove the spool valve block by removing the two Phillips-head screws and carefully sliding the block off the spool (Figure 14).
7. Carefully remove the spool by sliding the end of the spool out of the connection clip. Excessive force may bend spool.
8. Remove the main cover.
9. Remove the plastic board cover by removing the three retaining screws (see Figure 16).
10. Disconnect the flexible tubing from the barbed fitting at the driver module assembly (see Figure 15).
11. Use the ¼" nutdriver to remove the barbed fitting from the driver module assembly.
12. Unplug the two wiring connections that link the driver module assembly to the main PCB assembly.
13. Feed the two wires on the driver module back into the driver module compartment so that they stick out the driver module opening (see Figure 12). This will allow the driver module to thread out without tangling or cutting the wires.
14. Grasp the base of the driver module and turn it counterclockwise to remove. After it is threaded out, carefully retract the driver module from the housing.

*Figure 16: Main PCB Assembly*




15. Remove the barbed fitting from the side of the new driver module using the ¼" nutdriver.

16. Verify that the O-ring is in place on the top of the new driver module. Lay the wires back along the side of the driver module as shown in Figure 12 and hold the wires in position by hand.

17. Gently insert the driver module into the driver module compartment in the housing. Turn the driver module clockwise to thread it into the housing. Continue rotating the driver module until it bottoms out.

18. Once the driver module has bottomed out so that the threads are fully engaged, rotate the driver module counter clockwise until the flat on the driver module and the flat on the housing are aligned. This will align the screw hole for the next step.

19. Verify that the nylon gasket is in the counter bore in the driver module retaining screw hole as shown in Figure 14.

20. Insert a driver-to-housing screw into the driver housing through the counterbored hole in positioner main housing. Tighten with a Phillips screwdriver.
21. Reach through the main compartment into the driver module compartment of the positioner and install the barbed fitting on the side of the driver module using the ¼" nutdriver.

    **NOTE:** Do not mix the barbed fitting with those from older Logix positioners. Older models contain orifices that will not work in the Logix 3400IQ model. Orifices are brass-colored, barbed fittings are silver-colored.
22. Reconnect the flexible tube coming from the regulator to the barbed fitting.
23. Feed the driver module wires into the main chamber of the housing, and connect them to the main PCB Assembly.
24. Verify that the three O-rings are in the counterbores on the machined platform where the spool valve block is to be placed (Figure 22).
25. Carefully slide the spool into the connecting clip on the top of the driver module assembly.
26. Carefully slide the block over the spool, using the machined surface of the housing base as a register (Figure 14). Slide the block toward the driver module until the two retaining holes line up with the threaded holes in the base.
27. Install two spool-valve screws and tighten securely with a Phillips screwdriver (see Figure 14).
28. Slide the spool valve cover assembly over the spool valve until the tang engages into the housing slot. Install spool valve cover screw and tighten securely (see Figure 13).
29. Install the plastic board cover. Insert the three retaining screw through the plastic cover into the threaded boss and tighten evenly, using a Phillips screwdriver. Do not overtighten (see Figure 16).
30. Reconnect power and air supply to the positioner and perform a stroke calibration.
31. Reinstall all covers.

## 8.2 Regulator

The regulator reduces the pressure of the incoming supply air to a level that the driver module can use.

**Replacing Regulator**
To replace the regulator, refer to Figures 12 and 16 and proceed as outlined below. The following tools are required:



- Phillips screwdriver
- ¼" nutdriver

C **WARNING:** Observe precautions for handling electrostatically sensitive devices.

1. Make sure valve is bypassed or in a safe condition.
2. Disconnect the power and air supply to the unit.
3. Remove the main cover.
4. Remove the plastic board cover by removing the three retaining screws (see Figure 16).
5. Remove the retaining screw from the main PCB assembly.
6. Remove the five wire connections from the main PCB assembly and lift the main PCB out of the housing.
7. Remove the four screws from the regulator base. Verify that as regulator is removed, the O-ring and filter remain in the counter-bore.
8. Remove tubing and barbed fitting from the regulator base.
9. Install barbed fitting and tubing to the new regulator.
10. Verify O-ring and filter are in the counterbore. Install new regulator using 8-32 x ½" screws.

    **NOTE:** Do not mix the regulator with those from older Logix positioners. Older models contain regulators with different settings that will not work in the Logix 3400IQ model. The regulator pressure setting is printed on the top of the regulator. The Logix 3400IQ regulator is set to 17.4 psig.
11. Reinstall the five wire connections.
12. Install the main PCB into the housing. Insert the retaining screw through the board into the threaded boss and tighten evenly, using a Phillips screwdriver. Do not overtighten.
13. Install the plastic board cover. Insert the three retaining screws through the plastic cover into the threaded boss and tighten evenly, using a Phillips screwdriver. Do not overtighten (see Figure 16).
14. Reinstall all covers.

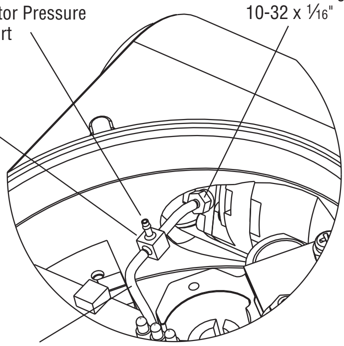
## 8.3 Checking or Setting Internal Regulator Pressure

To check or set the internal regulator pressure, refer to Figure 17 and proceed as outlined below. The tools and equipment used in the next procedure are from indicated vendors. The following tools are required:

- Calibrated pressure gauge (0 to 30 psi)
- 1⁄16" flexible tubing
- Barbed Tee (Clippard Minimatic part number T22-2 or equivalent)
- 3⁄32" Allen wrench
- 3⁄8" open-end wrench

C **WARNING:** Observe precautions for handling electrostatically sensitive devices.

