FLOWSERVE

USER INSTRUCTIONS

Logix 510si Series

Digital Positioner

FCD LGENIM0510-01 09/09

Installation

Operation

Maintenance

Experience In Motion

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1 USING FLOWSERVE VALVES, ACTUATORS AND ACCESSORIES CORRECTLY

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.

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 manufactures. 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 is 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 510si OVERVIEW

The Logix 510si is a two-wire, 4-20 mA input digital valve positioner. The Logix 510si positioner controls single-acting actuators with linear and rotary mountings. The Logix 510si 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 87 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

4 SPECIFICATIONS

Table 1: Input Signal	
Input Signal Range	4 - 20 mA
Compliance Voltage	6 VDC
Voltage Supply (maximum)	30 VDC
Minimum Required Operating Current	3,6 mA

Table 2: Stroke Output	
Feedback Shaft Rotation	Min. 15°, max 90° 40° recommended for linear applications

Table 3: Air Supply	
Air Supply 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 to 87 psi)
Air Consumption (steady state)	0,08 Nm³/h @ 1,5 bar (0,047 SCFM @ 22 psi) 0,12 Nm³/h @ 6,0 bar (0,071 SCFM @ 87 psi)

Table 4: Output Signal	
Output Pressure Range	0 to 100% of air supply pressure
Output Flow Capacity	2,4 Nm³/h @ 1,5 bar (1,41 SCFM @ 22 psi) 7,0 Nm³/h @ 6,0 bar (4,12 SCFM @ 87 psi)

Table 5: Shipping Weights	
Base Positioner without Accessories	1,2 kg (2,65 lbs)

Table 6: Performance Characteristics (typical)	
Linearity	< +/- 1,0%
Resolution	< 0,3%
Repeatability	< 0,5%
Deadband	< 0,5%

Table 7: Environmental Conditions	
Operating Temperature Standard	-20 °C to +80 °C (-4 °F to +178 °F)
Operating Temperature Low	-40 °C to +80 °C (-40 °F to +178 °F)
Transport and Storage Temperature	-40 °C to +80 °C (-40 °F to +178 °F)
Operating Humidity	0 to 100% non-condensing

Table 8: Hazardous Area Specifications	
ATEX	II1G Ex ia IIC T4 - T6 II3G Ex ic IIC T4 - T6
FM	Class I, Division 2, Groups A,B,C,D Temp. Class. T4 Ta = 85°C Class I Zone = Group IIC T4 Ta = 85°C Class I, Division 2, Groups A,B,C,D Temp. Class. T4 Ta = 85°C
CSA	Class I Division 1, Groups A,B,C,D Class I Division 2, Groups A,B,C,D

Table 9: Limit Switches (optional)	
Type	**P&F SJ2-S1N**
Load current	< 1 mA < 3 mA
Voltage range	5 - 25 VDC
Hysteresis	0,2 %
Temperature	-25 °C to 100 °C (-13 °F to 212 °F)
Type	**P&F SJ2-SN**
Load current	< 1 mA < 3 mA
Voltage range	5 - 25 VDC
Hysteresis	0,2 %
Temperature	-40 °C to 100 °C (-40 °F to 212 °F)
Type	**P&F SJ2-N**
Load current	< 1 mA < 3 mA
Voltage range	5 - 25 VDC
Hysteresis	0,2 %
Temperature	-25 °C to 100 °C (-13 °F to 212 °F)

