



*Logix 500si series
Digital Positioners*

*Installation
Operation
Maintenance*



Experience In Motion

Contents

1. General information	3
1.1 Using	3
1.2 Terms concerning safety	3
1.3 Protective clothing	3
1.4 Qualified personnel	3
1.5 Installation	3
1.6 Spare parts	4
1.7 Service / repair	4
1.8 Storage	4
1.9 Valve and actuator variations	4
2. Unpacking	4
3. LOGIX 500si overview	5
4. Specifications	5
5. Principle of operation	6
6. Mounting and installation	6
6.1 General	6
6.2 Mounting of the Logix 500si Positioner on a Linear Pneumatic Actuator (NAMUR / IEC 534 part 6)	7
6.3 Rotary actuators	8
7. Tubing positioner to actuator	11
8. Wiring and grounding guidelines	12
8.1 Grounding screw	12
8.2 Electromagnetic compatibility	12
8.3 Compliance voltage	13
8.4 Cable requirements	13
9. Startup	14
9.1 Local interface operation	14
9.2 Initial DIP switch setting	14
9.3 Configuration dipswitch setup	14
9.4 Calibration switches	16
9.5 Quick-Cal operation	17
9.6 HART 275 Handheld Communicator	18
9.7 Use of sorttools communication software	18
9.8 Integration of third-party software	19
10. Status codes	19
11. Version number checking	21
12. Limit switch unit (Optional)	22
12.1 General	22
12.2 Model selection	22
12.3 Principle of operation	22
12.4 Installation	22
12.5 Start-up	22
12.6 Technical data	23
13. Trouble shooting	24
14. Certificates	25
15. Spare parts	30

1. General information

1.1 Using

The following instructions are designed to assist in unpacking, installing and performing maintenance as required on FLOWSERVE products. Product users and maintenance personnel should thoroughly review this bulletin prior to installing, operating or performing any maintenance.

In most cases FLOWSERVE valves, actuators and accessories are designed for specific applications (e.g. with regard to medium, pressure, temperature). For this reason they should not be used in other applications without first contacting the manufacturer.

1.2 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.



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



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



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 emphasised 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.

1.3 Protective clothing

FLOWSERVE products are often used in problematic applications (e.g. extremely high pressures, dangerous, toxic or corrosive mediums). In particular valves with bellows seals point to such applications. When performing service, inspection or repair operations always ensure, that the valve and actuator are depressurised and that the valve has been cleaned and is free from harmful substances. In such cases pay particular attention to personal protection (protective clothing, gloves, glasses etc.).

1.4 Qualified personnel

Qualified personnel are people who, on account of their training, experience and instruction and their knowledge of relevant standards, specifications, accident prevention regulations and operating conditions, have been authorised by those responsible for the safety of the plant to perform the necessary work and who can recognise and avoid possible dangers.

1.5 Installation

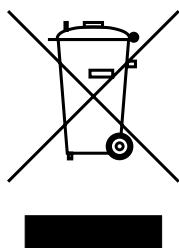
DANGER: Before installation check the order-no, serial-no. and/or the tag-no. to ensure that the valve/actuator is correct for the intended application.



Do not insulate extensions that are provided for hot or cold services.

Pipelines must be correctly aligned to ensure that the valve is not fitted under tension.

Fire protection must be provided by the user.



Disposal of product when taken out of service.

According to EU legislation, this product must be recovered for separation of materials and may not be disposed of as unsorted municipal waste.

If you wish you can return this Sensistor product to the manufacturer for recovery.

The manufacturer has the right to refuse taking back products that are inadequately packaged and thereby presents safety and/or health risks to the staff.

The manufacturer will not reimburse you for the shipping cost.

1.6 Spare parts

Use only FLOWSERVE original spare parts. FLOWSERVE cannot accept responsibility for any damages that occur from using spare parts or fastening materials from other manufacturers. If FLOWSERVE products (especially sealing materials) have been on store for longer periods check these for corrosion or deterioration before using these products. Fire protection for FLOWSERVE products must be provided by the end user.

1.7 Service / repair

To avoid possible injury to personnel or damage to products, safety terms must be strictly adhered to. Modifying this product, substituting nonfactory parts, or using maintenance procedures other than outlined in this instruction could drastically affect performance and be hazardous to personnel and equipment, and may void existing warranties. Between actuator and valve there are moving parts. To avoid injury FLOWSERVE provides pinch-point-protection in the form of cover plates, especially where side-mounted positioners are fitted. If these plates are removed for inspection, service or repair special attention is required. After completing work the cover plates must be refitted.

Apart from the operating instructions and the obligatory accident prevention directives valid in the country of use, all recognised regulations for safety and good engineering practices must be followed.

WARNING:

Before products are returned to FLOWSERVE for repair or service FLOWSERVE must be provided with a certificate which confirms that the product has been decontaminated and is clean. FLOWSERVE will not accept deliveries if a certificate has not been provided (a form can be obtained from FLOWSERVE).



1.8 Storage

In most cases FLOWSERVE products are manufactured from stainless steel. Products not manufactured from stainless steel are provided with an epoxy resin coating. This means that FLOWSERVE products are well protected from corrosion. Nevertheless FLOWSERVE products must be stored adequately in a clean, dry environment. Plastic caps are fitted to protect the flange faces to prevent the ingress of foreign materials. These caps should not be removed until the valve is actually mounted into the system.

1.9 Valve and actuator variations

These instructions cannot claim to cover all details of all possible product variations, nor in particular can they provide information for every possible example of installation, operation or maintenance. This means that the instructions normally include only the directions to be followed by qualified personal where the product is being used for its defined purpose. If there are any uncertainties in this respect particularly in the event of missing product-related information, clarification must be obtained via the appropriate FLOWSERVE sales office.

2. Unpacking

Each delivery includes a packing slip. When unpacking, check all delivered valves and accessories using this packing slip.

Report transport damage to the carrier immediately.

In case of discrepancies, contact your nearest FLOWSERVE location.

3. LOGIX 500si overview

The **Logix 500si** is a two-wire loop powered, 4-20 mA input digital valve positioner.

The **Logix 500si** positioner controls actuators with linear and rotary mountings.

Logix 520si also utilizes the HART protocol to allow two-way remote communication with the positioner.

The **Logix 500si** 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 1,5 to 6 barg (22 to 105 psig), 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 recommended for all applications due to the close tolerances in the positioner.

Logix 500si positioner accessories: Optional analog feedback system as well as limit switch unit and a directly attachable double acting module.

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

4. Specifications

Table 1: Input Signal

	510si	520si
Input Signal Range	4 - 20 mA	
Compliance Voltage	6,0 VDC (analog)	12,0 VDC with HART signal
Voltage Supply (max.)	30 VDC	
Minimum Required Operating Current	3,6 mA	

Table 2: Stroke Output

	510si	520si
Feedback Shaft Rotation	0° to 90° normal	min 15° max 90°
Rotation	0° to 40° min.	40° recommended for linear appl.

Table 3: Supply Air

Supply Air Quality	Free from moisture, oil and dust per IEC 770 and ISA-7.0.01
Input Pressure Range	1,5 to 6,0 bar (22 – 102 psi)
Air Consumption (steady state)	0,08 Nm ³ /h @ 1,5 bar 0,047 SCFM @ 22 psi 0,120 Nm ³ /h @ 6,0 bar 0,071 SCFM @ 102 psi

Table 4: Output Signal

Output Pressure Range	0 - 100 % of supply air pressure
Output Flow Capacity (input @ pressure)	2,4 Nm ³ /h @ 1,5 bar 1,41 SCFM @ 22 psi 7,0 Nm ³ /h @ 6,0 bar 4,12 SCFM @ 90 psi

Table 5: Performance Characteristics (typical)

	510si	520si
Linearity	< ± 1,0%	
Resolution	< 0,3%	< 0,1%
Repeatability	< 0,5%	< 0,2%
Deadband	< 0,5%	< 0,2%

Table 6: Environmental Conditions

Operating Temperature	Standard	-20 to 80°C -4 to 178°F
	Low	-40 to 80°C -40 to 178°F
Transport and Storage Temperature		-40 to 80°C -40 to 178°F
Operating Humidity		0 – 100% non-condensing

Table 7: Hazardous Area Specifications

ATEX	Ex II 1G EEx ia II C T6 Certificate No. Sira03ATEX2243
Non-incendive	FM Class 1, Division 2 Groups A, B, C, D Temp. Class. T4 Ta = 85 °C
Intrinsic Safety	FM Class 1, Division 1 Groups A, B, C, D Temp. Class. T4 Ta = 85°C

Table 8: Physical Specifications

Housing Material	Cast aluminum, powder-painted
Soft Goods	Nitrile
Weight	1,2 kg (2,7 lbs)

