Logix 500 Digital Positioner

GENERAL INFORMATION

The following instructions are designed to assist in unpacking, installing and performing maintenance as required on Logix™ 500 Digital Positioners. Series 500 is the term used for all the positioners within the family; however, specific numbers indicate features specific to a model: Logix 520 indicates that the positioner uses HART® protocol. 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, users must strictly adhere to WARNING and CAUTION notes. Modifying this product, substituting non-factory or inferior parts, or using maintenance procedures other than outlined could drastically affect performance and be hazardous to personnel and equipment, and may void existing warranties.

WARNING: This product has electrical conduit connections in either thread sizes 0.5-inch NPT or M20 which appear identical but are not interchangeable. 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 office.

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

Unpacking

1. While unpacking the Logix 500 positioner, check the packing list against the materials received. Lists describing the system and accessories are included in each shipping container.

   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.

2. In the event of shipping damage, contact the shipper immediately.
3. Should any problem arise, contact a Flowserve Flow Control Division representative.

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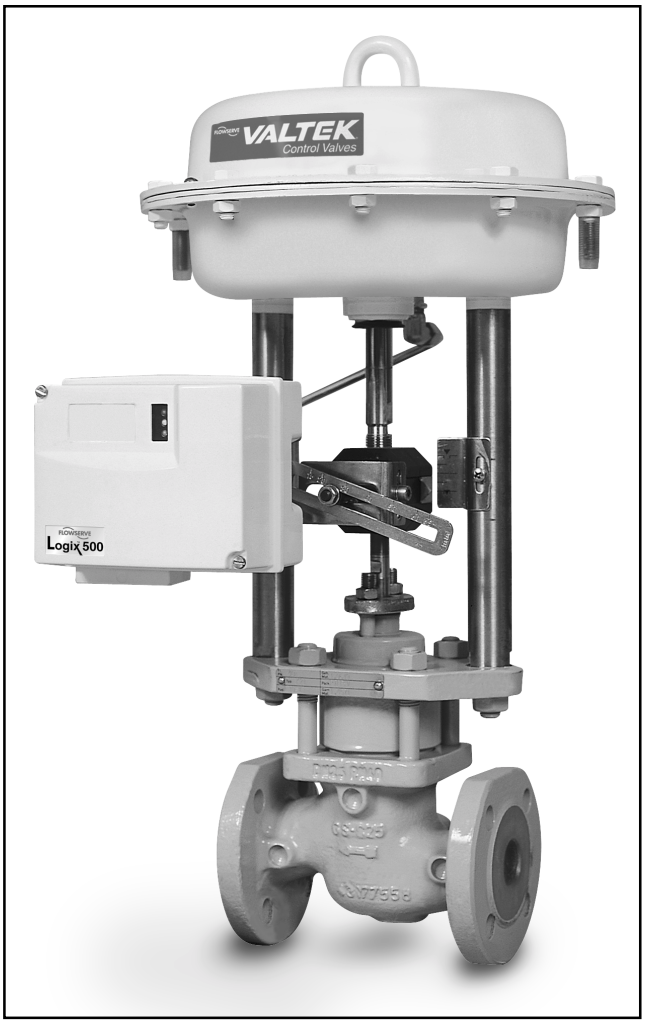


Logix 500 Digital Positioner on Valtek 2000 Control Valve

Flowserve Corporation, Valtek Control Products, Tel. USA 801 489 8611

Logix 500 Overview

The Logix 500 is a two-wire, 4-20 mA input digital valve positioner. The Logix 520 also utilizes the HART protocol to allow two-way remote communication with the positioner. The Logix 500 positioner controls single-acting actuators with linear and rotary mountings. The Logix 500 is completely powered by the 4-20 mA input signal. The minimum input signal required to function is 3.6 mA.

Since the positioner is insensitive to supply pressure changes and can handle supply pressures from 22 to 87 psig (1.5 to 6 barg), a supply regulator is usually not required; however, 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). A coalescing air filter is strongly recommended for all applications due to the close tolerances in the positioner.

NOTE: *The air supply must conform to ISA Standard ISA 7.0.01 or IEC 770 (a dew point at least 18° F / 10° C below ambient temperature, particle size below five microns – one micron recommended – and oil content not to exceed one part per million).*

Specifications

Table 1: Input Signal

Input Signal Range	4 - 20 mA (with HART)
Compliance Voltage (with HART signal)	12.0 VDC
Voltage Supply (maximum)	30 VDC
Minimum Required Operating Current	3.6 mA

Table 2: Stroke Output

Feedback Shaft Rotation	0° to 90° normal 0° to 40° minimum

Table 3: Supply Air

Supply Air Quality	Free from moisture, oil and dust per ISA-7.0.01
Input Pressure Range	22 – 87 psi (1.5 to 6.0 bar)
Air Consumption (steady state)	0.047 SCFM @ 22 psi 0.08 Nm^3/h @ 1.5 bar 0.071 SCFM @ 87 psi 0.120 Nm^3/h @ 6.0 bar

Table 4: Output Signal

Output Pressure Range	0 – 100 % of supply air pressure
Output Flow Capacity (input @ pressure)	1.41 SCFM @ 22 psi 2.4 Nm^3/h @ 1.5 bar 4.12 SCFM @ 90 psi 7.0 Nm^3/h @ 6.0 bar

Table 5: Performance Characteristics (typical)

Linearity	< ± 1.0%
Resolution	< 0.1%
Repeatability	< 0.2%
Deadband	< 0.2%

Table 6: Environmental Conditions

Operating Temperature	Standard	-4 – 178° F -20 – 80° C
	Low	-40 – 178° F -40 – 80° C
Transport and Storage Temperature		-40 – 178° F -40 – 80° C
Operating Humidity	0 – 100% non-condensing	
Intrinsic Safety	EEx ib II C T4/T5/T6; Ta = 65/55/40° C	

Table 7: Physical Specifications

Housing Material	Cast aluminum, powder-painted
Soft Goods	Nitrile
Weight	2.7 lbs (1.2 kg)

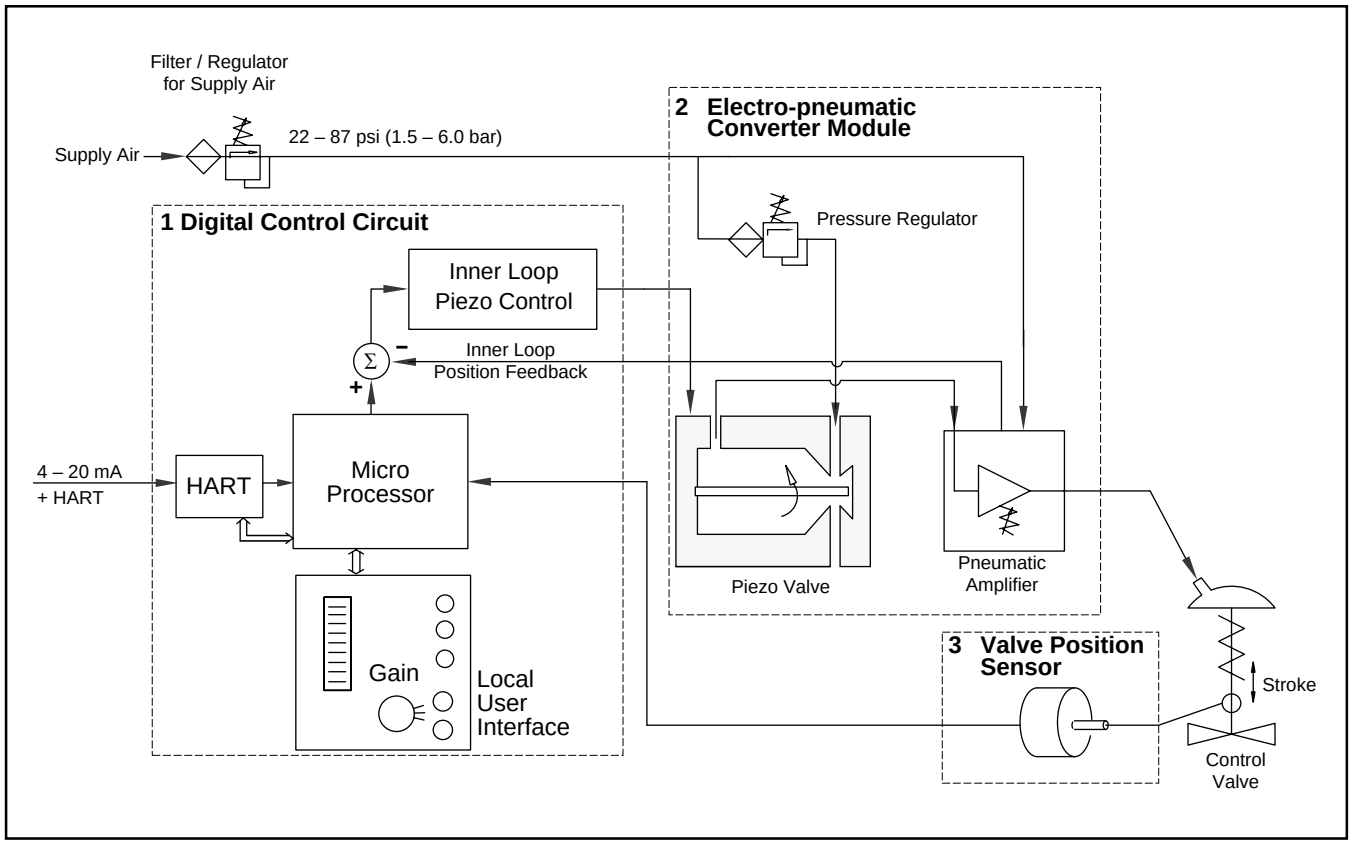


Figure 1: Logix 520 Principle of Operation

Principle of Operation

The Logix 520 positioner is a digital positioner that incorporates HART protocol for communication. The positioner consists of three main modules:

1. The microprocessor-based electronic control module includes HART communications and direct local user interface switches
2. The piezo value-based electro-pneumatic converter module
3. The infinite resolution valve position sensor.

