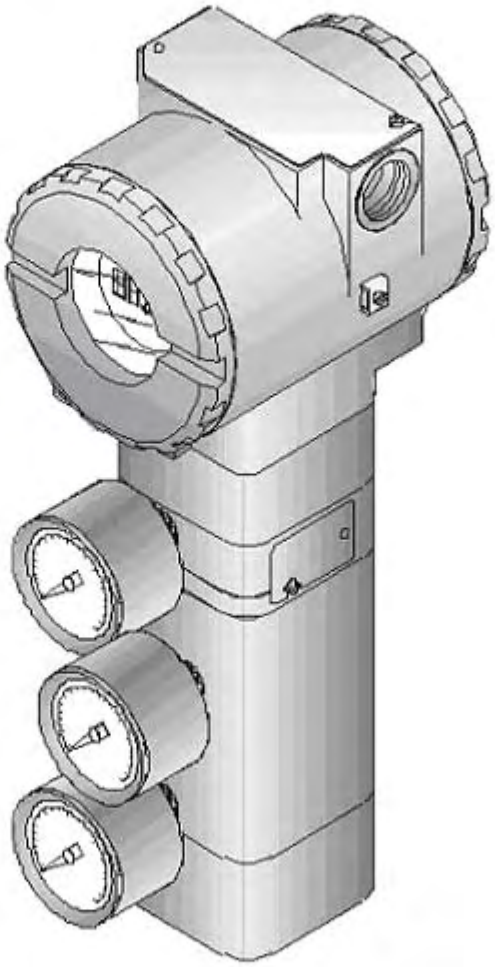
IM-P370-21
CH ISSUE 1

spirax sarco - SP302

OPERATION & MAINTENANCE
INSTRUCTIONS MANUAL

FIELDBUS VALVE POSITIONER



SP302
03.05

Introduction

The SP302 is a Fieldbus valve positioner for Single (spring return) or Double acting Linear motion type control valves e. g. Globe, Gate, Diaphragm, Pinch or Clamp and Rotary motion type control valves e. g. Ball, Butterfly or Plug with pneumatic type actuators e. g. Diaphragm, Piston, Vane, or Bellows. It is based on a field-proven piezo flapper and non-contacting Hall-effect position sensor that provides reliable operation and high performance. The digital technology used in the SP302 enabled the choice of several types of flow characterizations, an easy interface between the field and the control room and several interesting features that considerably reduce the installation, operating and maintenance costs.

The SP302 is part of Spirax Sarco's complete 302 line of Fieldbus devices.

Fieldbus is not only a replacement for 4-20 mA, or intelligent/Spirax Sarcot transmitter protocols, it contains much more. Fieldbus is a complete system enabling distribution of the control function to equipment in the field.

Some of the advantages of bi-directional digital communications are known from existing Spirax Sarcot transmitter protocols: Higher accuracy, multi-variable access, remote configuration and diagnostics, and multi-dropping of several devices on a single pair of wires.

The main requirements for Fieldbus were to overcome these problems. Closed loop control with performance like a 4-20 mA system requires higher speed. Since higher speed means higher power consumption, this clashes with the need for intrinsic safety. Therefore a moderately high communication speed was selected, and the system was designed to have a minimum of communication overhead. Using scheduling the system controls variable sampling, algorithm execution and communication so as to optimize the usage of the network, not loosing time. Thus, high closed loop performance is achieved.

Using Fieldbus technology, with its capability to interconnect several devices, very large control schemes can be constructed. In order to be user friendly the function block concept was introduced (users of SPIRAX SARCO CD600 should be familiar with this, since it was implemented there years ago). The user may now easily build and overview complex control strategies. Another advantage is added flexibility; the control strategy may be edited without having to rewire or change any hardware.

The SP302, like the rest of the 302 family, has several Function Blocks built in, like PID controller, Input Selector and Splitter/Output Selector, eliminating the need for separate device. This takes to reduced communication and thereby less dead-time and tighter control, not to mention the reduction in cost.

The need for implementation of Fieldbus in small as well as large systems was considered when developing the entire 302 line of Fieldbus devices. They have the common features of being able to act as a master on the network and be configured locally using a magnetic tool, eliminating the need for a configurator or console in many basic applications.

Get the best result of the SP302 by carefully reading these instructions.

WARNING

Throughout the operation of the positioner, including self-setup, do not touch the moving parts of valve/actuator/positioner assembly as they may unexpectedly move automatically. Make sure to disconnect supply air before touching any moving parts.

NOTE

This manual is compatible with version 3XX, where 3 denotes software version and XX software release. The indication 3.XX means that this manual is compatible with any release of software version 3.