Table 9: Shipping weights

Shipping weights (incl. mounting kit)	with pressure gauges: 1,6 kg without pressure gauges: 1,2 kg
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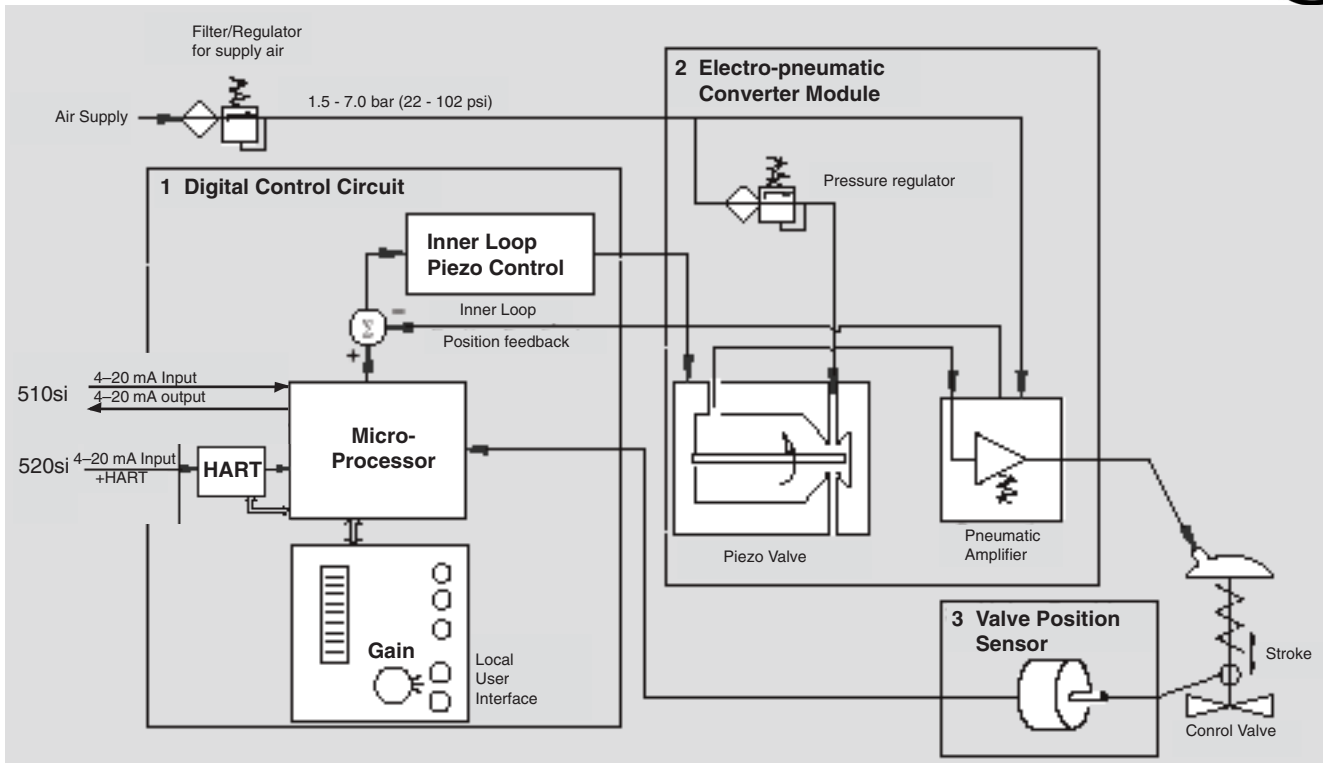


Figure 1. Principle of Operation

5. Principle of operation

The **Logix 500si** positioner is a digital positioner with various options. The positioner consists of three main modules:

1. The microprocessor-based electronic control module includes direct local user interface switches
2. The piezo valve-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 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.

6. Mounting and installation

6.1 General

Before starting installation, inspect the digital positioner for any transit damages. The Logix 500si 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 feed-back is realized by a follower arm and stem clamps.

The mounting of rod actuators (according to NAMUR) is described in Figure 3.

For the two mounting possibilities of cast yoke actuators (according to NAMUR, IEC 534 part 6) refer to Figure 5.

After installation, ensure all screw connections are tightened correctly and all moving parts are free from excessive friction.

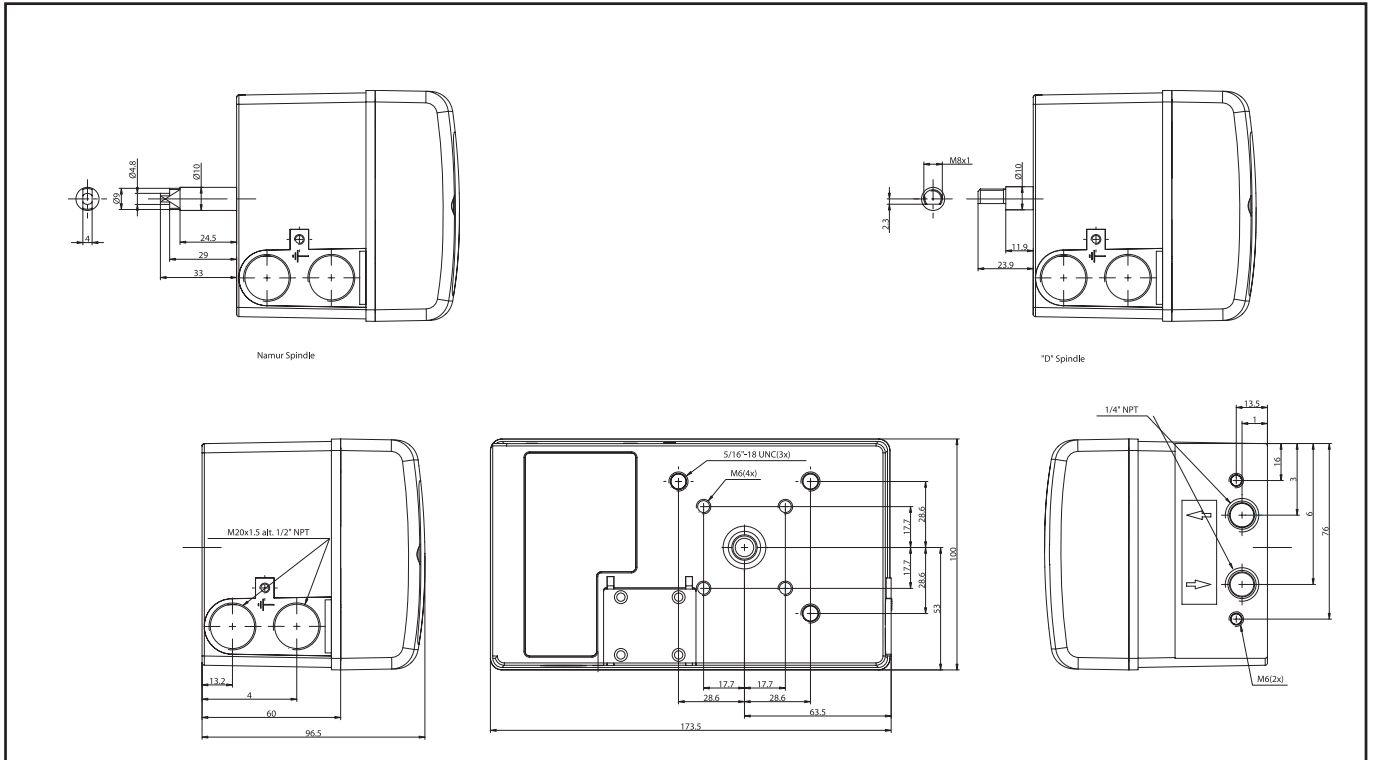


Figure 2. Dimensional drawing

6.2 Mounting of the Logix 500si positioner on a linear pneumatic actuator (NAMUR / IEC 534 part 6)

(See Figure 3)

The mounting of a rod actuator kit (according to IEC 534 part 6) is described in an example by using the following equipment:

Valve: Standard globe valve or equivalent

Actuator: Single-acting pneumatic actuator

Positioner: Logix 500si Series 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 (Figures 3 and 6)

1. Unscrew the lock nut for the follower arm attachment.
2. Place the follower arm on the shaft at the back of the positioner and fasten it with the lock nut. The follower pin should point back from the positioner.



CAUTION: Maximum torque 0,25 Nm (0,18 ft-lbs).

Mounting the stem clamp bracket and take-off arm (Figure 3)

1. Attach the stem clamp bracket to the stem clamp and fasten it with two hexagon socket screws and lock washers.
2. Attach the take off arm to the stem clamp bracket and fasten it with a hexagon socket capscrew and a washer. Ensure the take-off arm slot is centered.

Mounting the positioner (Figure 3)

1. Adjust the actuator to mid-stroke.
2. Pre-assemble the mounting bracket on the left actuator leg hand-tight with two U-bolts, nuts and lockwashers.
3. Attach the positioner to the pre-assembled mounting bracket and fasten it with two hexagon head screws and two lock washers. Check that the follower pin is inserted in the slot of the take-off arm and the follower arm 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 3) by 180° and attach it to the opposite side of the stem clamp bracket.

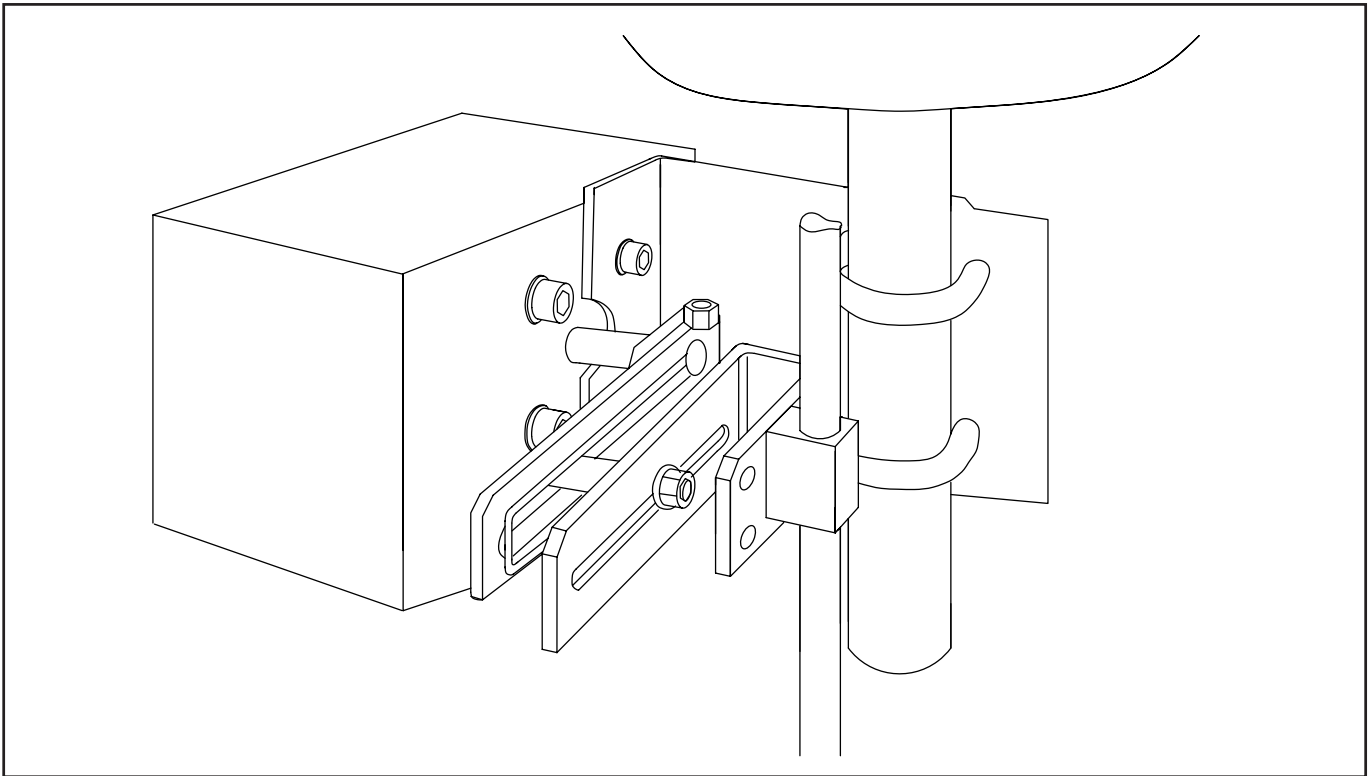


Figure 3. Mounting on a Rod Actuator (IEC 534 part 6)

Follower pin adjustment (Figure 4)

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 (Figure 6).
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 4) 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 too near to the slot end of the take-off arm.