The basic positioner operation is best understood by referring to Figure 1. The complete control circuit is powered by the two-wire, 4-20 mA command signal. The HART module sends and receives the superimposed FSK HART digital communications over the 4-20 mA signal wires providing two-way remote digital communications to the microprocessor. The analog 4-20 mA command is passed to the microprocessor, where it is compared to the measured valve stem position. The control algorithm in the processor performs control calculations and produces an output command to the piezo valve, which drives the pneumatic amplifier. The position of the pilot valve in the pneumatic amplifier is measured and relayed to the inner loop control circuit. This two-stage control provides for more responsive and tighter control than is possible with a single stage control algorithm. The pneumatic amplifier controls the airflow to the actuator. The change of pressure and volume of the air in the actuator causes the valve to stroke. As the valve approaches the desired position, the difference between the commanded position and the measured position becomes smaller and the output to the piezo is decreased. This, in turn, causes the pilot valve to close and the resulting flow to decrease, which slows the actuator movement as it approaches, the new commanded position. When the valve actuator is at the desired position, the pneumatic amplifier output is held at zero, which holds the valve in a constant position.

MOUNTING AND INSTALLATION

Mounting

Before starting installation, inspect the digital positioner for any transit damages. The Logix 500 series positioner is installed with a mounting kit (according to NAMUR specification) to the left-hand actuator support rod. Generally, the unit can be installed in any mounting position. The stroke feedback is realized by a follower arm and stem clamps. For shipment, the follower arm (maximum stroke of 2.5 inch / 65 mm) is detached from the positioner to save space. A follower arm for a 4.0 inch (100 mm) stroke must be ordered separately.

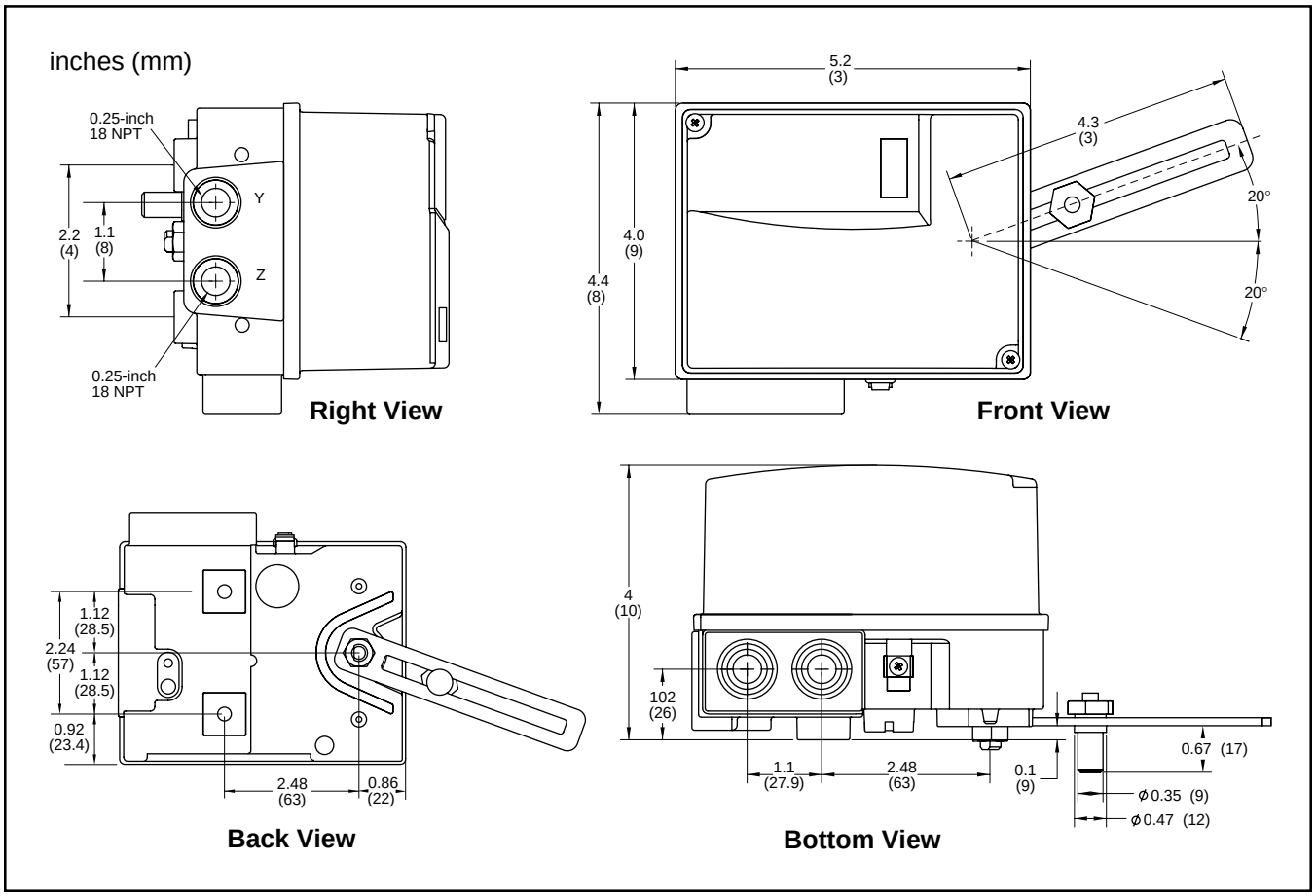


Figure 2: Dimensional Drawing of the Logix 500 Digital Positioner

The mounting of rod actuators (according to NAMUR) is described in Figure 6.

For the two mounting possibilities of cast yoke actuators (according to NAMUR, IEC 534 part 6) refer to Figure 4. After installation, ensure all screw connections are tightened correctly and all moving parts are free from excessive friction.

Valtek 2000, Kammer KA, Kammer KP, or standard NAMUR linear valves use the same mounting kits.

Mounting of the Logix 500 Series Positioner on a Linear Pneumatic Actuator (NAMUR) (Figure 6)

The mounting of a rod actuator kit (according to NAMUR) is described in an example by using the following equipment:

Valve: Standard globe valve or equivalent

Actuator: Single-acting pneumatic actuator

Positioner: Logix 500 with NAMUR mounting kit

Pre-assembly: Valve with actuator (valve stroke is matched with the actuator stroke)

For mounting, proceed as follows:

Mounting the Follower Arm

1. Unscrew the lock nut for follower arm attachment.
2. Place the follower arm (12) on the shaft at the back of the positioner (embossed scale facing the front) and fasten it with the lock nut. The follower pin (15) should point back from the positioner.

   CAUTION: Maximum torque 0.18 ft-lbs (0.25 Nm)

Mounting the Stem Clamp Bracket and Take-off Arm

1. Attach the stem clamp bracket (8) to the stem clamp (7) and fasten it with two hexagon socket screws (10) and lock washers (9).
2. Attach the take off arm (11) to the stem clamp bracket (8) and fasten it with a hexagon socket capscrew (16) and a washer (17). Ensure the take-off arm slot (11) is centered.

Mounting the Positioner

1. Adjust the actuator to mid-stroke.
2. Pre-assemble the mounting bracket (18) on the left actuator leg (5) hand-tight with two U-bolts (6), nuts (1) and lock washers' (2).