SAFETY INFORMATION

IMPORTANT
SAFETY INFORMATION:
PLEASE READ CAREFULLY

Hazards to be considered when installing/using/maintaining

1. Access
Ensure safe access and if necessary a safe working platform before attempting to work on the product.
Arrange suitable lifting gear if required.

2. Lighting
Ensure adequate lighting, particularly where detailed or intricate work is required e.g. electrical wiring.

3. Hazardous liquids or gases in the pipeline
Consider what is in the pipeline or what may have been in the pipeline at some previous time.
Consider: flammable materials, substances hazardaous to health, extremes of temperature.

4. Hazardous environment around the product
Consider, explosion risk areas, lack of oxygen (e.g. tanks, pits) dangerous gases, extremes of temperature, hot surfaces, fire hazard (e.g. during welding), excessive noise, moving machinery.
ATEX certifications are available on demand for explosion proof housings (ATEX II2GEExdIICT6) and for intrinsically safe electronic circuits (ATEX II2GEExdIICT6).

5. The system
Consider the effect on the complete system of the work proposed. Will any proposed action (e.g. closing isolating valves, electrical isolation) put any other part of the system or any other workers at risk? Dangers might include isolation of vents or protective devices or the rendering ineffective of controls or alarms.
Ensure isolation valves are turned on and off in a gradual way to avoid system shocks.

6. Pressure systems
Ensure that any pressure is isolated and safety vented to atmospheric pressure.
Consider double isolation (double block and bleed) and the locking and/or labelling of valve shut.
Do not assume the system is de-pressurized even when the pressure gauge indicates zero.

7. Temperature
Allow time for temperature to normalise after isolation to avoid the danger of burns.

8. Tools and consumables
Before starting work ensure that you have suitable tools and/or consumables available. Use only genuine Spirax Sarco replacement parts.

9. Protective clothing
Consider whether any protective clothing is required, to protect against the hazards of, for example, chemicals, high/low temperature, noise, falling objects, dangers to eyes/face.

10. Permits to work
All works must be carried out or be supervised by a suitable competent person.

Where a formal permit to work system is in force it must be complied with.
Where there is no such system, it is recommended that a responsible person knows what work is going on and where necessary arrange to have an assistant whose primary responsibility is safety. Post warning notices if necessary.

11. Electrical work
Before starting work study the wiring diagram and wiring instructions and note any special requirements. Consider particularly:
mains supply voltage and phase, local mains isolation, fuse requirements, earthing, special cables, cable entries/cable glands, electrical screening.

12. Commissioning
After installation or maintenance ensure that the system is fully functioning.
Carry out tests on any alarms or protective devices.

13. Disposal
Unwanted equipment should be disposed of in a safe manner.

14. Returning products
Customers and stockists are reminded that under EC Health, Safety and Environmental Law, when returning products to Spirax Sarco they must provide information on any hazards and the precautions to be taken due to contamination residues or mechanical damage which may present a health, safety and environmental risk.
This information must be provided in writing including Health and Safety data sheets relating to any substances identified as hazardous.

Note: The products supplied by Spirax Sarco are classified as components and are not generally affected by the Machinery Directive 89/392/EEC.

Table of Contents

4. MAINTENANCE PROCEDURES

5. TECHNICAL CHARACTERISTICS

6. HAZARDOUS LOCATION INSTALLATION AND APPROVALS

Section 1

Installation

General

The overall accuracy of measurement and control depends on several variables. Although the converter has an outstanding performance, proper installation is essential, in order to maximize its performance.

Among all factors, which may affect converter accuracy environmental conditions are the most difficult to control. There are, however, ways to reduce the effects of temperature, humidity and vibration.

The **SP302** has a built-in temperature sensor to compensate for temperature variations. At the field, this feature minimizes the temperature variation effect.

Locating the positioner in areas protected from extreme environmental changes can minimize temperature fluctuation effects.

In warm environments, the positioner should be installed to avoid, as much as possible, direct exposure to the sun. Installation close to lines and vessels subjected to high temperatures should also be avoided.

Use of sunshades or heat shields to protect the positioner from external heat sources should be considered, if necessary.

Humidity is fatal to electronic circuits. In areas subjected to high relative humidity, the O-rings for the electronics cover must be correctly placed. Removal of the electronics cover in the field should be reduced to the minimum necessary, since each time it is removed, the circuits are exposed to humidity. The electronic circuit is protected by a humidity proof coating, but frequent exposures to humidity may affect the provided protection. It is also important to keep the covers tightened in place. Every time they are removed, the threads are exposed to corrosion, since painting cannot protect these parts. Code approved sealing methods on conduit entering the positioner should be employed.