The minimum lateral distance should be approximately 5 mm (0,2 inches) to prevent bending of the feed-back mechanism.

6.3 Rotary actuators

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

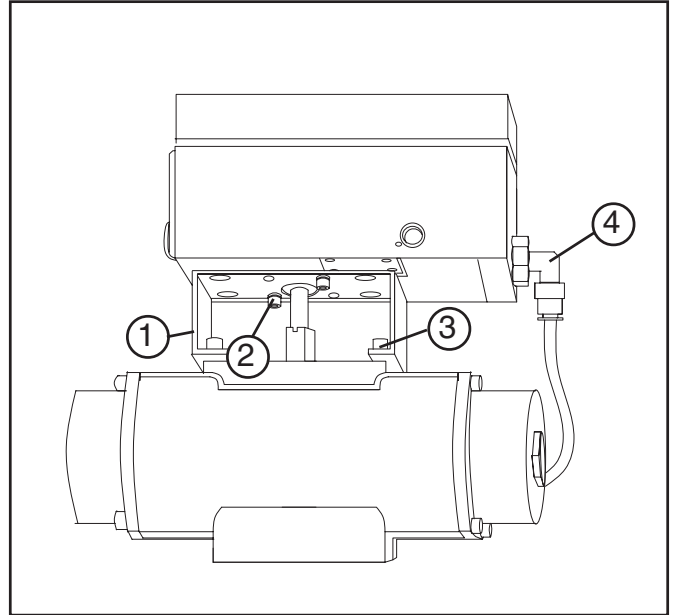
The mounting of a pneumatic double-piston part-turn valve actuator (in accordance with VDI/VDE 3845) is described as an example by using the following equipment:

Quarter-turn valve actuator: Rack & pinion or scotch yoke, closed or open by spring.

Rotary actuators VDI/VDE 3485 (Namur)

Mount bracket **1** to positioner. Secure with 4 x M6 screws **2**.

Fit positioner on actuator and secure with 4 x screws **3**.
Install tubing **4** between actuator and positioner.
See section 7.



Linear actuator “Flow act” (Direct mounting, integrated tubing).

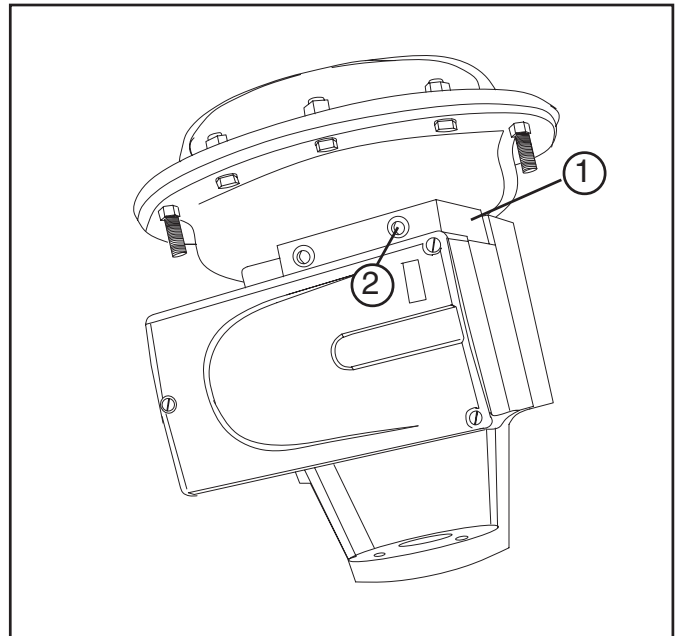
Check O-rings, Install bracket **1** to positioner and secure with screws.

Fit pin on valve stem.

Fit lever arm to positioner shaft.

Fit and check O-rings and positioner to actuator and secure with 2 x screws **2**.

No tubing needed, it's integrated with actuator, fit plug in positioner out port.



Linear actuator VDI/VDE 3847 (Direct mounting, integrated tubing).

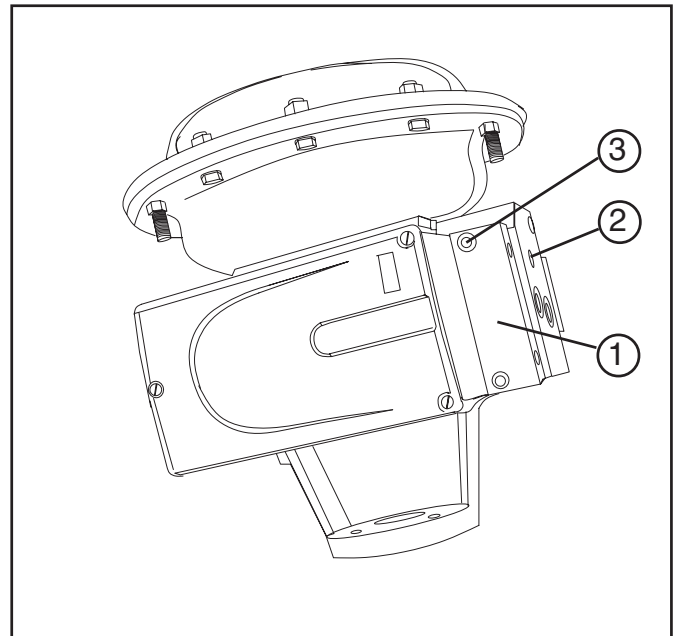
Check O-rings, Install bracket **1** to positioner and secure with 2 x screws **2**.

Fit pin on valve stem.

Fit lever arm to positioner shaft.

Fit and check O-rings and positioner to actuator and secure with 2 x screws **3**.

No tubing needed, it's integrated with actuator.



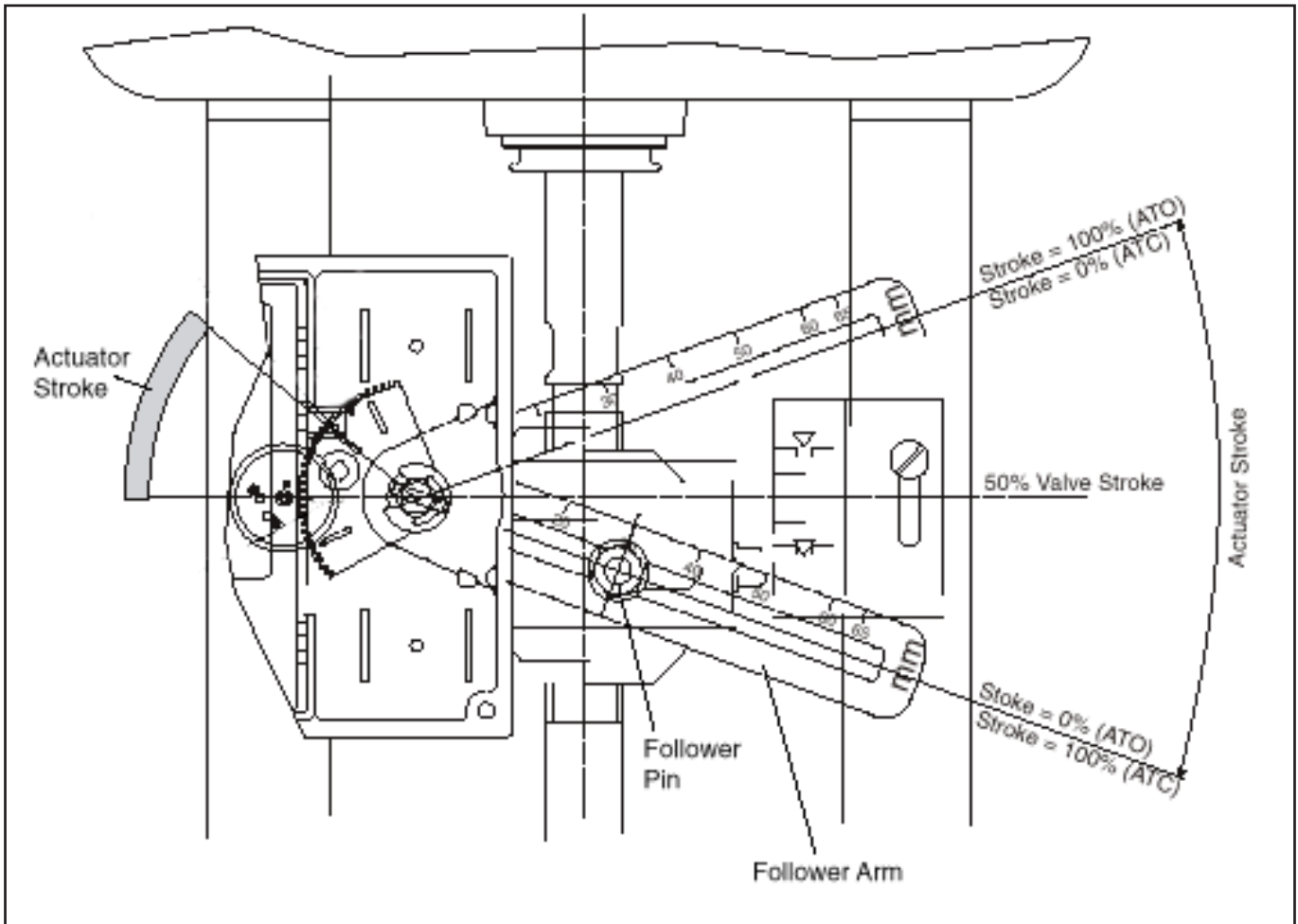


Figure 4. Basic Adjustment for a Linear Pneumatic Actuator

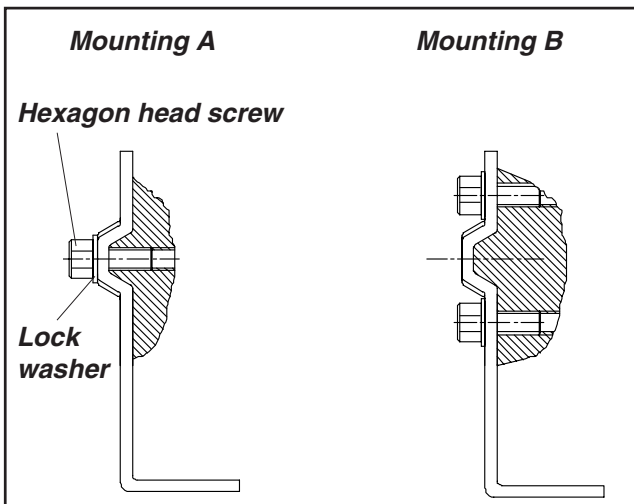


Figure 5. Yoke Actuator Mounting (according to IEC 534 part 6)