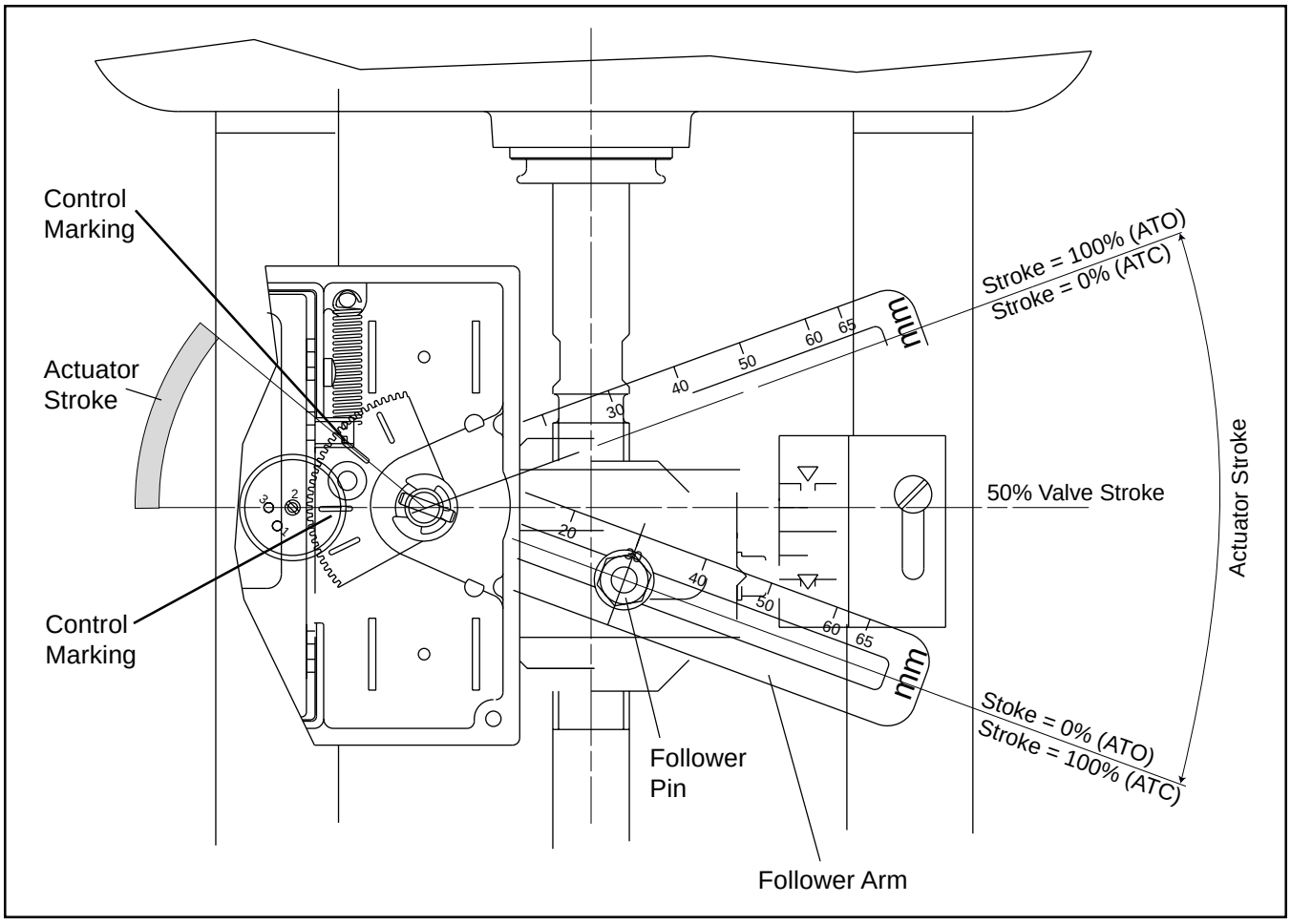


Figure 3: Basic Adjustment for a Linear Pneumatic Actuator

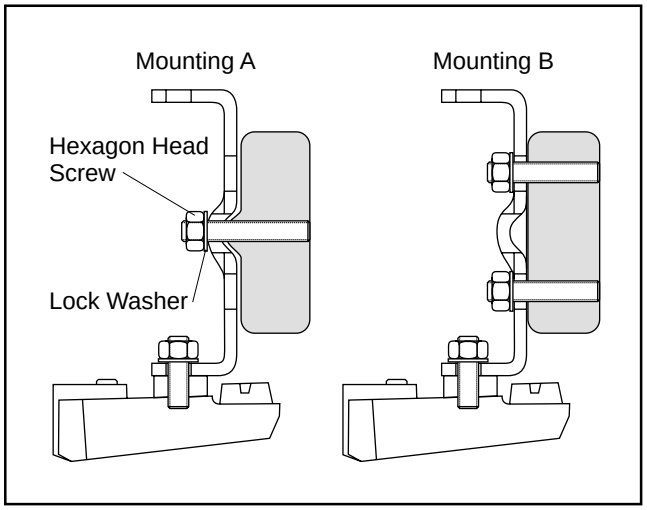


Figure 4: Yoke Actuator Mounting (according to NAMUR, IEC 534 part 6)

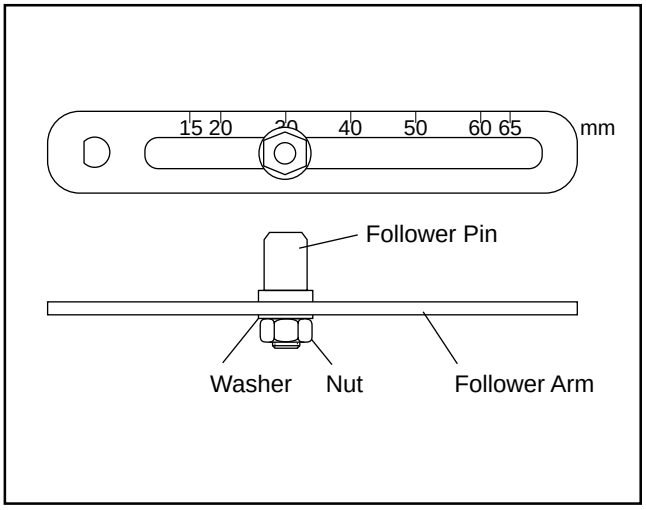


Figure 5: Take-off Arm (standard)

1. Nut (4x)
2. Lock washer (4x)
3. Lock washer (2x)
4. Hexagon head screw (2x)
5. Actuator leg (left)
6. U-bolt (2x)
7. Stem clamp
8. Stem clamp bracket
9. Lock washer (2x)
10. Hexagon socket screw (2x)
11. Take-off arm
12. Follower arm
13. Washer
14. Nut
15. Follower pin
16. Hexagon socket screw
17. Washer
18. Mounting bracket

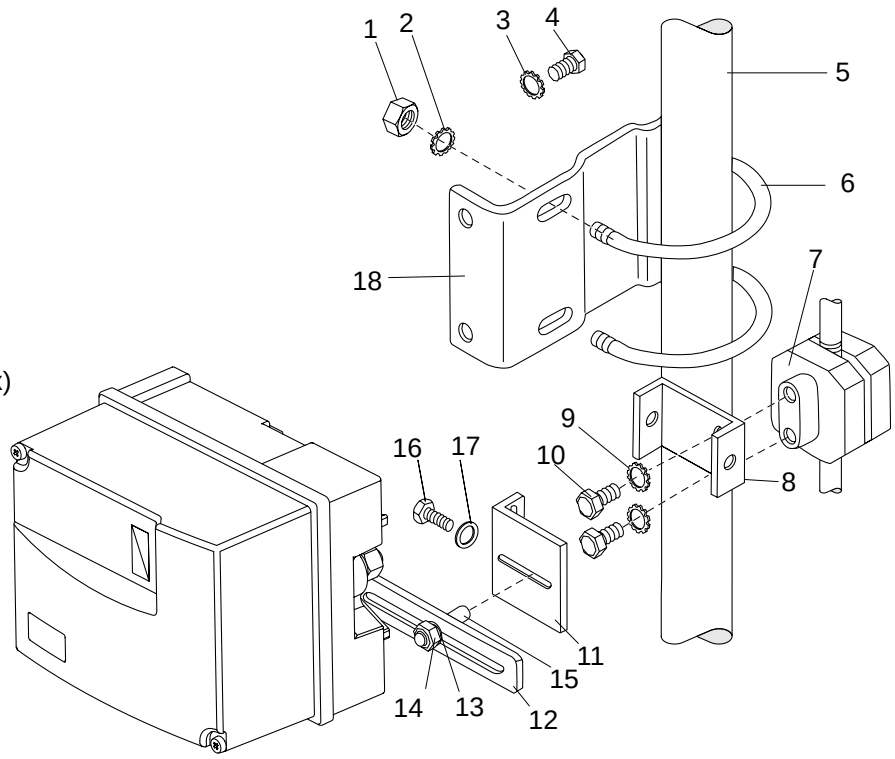


Figure 6: Mounting on a Rod Actuator (NAMUR)

3. Attach the positioner to the pre-assembled mounting bracket and fasten it with two hexagon head screws (4) and two lock washers (3). Check that the follower pin (15) is inserted in the slot of the take-off arm (11) and the follower arm (12) is positioned at a right angle to the outer edge of the positioner.
4. Tighten all screws and nuts.

   NOTE: *A slight unsymmetrical mounting increases the linearity deviation but does not affect the performance of the device. Depending on the actuator size and stroke it may be necessary to flip the take-off arm (Figure 6) by 180° and attach it to the opposite side of the stem clamp bracket (8).*

Follower Pin Adjustment

The positioner follower pin must be adjusted to match the valve stroke in the following manner:

1. Adjust the follower pin (STROKE + 10 mm) as indicated on the follower arm's embossed scale.
2. Exhaust the actuator.
3. Loosen the follower pin and shift it along the follower arm until the control marking on the feedback gear (Figure 3) is horizontal (points to the center of the feedback potentiometer). Fasten the follower pin in this position.
4. Adjust the actuator to full stroke and check the follower pin adjustment the same way as described in step 3. As the actuator strokes, the rotation of the feedback gear should be between the inner control markings. If the length of rotation is outside the control markings, adjust the follower pin farther out on the feedback lever to reduce the angle of rotation.