*Figure 17: Driver Module Regulator Pressure Check*




1. Make sure the valve is bypassed or in a safe condition.
2. Remove the main cover.
3. Remove the plastic board cover by removing the three retaining screws.
4. Remove the 1⁄16" flexible tubing from the barbed fitting on the side of the driver module.
5. Obtain a barbed tee and two pieces of 1⁄16" flexible tubing, a few inches in length each.
6. Position the barbed tee between the internal regulator and the driver module by connecting the 1⁄16" flexible tubing, found in the positioner, to one side of the barbed tee. Using one of the new flexible tubing pieces, connect the barbed tee to the barbed fitting on the side of the driver module. Connect the remaining port on the barbed tee to a 0 to 30 psi pressure gauge.
7. Reconnect the air supply to the positioner and read the internal regulator pressure on the 0 to 30 psig gauge. The internal pressure should be set to 17.4 ±0.2 psig. If adjustment is needed, loosen the set screw retaining nut on the top of the regulator using the 3⁄8" open-end wrench. Then adjust the regulator pressure by turning the set screw on the top of the regulator with the 3⁄32" Allen wrench.
8. Once the regulator pressure is set, tighten the set screw retaining nut on the top of the regulator, remove the air supply to the positioner, remove the barbed tee, and reconnect the flexible tubing from the regulator to the barbed fitting on the side of the driver module.

9. Install the plastic board cover. Insert the three retaining screws through the plastic cover into the threaded boss and tighten evenly, using a Phillips screwdriver. Do not overtighten (see Figure 16).
10. Reinstall all covers.

## 8.4 Spool Valve

The spool valve routes the supply air to one side of the actuator while venting the opposite side (see Figure 1). The position of the spool valve is controlled by the driver module.

**Replacing the Spool Valve**

To replace the spool valve, refer to Figures 12, 14 and 21 and proceed as outlined below. The following tools are required:

- Phillips screwdriver

1. Make sure the valve is bypassed or in a safe condition.
2. Disconnect the power and air supply to the unit.
3. Remove the spool valve cover by removing the screw and sliding the cover assembly backwards until the tab is clear of the slot. It is not necessary to remove the sheet metal cap, hydrophobic filter, or O-ring from this assembly (Figure 18).

   C **WARNING:** The spool (extending from the driver module assembly) is easily damaged. Use extreme caution when handling spool and spool valve block. Do not handle the spool by the machined portions of spool. The tolerances between the block and spool are extremely tight. Contamination in the block or on the spool may cause the spool to hang.

4. Remove the spool valve block by removing the two Phillips-head screws and carefully sliding the block off the spool (Figure 14).
5. Carefully remove spool by sliding end of spool out of connecting clip. Excessive force may bend the spool.
6. Verify that the three O-rings are in the counterbores on the machined platform where the new spool valve block is to be placed (Figure 22).
7. Carefully slide the spool into the connecting clip of the driver module assembly.
8. Carefully slide the block over the spool, using the machined surface of the housing base as a register (Figure 14). Slide the block toward the driver module until the two retaining holes line up with the threaded holes in the base.
9. Install two spool valve screws and tighten securely with a Phillips screwdriver (see Figure 14).

10. Slide the spool valve cover assembly over the spool valve until the tang engages into the housing slot. Install the spool valve cover screw and tighten securely (see Figure 13).
11. Reconnect power and air supply to the positioner and perform a stroke calibration.

## 8.5 Spool Valve Cover

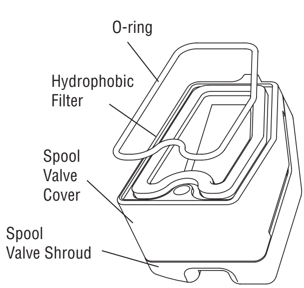
The spool valve cover incorporates a hydrophobic filter element in a two-piece cover. This protects the spool valve chamber from dirt and moisture and provides a low back pressure vent for exhaust air from the spool valve.

**Replacing Filter in Spool Valve Cover**
To replace the filter in the spool valve cover, refer to Figures 13 and 18 and proceed as outlined below. The following tools are required:

- Phillips screwdriver

1. Remove the spool cover by removing the screw and sliding the cover assembly backwards until the tab is clear of the slot. The sheet metal cover may be removed and cleaned with a brush or by blowing out with compressed air (Figure 13).
2. Remove the O-ring from around the hydrophobic filter element and set aside (Figure 18).
3. Remove the molded filter element by pulling it straight out of the chamber cover vent piece.
4. Install O-ring into base of chamber cover vent piece as shown in Figure 18.
5. Place new molded filter element into the chamber cover vent piece. This filter element provides part of the track to secure the O-ring installed in the last step.
6. Place spool valve shroud onto spool valve cover.
7. Place the spool valve cover assembly in place by setting it on the ramp and sliding it until the tab seats in the slot (Figures 13 and 18) and secure with a 8-32 screw.

*Figure 18: Spool Valve Cover Assembly*



# 8.6 Stem Position Sensor

The position feedback assembly transmits valve positions information to the processor. This is accomplished by means of a rotary position sensor that connects to the valve stem through a feedback linkage. To provide for accurate tracking of the pin in the slot, the follower arm is biased against one side of the slot with a rotary spring. This spring also automatically moves the position feedback assembly to its limit in the unlikely event of failure of any component in the linkage.