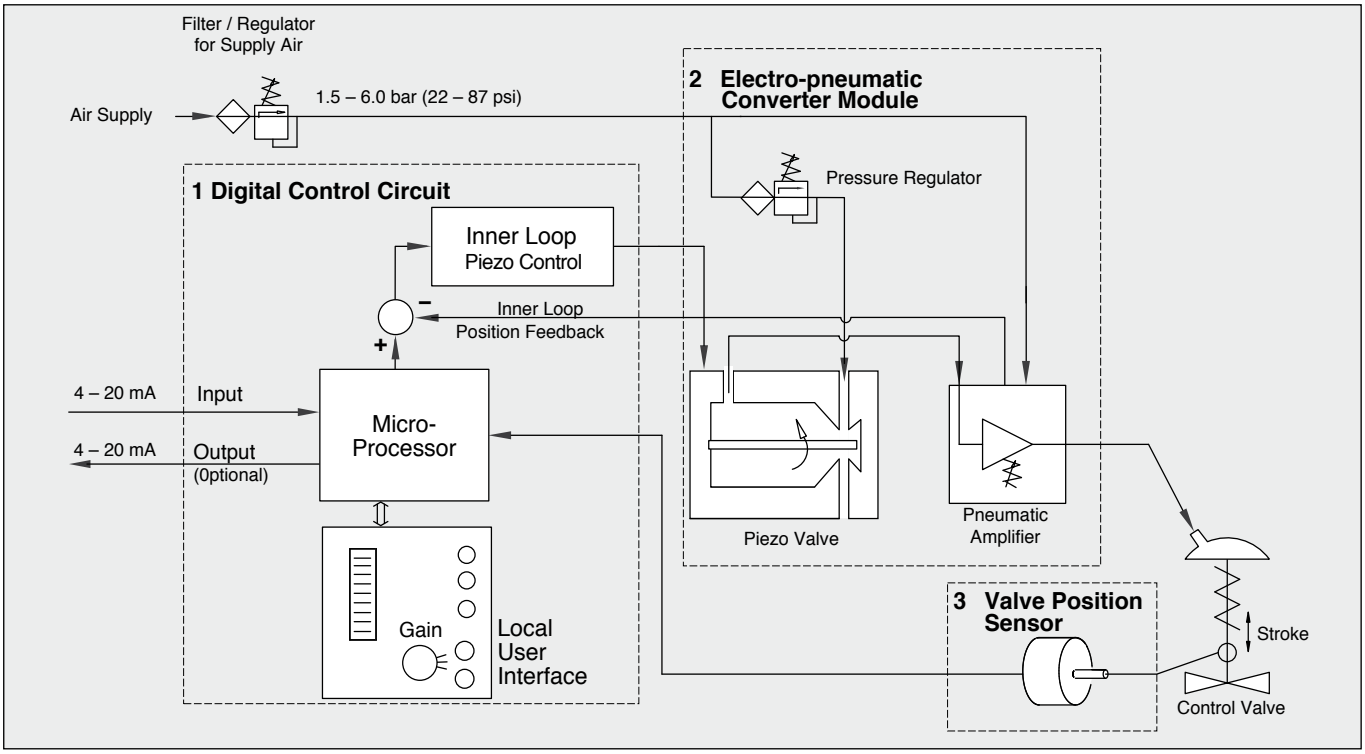


Figure 1: Logix 510si Principle of Operation

for all applications due to the close tolerances in the positioner. Optional analog feedback system as well as limit switch unit and a directly attachable double acting module complete the Logix 510si positioner accessories.

NOTE: *The air supply must conform to ISA 7.0.01or 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).*

5 PRINCIPLE OF OPERATION

The Logix 510si 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.

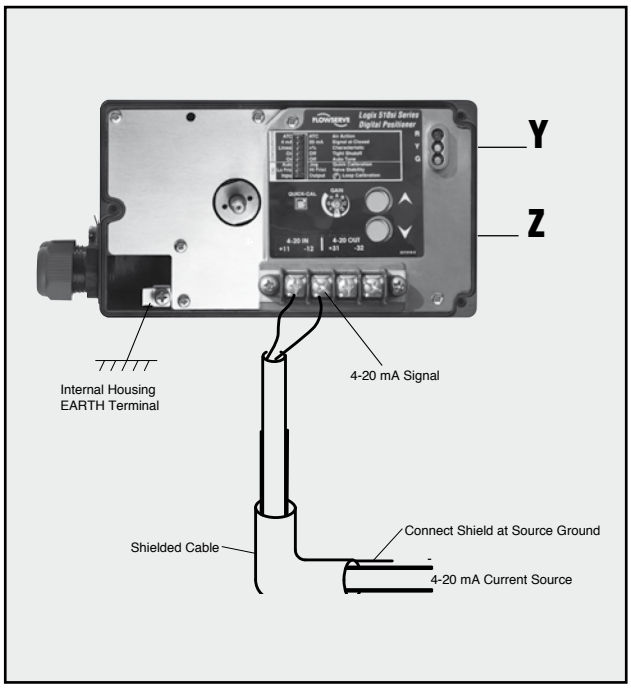


Figure 2: Wiring Diagram

6 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 – 87 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 Z. 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 (87 psi) a regulator is not required.

4. With an operating pressure of more than 6 bar (87 psi), a reducing regulator is required. The flow capacity of the regulator must be larger than the air consumption of the positioner (7 Nm^3/h @ 6 bar / 4,12 scfm @ 87 psi).

5. Connect the outlet connector Y of the positioner to the actuator with tubing, independent of the action (direct or reverse).

Table 10: Connection Table

Connection	Description
+11	Input+ 4..20 mA
-12	Input- 4..20 mA
+31*	Output+ 4..20 mA
-32*	Output– 4..20 mA
	Limit switch 1 - separate board
	Limit switch 2 - separate board
Y (0⇒)	Pneumatic output signal (outlet)
Z (0⇐)	Air supply

* Optional

7 WIRING AND GROUNDING GUIDELINES

Electrical connections: signal cable with cable passage (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*

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 510si 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 2)*

Connect the 4-20 mA current source to terminals +11 and -12 (Figure 2).

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 3)

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 510si impedance.

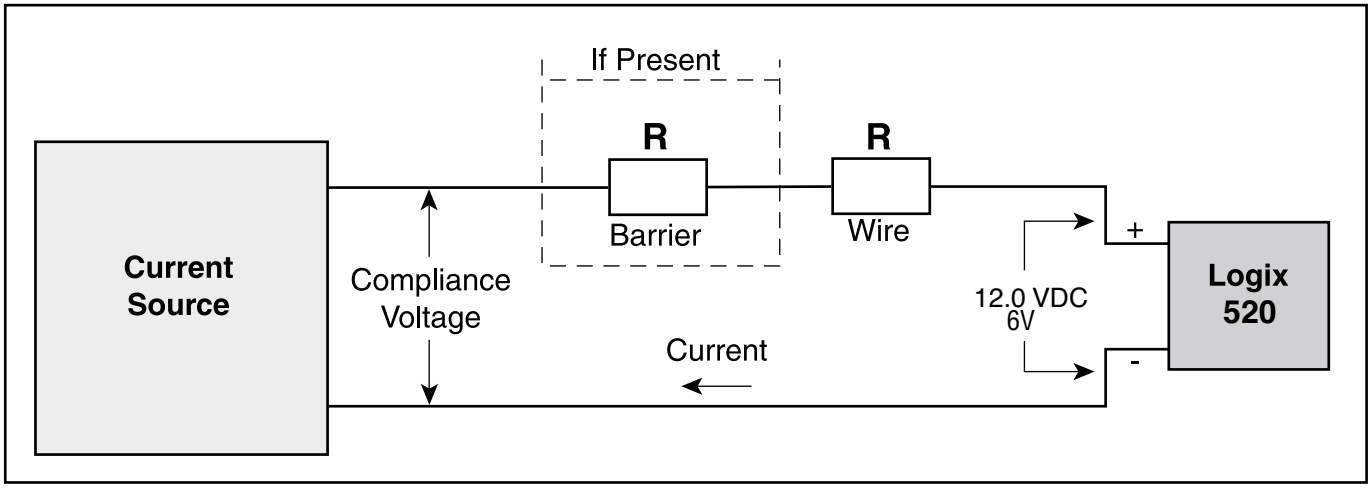


Figure 3: Compliance Voltage

The Logix 510si requires that the current loop system allow for a 6,0 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 510si, perform the following calculation:

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

The calculated available voltage must be greater than 6.0 VDC in order to support the Logix 510si.