   NOTE: *Stroke the actuator carefully and ensure the follower arm does not interfere with valve parts, actuator or positioner. Do not adjust the follower pin (15) too near to the slot end of the take-off arm (11). The minimum lateral distance should be approximately 0.2-inches (5 mm) to prevent binding of the feedback mechanism.*

ROTARY ACTUATORS

Mounting the Logix 500 Series positioner on a quarter-turn actuator (closed by spring)

The mounting of a pneumatic double-piston part-turn valve actuator (in accordance with VDI/VDE) is described as an example by using the following equipment:

Part-turn valve actuator: AMG Type SAF, closed by spring

Butterfly damper: 90° rotary angle

Pre-assembly: Mounting block with actuator, actuator with damper (damper position is adapted with the actuator stroke)

For mounting, proceed as follows:

Mounting the coupler (Figure 7)

Fasten the coupling by using one of the two 90° staggered threaded holes, which allows different actuator mounting (closed by spring / opened by spring).

1. Screw the hexagon socket screw (7) into the appropriate threaded hole (9 for closed-by-spring; 10 for opened-by-spring) in the coupling (8), so that the screw is not protruding into the coupling hole.
2. Place the coupling on the positioner's rotary connection. Ensure the hexagon socket screw (7) points to the recess on the rotary connection.
3. Fasten the socket screw (7) by using a hexagon socket screw key (3 mm).

Mounting the positioner (Figure 7)

1. Attach the mounting plate (1) to the positioner and fasten it with two hexagon head screws (3) and lock washers (2).
2. Place the mounting plate (1) with the positioner onto the mounting block (4) of the actuator. Ensure the coupler (8) fits on to the shaft of the quarter-turn connection on the part-turn valve actuator.
3. Hand-tighten the plate (1) onto the actuator with four nuts (5) and lock washers (6), center it and fasten the nuts.
4. Tighten all screws and nuts.

Tubing Positioner to Actuator

After mounting has been completed, tube the positioner to the actuator using the appropriate compression fitting connectors:

Air connections: 1/4" NPT (standard air connection)

Auxiliary power: Pressurized air or permissible gases, free of moisture and dust in according with IEC 770 or ISA 7.0.01.

Pressure range: 22 – 87 psi (1.5 – 6.0 bar)

For connecting the air piping, the following notes should be observed:

1. The positioner passageways are equipped with filters, which remove medium and coarse size dirt from the pressurized air. If necessary, they are easily accessible for cleaning.
2. Supply air should meet IEC 770 or ISA 7.0.01 requirements. A coalescing filter should be installed in front of the supply air connection Z. Now connect

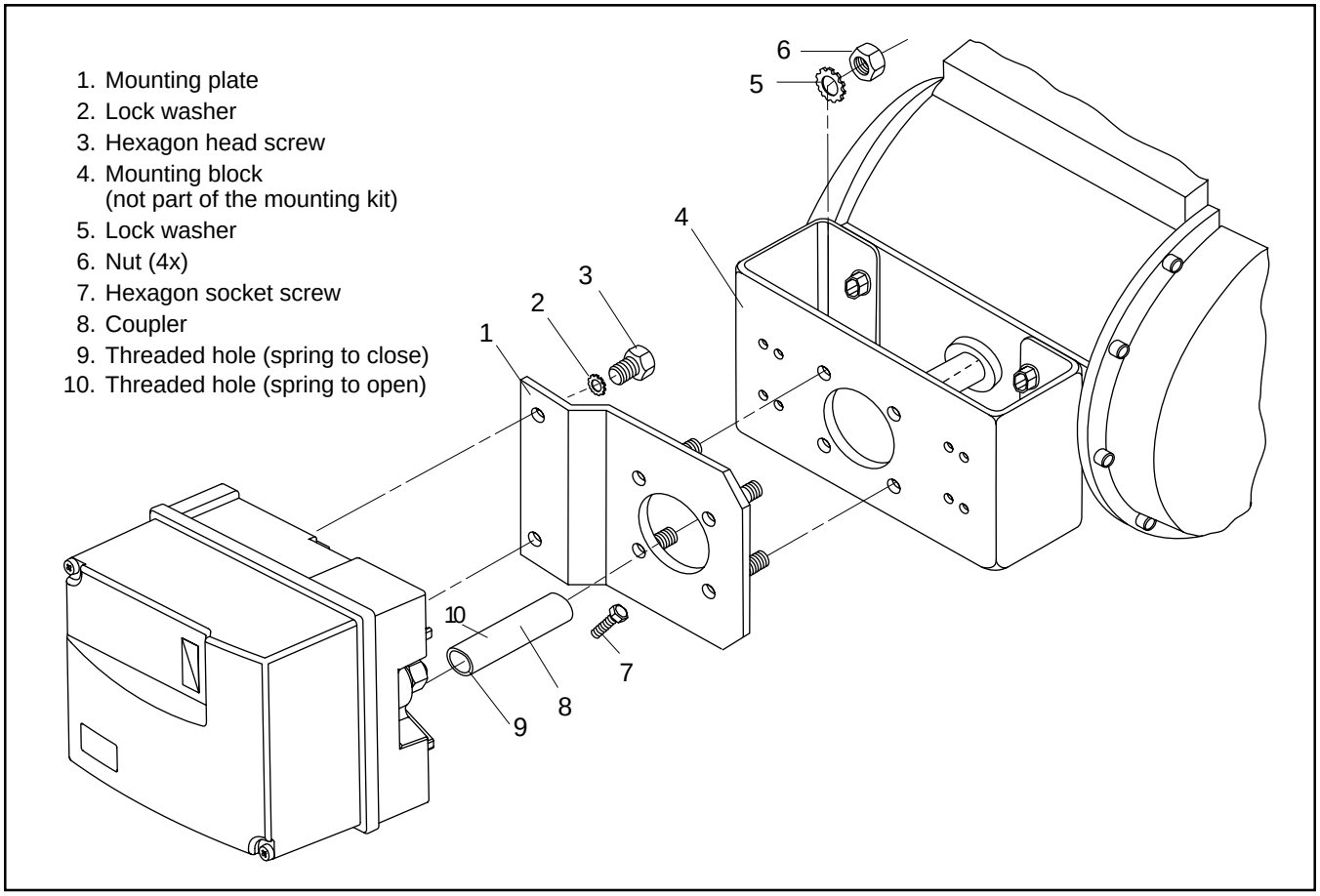


Figure 7: Mounting a Part-turn Valve Actuator (in acc. with VDI/VDE)

the air supply to the filter, which is connected to the Logix 500 series positioner.

3. With a maximum supply pressure of 87 psi (6 bar) a regulator is not required.
4. With an operating pressure of more than 87 psi (6 bar), a reducing regulator is required. The flow capacity of the regulator must be larger than the air consumption of the positioner (4.12 scfm @ 87 psi / 7 Nm^3/hr @ 6 bar).
5. Connect the outlet connector Y of the positioner to the actuator with tubing, independent of the action (direct or reverse).

Wiring and Grounding Guidelines

Electrical connections: signal cable with cable passage (NPT, PG13.5, or M20 x 1.5) to terminals 2 x 2.5 mm

Input signal: 4 – 20 mA, 4 – 12 mA, 12 – 20 mA

NOTE: *Observe the minimum requirements of voltage and equivalent electrical load: 12.0 VDC / 600 Ω / at 20 mA.*

The performance is ensured only for a minimum input current of 3.6 mA.

For wiring, the following notes should be observed:

NOTE: *The input loop current signal to the Logix 500 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. (Figure 8)*

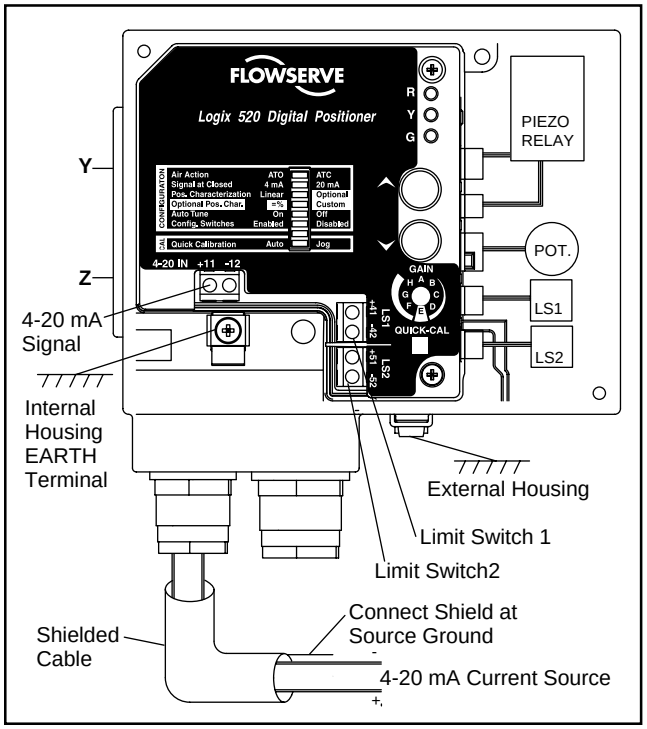


Figure 8: Wiring Diagram

Connect the 4-20 mA current source to terminals +11 and -12 (Figure 8).