**Stem Position Sensor Replacement**

To replace the stem position sensor, refer to Figure 16, 19 and 22 and proceed as outlined below. The following tools are required:

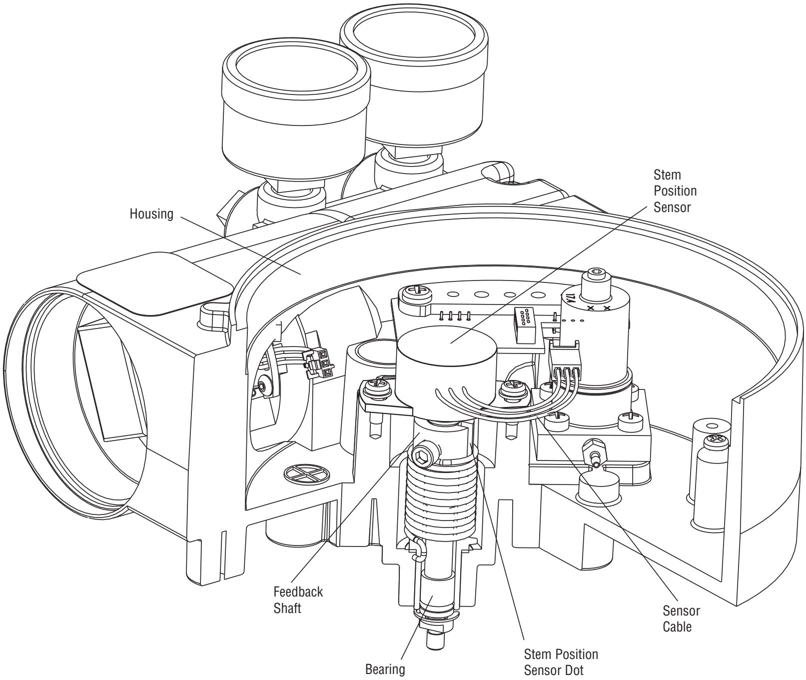
- Phillips screwdriver

C **WARNING:** Observe precautions for handling electrostatically sensitive devices.

1. Make sure the valve is bypassed or in a safe condition.
2. Disconnect the power and air supply to the unit.
3. Remove the main cover.
4. Remove the plastic board cover by removing the three retaining screws (see Figure 16).
5. Disconnect the position sensor wires from the main PCB assembly.
6. Remove the two rotary position sensor-retaining screws and lift the sensor out of the housing.
7. Turn the new position sensor shaft until the dot on the side of the shaft is aligned with the wires on the side of the position sensor (Figure 19).
8. Insert the position sensor into the shaft with the wires pointing toward the main PCB assembly. Turn the position sensor clockwise until bolting slots align with the housing screw holes and the wires on the sensor protrude over the main PCB assembly.

   **NOTE:** Do not mix the position sensor with those from older Logix positioners. Older models contain sensors with different ranges that will not work in the Logix 3400IQ model. The wires on the Logix 3400IQ position sensor are red, white and black.
9. Carefully center the position sensor on the shaft bore, insert and tighten the screws. Do not overtighten.
10. Route the wires along the side of the position sensor and reconnect to the main PCB assembly.
11. Install the plastic board cover. Insert the three retaining screws through the plastic cover into the threaded boss and tighten evenly, using a Phillips screwdriver. Do not overtighten (see Figure 16).
12. Reinstall all covers.
13. Reconnect power and air supply to the positioner and perform a stroke calibration.

*Figure 19: Stem Position Sensor Orientation*




## 8.7 Main PCB Assembly

The main printed circuit board (PCB) assembly contains the circuit boards and processors that perform control functions of the positioner. The main PCB is to be replaced as a unit. None of the components on the main PCB are serviceable. It consists of a controller board and a Fieldbus communication board.

**Replacing Main PCB Assembly**

To replace the main PCB assembly, refer to Figure 12 and 16 and proceed as outlined below. The following tools are required:

- Phillips screwdriver

C **WARNING:** Observe precautions for handling electrostatically sensitive devices.

1. Make sure the valve is bypassed or in a safe condition.
2. Disconnect the power and air supply to the unit.
3. Remove the main cover.

4. Remove the plastic board cover by removing the three retaining screws (see Figure 16).
5. Remove the retaining screw from the main PCB assembly.
6. Remove the five wire connections from the main PCB assembly and lift the main PCB out of the housing (see Figure 16).
7. Reinstall the five wire connections (see Figure 12) on the new main PCB.
8. Install the new main PCB into the housing. Insert the retaining screw through the board into the threaded boss and tighten, using a Phillips screwdriver. Do not over tighten.
9. Install the plastic board cover. Insert the three retaining screws through the plastic cover into the threaded boss and tighten evenly, using a Phillips screwdriver. Do not overtighten (see Figure 16).
10. Reinstall all covers.
11. Reconnect power and air supply to the positioner and reconfigure the positioner being sure to perform a stroke calibration.

## 8.8 Pressure Sensor Board

On advanced model Logix 3400IQ positioners, a pressure sensor board is installed in the positioner. The pressure sensor board contains two pressure sensors that measure the pressure on output ports 1 and 2. The main PCB electronics automatically senses the presence of the pressure sensor board. If present, the actuator pressure sensors are used in the positioner control algorithm to enhance valve stability. For optimal performance, the actuator pressure sensors need to be calibrated. The actuator pressure sensor calibration is performed using a 375 Handheld Communicator or Host configuration software.

In the standard model, the pressure sensor board is replaced by a plate that plugs the actuator pressure sensor ports. This plate can be replaced by a pressure sensor board to field-upgrade a standard model to an advanced model.

**Removing the Pressure Sensor Board (Advanced Model)**
To replace the pressure sensor board, refer to Figures 12, 16 and 21 and proceed as outlined below. The following tools are required:

- Phillips screwdriver

C **WARNING:** Observe precautions for handling electrostatically sensitive devices.

1. Make sure the valve is bypassed or in a safe condition.
2. Disconnect the power and air supply to the unit.
3. Remove the main cover.
4. Remove the plastic board cover by removing the three retaining screws (see Figure 16).

5. Disconnect the ribbon cable on the pressure sensor board from the PCB assembly (see Figure 12). Lifting the main board may make this easier.

6. Remove the two screws holding the pressure sensor board to the housing. Lift the metal stiffener plate off the pressure sensor board and set aside for future use.