Example: DCS Controller Voltage = 19 V

$R_{barrier}$ = 300Ω

R_{wire} = 25 Ω

$CURRENT_{MAX}$ = 20 mA

Voltage = 19 V - 0,020 A*(300Ω + 25 Ω)

= 12,5 V

The available voltage 12,5 V is greater than the required 6.0 V; therefore, this system will support the Logix 510si. The Logix 510si has an input resistance equivalent to 300 Ω at a 20 mA input current.

The Logix 510si 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 (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 510si positioner to restore operation.

8 STARTUP

8.1 Logix 510si Local Interface Operation

The Logix 510si 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, along with two jog buttons for manually spanning the positioner, or for local Jogging of the valve. There is also a switch block containing 8 switches. Five of the switches are for basic configuration settings, three are for calibration options There is also a rotary selector switch for adjusting the positioner gain settings. A 4-20 current loop calibration button is 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.

8.2 Initial DIP Switch Setting

Before placing the unit in service, set the dipswitches in the Configuration and Cal boxes to the desired control options. For a detailed description of each dipswitch setting, see sections below.

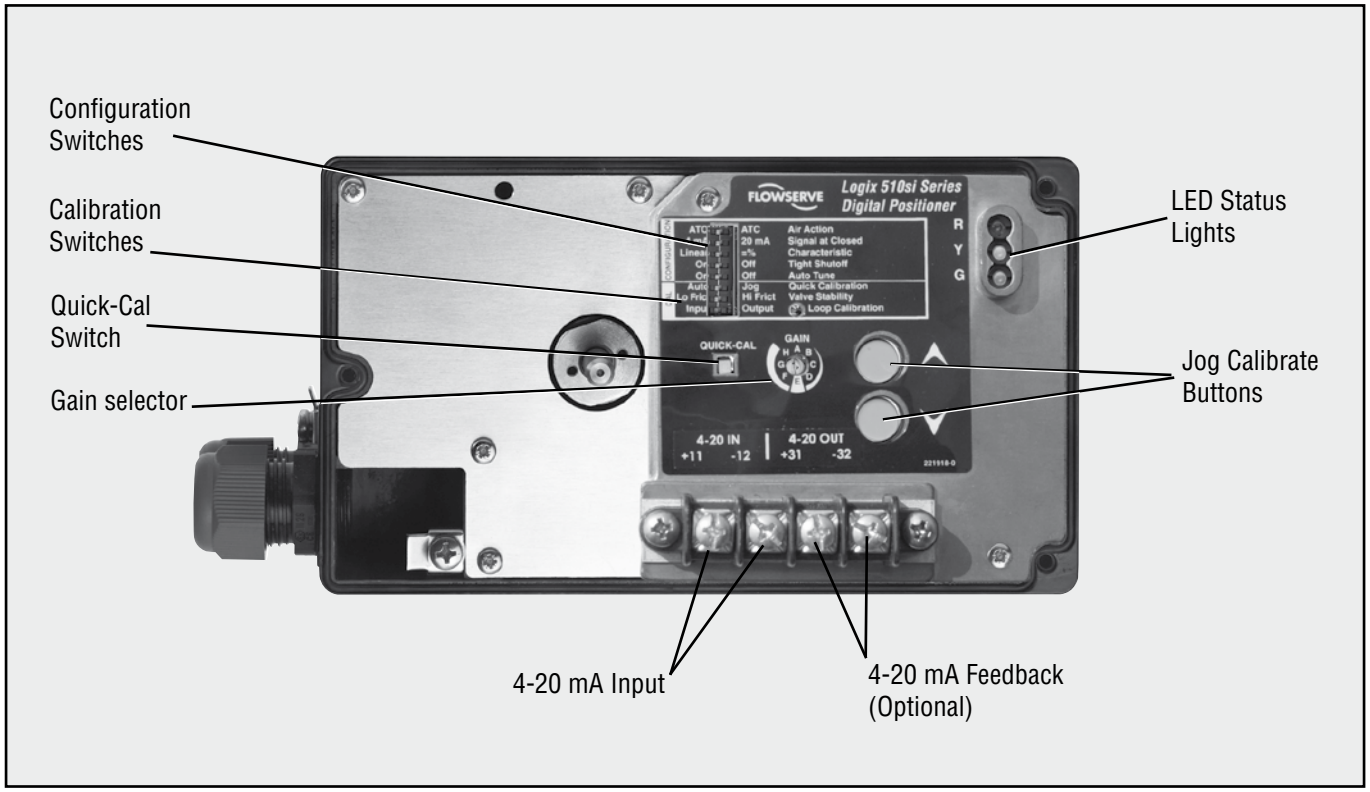


Figure 4: Logix 510si Local Interface

NOTE: *The switch settings in the Configuration box are activated only by pressing the Quick-Cal button.*

Operation of CONFIGURATION DIPswitch Setup -The first 5 DIP Switches are for basic configuration.

a. 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.

b. 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.

c. Characteristic

- Select Linear if the actuator position should be directly proportional to the input signal.
- The =% option will characterize the actuator response to the input signal based on a standard 30:1 equal percent rangeability curve.

d. Tight Shutoff

- Select On to have the positioner fully saturate the actuator closed at a signal less than 1%.
- Setting the switch in the Off position disables this feature.