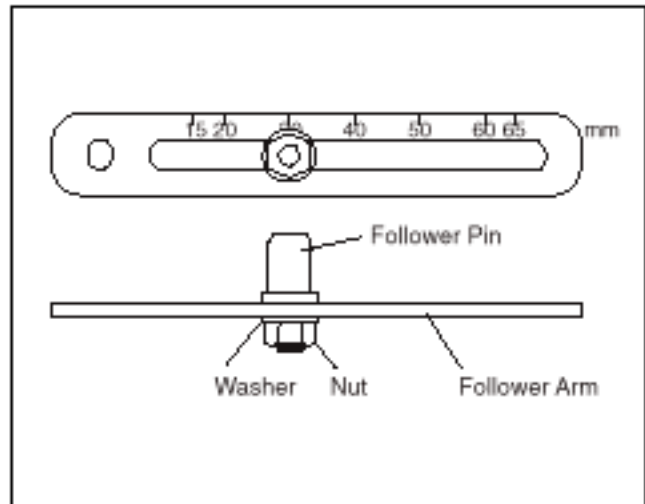


Figure 6. Follower Arm (standard)

Mounting the positioner (Figure 7)

2. Place the positioner (1) onto the mounting block (2) of the actuator using four screws (3) Ensure the coupler fits on to the shaft of the quarter-turn connection on the part-turn valve actuator.

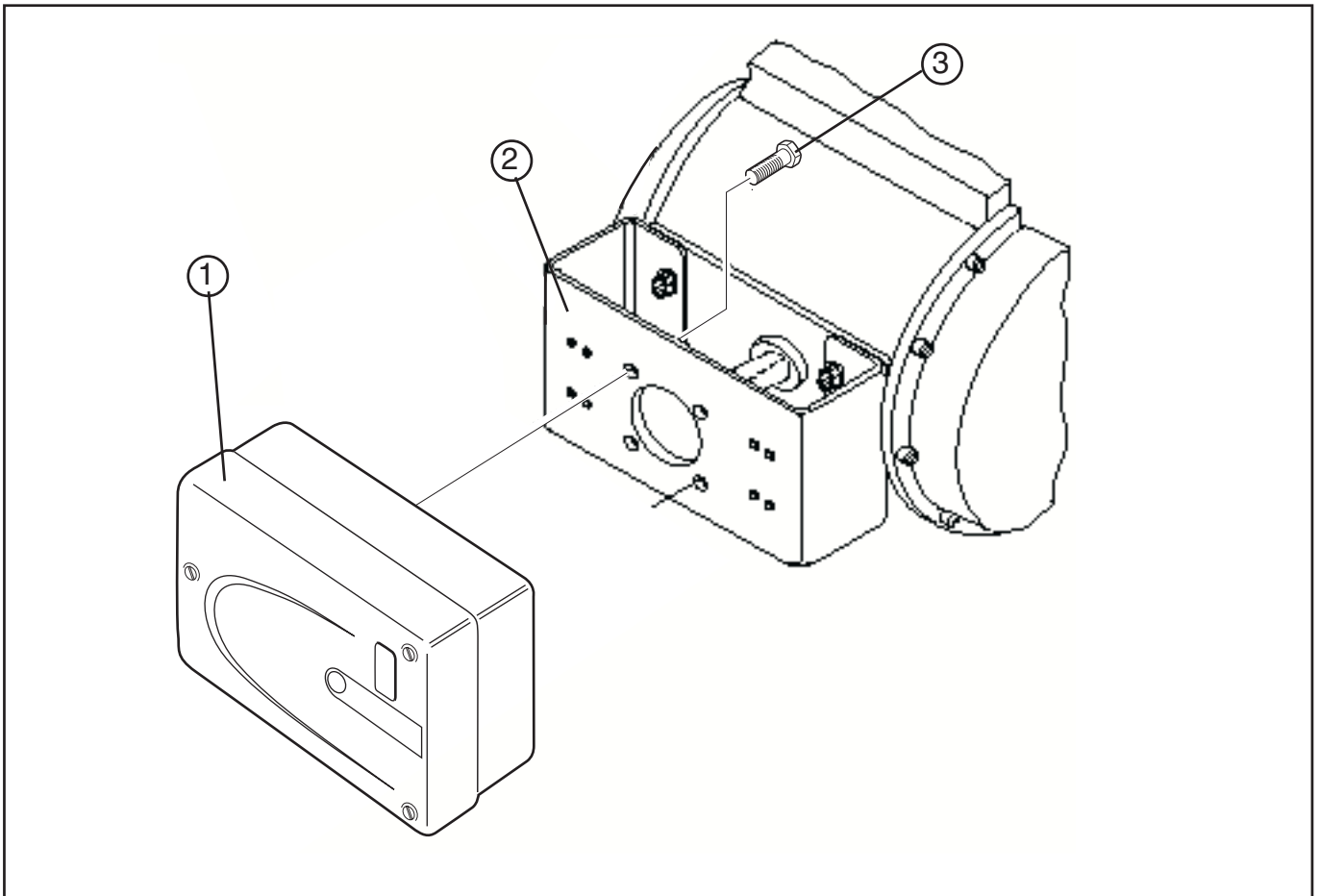


Figure 7. Mounting a Part-turn Valve Actuator in acc. with VDI/VDE3845

7. 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: 1,5 – 6,0 bar (22 – 102 psi).

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 ↓ (Figure 8). Now connect the air supply to the filter, which is connected to the Logix 500 Series positioner.

3. With a maximum supply pressure of 6 bar (102 psi) a regulator is not required.

4. With an operating pressure of more than 6 bar (102 psi), a reducing regulator is required.

The flow capacity of the regulator must be larger than the air consumption of the positioner (7 Nm³/h @ 6 bar / 4,12 scfm @ 102 psi).

5. Connect the outlet connector ↑ (Figure 8) of the positioner with tubing, independent of the action (direct or reverse).

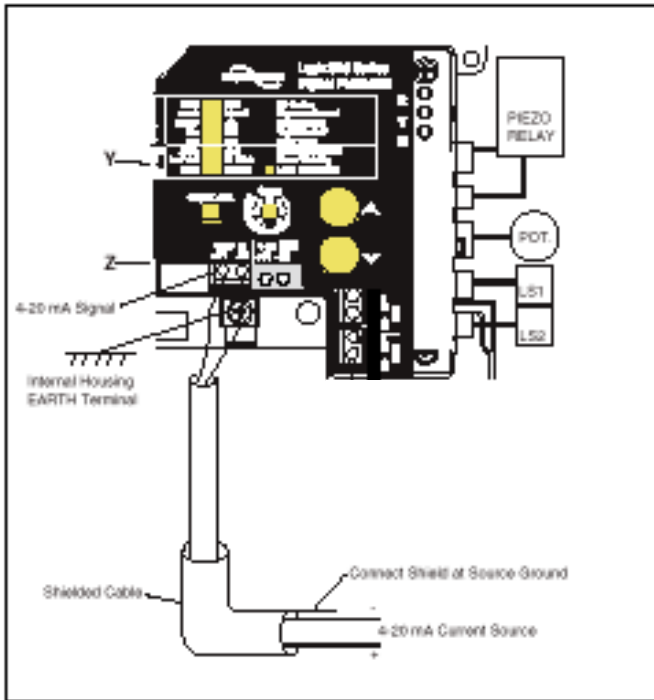


Figure 8. Connections

8. Wiring and grounding guidelines

Electrical connections: signal cable with cable passage ($\frac{1}{2}$ "NPT, or M20 x 1,5) to terminals 2 x 2,5 mm

Input signal: 4 – 20 mA

NOTE: Observe the minimum requirements of voltage and equivalent electrical load:

6,0 VDC / 300 Ω / at 20 mA (**510si**)

12,0 VDC / 600 Ω / at 20 mA (**520si**)

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 500si 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)

Connect the 4-20 mA current source to terminals +11 and -12, see connection table.

8.1 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.

Connection Tables

	Connection	Description
510si	+11	Input +4-20 mA
	-12	Input -4-20 mA
	+31*	Output +4-20 mA
	-32*	Output -4-20 mA
		Pneumatic output signal (outlet)
	Air supply	

	Connection	Description
520si	+11	Input +4-20 mA
	-12	Input -4-20 mA
		Pneumatic output signal (outlet)
		Air supply

* Optional

8.2 Electromagnetic compatibility

The **Logix 500si** 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 30 cm 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.

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 500si** positioner to restore operation.