7. Remove the pressure sensor board.

**Removing the Pressure Sensor Plug Plate (Standard Model)**
To upgrade a standard model to an advanced model, the pressure sensor plug plate must be removed and replaced by a pressure sensor board. The main PCB electronics automatically senses the presence of the pressure sensor board. If present, the actuator pressure sensors are used in the positioner control algorithm to enhance valve stability. For optimal performance, the actuator pressure sensors need to be calibrated. The actuator pressure sensor calibration is performed using a Handheld Communicator or host configuration software. To upgrade a standard model to an advanced model, refer to Figures 12, 16 and 21 and proceed as outlined below. The following tools are required:

- Phillips screwdriver

1. Make sure the valve is bypassed or in a safe condition.

2. Disconnect the power and air supply to the unit.

3. Remove the main cover.

4. Remove the plastic board cover by removing the three retaining screws (see Figure 16).

5. Remove the two screws holding the pressure sensor plug plate to the housing. Lift the metal stiffener plate off the pressure sensor plug plate and set aside for future use.

6. Remove the pressure sensor plug plate and discard.

**Installing the Pressure Sensor Board (Advanced Model)**
The pressure sensor board is installed on the advanced model only. To install the pressure sensor board, refer to Figures 12, 16 and 22 and proceed as outlined below. The following tools are required:

- Phillips screwdriver
- Torque wrench

C **WARNING:** Observe precautions for handling electrostatic sensitive devices.

1. Verify that the two pressure sensor O-rings (item 15) are in place in the housing.

2. Set the pressure sensor board assembly in place so that the O-rings make contact with the faces of the pressure sensors.



3. Place the metal stiffener plate (item 12) on top of the pressure sensor board over the pressure sensors and align the two holes in the pressure sensor plate with the threaded bosses in the housing.

4. Insert two screws through the stiffener plate and pressure sensor board into the threaded holes in the housing and tighten evenly, to 8 in-lb.
5. Connect the ribbon cable on the pressure sensor board to the main PCB assembly.
6. Install the plastic board cover. Insert the three retaining screws through the plastic cover into the threaded boss and tighten evenly, using a Phillips screwdriver. Do not overtighten.
7. Reinstall all covers.
8. Reconnect power and air supply to the positioner. Use the Host software or a handheld communicator to perform a pressure sensor calibration.

## 8.9 User Interface Board

The user interface board provides a connection point inside the explosion-proof housing for all hookups to the positioner.

**Replacing the User Interface Board**

To replace the user interface board, refer to Figures 6, 12, 16 and 22 and proceed as outlined below. The following tools are required:

- Phillips screwdriver

C **WARNING:** Observe precautions for handling electrostatic sensitive devices.

1. Make sure the valve is bypassed or in a safe condition.
2. Disconnect the power and air supply to the unit.
3. Remove the main cover.
4. Remove the plastic board cover by removing the three retaining screws (see Figure 16).
5. Remove the retaining screw from the main PCB assembly and lift the main PCB out of the housing (see Figure 16). It is not necessary to disconnect all of the wires, only the UI plug.
6. Remove the user interface cover.
7. Disconnect the field wiring from the user interface board terminals and remove the three screws that hold the user interface board in the housing (see Figure 6).
8. Remove the user interface board, carefully pulling the wiring through the bore.
9. Verify that the O-ring is in place in the counterbore in the positioner housing, or on the plug on the back of the UI tray.
10. Feed the wires on the back of the new user interface board through the passageway into the main chamber of the housing.
11. Set the user interface board in place and secure with three screws (see Figure 6).

12. Reconnect the field wiring to the user interface board terminals.
13. Install the main PCB into the housing. Insert the retaining screw through the board into the threaded boss and tighten evenly, using a Phillips screwdriver. Do not overtighten.
14. Install the plastic board cover. Insert the three retaining screws through the plastic cover into the threaded boss and tighten evenly, using a Phillips screwdriver. Do not overtighten (see Figure 16).
15. Reinstall the UI wire connection (see Figure 12).
16. Reinstall all covers.

# 9 Optional Vented Design

**NOTE:** See Figures 19 and 20

A standard Logix 3400IQ positioner is vented directly to the atmosphere. When supply air is substituted with sweet natural gas, piping must be used to route the exhausted natural gas to a safe environment. This piping system may cause some positioner back pressure in the main chamber (from the modulator and regulator) and spool chamber (from the actuator). Back pressure limitations are described below.

Two chambers must be vented on the Logix 3400IQ positioners: the main housing chamber and the spool valve chamber (Figures 20 and 21). The main chamber vent is located on the backside of the positioner (see Figure 20). Vented-design Logix 3400IQ positioners are supplied from the factory with a fitting installed in the main chamber vent. Connect the necessary tubing/piping to this fitting to route the exhausted natural gas to a safe environment.

The maximum allowable back pressure from the collection device on the main housing vent is 2.0 psig (0.14 barg). Vent flow rate is 0.5 std ft$^3$/min (1.4 std liter/min).

C **WARNING:** The back pressure in the main housing must never rise above 2.0 psig (0.14 barg).