Grounding Screw

The grounding screw, located inside the positioner cover, 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. The grounded screw must not be used to terminate signal shield wires.

Compliance Voltage (Figure 9)

Output compliance voltage refers to the voltage limit the current source can provide. A current loop system consists of the current source, wiring resistance, barrier resistance (if present), and the Logix 500 impedance. The Logix 500 requires that the current loop system allow for a 12.0 VDC drop across the positioner at maximum loop current.

CAUTION: Never connect a voltage source directly across the positioner terminals. This could cause permanent circuit board damage.

In order to determine if the loop will support the Logix 500, perform the following calculation.

$$\text{Voltage} = \text{Compliance Voltage } (@\text{Current}_{MAX}) - \text{Current}_{MAX} * (R_{barrier} + R_{wire})$$

The calculated voltage must be greater than 12.0 VDC in order to support the Logix 500.

Example: DCS Compliance Voltage = 19 V

$R_{barrier}$ = 300 Ω (if present)

R_{wire} = 25 Ω

CURRENT_{MAX} = 20 mA

Voltage = 19 V - 0.020 A*(300 Ω + 25 Ω) = 12.5 V

Table 8: Connection Table

Connection	Description
+11	Input +
-12	Input -
+41*	Limit switch 1 +
-42*	Limit switch 1 -
+51*	Limit switch 2 +
-52*	Limit switch 2 -
Y	Pneumatic output signal (outlet)
Z	Air supply (inlet)

* *= Optional connection*

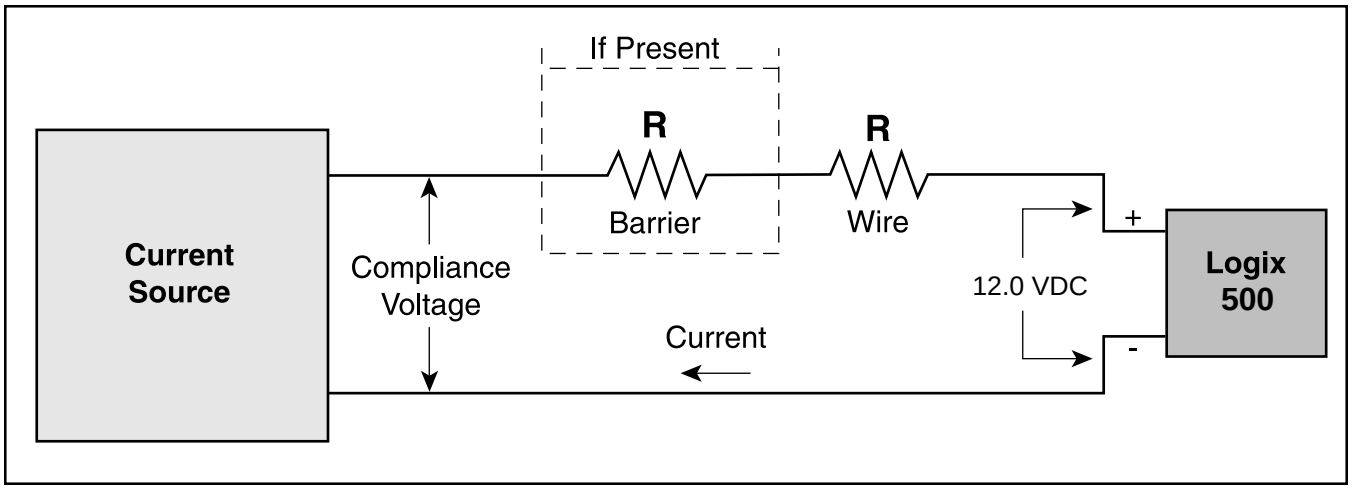


Figure 9: Compliance Voltage

The voltage 12.5 V is greater than the required 12.0 V; therefore, this system will support the Logix 500. The Logix 500 has an input resistance equivalent to 625 Ω at a 20 mA input current.

Cable Requirements

The Logix 520 digital positioner utilizes the HART communication protocol. This communication signal is superimposed on the DC 4-20 mA current signal. The two frequencies used by the HART protocol are 1200 Hz and 2200 Hz. To prevent distortion of the HART communication, cable capacitance and cable length restrictions must be calculated. The cable length must be limited if the capacitance is too high. Selecting a cable with lower capacitance/foot rating will allow longer cable runs. In addition to cable capacitance, the network resistance also affects the allowable cable length.

To calculate the maximum network capacitance use the following formula.

$$C_{network}\ (\mu F) \leq \left[\frac{65}{(R_{barrier} + R_{wire} + 390)} \right] - 0.0032$$

Example: $R_{barrier} = 300\ \Omega$ (if present)

$R_{wire} = 50\ \Omega$

$$C_{cable} = \frac{22\ \rho F}{foot} = \frac{0.000022\ \mu F}{foot}$$

$$\left[\frac{65}{(300 + 50 + 390)} \right] - 0.0032 = 0.08\ \mu F = C_{network}(\mu F)(Max)$$

$$\text{Max. Cable Length} = \frac{C_{network}\ (\mu F)}{C_{cable}}$$

$$\text{Max. Cable Length} = \frac{0.08\ \mu F}{0.000022\ \mu F/foot} = 3636\ ft.$$

To control cable resistance, No. 24 AWG cable should be used for runs less than 5000 feet. For cable runs longer than 5000 feet, No. 20 AWG cable should be used.

Electromagnetic Compatibility

The Logix 520 digital positioner has been designed to operate correctly in electromagnetic (EM) fields found in typical industrial environments. Care should be taken to prevent the positioner from being used in environments with excessively high EM field strengths (greater than 10 V/m). Portable EM devices such as hand-held two-way radios should not be used within one feet of the device.

Ensure proper wiring and shielding techniques of the control lines, and route control lines away from electromagnetic sources that may cause unwanted noise. An electromagnetic line filter can be used to further eliminate noise (Flowserve Part Number 10156843).

In the event of a severe electrostatic discharge near the positioner, the device should be inspected to ensure correct operability. It may be necessary to recalibrate the Logix 520 positioner to restore operation.

STARTUP

Logix 500 Local Interface operation

The Logix 500 local user interface 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 Quick-Cal™ button for automatic zero and span setting, along with two jog buttons for spanning valve/actuators with no fixed internal stop in the open position. There is also a switch block containing eight switches. Six of the switches are for basic configuration settings and one is for calibration options and one

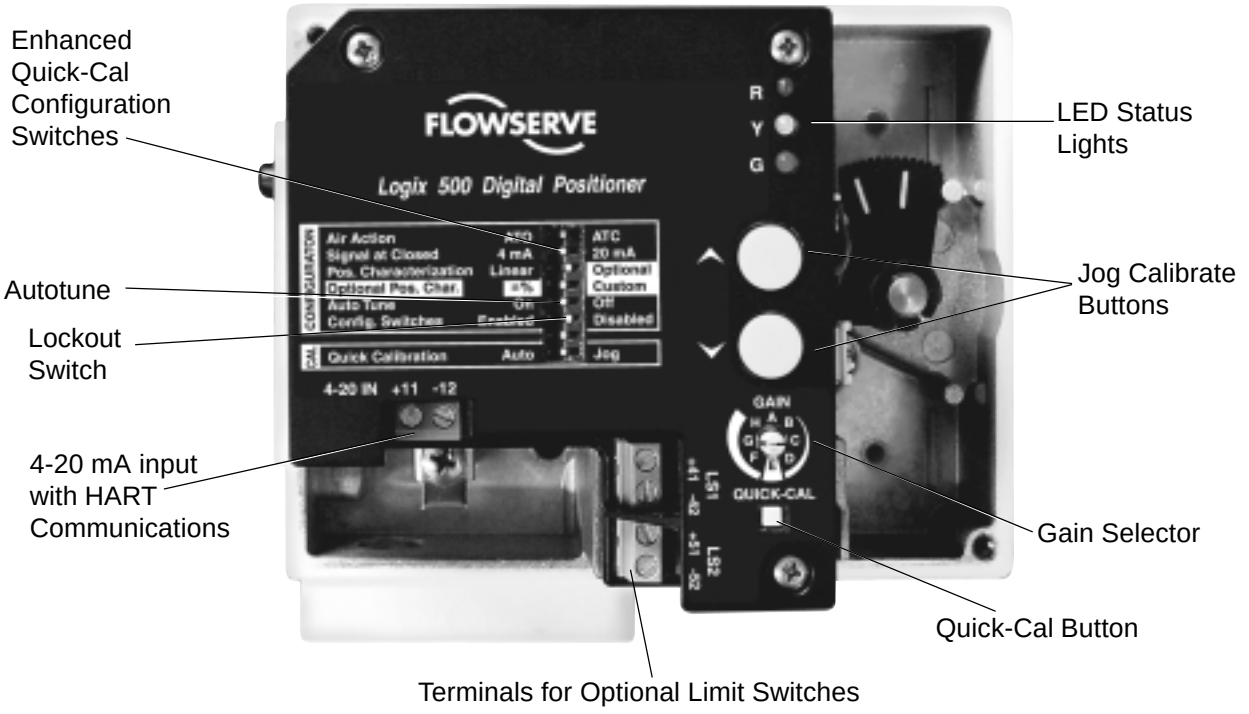


Figure 10: Logix 500 Local Interface

is for future enchancements. There is also a rotary selector switch for adjusting the positioner gain settings. For indication of operational status or alarm conditions there are also three LEDs on the local user interface.