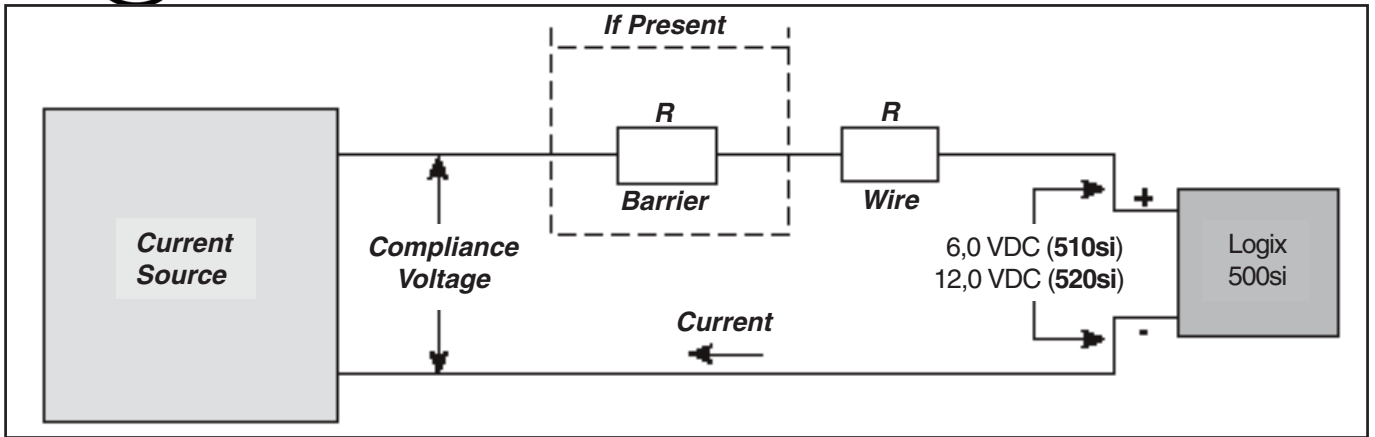


Figure 9. Compliance voltage

8.3 Compliance voltage

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 510/520** impedance.

510si

The **Logix 510si** requires that the current loop system allow for a 6,0 VDC drop across the positioner at maximum loop current.

520si

The **Logix 520si** 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 500si**, perform the following calculation:

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

510si

To support the **Logix 510** the calculated voltage must be greater than 6.0 VDC.

520si

To support the **Logix 520** the calculated voltage must be greater than 12.0 VDC.

Example: DCS Compliance Voltage = 19 V

$$R_{\text{barrier}} = 300\Omega$$

$$R_{\text{wire}} = 25\Omega$$

$$\text{CURRENT}_{\text{MAX}} = 20 \text{ mA}$$

$$\text{Voltage} = 19 \text{ V} - 0,020 \text{ A}(300\Omega + 25\Omega) = 12,5 \text{ V}$$

510si

This system will support the **Logix 510si**, as the voltage 12,5 V is greater than the required 6,0 V. The **Logix 510si** has an input resistance equivalent to 300Ω at a 20 mA input current.

520si

This system will support the **Logix 520si**, as the voltage 12,5 V is greater than the required 12,0 V. The **Logix 520si** has an input resistance equivalent to 600Ω at a 20 mA input current.

8.4 Cable requirements

The Logix 520 si 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/mm rating will allow longer cable runs. In addition to cable capacitance, the network resistance also affects the allowable cable length.

$$C_{\text{network}}(\mu\text{F}) \leq \frac{65\Omega}{(R_{\text{barrier}} + R_{\text{wire}} + 390\Omega)} - 0,0032$$

Example:

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

$$R_{\text{wire}} = 50 \Omega$$

$$C_{\text{cable}} = \frac{72 \text{ pF}}{\text{m}} = \frac{0,000072 \mu\text{F}}{\text{m}}$$

$$\left[\frac{65}{(300 + 50 + 390)} \right] - 0,0032 = 0,08 \mu\text{F} =$$

$$= C_{\text{network}}(\mu\text{F})(\text{Max})$$

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

$$\text{Max. Cable Length} = \frac{0,08\mu\text{F}}{0,000072 \mu\text{F/m}} = 1111 \text{ m}$$

To control cable resistance, No. 24 AWG cable should be used for runs less than 1500 m. For cable runs longer than this, No. 20 AWG cable should be used.



Note! When installing Logix 500si intrinsically safe, always consider the information on page 24-27.

9. Startup

9.1 Local interface operation

The Logix 500si local user interface allows the user to fully configure the operation of the positioner, tune the response, and calibrate the positioner. The Local interface consists of:

- a quick calibration button for automatic zero and span setting
- two jog buttons for manually spanning the positioner, or for local Jogging of the valve
- a switch block containing eight switches for basic configuration settings and calibration options
- a rotary selector switch for adjusting the positioner gain settings
- a 4-20 current loop calibration button accessed through a hole in the cover next to the bottom dipswitch

For indication of the operational status or alarm conditions there are 3 LEDs on the local user interface. This document describes the setting and use of the Logix 510si user interface.

9.2 Initial DIP switch setting

Before placing the unit in service, set the dipswitches 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 (**510si/520si**), or by utilizing the stroke calibration features provided by a handheld or by Flowserve PC software (**520si**).

9.3 Configuration dipswitch setup

• 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.

• 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.

4 mA

Makes the valve fully closed when the signal is 4mA and fully open when the signal is 20 mA.

20 mA

Makes the valve fully closed when the signal is 20 mA and fully open when the signal is 4 mA.

• Characteristic 510si

Linear

The actuator position directly proportional to the input signal.

510si

=%

Characterizes the actuator response to the input signal based on a standard 30:1 equal percent rangability curve.

• Pos. Characterization 520si

Linear

The actuator position directly proportional to the input signal.

Optional

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

Optional Pos. Char.

If the Pos. Characterization switch is set to **optional**, this switch is active with the following options:

520si

=%

Characterize the actuator response to the input signal based on a standard 30:1 equal percent rangability curve.

Custom

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.

• Tight Shutoff 510si

On

to have the positioner fully saturate the actuator closed at a signal less than 1%.

510si

Off

Disables this feature.

• Auto Tune

This switch controls whether the positioner will auto tune itself every time the quick cal button is pressed.

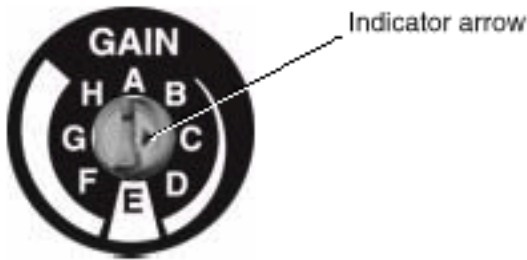
On

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.

NOTE! There is a small black arrow indicating the selection. The slot does not indicate the chosen gain.

Figure 10. Local interface





- If the rotary Gain selector switch is set to **E** with the autotune 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. The positioner is preset to Autotune - On at the factory. This is the recommended setting.

The gain selector operates as a “live” switch. This means that changes to the switch position while the positioner is in normal operation will have immediate effect on the control algorithm.

• Config. Switches

Enabled

The Logix **520si** will read all of the configuration switches each time a Quick-Cal is performed to determine the configuration.

520si

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.

9.4 Calibration switches

• Stability Switch

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

Lo frict

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.

Hi frict

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.

• Quick calibration

Auto

Is selected if the valve/actuator assembly has an internal stop in the open and closed positions. 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 section 10.4 on how to perform an auto positioner calibration.

Jog

Is selected if the valve/actuator assembly has no calibration stop in the open position and or if you want to manually set the closed position. In the Jog mode the positioner waits for the user to set the open and closed positions using the Jog buttons labeled with then ▲ and ▼ arrows. See the detailed instructions in section 10.4 on how to perform a manual calibration using the “Jog” buttons.

• Loop Calibration

This setting determines whether the input or output is calibrated when a loop calibration is initialized.

Input loop calibration

A loop calibration, requiring an external current source, will be started when the Loop calibration button is pressed with a small object with the switch in the Input position.

Note that the valve will be locked at its position when an input loop calibration is initiated until the calibration is completed. If a loop calibration is started with the **Input** loop selected on the Loop calibration Dip switch, the LED's will flash a sequence of Y-G-G-Y indicating that it is waiting for the minimum signal to be input to the positioner on terminals +11 and -12 from an external 4-20 mA current source. Normally this will be 4 mA, but if split range operation is required use the minimum current for the desired operating range. When the minimum signal value is set at the desired value, press the ▲ and ▼ buttons simultaneously to proceed to the next step. The LED's will now flash a sequence of Y-G-Y-R indicating that it is waiting for the maximum signal to be input to the positioner. Normally this will be 20 mA, but if split range operation is required use the maximum current for the desired range. When the maximum signal value set at the desired value, press the ▲ and ▼ buttons simultaneously to set the span. The LED's then will flash a sequence of Y-Y-G-G indicating that the calibration is complete. The signal can now be adjusted to the desired output value without affecting the valve position. Press the ▲ and ▼ buttons simultaneously to put the unit back in operation. Note that the input calibration correlates the signal to 0% and 100% signal it does not affect the position calibration all since that calibration is done separately with the Quick-Cal button.

510si

Output loop calibration (optional)

Loop calibration, requiring an external current meter and power source, will be started when the Loop calibration button is pressed with a small object with the switch in the Output position.

If a loop calibration is started with the **Output** loop selected on the Loop calibration Dip switch, the LED's will flash a sequence of Y-G G-G indicating that it is waiting for the 0% signal to be adjusted using the ▲ and ▼ buttons for the output current loop on positioner on terminals +31 and -32. (Note that the loop must be externally powered with a voltage between 12VDC and 40VDC and a current meter used to measure the current in the loop). Normally this will be 4 mA, but if split range operation is required adjust to the minimum current for the desired range. When the 0% signal value is set at the desired value, press the ▲ and ▼ buttons simultaneously to proceed to the next step.

The LED's will now flash a sequence of Y-R-G-Y indicating that it is waiting for the 100% signal to be adjusted using the ▲ and ▼ buttons for the output current loop. Normally the 100% setting will be 20 mA, but if split range operation is required adjust to the maximum current for the desired range. When the 100% signal value set at the desired value press the ▲ and ▼ buttons simultaneously to complete the calibration.

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.

9.5 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 pro-

gress 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 the desired 100% position. Now 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.)

Note: It is recommended that the first time a Logix 510si is installed on a new actuator that a second QUICK-CAL be performed.

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.

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 the Quick-Cal button.

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.

520si

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.

Special settings—several adjustments to the Logix 520 such as split-range, MPC, soft stop, etc. cannot be set using the local interface.

To set these parameters please refer to the appropriate communications tool manual.