*Figure 20: Main Housing Vent*

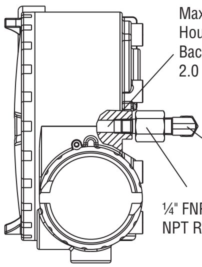
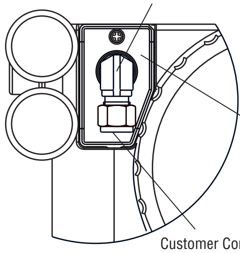
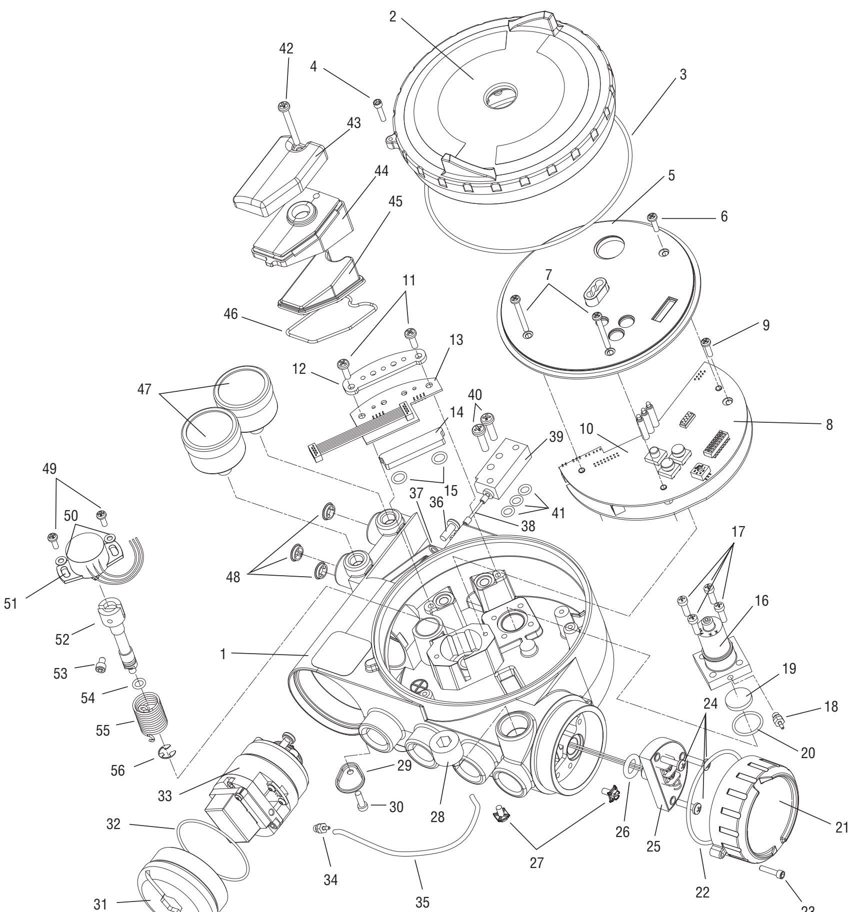



*Figure 21: Spool Cover Vent*




The spool valve chamber (see Figure 21) must also be vented through the spool valve cover. Vented-design Logix 3400IQ positioners are supplied from the factory with a fitting installed in the spool valve cover (item SKU 179477). Connect the necessary tubing/piping to this fitting to route the exhausted natural gas to a safe environment. The maximum allowable back pressure in the spool valve chamber is 8 psig (0.55 barg). Pressures greater than 8 psig will cause vented gas to leak past the spool cover O-ring to the atmosphere and will result in overshoot of the positioner.

*Figure 22: Exploded Drawing*



# 10 Parts List

*Table XI: Parts*

| Item No. | Part |
|---|---|
| 1 | Housing Logix 3000IQ Positioner |
| 2 | Main Housing Cover |
| 3 | O-ring, Main Housing Cover |
| 4 | Screw, Anti-rotation |
| 5 | Plastic Main PCB Cover |
| 6 | Screw, Main PCB Cover Short (2) |
| 7 | Screw, Main PCB Cover Long |
| 8 | Main PCB Assembly |
| 9 | Screw, Main PCB Assembly Retaining |
| 11 | Screw, Pressure Sensor Board (2) |
| 12 | Pressure Sensor Board Stiffener |
| 13 | Pressure Sensor Board (Advanced Only) |
| 14 | Pressure Sensor Plug Plate (Standard Only) |
| 15 | O-ring, Pressure Sensor to Housing (2) |
| 16 | Pressure Regulator, 5 to 30 psig (Includes 2 O-rings) |
| 17 | Screw, Regulator Plate to Housing (4) |
| 18 | Hex Barbed Fitting with Captive O-ring |
| 19 | Internal Filter |
| 20 | O-ring, Interface Plate to Housing Seal |
| 21 | Customer Interface Cover |
| 22 | O-ring, Customer Interface Cover |
| 23 | Screw, Anti-rotation |
| 24 | Screw, User Interface Board (3) |
| 25 | User Interface Board Potted Assembly |
| 26 | O-ring, User Interface Board |
| 27 | Grounding Screw (2) |
| 28 | Threaded Plug |
| 29 | Main Vent Cover |
| 30 | Screw, Main Vent Cover |
| 31 | Driver Module Cover |
| 32 | O-ring, Driver Module Cover |
| 33 | Driver Module Assembly |
| 34 | Hex Barbed Fitting with Captive O-ring |
| 35 | Flexible Tubing |
| 36 | Screw, Driver to Housing |
| 37 | Nylon Washer |
| 38 | Spool Valve |
| 39 | Spool Valve Block |
| 40 | Screw, Spool Valve to Housing (2) |
| 41 | O-ring, Spool Valve (3) |
| 42 | Screw, Spool Valve Cover |
| 43 | Spool Valve Shroud |
| 44 | Spool Valve Cover |
| 45 | Hydrophobic Filter, Spool Valve Chamber |
| 46 | O-ring, Spool Valve Cover |
| 47 | Pressure Gauge, 0-160 psig (2) |
| 48 | Air Screen (3) |
| 49 | Screw, Position Feedback Potentiometer to Housing (2) |
| 50 | Metal Washer (2) |
| 51 | Position Feedback Potentiometer |
| 52 | Feedback Shaft |
| 53 | Screw, Spring to Feedback Shaft |
| 54 | O-ring, Feedback Shaft |
| 55 | Torsion Spring |
| 56 | E-ring |

# 11 Logix 3400*IQ* Spare Parts Kits

(See Figure 22 for item numbers.)