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

- **On** enables an automatic tuning feature that will automatically determine the positioner gain settings every time a "Quick-Cal" is performed. The gain settings can be modified after a calibration by adjusting the rotary "Gain" switch.

NOTE: *there is a small black arrow indicating the selection. The slot does not indicate the chosen gain.*

- If the rotary "Gain" selector switch is set to "**E**" with the auto tune switch **on**, a Flowserve standard 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 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.

8.3 Setup of the CAL DIPswitches - The last 3 DIP Switches are for calibration configuration.

a. Quick calibration operating mode.

- Select **Auto** 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.
- Select **Jog** if the valve/actuator assembly has no calibration stop in the open position 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 labelled with the Δ and ∇ arrows. See the detailed instructions in section 8.4 on how to perform a manual calibration using the "Jog" buttons.

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

- Placing the switch to the left optimizes the response for low friction, high performance control valves. This setting provides for optimum response times when used with most low friction control valves.
- Placing the switch to the right optimizes the response for valves and actuators with high friction levels. This setting slightly slows the response and will normally stop limit cycling that can occur on high friction valves.

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.***

c. Loop Calibration- this setting determines whether the input or output is calibrated when a loop calibration is initialized.

- An Input 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. See the detailed instructions in section 8.7.1 on how to perform an **Input** calibration using the Loop calibration button.
- An **Output** (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. See the detailed instructions in section 8.7.2 on how to perform an **Output** calibrtion using the Loop calibration button.

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.*

8.4 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 3 seconds will initiate the calibration. The settings of all the configuration switches are read and the operation of the positioner adjusted accordingly. 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 (be careful not to confuse 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 LED's will initially flash in a sequence of Y-R-R-G (yellow-red-red-green) which indicates that the user must use the jog keys to manually position the valve to 100%. When the valve is approximately at the position desired for 100% open, press both the D and — buttons simultaneously to proceed to the next step. (Note that the Logix 510si is only setting internal gain and direction of rotation parameters at this point the actual span is set after the zero is set.) The valve will then moved closed and flash a Y-G-G-R sequence, allowing the user to adjust the valve position to 0% using the jog buttons. When the stem is properly positioned press both the D and — buttons simultaneously again to register the 0% position and to proceed. The valve will then stroke back to the 100% open position and the calibration LED's will flash in a sequence of Y-R-R-G again and wait for the user to make final adjustments. When the 100% is correct press both the D and — buttons simultaneously to continue. No more user actions are required while the calibration process automatically finishes. 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 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.*

8.5 Local control of valve position-Can be done from the user interface by holding both jog buttons while then simultaneously pressing the quick cal button for 3 seconds. When in this mode the position can be adjusted using the Δ and ∇ buttons. While in this mode the LED's will flash a YGRR (yellow-green-red-red) sequence. To exit the local control mode and return to normal operation, briefly press the quick-Cal button.

8.6 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.

8.7 Loop Calibration – Using a small pointed object push and hold, the Loop Calibration button through the small hole on the electronic cover for 3 seconds to initiate calibration of either the 4-20 mA input or output current loop as selected by the bottom Dip switch.

8.7.1 Input loop calibration - 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 Δ 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 Δ 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 Δ 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 at all since that calibration is done separately with the Quick-Cal button.

8.7.2 Output loop calibration (optional) - 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 Δ 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 Δ 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 Δ 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 is set at the desired value press the Δ and ∇ buttons simultaneously to complete the calibration.

8.7.2.1 Logix 510 Binary / Linear Analog Output

Flowserve has added a Binary AO feature to the Logix 510 positioner. This feature will allow the standard Analog 4-20mA current Output of the Logix 510 to be used as a Position Deviation Alarm Indicator. One distinct current level will be used to indicate the alarm condition, and another distinct current level will be used to indicate normal operation.

8.7.2.2 To activate the Binary AO feature:

1. Move the AI/AO calibration dip switch to the AO position.
2. While pressing the 'Jog Down' Button, press and hold the 'Loop Cal' Button for at least 3 seconds, then release all buttons. This should not begin a calibration sequence. If a calibration does begin, briefly press the 'Loop Cal' Button again to cancel it.

The unit is now in Binary AO mode. No blink code or other confirmation is given, however, the AO loop current will now be either the Normal (NoFail) current level or the Fail current level.

8.7.2.3 To (re)activate the Linear AO feature:

1. Move the AI/AO calibration dip switch to the AO position.
2. While pressing the 'Jog Up' Button, press and hold the 'Loop Cal' Button for at least 3 seconds.

The unit is now in Linear AO mode. No blink code or other confirmation is given, however, the AO loop current will now represent the valve stem position in percent. This is the default setting following any factory reset.

8.7.2.4 To calibrate the Binary AO current levels:

1. Set the unit to Binary AO mode as described above.
2. Press and hold only the 'Loop Cal' Button for at least 3 seconds. The AO current level will initially be set to the Fail setting, and the blink code will indicate 'Waiting for user to set AO Zero' (YGGG).
3. The 'Fail' current level can be adjusted by pressing the 'Jog Up' or the 'Jog Down' buttons until the desired current is obtained.
4. Press and release both Jog buttons simultaneously to accept the value. The AO current level will now be set to the Normal (NoFail) setting, and the blink code will indicate 'Waiting for user to set AO Span' (YGYY).
5. The 'Normal' current level can be adjusted by pressing the 'Jog Up' or the 'Jog Down' buttons until the desired current is obtained.
6. Press and release both Jog buttons simultaneously to accept the value. The blink code will return to a sequence beginning with Green to indicate everything is back online.