9.6 HART 275 Handheld Communicator

520si

The Logix 520 si 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 si Digital Positioner with HART 275 Communicator User Guide

9.7 Use of softtools communication software

520si

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

9.8 Integration of third-party software

520si

The Logix 520 si positioner can be used with:

- Siemens PDM™
- Fisher Rosemount AMS™

10. Status 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.
520si	GGYG	3 Digital command mode - The analog 4-20 mA input signal is ignored in this mode and a 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 page XX for more information)
	GGYR	4 Initializing, or LED test mode - This sequence should only be visible for 3 sequences when powering up the unit.
520si	GGRG	5 Cycle limit - The cycle limit set by the user has been exceeded. To clear use handheld or Flowserve supplied software to reset.
	GGRY	6 Travel limit -The total accumulated travel limit set by the user has been exceeded. To clear use handheld or Flowserve supplied software to reset.
	GYR	7 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	8 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	9 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	10 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.
520si	YGYG	11 Signature test in progress - This is a test initiated by Flowserve supplied software that can only be cancelled by that software.
	YYYG	12 Loop Calibration in Progress - Calibration sequence controlled by a handheld or Flowserve supplied software that can only be cancelled by that software.
	YRGG	13 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	14 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.

510si	YYGG		Calibration complete - indicates that a 4-20 mA command calibration is complete. This pause allows the signal to be adjusted without affecting the valve position. Press the \triangle and ∇ buttons simultaneously to put the unit back in operation.
	YYR	15	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.
	YYR	16	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	17	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	18	Waiting for JOG set point from User - only used during Jog calibration see explanation in Quick-Cal section of main document for operation.
	YRYG	19	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.
	YRY	20	Feedback no-motion during calibration - Indicates that there was no motion of the actuator based on the current stroking 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	21	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	22	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	23	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	24	Feedback unstable during calibration - Check for loose linkages or loose position 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.
	YGGG	17	4-20 mA output 0% - Waiting for the user to adjust the 0% 4-20 mA output during calibration.
	YGGY	18	4-20 mA input 0% - Waiting for 0% 4-20 mA command input during command calibration.
	YGGR	19	Jog 0% - Waiting for 0% position JOG set point from User - only used during Jog calibration see explanation in Quick-Cal section of main document for operation
	YGY	20	4-20 mA output 100% - Waiting for the user to adjust the 100% 4-20 mA output during calibration.
	YGYR	21	4-20 mA input 100% - Waiting for 100% 4-20 mA command input during command calibration.
	YGRY	22	Analog output span too small - The span must be calibrated to a range greater than 3.0 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 or if the \blacktriangle and \blacktriangledown buttons are pressed simultaneously the calibrated span will be used even though it is less than the recommended range.
	YRGY	25	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.

Colors	Identifier	Indication and resolution
R - - -		Any sequence starting with a red light indicates that there is an operational problem with the unit.
RGRR	26	Position Deviation - The position has exceeded user defined error band between command and position.
520si	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 1,23 V 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 -40 °C (-40 °F) or 85 °C (185 °F).
	RRYY	33 Piezo voltage - Bad electronic assembly, replace.
520si	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.

11. Version number checking

The version number of the embedded code may be checked at any time except during a calibration by holding down the ▲ button. This will not alter the operation of the unit other than to change the blink sequence to 3 blinks indicating the major version number. Holding the ▼ 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 ▲ button gave a G-G-R code, and holding the ▼ button gave a Y-Y-G code then the resulting version number would be (0+0+2).(9+3+0) or version 2.12.

12. 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).

12.1 General

The Logix 500si digital positioner can be equipped with an additional limit switch unit.

12.2 Model selection

To select the suitable Logix 500si version see product information.

12.3 Principle of operation

(Figure 11)

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.

12.4 Installation

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

Switches (Figure 11)

Install 3 x screws (1) into positioner housing.
Install PC board (2) on screws (1), secure with 3 x screws (3).

Install cam assembly (4) and secure with screws.

To connect switches — see termination table.

For units installed in Hazardous areas special installation caution and procedure is required.

To adjust switches

Loosen 2 x screws on top of cam assembly, rotate cams to desired switching position.

Tighten screws on the cam assembly.

12.5 Start-up

After the Logix 500si 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.

1. Loosen the two screws on puck (4), figure 11.
2. Move the positioner to the first switching position.
3. Set the switching point of the limit switch by adjusting the lower arm of the lower switch (LS2).
4. Move the positioner to second switching position (LS2).
5. Set the switching point of the limit switch by adjusting the cam of the upper switch.
6. Tighten the two screws on puck (4), figure 11.
7. Check the two switching points and repeat the adjustment steps 1 to 6, if necessary.

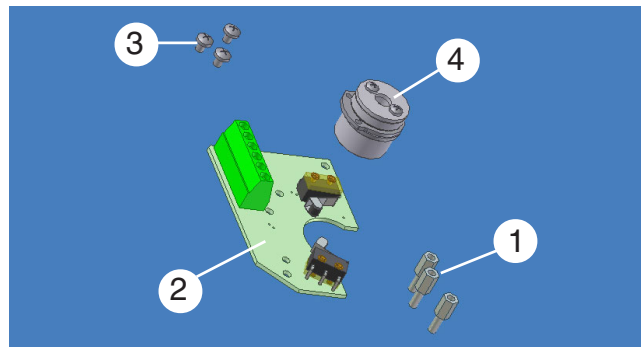


Figure 11. Limit switch

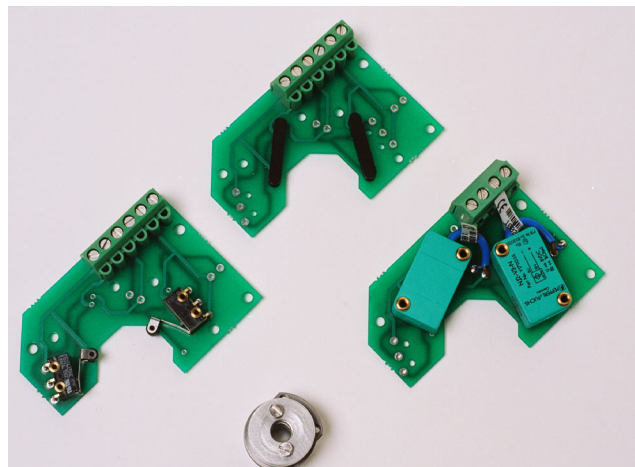
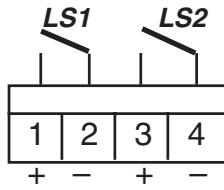


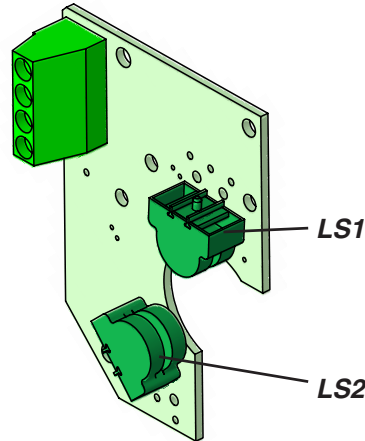
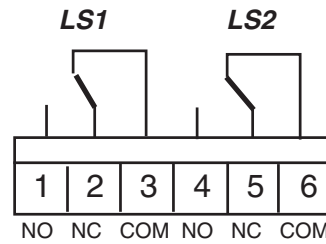
Figure 12. Switch types

Switch connection

Namur sensors



Mechanical or Proximity switches

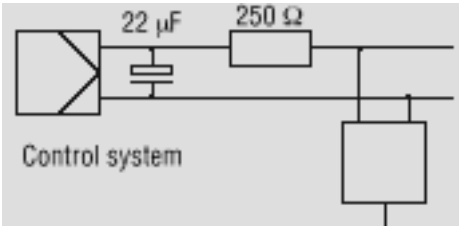


12.5 Technical Data

Mechanical switches D2-SP14M	
Type	SPDT
Size	Sub Sub miniature
Rating	3 A/125 V AC 2 A/30 V DC
Proximity switches D2-SP14P	
Type	SPDT
Rating	5 W/250 mA/30 V DC/125 V AC
Operating time	0.7 ms
Breakdown voltage	200 VDC
Contact resistance	0.1 Ω
Mechanical/electrical life	>50 x 10 ⁶ operations
Namur sensors D2-SP14N P&F NJ2-V3-N	
Type	Proximity DIN 19234 NAMUR
Load current	≤ 1 mA ≤ 3 mA
Voltage range	5 - 25 VDC
Hysteresis	0.2 %
Temp	-20°C to 85°C (-4°F to 185°F)
Namur sensors D2-SP14 P&F SJ2-S1N	
Type	Proximity DIN 19234 NAMUR
Load current	≤ 1 mA ≤ 3 mA
Voltage range	5 - 25 VDC
Hysteresis	0.2 %
Temp	-25°C to 100°C (-13°F to 212°F)
Namur sensors D2-SP14 P&F SJ2-SN	
Type	Proximity DIN 19234 NAMUR
Load current	≤ 1 mA ≤ 3 mA
Voltage range	5 - 25 VDC
Hysteresis	0.2 %
Temp	-40°C to 100°C (-40°F to 212°F)
Namur sensors D2-SP14 P&F SJ2-N	
Type	Proximity DIN 19234 NAMUR
Load current	≤ 1 mA ≤ 3 mA
Voltage range	5 - 25 VDC
Hysteresis	0.2 %
Temp	-25°C to 100°C (-13°F to 212°F)

13. Trouble shooting

Logix 500 si symptoms and solutions

Failure	Probable Cause	Corrective action
No LED is blinking	<ol style="list-style-type: none"> 1. Current source below 3,6 mA 2. Incorrect wiring polarity 	<ol style="list-style-type: none"> 1. Verify current source supplies at least 3,6 mA 2. Check wiring for correct polarity
Erratic communications	<ol style="list-style-type: none"> 1. Current source bandwidth not limited to 25Hz 2. Maximum cable length or cable impedance exceeded 3. HART modem connected to PC RS-232 port not receiving enough power 4. Interference with I.S. barrier 5. Current source stripping (filtering) HART signal 	<ol style="list-style-type: none"> 1. Maximum allowable current source rate of change is 924 mA per second 2. Check cable conductor size, length and capacitance. Refer to Cable Requirements on page 13. 3. Verify laptop battery is not low 4. Must use HART compatible I.S. barrier 5. Use the HART filter (VHF) available from Flowserve (FLS part-No. 10156843) Alternatively a 250 Ω and a 22 μF capacitor, installed according to the following schematic drawing can be used to establish communication 
Unit does not respond to analog commands	<ol style="list-style-type: none"> 1. Unit is in digital command mode 2. Error occurred during calibration 	<ol style="list-style-type: none"> 1. Switch to analog command mode with handheld communicator or Soft Tools. 2. Correct calibration error. Recalibrate
Valve position reading is not what is expected	<ol style="list-style-type: none"> 1. Stem position sensor mounting is off 180 degrees 2. Stroke not calibrated 3. Tight shutoff MPC (Minimum position cutoff) is active 4. Custom characterization or soft stops active 	<ol style="list-style-type: none"> 1. Reposition sensor 2. Calibrate stroke 3. No action 4. No action
Position is driven fully open or closed and will not respond to command	<ol style="list-style-type: none"> 1. Stroke not calibrated 2. Inner-loop hall sensor not connected 3. Wrong air action entered in software 4. Actuator tubing backward 5. Electro-pneumatic converter malfunctioning 6. Control parameter inner-loop offset is too high/low resumes 	<ol style="list-style-type: none"> 1. Calibrate valve stroke 2. Verify hardware connections 3. Check ATO (Air-to-open) and ATC (Air-to-Close) settings. Recalibrate 4. Verify ATO/ATC actuator tubing 5. Replace electro-pneumatic converter 6. Adjust inner-loop and see if proper control
Sticking or hunting operation of the positioner	<ol style="list-style-type: none"> 1. Contamination of the electro-pneumatic converter. 2. Control tuning parameters not correct 	<ol style="list-style-type: none"> 1. Check air supply for proper filtering and meeting ISA specifications ISA-7.0.01 2. Lower proportional gain settings