*Table XII: Spare Parts Kits*

| Item No. | Description | Quantity |
|---|---|---|
| Kit 2: Driver Module Assembly -40° to 80°C Kit, P/N 199786.999.000 | | |
| 16 | Pressure Regulator | 1 |
| 17 | Screw, Regulator to Housing | 4 |
| 33 | Driver Module Assembly | 1 |
| 34 | Hex Barbed Fitting w/ Captive O-ring | 1 |
| 36 | Screw, Driver to Housing | 1 |
| 37 | Nylon Washer | 1 |
| Kit 3: Spool Assembly Valve Kit, P/N 199787.999.000 | | |
| 38 | Spool | 1 |
| 39 | Spool Valve Block | 1 |
| 40 | Screw, Spool Valve to Housing | 2 |
| 41 | O-ring, Spool Valve | 3 |
| Kit 4: Pressure Regulator, P/N 215814.999.000 | | |
| 16 | Pressure Regulator with Captive O-rings | 1 |
| 17 | Screw, Regulator to Housing | 4 |

| Item No. | Description | Quantity |
|---|---|---|
| Kit 5: Feedback Shaft Kit, P/N 199788.999.000 | | |
| 52 | Feedback Shaft | 1 |
| 53 | Screw, Spring to Feedback Shaft | 1 |
| 54 | O-ring, Feedback Shaft | 1 |
| 55 | Torsion Spring | 1 |
| 56 | E-ring | 1 |
| Kit 6: Feedback Shaft Kit (NAMUR), P/N 218814.999.000 | | |
| 52 | Feedback Shaft | 1 |
| 53 | Screw, Spring to Feedback Shaft | 1 |
| 54 | O-ring, Feedback Shaft | 1 |
| 55 | Torsion Spring | 1 |
| 56 | E-ring | 1 |

| Item No. | Description | Quantity |
|---|---|---|
| Kit 7: Soft Goods Kit, P/N 199789.999.000 | | |
| 3 | O-ring, Main Housing Cover | 1 |
| 15 | O-ring, Pressure Sensor to Housing | 2 |
| 20 | O-ring, Regulator to Housing | 1 |
| 22 | O-ring, User Interface Cover | 1 |
| 26 | O-ring, User Interface Board | 1 |
| 35 | Flexible Tube | 1 |
| 37 | Nylon Washer | 1 |
| 41 | O-ring, Spool Valve to Housing | 3 |
| 45 | Hydrophobic Filter, Spool Valve Chamber | 1 |
| 46 | O-ring, Spool Valve Cover | 1 |
| 54 | O-ring, Feedback Shaft | 1 |
| Kit 8: Standard Model Pressure Sensor Plug Plate Kit, P/N 199790.999.000 | | |
| 11 | Screw, Pressure Sensor Board | 2 |
| 14 | Pressure Sensor Plug Plate | 1 |
| 15 | O-ring, Pressure Sensor to Housing | 2 |

| Item No. | Description | Quantity |
|---|---|---|
| Kit 9: Advanced Model Pressure Sensor Board Kit, P/N 199791.999.000 | | |
| 11 | Screw, Pressure Sensor Board | 2 |
| 13 | Pressure Sensor Board | 1 |
| 15 | O-ring, Pressure Sensor to Housing | 2 |
| Kit 10: Main PCB Assembly Kit, P/N 230226.999.000 | | |
| 6 | Screw, Main PCB Cover Short | 2 |
| 7 | Screw, Main PCB Cover Long | 1 |
| 8 | Main PCB | 1 |
| 9 | Screw, Main PCB Retaining Screw | 1 |
| Kit 11: User Interface Board Kit, P/N 230227.999.000 | | |
| 24 | Screw, User Interface to Housing | 3 |
| 25 | User Interface Board | 1 |
| 26 | O-ring, User Interface Board | 1 |
| Kit 13: Position Feedback Potentiometer Kit, P/N 199794.999.000 | | |
| 49 | Screw, Feedback Potentiometer to Housing | 2 |
| 50 | Metal Washer | 2 |
| 51 | Position Feedback Potentiometer | 1 |

# 12 Logix 3400*IQ* Mounting Kits

## 12.1 Valtek Mounting Kits

*Table XIII: Valtek Linear Mounting Kits*

| Spud | 25 $in^2$ | | 50 $in^2$* | | 100-200 $in^2$ | |
|---|---|---|---|---|---|---|
| | Standard | Handwheel | Standard | Handwheel | Standard | Handwheel |
| 2.00 | 164432 | 164433 | 164434 | 164433 | | |
| 2.62 | | | 164435 | 164436 | 164437** | 164436 |
| 2.88 | | | | | 164437 | 164438 |
| 3.38 | | | | | 164439 | 164440 |
| 4.75 | | | | | 164439 | 164440 |

** A 50 square", 2.00 spud with live loading requires kit number. ** Live-loading is not available on a 100 $in^2$, 2.62 spud.*

*Table XIV: Valtork Rotary Mounting Kits**

| Spud | 25 $in^2$ | | 50 $in^2$* | | 100-200 $in^2$ | |
|---|---|---|---|---|---|---|
| | Standard | Optional | Standard | Optional | Standard | Optional |
| 0.44 | 135429 | 135432 | 135430 | | 135431 | |
| 0.63 | 135429 | 135437 | 135430 | 135433 | 135431 | |
| 0.75 | 135429 | 135438 | 135430 | 137212 | 135431 | |
| 0.88 | 135429 | 135439 | 135430 | 137213 | 135431 | 135434 |
| 1.12 | 135429 | | 135430 | 137214 | 135431 | 137215 |
| 1.50 | 135429 | | 135430 | | 135431 | 137216 |
| 1.75 | 135429 | | 135430 | | 135431 | 137217 |

** Standard: All rotary valves with standard accessories (end of shaft mount). Optional: All rotary valves with handwheels or volume tanks (linkage design).*