The Logix 510si AO circuitry needs about 10V minimum voltage drop to operate properly, which means that the maximum current available with 3.4k of external resistance and a 24V supply is about 4mA. ((24v-10v)/3.4k). Any calibrated value greater than 4mA will result in only the 4mA max being produced, unless the 3.4k external resistance is reduced or removed.

The default current levels with 3.4k of external loop resistance and a 24V supply are 4mA (Normal) and 0.5mA (Fail), with voltages across the external resistance being 13.6V (Normal) and 1.7V (Fail). With no external loop resistance , the current becomes 7mA (Normal) and 0.5mA (Fail), and a voltage drop of 24V in both cases.

9 LIMIT SWITCH UNIT

CAUTION: The installation of hazardous location 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).

9.1 General

The Logix 520MD digital positioner can be equipped with an additional limit switch unit.

9.2 Principle of Operation

The lever / coupling moves the vane into the slot of the limit switches LS1 or LS2. 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.

9.3 Installation (Figure 5)

The limit switch unit is fitted to the positioner when delivered but can be retrofitted. Fit 3 spacer screws (1) to positioner housing. Place PC board (2) on spacer screws (1), secure with 3 mounting screws (3).

Switches (Figure 6)

Install vane assembly (4) and secure with 2 screws. For electrical connect see Figure 6.

WARNING: *For units installed in Hazardous areas special installation cautions and procedures are required.*

9.4 Adjusting switches

Use the following procedure to adjust the switches

1. Loosen the two screws on the vane (4), figure 5.
2. Stroke the valve to the first switching position.
3. Set the switching point of the limit switch by adjusting the lower vane for the lower switch (LS2).
4. Stroke the valve to the second switching position (LS1).
5. Set the switching point of the limit switch by adjusting the vane for the upper switch.
6. Tighten the two screws on the vane (4), figure 5.
7. Check the two switching points and repeat the adjustment steps 1 to 6, if necessary.

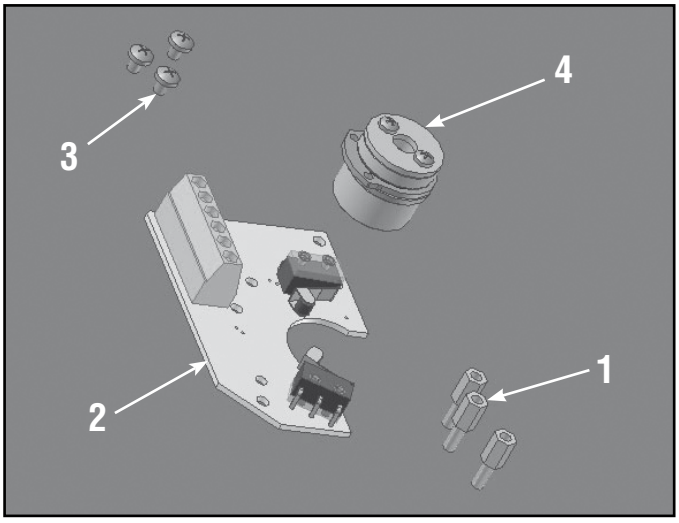


Figure 5: Limit switches

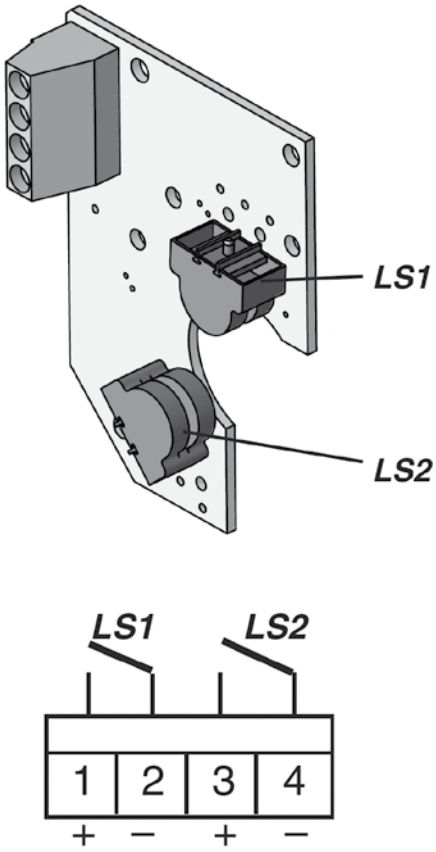


Figure 6: Switch connections

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.
GGGY	2	**MPC active** - The command is below the 1% command limit for tight shutoff feature. This is a normal condition for a closed valve. To clear the condition, adjust the command signal above the specified MPC value, or disable the feature by moving the Tight Shutoff switch to the off position and recalibrating.
GGYR	3	**LED test mode**, **Initializing** - This sequence should only be visible for 3 sequences when powering up the unit.
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.
YYYY	4	**Relay not operating during calibration** – Most Likely the Air supply is not connected. Could also be due to a bad pneumatic relay, failed electronics, or a loose or bad connector from the electronics to the relay.
YYYR	5	**Command minimum saturated** - Calibration error indicating that the 4-20 mA signal corresponding to the minimum command was too low. Adjust the signal to higher 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	6	**Command span** - Calibration error indicating that the 4-20 mA signal was below the minimum calibration span. The minimum calibration span is 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 Δ and ∇ buttons are pressed simultaneously the calibrated span will be used even though it is less than the recommended range.
YYRY	7	**Command maximum saturated** - Calibration error indicating that the 4-20 mA signal corresponding the maximum command was too high. Adjust the signal a lower 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.
YYGG	8	**Calibration complete** - Indicates that a 4-20 command calibration is complete. This pause allows the signal to be adjusted without affecting the valve position. Press the Δ and ∇ buttons simultaneously to put the unit back in operation.
YRRR	9	**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. Also check the air supply to make sure the system is properly 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 or if the Δ and ∇ buttons are pressed simultaneously the calibrated span will be used even though it is less than the recommended range.
YRRY	10	**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.
YRRG	11	**Waiting for 100% position JOG set point from User** - only used during Jog calibration see explanation in Quick-Cal section of main document for operation.
YRYY	12	**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.
YRYG	13	**Setting IL offset** (during Stroke calibration) - An automatic step in the calibration process that is done with the valve a 50% position. This must be completed for proper operation.