14. Certificates



1 EC TYPE-EXAMINATION CERTIFICATE
 Equipment intended for use in Potentially Explosive Atmospheres Directive 94/9/EC

2 Certificate Number: Sira 03ATEX243
 3 Equipment: Logix Series 500 si Digital Positioners
 4 Applicant: Flowserve FCD Corporation
 5 Address: 1350 North Mountain Springs Parkway
 Springfield
 UT 84663
 USA

7 This equipment and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

8 Sira Certification Service, notified body number 0518 in accordance with Article 9 of Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in confidential report number RS2A10316A.

9 Compliance with the Essential Health and Safety Requirements, with the exception of those listed in the schedule to this certificate, has been assured by compliance with the following documents:

EN 50014:1997 plus Amendments A1 and A2
 EN 50020:1999
 EN 50284:1999

10 If the sign 'X' is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

11 This EC type-examination certificate relates only to the design and construction of the specified equipment. If applicable, further requirements of this Directive apply to the manufacture and supply of the equipment.

12 The marking of the equipment shall include the following:



II 1 G
 EEx Ia IIC T4 Ta = -40°C to +85°C
 EEx Ib IIC T5 Ta = -40°C to +55°C
 EEx Ia IIC T6 Ta = -40°C to +40°C

[Signature]
 M D Shearman
 Certification Manager

Project Number 52A10316
 Date 12 June 2003
 C. Index 12

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SCHEDULE

13 EC TYPE-EXAMINATION CERTIFICATE Sira 03ATEX243

DESCRIPTION OF EQUIPMENT

The Logix Series 500 si Digital Positioners are single-acting digital positioners. They combine piezo-valve technology with inner-loop feedback to provide control with minimal air consumption. The positioners are configured at the valve. The essential configuration settings do not require a hand-held device or a host system. LED status lights allow the user to determine the condition of the device by visual inspection.

The Series 510 si Digital Positioners are installed within a die-cast aluminium enclosure and comprise the following:

- Main circuit board
- Hart Communication Board (fitted to some models)
- Piezo relay
- Hall effect sensor
- Feedback potentiometer
- Connections to two external limit switches, these are Pepperl & Fuchs proximity switches type S3J5N that are certified by PTB as intrinsically safe, certificate number 99ATEX2219X marked II 2G; EEx Ia IIC T6

A standard temperature version and a low temperature version are available. The standard version is suitable for -20°C and the low temperature for -40°C. The equipment complies with the standards for intrinsic safety with input parameters as follows:

Terminals 11-12 Uj = 30 V Uj = 30 V
 Ii = 100 mA Ii = 100 mA
 Pi = 800 mW Pi = 800 mW
 Ci = 0 Ci = 0
 Li = 0 Li = 0

Terminals 31-32 (Used only for the AO option with the 510 circuit board)

14 DESCRIPTIVE DOCUMENTS

Drawings

Drawing	Sheet	Rev	Date	Title
181278	1 of 11	0	04 Feb 02	Logix 510 Board Fabrication Drawing
181278	2 of 11	0	04 Feb 02	Logix 510 Board Top Silkscreen Layer
181278	3 of 11	0	04 Feb 02	Logix 510 Board Top Solder Mask Layer
181278	4 of 11	0	04 Feb 02	Logix 510 Board Top Signal Layer
181278	5 of 11	0	04 Feb 02	Logix 510 Board Middle #1 Signal Layer
181278	6 of 11	0	04 Feb 02	Logix 510 Board Power Plane Layer
181278	7 of 11	0	04 Feb 02	Logix 510 Board Ground Plane Layer
181278	8 of 11	0	04 Feb 02	Logix 510 Board Middle #2 Signal Layer
181278	9 of 11	0	04 Feb 02	Logix 510 Board Bottom Signal Layer
181278	10 of 11	0	04 Feb 02	Logix 510 Board Bottom Solder Mask Layer
181278	11 of 11	0	04 Feb 02	Logix 510 Board Bottom Silkscreen Layer

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EC TYPE-EXAMINATION CERTIFICATE VARIATION

CERTIFICATE NUMBER Sira 02ATEX2243 Dated 12 June 2003
VARIATION NUMBER 1 (ONE) Dated 28 January 2004

- Pepperl and Fuchs Slotted Type Namur Sensor S12-SN, PTB certificate no. PTB 00ATEX2049X, the following safety parameters apply:

Terminals T1, 2, 3 and 4 input parameters

U_i = 16 V
 I_i = 52 mA
 P_i = 169 mW
 C_i = 40 nF
 L_i = 100 µH

- Pepperl and Fuchs Slotted Type Namur Sensor S12-S1N, PTB certificate no. PTB 00ATEX2049X, the following safety parameters apply:

Terminals T1, 2, 3 and 4 input parameters

U_i = 16 V
 I_i = 52 mA
 P_i = 169 mW
 C_i = 40 nF
 L_i = 100 µH

- Pepperl and Fuchs Slotted Type Namur Sensor S12-N, PTB certificate no. PTB 99ATEX2219X, the following safety parameters apply:

Terminals T1, 2, 3 and 4 input parameters

U_i = 16 V
 I_i = 52 mA
 P_i = 169 mW
 C_i = 40 nF
 L_i = 100 µH

- 2 The introduction of the following certification code to be applied to products that incorporate either the Slotted Type Namur Sensor S12-SN, the Slotted Type Namur Sensor S12-S1N or the Slotted Type Namur Sensor S12-N.

EEK Ia IIC T4 (Ta= -40°C to +78°C)

- 3 The introduction of three conditions of certification, clauses 17.5, 17.6 and 17.7, that are associated with the addition of the limit switches.

- 4 The composition of the Model Number to be modified.

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Page 2 of 4

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EC TYPE-EXAMINATION CERTIFICATE VARIATION

CERTIFICATE NUMBER Sira 02ATEX2243 Dated 12 June 2003
VARIATION NUMBER 1 (ONE) Dated 28 January 2004

VARIATION TO EQUIPMENT

To permit:

- 1 The option to add the following limit switches:

- Mechanical switches that are considered to be simple apparatus and identified as DG Subminiature switch on Cherry Mechanical Switch, the following safety parameters apply:

Terminals T1,3,4 and 6, normally open or Terminals T2, 3, 5 and 6, normally closed

U_i = 28 V
 I_i = 45 mA
 P_i = 315 mW
 C_i = 1 nF
 L_i = 1 µH

- Hamin 59045 Reed Proximity Switch, the following safety parameters apply:

Terminals T1, 3, 4 and 6 input parameters

U_i = 10.6 V
 I_i = 29.7 mA
 P_i = 79 mW
 C_i = 1 nF
 L_i = 1 µH

- Pepperl and Fuchs Namur Proximity Switch NJ2-V3-N, PTB certificate no. PTB 00ATEX2032X, the following safety parameters apply:

Terminals T1, 2, 3 and 4 input parameters

U_i = 16 V
 I_i = 52 mA
 P_i = 169 mW
 C_i = 40 nF
 L_i = 50 µH

File No 52A10872

Report No. R52A10872A

C Eliaby
Certification Officer

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Page 1 of 4



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EC TYPE-EXAMINATION CERTIFICATE VARIATION

CERTIFICATE NUMBER Sira 02ATEX2243 Dated 12 June 2003
VARIATION NUMBER 1 (ONE) Dated 28 January 2004

Description	Certificate No	Key attributes
Pepperl and Fuchs Slotted Type Namur Sensor S12-SN and Slotted Type Namur Sensor S12-S1N	PTB 00ATEX2049X	U1 = 16 V I1 = 52 mA P1 = 169 mW C1 = 30 nF L1 = 100 µH
Pepperl and Fuchs Slotted Type Namur Sensor S12-N	PTB 99ATEX2219X	U1 = 16 V I1 = 52 mA P1 = 169 mW C1 = 30 nF L1 = 100 µH

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EC TYPE-EXAMINATION CERTIFICATE VARIATION

CERTIFICATE NUMBER Sira 02ATEX2243 Dated 12 June 2003
VARIATION NUMBER 1 (ONE) Dated 28 January 2004

DESCRIPTIVE DOCUMENTS

Number	Sheet	Rev	Date	Description
214011	1 of 1	1	23 Sep 03	Nameplate Logix 500sl
D2-AS14C	1 of 1	-	16 Oct 03	PMV Positioner D2
D2-AS-14D	1 of 1	-	12 Jun 03	PMV Positioner D2
D2-14 R21 copper layer 1	1 of 1	-	27 Jun 03	Switch Board D2/500sl Positioner
D2-14 R21 copper layer 2	1 of 1	-	27 Jun 03	Switch Board D2/500sl Positioner
D2-14 R21 silk layer 1	1 of 1	-	27 Jun 03	Switch Board D2/500sl Positioner

ADDITIONAL CONDITIONS OF CERTIFICATION

- When the PTB certified slotted switches S12-SN, S12-S1N, S12-N are used, the equipment shall be marked with an upper ambient temperature of 78°C and a temperature class of T4.
- The certified switches N12-V3-N, S12-SN, S12-S1N and S12-N shall be installed in accordance with the special conditions for safe use that are detailed in their associated certificates either PTB 00ATEX2049X, PTB 99ATEX2219X or PTB 00ATEX2032X.
- This certificate relies on the following previously certified products. When used as part of the Logix Series 500 sl Digital Positioners, the key attributes listed in the table below shall still be maintained by their original certificate.