## 12.2 Logix O.E.M. Mounting Kits

*Table XV: Logix O.E.M. Mounting Kits*

| Brand | Model | Size | Mounting Kit | |
|---|---|---|---|---|
| Fisher | 657 & 667 | 30 | 213905 | 0.5" – 1.5" stroke |
| | | 34 | 141410 | |
| | | 40 | | |
| | | 50 | 171516 | 0.5" – 1.5" stroke |
| | | | 171517 | 2" stroke |
| | | 60 | 171516 | 0.5" – 1.5" stroke |
| | | | 171517 | 2" stroke |
| | | 70 | 171518 | 4" stroke |
| | | 80 | 171519 | |
| | 1250 | 225 | 173371 | |
| | | 450 | | |
| | | 675 | | |
| | 1052 | 33 | 171549 | Rotary |
| | 657-8 | 40 | 173798 | |
| Neles | RC | | 171512 | |
| | RD | | 178258 | |
| Foxboro | Slid-Std | | 173567 | |
| | Linear | | 178258 | |
| Honeywell | VST-VA3R | 17-in. dia. | 173798 | |
| | VSL-VA1D | 12-in. dia. | 173798 | |

*Continued on page 72*

*Table XV: Logix O.E.M. Mounting Kits (continued)*

| Brand | Model | Size | Mounting Kit | |
|---|---|---|---|---|
| Masoneilan (Linear Actuators) | 37 | 9 | 171721 | |
| | | 11 | 171721 | |
| | | 13 | 171720 | |
| | | 18 | 173382 | |
| | | 24 | 173896 | |
| | 38 | 11 | 173235 | |
| | | 13 | 173234 | |
| | | 15 | 186070 | |
| | | 18 | 173382* | |
| | | 24 | 173896 | |
| | 71 Domotor | 25 | 173325 | |
| | | 50 | 173335 | |
| | | 100 | 173336 | |
| | 88 | 6 | 171722 | |
| | | 16 | 173827 | |
| | 47 | B | 173361 | |
| | 48 | B | 173361 | |
| | "D" Domotor | 200 | 175141 | |
| | 71-2057AB-D | | 176179 | |
| | 71-40413BD | | 176251 | |
| Masoneilan (Rotary Actuators) | 33 | B | 173298 | |
| | 35 | 4 | 173298 | |
| | | 6 | 173298 | |
| | | 7 | 173298 | |
| | 70 | 10 | 173298 | |
| **Valtek** | Trooper | | 166636 | 0.75" – 1.50" Std |
| Automax | R314 | | 141180 | HD |
| | SNA115 | | NK313A | |

*Continued on page 73*

*Table XV: Logix O.E.M. Mounting Kits (continued)*

| Brand | Model | Size | Mounting Kit |
|---|---|---|---|
| **Vangard** | 37/64 | | 175128 |
| **Air-Torque** | AT Series | AT0 – AT6 | Consult factory |
| **Automax** | SNA Series | SNA3 – SNA2000 | |
| | N Series | N250.300 | |
| | R Series | R2 – R5 | |
| **Bettis** | RPC Series | RP – TPC11000 | |
| | G Series | G2009-M11 – G3020-M11 | |
| **EL-O-Matic** | E Series | E25 – E350 | |
| | P Series | P35 – P4000 | |
| **Hytork** | XL Series | XL45 – XL4580 | |
| **Unitorq** | M Series | M20 – M2958 | |
| **Worcester** | 39 Series | 2539 - 4239 | |

**Adjustable mounting kit 173798 may be needed if handwheels are used.*

## 12.3 NAMUR Accessory Mounting Kit Part Numbers

Use prefix “NK” and choose bracket and bolt options from the following table.

*Table XVI: NAMUR Accessory Mounting Kit Part Numbers*

| Bracket Option | Description |
|---|---|
| 28 | 20 mm pinion x 80 mm bolt spacing |
| 28 | 38 mm pinion x 80 mm bolt spacing |
| 313 | 30 mm pinion x 80 mm bolt spacing |
| 513 | 50 mm pinion x 130 mm bolt spacing |
| **Bolt Option** | **Description** |
| A | 10-24 UNC bolting |
| B | 10-32 UNF bolting |
| L | M5-.8 metric bolting |

*Example: NK313A, NAMUR Accessory Mounting Kit with 30 mm pinion x 80 mm bolt spacing and 10-24 UNC bolting.*

# 13 Frequently Asked Questions

**Q: I set the Final Value Cutoff Low at 5 percent. How will the positioner operate?**
A: Assume that the present command signal is at 50 percent. If the command signal is decreased, the positioner will follow the command until it reaches 5 percent. At 5 percent, the spool will be driven fully open or fully closed, depending on the air action of the valve, in order to provide full actuator saturation and tight shutoff. The positioner will maintain full saturation below 5 percent command signal. As the command increases, the positioner will remain saturated until the command reaches 6 percent (there is a 1 percent hysteresis value added by the positioner). At this point, the stem position will follow the command signal. While in Final Value Cutoff, the Logix 3400*IQ* LEDs will blink GGGY.

**Q: I have Final Value Cutoff set to 3 percent but the valve will not go below 10 percent.**
A: Is a lower soft stop enabled? The lower soft stop must be less than or equal to zero percent in order for the Final Value Cutoff to become active. If a positive lower soft stop is written, this stop will take priority over the Final Value Cutoff feature. When the lower soft stop is reached, the positioner will blink a GYYR code.

**Q: Will soft stops prevent the valve from going to its fail position?**
A: No.

**Q: What is the difference between a model with Standard diagnostics and a model with Advanced diagnostics?**
A: The model with Advanced diagnostics adds top and bottom actuator pressure sensors. This allows for more diagnostic calculations such as loss of pressure, friction, advanced signatures, and troubleshooting. The pressure sensors, if present, are also used in the positioner control algorithm to enhance valve stability.

**Q: Can I upgrade from a Standard to an Advanced?**
A: Yes. Referencing the IOM, an advanced pressure sensor board assembly can be purchased. Simply replace the pressure sensor plug plate with the advanced pressure sensor board. Perform an actuator pressure calibration.