Colors	Identifier	Indication and resolution
YRYR	14	**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.
YRGG	15	**Stroke Calibration in Progress** - Calibration sequence started using the local Quick- Cal button. It may be cancelled by briefly pushing the quick-cal button.
YRGY	16	**Unable to set IL offset during QUICK-CAL** – This may occur on very large or small actuators on the first calibration attempt. The Logix 510 will automatically adjust parameters for future calibrations. To Continue briefly push the quick-cal button to acknowledge and restart Quick-Cal.
YRGR	17	F**eedback 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.
YGGG	18	**4-20 mA output 0%** - Waiting for the user to adjust the 0% 4-20 mA output during calibration.
YGGY	19	**4-20 mA input 0%** - Waiting for 0% 4-20 mA command input during command calibration.
YGGR	20	**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
YGYY	21	**4-20 mA output 100%** - Waiting for the user to adjust the 100% 4-20 mA output during calibration.
YGYR	22	**4-20 mA input 100%** - Waiting for 100% 4-20 mA command input during command calibration.
YGRY	23	**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 Δ and ∇ buttons are pressed simultaneously the calibrated span will be used even though it is less than the recommended range.
YGRR	24	**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. **Logix 510si Status Condition Codes**
R - - -		Any sequence starting with a red light indicates that there is an operational problem with the unit.
RRYY	25	**Piezo voltage -** (bad electronic assembly - replace.)
RYYR	26	**Relay not operating** – Most Likely the Air supply is disconnected. Could also be due to a bad pneumatic relay, failed electronics, or a loose or bad connector from the electronics to the relay
RYRY	27	**Relay failed** – Could be due to a bad pneumatic relay, failed electronics, or a loose or bad connector from the electronics to the relay
RGRR	28	**Position Deviation** – Indicates that he position has exceeded a fixed 20% error between command and position for a period of time 5 times longer than the recorded stroke time. This error is usually seen when the positioner is first mounted and powered up before a stroke calibration has been done. If the positioner is properly calibrated, the air supply is correct, and the linkage is properly adjusted this error normally indicates that there is a mechanical problem in the positioner, actuator, or valve that is preventing the valve from stroking properly. If a regulated air supply connected to the actuator properly strokes the valve this indicates a bad positioner and should be replaced if a calibration does not clear the error.

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 Δ 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 Δ 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 TROUBLESHOOTING LOGIX 510SI DIGITAL POSITIONERS

Failure	Probable Cause	Corrective action
No LED is blinking	1. Current source below 3.6 mA 2. Incorrect wiring polarity	1. Verify current source is outputting at least 3,6 mA 2. Check wiring for correct polarity
Unit does not respond to analog commands	1.Error occurred during calibration	1. Correct calibration error. Recalibrate
Valve position reading is not what is expected	1. Stroke not calibrated 2. Stem position sensor mounting is off 180 degrees	1. Recalibrate 2. Orient sensor properly
Position is driven fully open or closed and will not respond to command	1. Stroke not calibrated 2. Inner-loop hall sensor not connected 3. Wrong air action set on DIP switch 4. Actuator tubing backward 5. Electro-pneumatic converter malfunctioning	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
Sticking or hunting operation of the positioner	1. Contamination of the electro-pneumatic converter. 2. Control gain set too high	1. Check air supply for proper filtering and meeting ISA specifcations ISA-7.0.01 2. Lower gain switch settings

13 SPARE PARTS KITS

Item No.	Description		Part-No.
1	Cover Assembly	Yellow	255240.999.000
		White	218771.999.000
		Black	218772.999.000
2	PC Board Assembly Logix 510si		234324.999.000
	PC Board Assembly Logix 510si with analog feedback		234323.999.000
3	Relay Module Assembly: -20ºC to 85ºC (-4ºF to 185ºF)		230103.999.000
	Relay Module Assembly: -40ºC to 85ºC (-40ºF to 185ºF)		218773.999.000
4	Repair kit for Potentiometer Assembly		218774.999.000
5	Position Feedback Assembly		218774.999.000
8	Follower Arm Assembly	Max. stroke 65 mm	214323.999.000
		Max. stroke 110 mm	214322.999.000

Mounting Kits

	Description	Part-No.
–	IEC 534 part 6 (FloTop, Kämmer KA, Kämmer KP, and standard NAMUR linear valves)	213619.999.000
–	Rotary VDI/VDE 3845 (DIN ISO 5211)	188151.999.000
–	Flowserve direct mounting	214004.999.000
–	Linear VDI / VDE 3847	255242.999.000