Description	Certificate No	Key attributes
DG Subminiature switch or Cherry Mechanical Switch	Not applicable, simple apparatus	U1 = 28 V I1 = 45 mA P1 = 315 mW C1 = 1 nF L1 = 1 µH
Hainlin 5904S Reed Proximity Switch	Not applicable, simple apparatus	U1 = 10.6 V I1 = 29.7 mA P1 = 79 mW C1 = 1 nF L1 = 1 µH
Pepperl and Fuchs Namur Proximity Switch N12-V3-N	PTB 00ATEX2032X	U1 = 16 V I1 = 52 mA P1 = 169mW C1 = 30 nF L1 = 50 µH

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FM Approvals
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 P.O. Box 9102, Norwood, MA 02062 USA
 T: 781.762.4300 F: 781.762.9375 www.fmglobal.com

CERTIFICATE OF COMPLIANCE

HAZARDOUS (CLASSIFIED) LOCATION ELECTRICAL EQUIPMENT

This certificate is issued for the following equipment:

Logix 520 Digital Positioner
 IS / I / 1 / ABCD / T4 Ta = 85°C; 192022 – Entity
 I / O / AEx ia IIC T4 Ta = 85°C; 192022 – Entity
 NI / I / 2 / ABCD / T4 Ta = 85°C
 Entity parameters:
 Terminals J6
 UI = 30 V Ii = 100mA Pi = 800mW Ci = 0 Li = 0
 Terminals J4 and J8 Ii = 52mA Pi = 169mW Ci = 50nF Li = 250µH
 UI = 16V Ii = 52mA Pi = 169mW Ci = 50nF Li = 250µH

Equipment Ratings:

Intrinsically safe for Class I Division 1 Groups A, B, C and D; Intrinsically safe for Class I Zone 0 Group IIC indoor Hazardous (Classified) Locations meeting Entity requirements when installed in accordance with Control Drawing 192022. Temperature Classification T4 at an ambient of 85°C. Nonincendive for Class I Division 2 Groups A, B, C and D indoor Hazardous (Classified) Locations Temperature Classification T4 at an ambient of 85°C.

Approved for:

Flowserve FCD Corporation
 Springville UT 84663



3015410
 Page 1 of 2

FM Approvals HLC 8/02



This certifies that the equipment described has been found to comply with the following FM Approval Standards and other documents:

- Class 3600 1998
- Class 3610 1999
- Class 3611 1999

Original Project ID: 3015410 FM Approval Granted: September 16, 2002

Subsequent Revision Reports / Date FM Approval Amended

Report Number	Date	Report Number	Date

FM Global Technologies LLC

Nicholas P. Ludlam
 Technical Team Manager

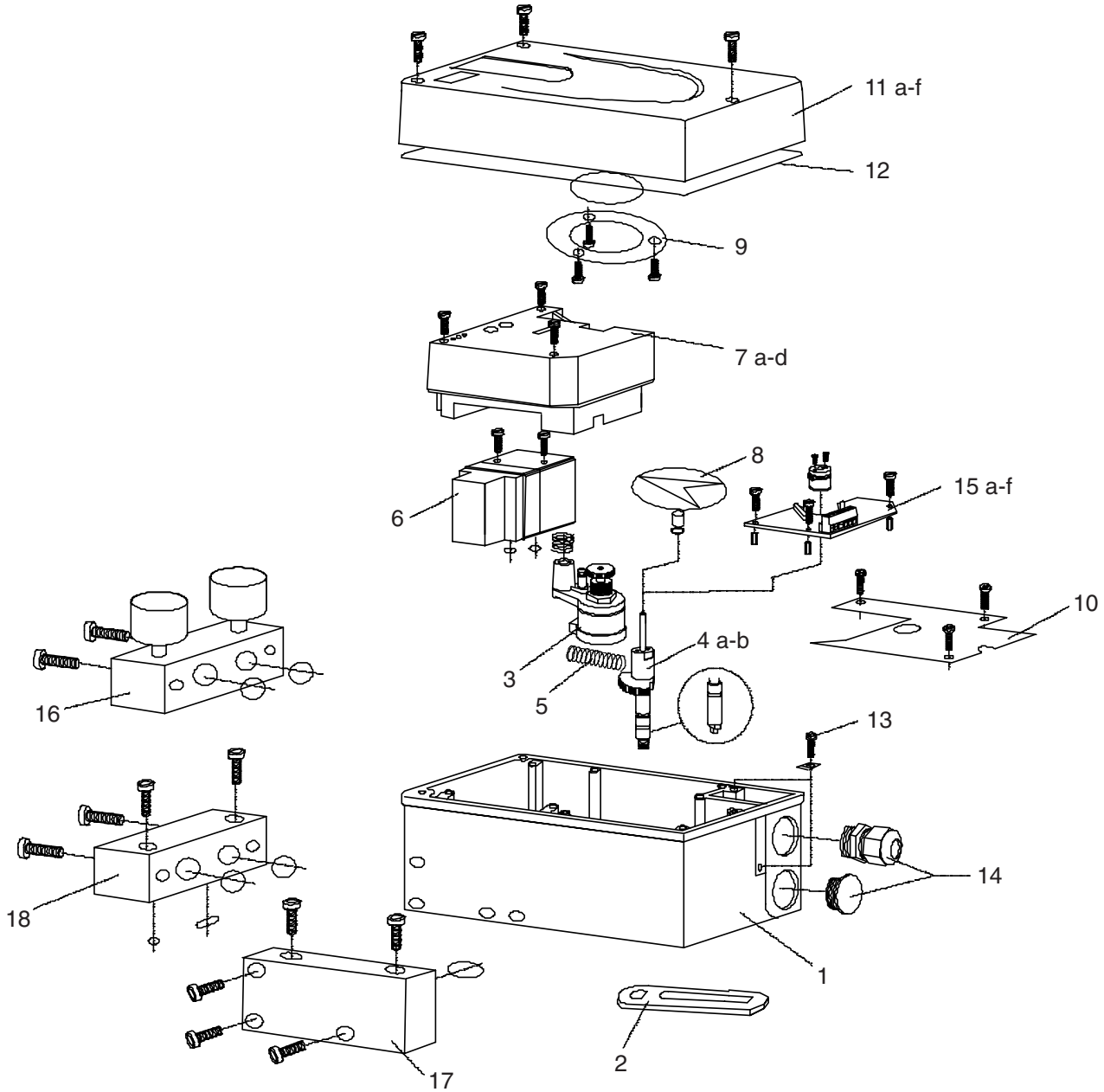
September 16, 2002
 Date



3015410
 Page 2 of 2

FM Approvals HLC 8/02

15. Spare parts



POS	Part number	Description	Remarks
1		Housing	N/A
2	30115	Lever arm compl.	
3	30116	Potentiometer assy. compl.	
4a	D2-AS5D	Shaft D-type Linear, incl. nut	
4b	D2-AS5N	Shaft VDI/VDE 3845 Rotary	
5	30119	Spring	
6a	D2-SP50 STD	Air relay assy. incl. O-rings, screws, standard temp.	
6b	D2-SP50 LT	Air relay assy. incl. O-rings, screws, low temp.	
7a	30121	Electronic module assy. (incl. screws, cover)	
7b	30122	Electronic module HART assy.	
7c	30735	Electronic module 4-20 mA feedback assy.	
7d	30123	Electronic module assy	EEx ia
7e	30124	Electronic module HART assy.	EEx ia
7f	30736	Electronic module 4-20 mA feedback assy	EEx ia
8a	30125	Indicator flat assy. incl. adapter	
8b	D2-SP17	Indicator dome assy.	
9a	D2-SP31	Indicator cover flat assy. incl. screws	
9b	D2-SP52	Indicator cover dome assy. incl. screws	
10	30127	Cover plate incl. screws	
11a	D2-AS25DB	PMV cover, for indicator, black, incl. screws	
11b	D2-AS25DBI	PMV cover, indicator, black, incl. screws	
11c	D2-AS25LB	Logix cover, no indicator, black, incl. screws	
11d	D2-AS25LBI	Logix cover, indicator, black, incl. screws	
11e	D2-AS25LW	Logix cover, no indicator, white, incl. screws	
11f	D2-AS25LWI	Logix cover, indicator, white, incl. screws	
12	30737	Seal and O-ring kit	
13	30135	Screw and washer kit	
14	30738	Plug and cable gland kit, black	
15a	D2-SP14M	Mechanical switches assy. compl.(incl. cams, screws)	
15b	D2-SP14P	Proximity switches assy. compl.	
15c	D2-SP14N	P+F NJ2-V3-N sensors assy. compl.	
15d	D2-SP14 D4	P+F SJ2 S1N sensors assy. compl.	
15e	D2-SP14 D5	P+F SJ2 SN sensors assy. compl.	
15f	D2-SP14 D6	P+F SJ2N sensors assy. compl.	
16a	D2-SP40GB0	Gauge block B 1/4"NPT, 1/4"NPT, 1/8"NPT, no gauges	*
16b	D2-SP40GC0	Gauge block C 1/4"NPT, 1/4"NPT, 1/8"G, no gauges	*
17	30144	Flowtop mounting kit incl. O-rings, screws	
18	30145	VDI/VDE 3847 mounting assy. incl. O-rings, screws	
	29414	Linear mounting kit Namur IEC 534-6	S05
	30168S	Linear mounting kit Namur IEC 534-6 bracket 97 mm	S39, see table
	30168L	Linear mounting kit Namur IEC 534-6 bracket 195 mm	S39, see table
	40613S	Mounting kit Valtek actuator, short arm D2-42	S39
	40613L	Mounting kit Valtek actuator, long arm D2-29	S39

* If you want gauges to the gauge block, change the last "0" in the above gauge block part number to one of below:

- 1 Output PSI/BAR/KPA Stainless with brass internals
- 2 Output + supply PSI/BAR/KPA Stainless with brass internals
- 3 Output PSI/BAR/KPA Stainless with stainless internals
- 4 Output + supply PSI/BAR/KPA Stainless with stainless internals

(For example, D2-SP40GB1, Gauge block B with one gauge SS/Brass)

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