Initial DIP Switch Setting

Before placing the unit in service, set the DIP switches in the *Configuration* and *Cal* boxes to the desired control options.

NOTE: *The switch settings in the* Configuration *box are activated* ***only*** *by pressing the* Quick-Cal *button or by utilizing the stroke calibration features provided by a handheld or by Flowserve PC software.*

Operation of Configuration DIP Switches Setup

The first six DIP switches are for basic configuration

1. **Air Action** – Must be set to match the configuration of the valve/actuator mechanical configuration.

   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.**

2. **Signal at Closed** – Normally this will be set to 4 mA for an air-to-open actuator, and 20 mA for an air-to-close actuator configuration.

   Selecting 4 mA will make the valve fully closed when the signal is 4ma and fully open when the signal is 20 mA.

   Selecting 20 mA will make the valve fully closed when the signal is 20 mA and fully open when the signal is 4 mA.

3. **Pos. Characterization**

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

   Select *Optional* if another characteristic is desired, which is set in conjunction with the next switch, labeled *Optional Pos. Char.*

4. **Optional Pos. Char.** – If the *Pos. Characterization* switch is set to optional, this switch 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 rangability curve.

   If *Custom* is selected, the positioner will be characterized to a custom table that must be set-up using a properly configured HART 275 handheld or other host software.

5. **Auto Tune** – This switch controls whether the positioner will auto tune itself every time the Quick-Cal button is pressed

   On enables an auto tune feature that will automatically determine the positioner gain settings every

time a Quick-Cal is performed based on the setting of the rotary *Gain* switch.

If the rotary *Gain* selector switch is set to *E* with the auto tune switch *On*, a Flowserve nominal response tuning set will be calculated and used.

If the rotary *Gain* selector switch is set to *D*, *C*, *B*, or *A* with the *Auto Tune* switch *On*, progressively lower gain settings will be calculated and used.

If the rotary *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.

Off forces the positioner to use one of the factory preset tuning sets determined by the rotary *Gain* selector switch. Settings *A* through *H* are progressively higher gain predefined tuning sets.

6. **Config. Switches** — By selecting *Enabled*, the Logix 500 will read all of the configuration switches each time a *Quick-Cal* is performed to determine the configuration.

   Selecting *Disabled* retains the last configuration in memory (from the last successful calibration) before the switch was set to *Disabled*. With this setting a *Quick-Cal* only zeros and spans the positioner.

Setup of the Cal DIP Switch for the Quick Calibration operating mode

1. Select *Auto* if the valve/actuator assembly has an internal stop in the 100% stroke 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.
2. Select *Jog* if the valve/actuator assembly has no 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 the next section on how to perform a manual calibration using the *Jog* buttons.

   WARNING: During the Quick-Cal operation the valve may stroke unexpectedly. Notify proper personnel that the valve will stroke, and make sure the valve is properly isolated.

Quick-Cal Operation

The *Quick-Cal* button is used to locally initiate a calibration of the positioner. Pressing and holding the *Quick-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. The *Gain Selector* switch is also read and action will be taken to adjust the gain according to the settings of the calibration switches as described in the previous section. A *Quick-Cal* can be aborted at any time by briefly pressing the *Quick-Cal* button and the previous settings will be retained.

If the *Quick calibration* switch (not to be confused with the *Quick-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. (See the appendix for an explanation of the various light sequences.)

WARNING: When operating using local control of the valve, 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.

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. The LEDs will then flash in a sequence of Y-R-R-G (yellow-red-red-green) which indicates the user must now use the *Jog* keys to manually position the valve to approximately 100%. When the valve is approximately 100% open press both *Jog* buttons simultaneously to proceed to the next step. The valve will then stroke and then wait while flashing the Y-R-R-G sequence again, allowing the user to adjust the valve position a second time to exactly 100% using the *Jog* buttons. When the stem is properly positioned press both *Jog* buttons 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. (See the appendix for an explanation of the various light sequences.)

Local control of valve position — Can be done from the user interface by holding both jog buttons and then simultaneously pressing the *Quick-Cal* button. While in this mode the LEDs will flash a Y-G-R-R (yellow-green-red-red) sequence. To exit the local control mode and return to normal operation, briefly press *Quick-Cal*.

Factory reset — hold *Quick-Cal* button while applying power and all of the internal variables including calibration will be reset to factory defaults. The positioner must be re-calibrated after a factory reset. Tag names and other user configured limits, alarm settings, and valve information will also need to be restored. A factory reset will always reset the command source to analog 4-20 mA.

Table 9: Logix 500 Status Condition Codes

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	No errors, alerts, or warnings; and the unit is in analog control mode.
GGGY	2	**MPC active -** The command is below the user set limit for tight shutoff feature. This is a normal condition for a closed valve. The factory default setting is 1% command. To clear the condition use handheld or Flowserve supplied software to reset the MPC if the range is incorrect or adjust the command signal above the specified MPC value.
GGYG	3	**Digital command mode -** The analog 4-20 mA input signal is ignored in this mode and a handheld or handheld or Flowserve supplied software is needed to change the position command. (Note a factory reset is the only method to reset the command back to analog control mode from the local interface if a PC or handheld configurator is not available. A reset will cause the loss of other data. See section 5 in the main document for more information.)
GGYR	4	**Cycle limit -** The cycle limit set by the user has been exceeded. To clear use handheld or Flowserve supplied software to reset.
GGRY	5	**Travel limit -**The total accumulated travel limit set by the user has been exceeded. To clear use handheld or Flowserve supplied software to reset.
GYYR	6	**Soft Stop Lower -** The unit is being commanded to exceed a user defined lower travel limit and the internal software is holding the position at the limit. To clear the condition use handheld or Flowserve supplied software to reset the limit if more travel is needed or adjust the command signal back in the specified range.
GYRY	7	**Soft Stop Upper -** The unit is being commanded to exceed a user defined upper travel limit and the internal software is holding the position at the limit. To clear the condition use handheld or Flowserve supplied software to reset the limit if more travel is needed or adjust the command signal back in the specified range.
GRYR	8	**Position Lower -** The position has reached or is exceeding a user defined lower travel indicator similar to a limit switch indicator. To clear the condition use handheld or Flowserve supplied software to reset the indicator if more travel is needed or adjust the command signal back in the specified range.
GRRY	9	**Position Upper -** The position has reached or is exceeding a user defined upper travel indicator similar to a limit switch indicator. To clear the condition use handheld or Flowserve supplied 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	10	**Signature test in progress-** This is a test initiated by Flowserve supplied software that can only be cancelled by that software.
YYYG	11	**Loop Calibration in Progress -** Calibration sequence controlled by a handheld or Flowserve supplied software that can only be cancelled by that software.
YRGG	12	**Stroke Calibration in Progress -** Calibration sequence started either using the local Quick-Cal button or by a handheld or Flowserve supplied software. It may be cancelled by briefly pushing the Quick-Cal button.
YGRR	13	**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 Quick-Cal button.

Table 9: Logix 500 Status Condition Codes (continued)

Colors	Identifier	Indication and resolution
YYYR	14	**Command 0 saturated -** Calibration error indicating that the 4-20 mA signal corresponding to 0% position was out of range. Adjust the signal to the correct range and re-do the calibration. This error may be cleared by briefly pushing the Quick-Cal button, which will force the positioner to use the parameters from the last good calibration.
YYRY	15	**Command 100 saturated -** Calibration error indicating that the 4-20 mA signal corresponding to 100% position was out of range. Adjust the signal to the correct range and re-do the calibration. This error may be cleared by briefly pushing the Quick-Cal button, which will force the positioner to use the parameters from the last good calibration.
YYRR	16	**Command span -** Calibration error indicating that the 4-20 mA signal was below the minimum calibration span. The minimum calibration span is 1.28 mA. This error may be cleared by briefly pushing the Quick-Cal button, which will force the positioner to use the parameters from the last good calibration.
YRRG	17	**Waiting for JOG set point from User -** only used during Jog calibration see explanation in Quick-Cal section of main document for operation.
YRYG	18	**Setting IL Offset** (in Stroke Cal) - 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	**Feedback no-motion during calibration -** 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 Quick-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 Quick-Cal button, which will force the positioner to use the parameters from the last good calibration.
YRYR	20	**Feedback 0 saturated -** Calibration error indicating that the position sensor was out of range during the calibration. 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 Quick-Cal button, which will force the positioner to use the parameters from the last good calibration.
YRRY	21	**Feedback 100 saturated -** Calibration error indicating that the position sensor was out of range during the calibration. 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 Quick-Cal button, which will force the positioner to use the parameters from the last good calibration.
YRRR	22	**Feedback span -** The range of motion of the position feedback arm was too small. 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. This error may be cleared by briefly pushing the Quick-Cal button, which will force the positioner to use the parameters from the last good calibration.
YRGR	23	**Feedback unstable during calibration -** Check for loose linkages or loose positioner sensor. This error may be cleared by briefly pushing the Quick-Cal button, which will force the positioner to use the parameters from the last good calibration.
YRGY	24	**Feedback unstable setting IL Offset -** Check for loose linkages or loose positioner sensor. This can also be caused by over tightened packing, very sticky packing, or very high gain settings. This error may be cleared by briefly pushing the Quick-Cal button, which will force the positioner to use the parameters from the last good calibration.