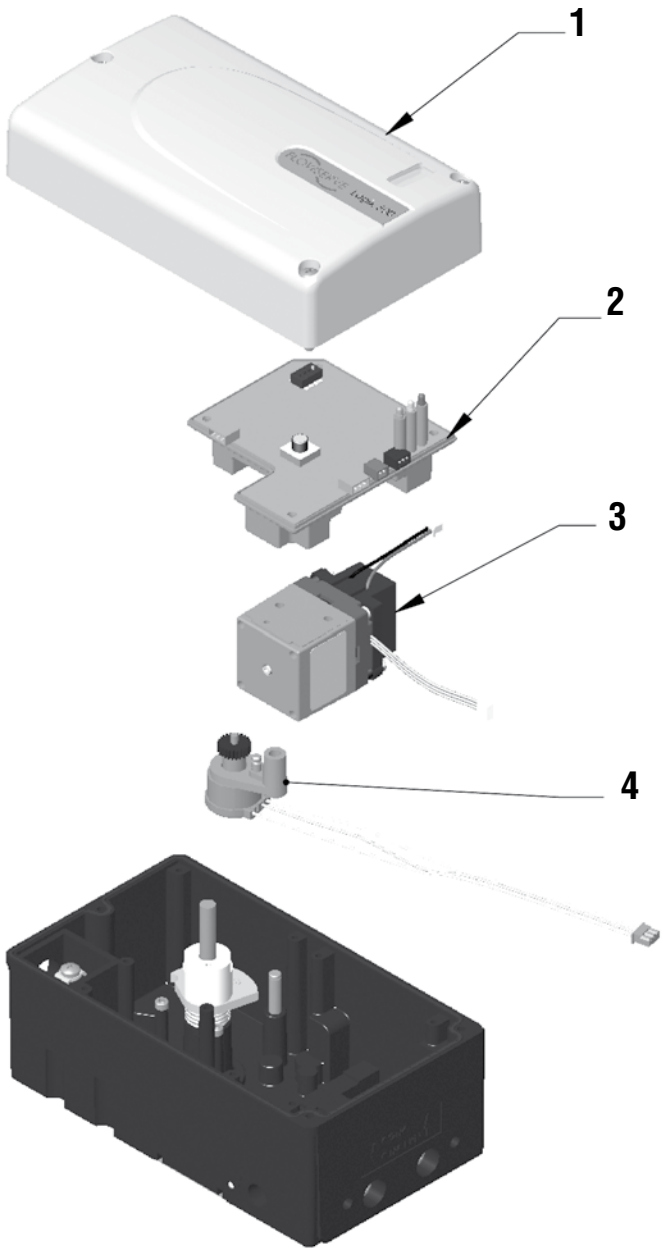


Figure 7: Exploded drawing for spare parts

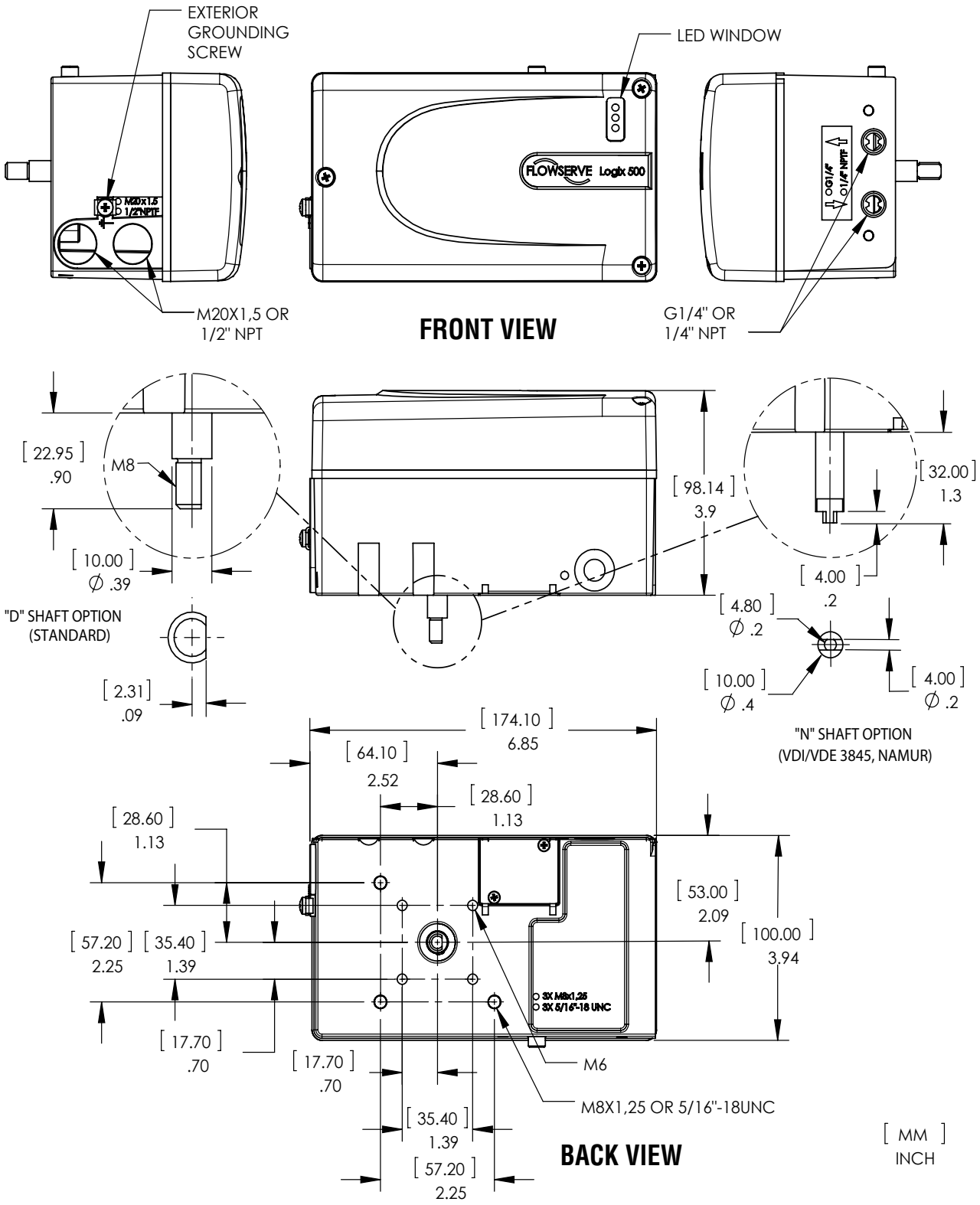
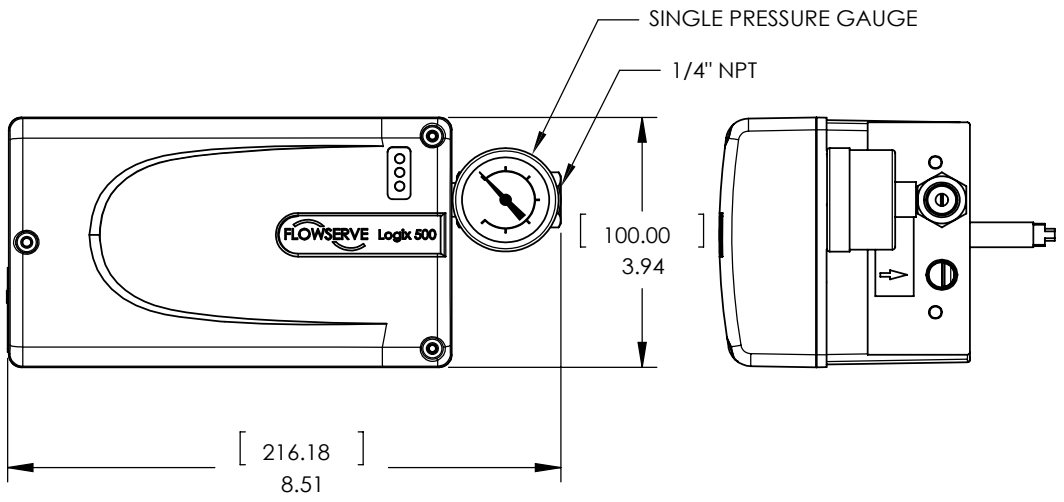
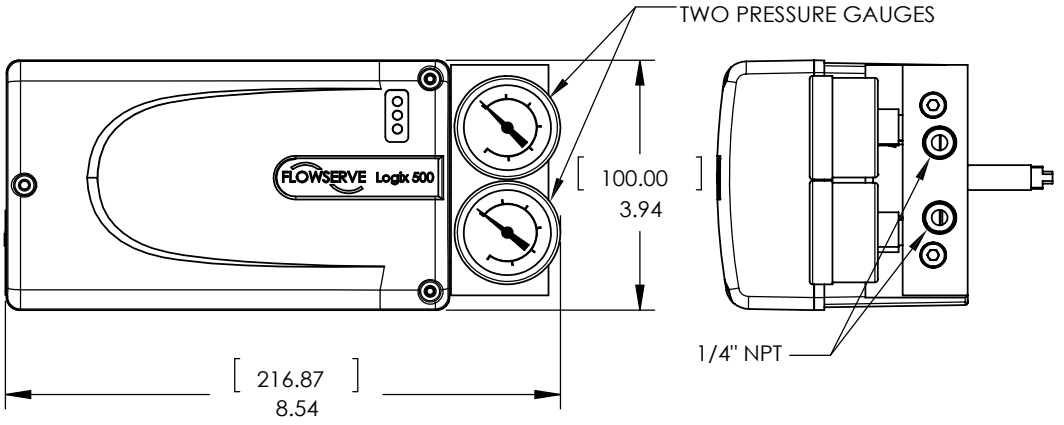