# 14 How to Order

*Table XVII: How to Order*

| Selection | | Code | Example |
|---|---|---|---|
| | | 3 | 3 |
| **Protocol** | Foundation Fieldbus* | 4 | 4 |
| **Electronic Hardware Options** | Standard Diagnostics* | 0 | 1 |
| | Advanced Diagnostics | 1 | |
| **Housing & Brand** | Aluminum, White Paint (Valtek)* | 0 | 0 |
| | Stainless Steel, No Paint (Valtek) | 1 | |
| | Aluminum, Black Paint (Automax) | 2 | |
| | Aluminum, Food Grade White Paint (Automax) | 3 | |
| | Aluminum, Accord (Balck Paint) | 4 | |
| | Aluminum, Accord (Food-Grade White Paint) | 5 | |
| | Aluminum - Off Shore Paint | 6 | |
| | | IQ | IQ |
| **Certifications** | Explosionproof Class I, Div 1, Groups B, C, D<br>DIP Class II,III Division 1 E, F, G | 01 | 1 |
| | Intrinsically Save Class I, Dive 1, Groups A,B,C,D<br>Nonincendive Class I,II,III Division 2 A,B,C,D,E,F,G | 02 | |
| | INMETRO BR-EX ia IIC T4/T5; BR-Ex d IIB+H2 T5 (South America) | 06 | |
| | Flame Proof EEx d IIB+H2; ATEX II 2 G | 07 | |
| | General Purpose | 14 | |
| | Ex ia IIC, ATEX II 1 G | 15 | |
| | Ex nA nL IIC, ATEX II 3 G | 20 | |
| | IECEx Ex ia IIC | 21 | |
| **Shaft/Feedback Shaft** | DD 316 SSI Shaft (Valtek Standard)* | D6 | D6 |
| | NAMUR 316 SSI (VDI/VDE 3845) | N6 | |
| **Conduit Connections/ Threaded Connections** | ½" NPT | E | E |
| | M20 | M | |
| **Action** | 4-way (Double-Acting) | 04 | 04 |
| | 3-way (Single-Acting) | 03 | |
| | 4-way Vented (Double-Acting) | 4V | |
| | 3-way Vented (Single-Acting) | 3V | |
| **Temperature** | Low -40°C to 85°C (-40°F to 185°F)* | 40 | 40 |
| **Gauges** | Gauges (Valtek standard)* | 0G | 0G |
| | SS with SS internals, psi (bar/kPa) | 0S | |
| | SS with SS internals, psi (kg/cm²) | KS | |
| | SS with brass internals, psi (kg/cm²) | KG | |
| | Stainless Steel | 0S | |
| | No Gauges | 0U | |
| **Special Options** | None* | 00 | 00 |
| | Remote Mount Feedback (Only available with Certification Option 14) | RM | |
| | Fail Option Feedback** | SF | |

**Indicates Standard Product Configuration*

***Contact factory before specifying this option*

# 15 Troubleshooting

*Table XVIII: Troubleshooting*

| Failure | Probable Cause | Corrective Action |
|---|---|---|
| No LED is blinking | Voltage of supply source is not high enough | Verify that voltage source can supply at least 9 V |
| | Current draw incorrect | Verify current draw of device (23 mA) and that of other devices on the loop aren't pulling too much current |
| Erratic communica-tions | Maximum cable length or cable impedance exceeded | Check cable conduction size, length and capacitance. Refer to Section 6.4, "Cable Requirements" |
| | Improper grounding | Terminate and ground segment properly. |
| | Interference with I.S. barrier | Must use FF-compatible I.S. barrier |
| | Host FB card not configured or connected correctly | Check connections and configurations of card |
| Unit does not respond to Final Value commands | Unit is in Auto mode | Put in OOS mode |
| | Error occurred during calibration | Check blink codes on positioner and correct calibration error. Recalibrate |
| Valve position reading is not what is expected | Positioner tubing backwards | Re-tube the actuator |
| | Stem position sensor mounting is off 180° | Remount position sensor |
| | Stroke not calibrated | Perform RE-CAL |
| | Tight shutoff is active | Verify settings using PC or handheld software |
| | Customer characterization or soft stops active | Verify customer characterization and soft stops |

| Failure | Probable Cause | Corrective Action |
|---|---|---|
| Position is driven fully open or closed and will not respond to command | Stroke not calibrated | Check DIP switch settings and calibrate valve stroke |
| | Inner-loop hall sensor not connected | Verify hardware connections |
| | Wrong air action entered in software | Check ATO (Air-to-open) and ATC (Air-to-close) settings. Recalibrate |
| | Actuator tubing backward | Verify ATO/ATC actuator tubing |
| | Driver module Electro-pneumatic converter malfunctioning | Replace driver module |
| | Control parameter inner-loop offset is too high/low | Adjust inner-loop offset and see if proper control resumes |
| Sticking or hunting operation of the positioner | Contamination of the driver module | Check air supply for proper filtering and meeting ISA specifications ISA-7.0.01. Check the spool valve for contamination |
| | Control tuning parameters not correct | Adjust gain settings using local gain switch |
| | Packing friction high | Enable the stability DIP switch on the local interface and recalibrate. If problem persists, enable pressure control with handheld communicator or SoftTools and recalibrate |
| | Corroded or dirty spool valve | Disassemble and clean spool valve |

** Final Value Cutoff*

**NOTE:** Refer to blink codes for self diagnostics of other errors. See document #VLAIM0046. Refer to Logix 3400/1400 Reference Manual for Fieldbus related troubleshooting.

**United States**
Flowserve Corporation
Flow Control
1350 N. Mt. Springs Parkway
Springville, UT 84663
Phone: 801-489-8611
Fax: 801-489-3719

FCD LGENIM3401-01 Printed in USA.

***To find your local Flowserve representative:***

For more information about Flowserve Corporation, visit www.flowserve.com or call USA 1 800 225 6989

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