Table 9: Logix 500 Status Condition Codes (continued)

Colors	Identifier	Indication and resolution
R - - -		Any sequence starting with a red light indicates that there is an operational problem with the unit.
RGRR	25	**Position Deviation -** The position has exceeded user defined error band between command and position.
RYGG	26	**Initializing, or LED test mode -** This sequence should only be visible for 3 sequences when powering up the unit.
RYYY	27	**Hall sensor non-motion -** Check to make sure the air supply is connected. This error may be cleared by briefly pushing the Quick-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.
RYYR	28	**Hall sensor lower position -** Check to make sure the air supply is connected. This error may be cleared by briefly pushing the Quick-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.
RYRY	29	**Hall sensor upper position -** Check to make sure the air supply is connected. This error may be cleared by briefly pushing the Quick-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	**1.23v reference -** Bad electronic assembly, replace.
RRGR	31	**12-bit A/D reference -** Bad electronic assembly, replace.
RRYG	32	**Temperature limit -** The internal positioner temperature is currently exceeding operational limits of -40ºF (-40ºC) or 185ºF (85ºC).
RRYY	33	**Piezo voltage -** Bad electronic assembly, replace.
RRYR	34	**Board current high -** Check internal wiring and connectors for electrical shorts, if no shorts bad electronic assembly, replace.
RRRG	35	**12-bit D/A reference -** Bad electronic assembly, replace.
RRRY	36	**EEprom checksum error -** The checksum of the internal data has become corrupted. Cycle power and complete a Quick-Cal if needed. Check internal data to verify correct settings. If the error still occurs, bad electronic assembly, replace.

Figure 11: Limit Switch Unit

HART 275 HANDHELD COMMUNICATOR AND SOFTTOOLS CONFIGURATION AND DIAGNOSTIC SOFTWARE

The Logix 520 supports and is supported by the HART 275 Handheld Communicator. The DD and the manuals listed below can be obtained from the HART Communication Foundation or from your Flowserve representative. For more information please see the following guides:

- *Product Manual for the HART Communicator*
- *Logix 520 Digital Positioner with HART 275 Communicator User Guide*

Flowserve corporation has written custom configuration and diagnostic software for the Logix 500 series called SoftTools™. This software and the *SoftTools Quick Start Guide* are available from a Flowserve representative.

LIMIT SWITCH UNIT (Optional)

CAUTION: The installation of explosion proof electrical equipment must comply with the procedures contained in the certificates of conformance. Country specific regulations may apply. Electrical safety is determined only by the power supply device (Positioner operation with limited voltage only).

General

The Logix 500 digital positioner can be equipped with an additional limit switch unit, designed as a two-wire sensor in accordance with NAMUR. The low voltage and current characteristics of these sensors allows operation in hazardous areas.

Model Selection

To select the suitable Logix 500 version see product information.

Principle of operation

The stroke of the diaphragm actuator or the rotary angle of the rotary valve actuator is picked up by a stroke lever or by a coupling at the actuator connection. The lever/coupling moves the vane into the slot of the limit switches LS1 or LS2 via shaft. The sensors are designed as a proximity vane type switch. The switching function is triggered if a ferromagnetic object (vane) is inserted between the coils. The switching point can be set by adjustment of the vane.

Installation

The limit switch unit is delivered already fitted to the positioner and can not be retrofitted.

Start-up

After the Logix 500 digital positioner start-up in accordance with the application is complete, the limit switch unit can be adjusted and operation can be effected. For adjustment remove the positioner cover. Figure 14 shows the maximum switching range of the limit switches LS1 and LS2.

The switching points of the limit switches can be set by an adjustment of the vane as follows (Figure 13):

1. Loosen the knurled screw (Figure 13) at the stroke lever axis (1/2 to 1 rotations).
2. Move the positioner to the first switching position.
3. Set the switching point of the limit switch LS2 by adjusting the vane of the lower switch. For adjustment turn the corresponded slotted screw clockwise or counterclockwise.
4. Move the positioner to second switching position.
5. Set the switching point of the limit switch LS1 by adjusting the vane of the upper switch. For adjustment turn the corresponded slotted screw clockwise or counterclockwise.
6. Tighten the knurled screw.
7. Check the two switching points and repeat the adjustment steps 1 to 6, if necessary.

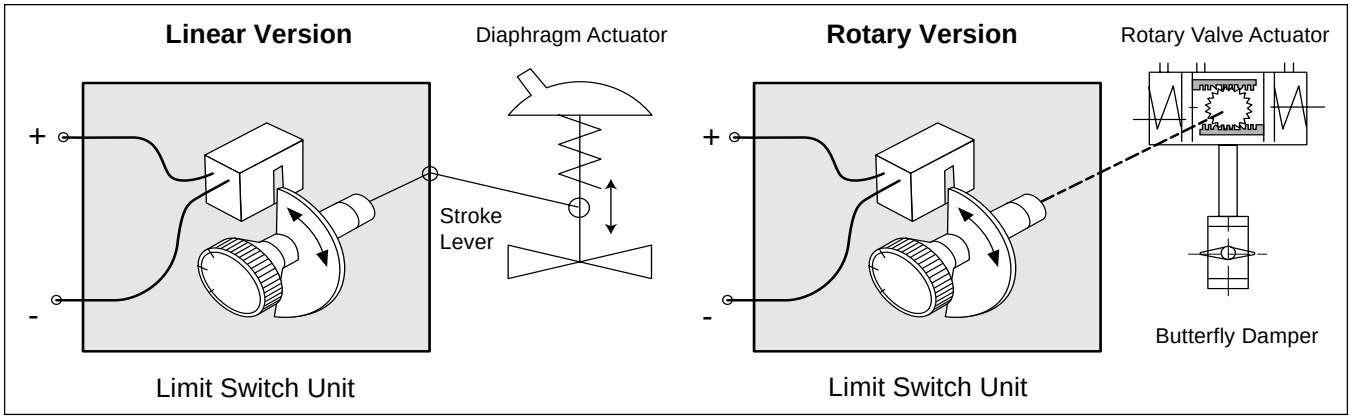
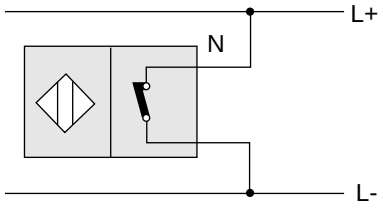


Figure 12: Principle of Operation

Table 10: Technical Data

Type	Two-wire - proximity vane type switch	SJ 3,5-N	SJ 3,5-SN	SJ 5-N
General	Operating voltage	8Vdc		
	Application	Limit sensing for positioners		
	Switches fitted	2 proximity vane type switches (delivery in combination only with positioner; can not be retrofitted)		
	Switching action	Normally open (NO) in acc. with NAMUR (DIN 19234)		
				
	Dimensions	The limit switch unit does not change the Logix 500 dimensions		
Supply	Supply voltage	$U_{max.} \leq 16Vdc$		
	Supply current	$I_{max.} \leq 52mA$		
Output signal	With target	≤ 1mA		
	Without target	≤ 3mA Short circuit-proofed		
Control characteristics	Switching hysteresis (in acc. with 20mm STROKE)	5% (= 1mm STROKE)		
	Repeatability	0.05% (= 0.01mm STROKE)		
	Ambient temperature sensitivity	< 1.5% (0.3mm) / 10K		
	Vibration sensitivity	< 1% at 2g (0.5...500 Hz) in accordance with IEC 65B section 133 (draft)		
Environmental - conditions	Operating temperature	-25 C...+100 C	-40 C...+100 C	-25 C...+100 C
	Intrinsic safety	EEx ib II C T4/T5/T6; Tu=80/65/50 C in accordance with EN 50014 and EN 50020		