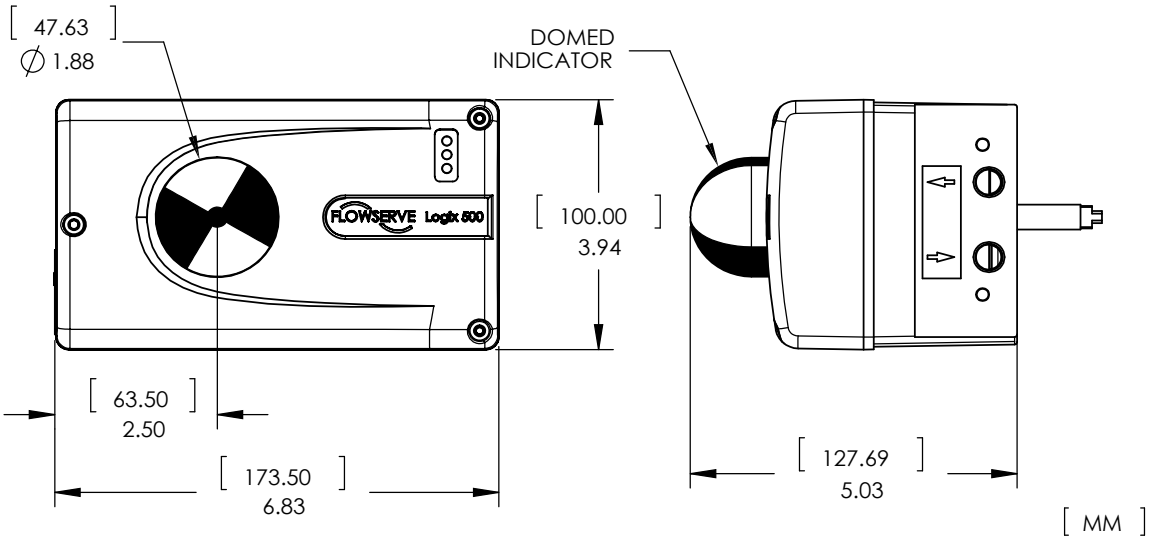
Figure 8: Dimensional Drawing for the Logix 500si Series Digital Positioner



AUXILIARY OPTIONS - "GA" (GAUGE ADAPTER)



AUXILIARY OPTIONS - "GM" (GAUGE MANIFOLD)



POSITION INDICATOR - "D" (DOMED INDICATOR)

Figure 9: Dimensional Drawing for the Logix 500si with options