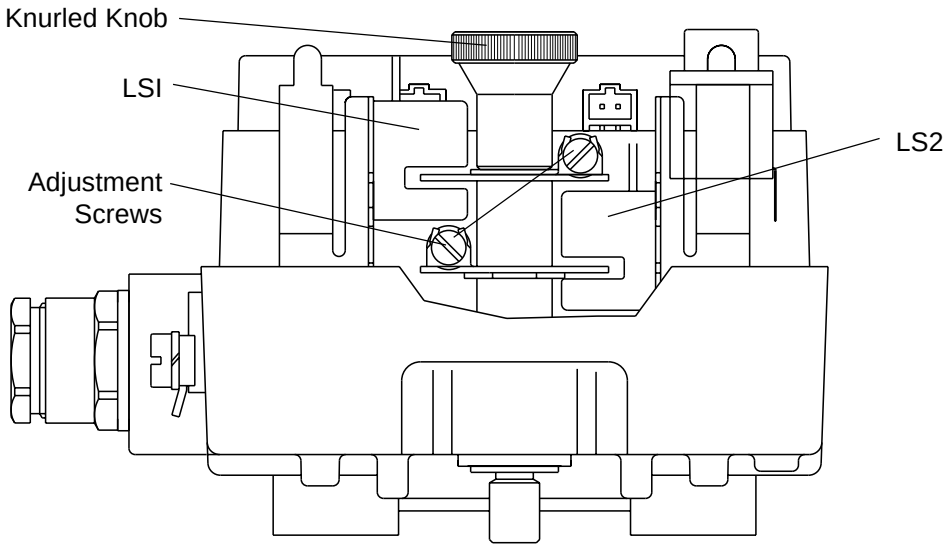
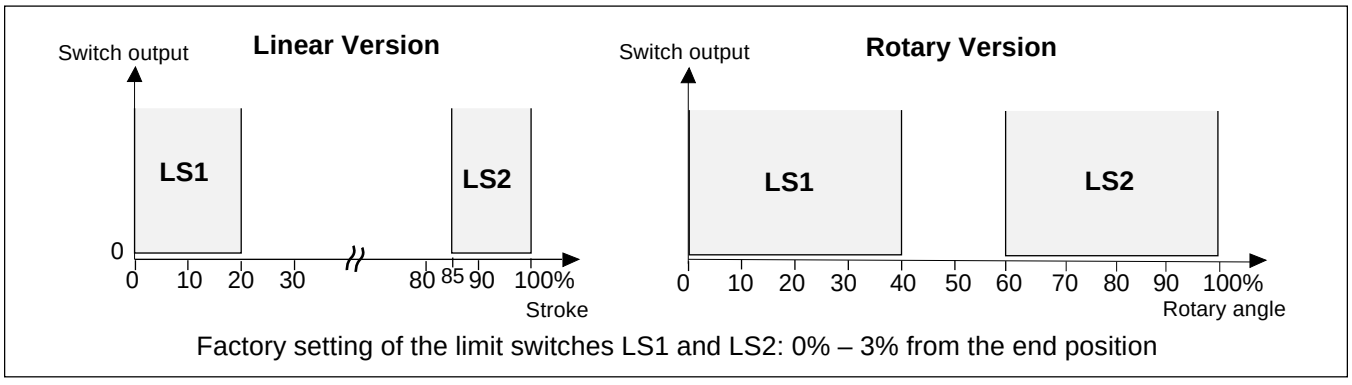


Figure 13: Proximity Vane Type Switch with Positioner (side view)

Troubleshooting Logix 500 Digital Positioners

Failure	Probable Cause	Corrective action
No LED is blinking	1. Current source below 3.6 mA	1. Verify current source is outputting at least 3.6 mA
	2. Incorrect wiring polarity	2. Check wiring for correct polarity
Erratic communications	1. Current source bandwidth not limited to 25Hz	1. Maximum allowable current source rate of change is 924 mA per second
	2. Maximum cable length or cable impedance exceeded	2. Check cable conductor size, length and capacitance. Refer to 'Cable Requirements' on page 11.
	3. HART modem connected to PC RS-232 port not receiving enough power	3. Verify laptop battery is not low
	4. Interference with I.S. barrier	4. Must use HART compatible I.S. barrier
	5. Current source stripping (filtering) HART signal.	5. Use the HART filter (VHF) available from Flowserve
Unit does not respond to analog commands	1. Unit is in digital command mode	1. Switch to analog command mode with handheld communicator or Soft-Tools.
	2. Error occurred during calibration	2. Correct calibration error. Recalibrate
Valve position reading is not what is expected	1. Stem position sensor mounting is off 180 degrees	
	2. Stroke not calibrated	
	3. Tight shutoff (M.P.C.)* is active	
	4. Custom characterization or soft stops active	
Position is driven fully open or closed and will not respond to command	1. Stroke not calibrated	1. Calibrate valve stroke
	2. Inner-loop hall sensor not connected	2. Verify hardware connections
	3. Wrong air action entered in software	3. Check ATO (Air-to-open) and ATC (Air-to-Close) settings. Recalibrate
	4. Actuator tubing backward	4. Verify ATO/ATC actuator tubing
	5. Electro-pneumatic converter malfunctioning	5. Replace electro-pneumatic converter
	6. Control parameter inner-loop offset is too high/low	6. Adjust inner-loop and see if proper control resumes
Sticking or hunting operation of the positioner	1. Contamination of the electro-pneumatic converter.	1. Check air supply for proper filtering and meeting ISA specifications ISA-7.0.01
	2. Control tuning parameters not correct	2. Lower proportional gain settings

* MPC (Minimum position cutoff)



Factory setting of the limit switches LS1 and LS2: 0% – 3% from the end position

Figure 14: Adjustable Switching Range

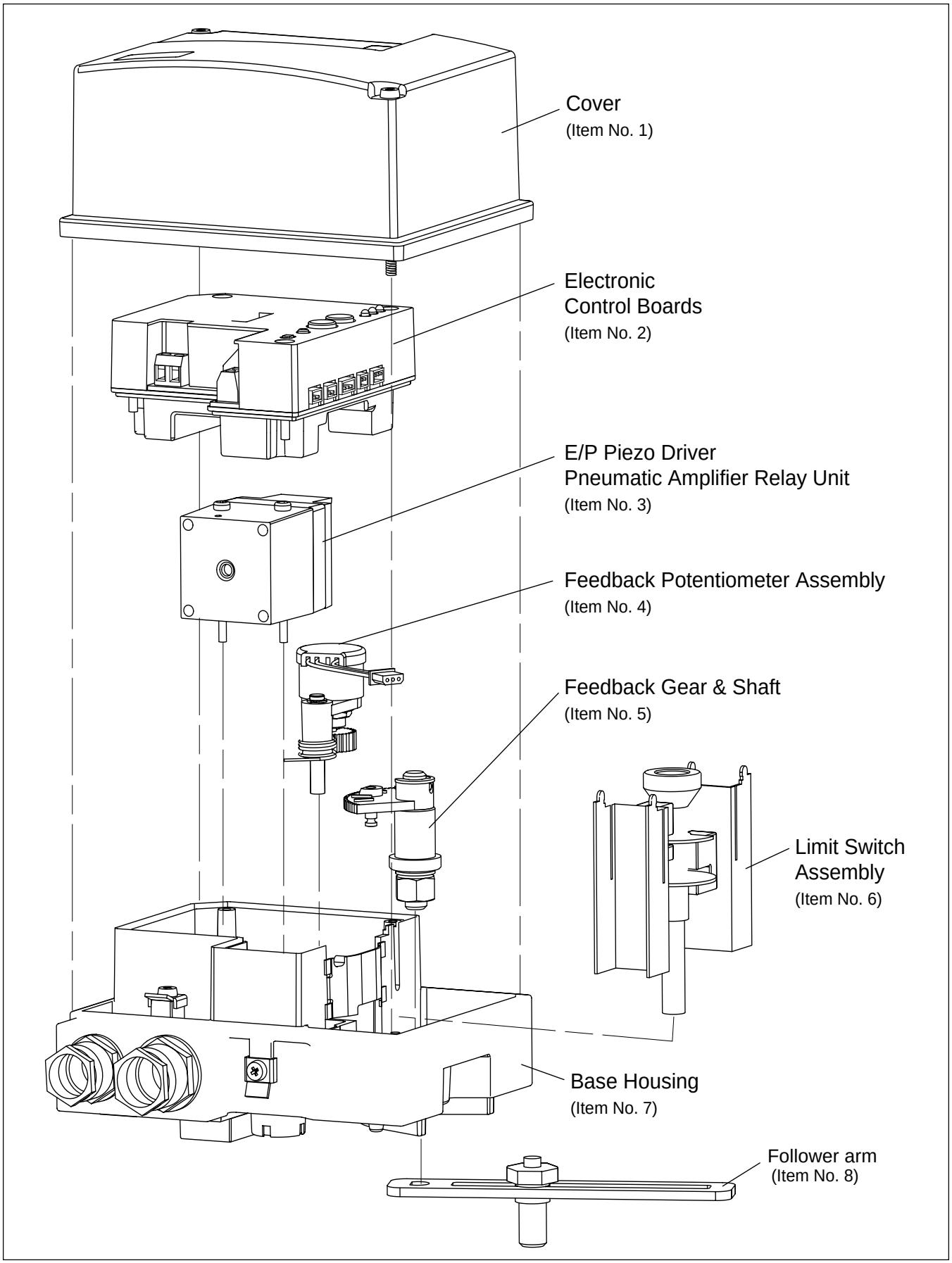


Figure 15: Exploded View

Spare Part Kits

Item No.	Description		Part No.
–	Repair kit for Logix 500-Relay Module Assembly		H10011500
–	Repair kit for Potentiometer Assembly		H10011600
4	Position Feedback Assembly		H10011700
2	PC Board Assembly		H1001200
8	Follower Arm Assembly	Max. stroke 65 mm Max. stroke 110 mm	H194512001 H194512002
1	Cover Assembly	Yellow White Black	H10011900GE H10011900WE H10011900SW

Mounting Kits

Item No.	Description	Part No.
–	NAMUR (Valtek 2000, Kammer KA, Kammer KP, and standard NAMUR linear valves)	H192685001
–	Rotary VDI/VDE	H194984001

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