Although the positioner is virtually insensitive to vibration, installation close to pumps, turbines or other vibrating equipment should be avoided.

Mounting

The mounting of positioner **SP302** will depend on actuator type, single (spring return) action or double action and on actuator movement, if it is linear or rotary. Two supports are required for mounting, one for the magnet and the other for the positoner itself. Spirax Sarco may supply them both since they are specified in the order code. (See Table 5.2 – Bracket Ordering Code).

Rotary Movement

Install the magnet on the valve stem using the magnet support (See Figure 1.2 - Positioner on Rotary Actuator).

Install the positioner support on the actuator. The actuator should be in accordance with standard VDI/VDE 5845, all you have to do is tighten the four screws with the lock washers on the standard support.

For special supports, refer to specify instructions. After installing the support on the actuator, it is possible to mount the positioner **SP302** on the support by means of the four screws with lock washers.

Make sure that the arrow engraved on the magnet coincides with the arrow engraved on the positioner when the valve is in mid travel.

If the installation of the positioner or magnet should be altered, or if there should be any other modification, the positioner will require a recalibration.

As to the type of valve action, refer to paragraph "Pneumatic Connections".

Linear Movement

Install the magnet on the valve stem using the magnet support (See Figure 1.3 - Positioner on Linear Actuator).

Install the positioner support on the actuator. The actuator support may be secured in place as per standard NAMUR/IEC 536-4 or in accordance with user specified boring. Install the positioner on the support and tighten the four screws in the threaded bores located on the side opposite to the pressure gages (See Figure 1.3 - Positioner on Linear Actuator). Use lock washers in order to prevent screw slackening.

Make sure that the support is not obstructing the exhaustion outlets.

Make sure that arrow engraved on the magnet coincides with the arrow engraved on the positioner when the valve is in mid travel.

If the installation of the positioner or magnet should be altered, or if there should be any other modification, the positioner will require a recalibration.

Pneumatic Connections

In those applications where such requirements can not be fulfilled, the use of filters is acceptable. Positioner **SP302** may be supplied, upon request, with filters manufactured by others.

Air supply pressure to the **SP302** shall be between 1.4 bar (20 psi) and 7 bar (100 psi). In case such requirements can not be fulfilled, the use of an air pressure regulator is acceptable.

Use sealant on threads. Sealants like PTFE (Teflon) tape shall be avoided because they may fragment and eventually obstruct internal parts.

The positioner **SP302** may be supplied with pressure gages. There are taps available for IN, OUT1 and OUT2. Before connecting the pressure gages, make sure that all lines be completely purged.

Valve positioner **SP302** has two pneumatic outputs. They work on opposite directions to open or close the valve.

WARNING

The **SP302** should fail, for example, because of a power failure. The output identified as OUT1 (output 1) goes to nearly zero, while the output identified as OUT2 (output 2) goes to nearly the air supply pressure.

Pneumatic connections are identified as IN (input) for the air supply, and OUT1 and OUT2 for Output 1 and Output 2 respectively (See
Figure 1.1 - SP302 Dimensional Drawing). Use 1/4 NPT connections. Sealant may be used NPT threads. Connect the air supply tubing to the connection identified as IN. Make sure that the air supply pressure does not exceed the maximum rating accepted by the positioner or actuator. The tubing used to connect the positioner **SP302** to the actuator shall be as short as possible.

NOTE

Make sure that sealant does not enter the positioner.

The are six exhaust outputs in the **SP302**, all of them fitted with filters (See
Figure 1.1 - SP302 Dimensional Drawing).

It is very important that such outputs are neither blocked nor obstructed, because the air must circulate freely.

All filters shall be inspected to make sure they will not obstruct the outputs (Refer to Section 4 - Maintenance Procedures).

Double Action - Air to Open (Fail Close)
Connect Output 1 (OUT1) of the positioner to the input identified as OPEN in the actuator, and connect Output 2 (OUT2) of the positioner to the input CLOSE in the actuator (See Figure 1.1 - SP302 Dimensional Drawing).

Double Action - Air to Close (Fail Open)
Connect Output 2 (OUT2) of the positoner to the input identified as OPEN in the actuator, and connect Output 1 (OUT 1) of the positioner to the input CLOSE of the actuator.

Single Action
Connect Output 1 (OUT1) of the positioner to the input of the actuator. Use a plug to block Output 2 (OUT2). (The Figure 1.2 - Positioner on Rotary Actuator and Figure 1.3 - Positioner on Linear Actuator show the positioner in rotary and linear actuators).

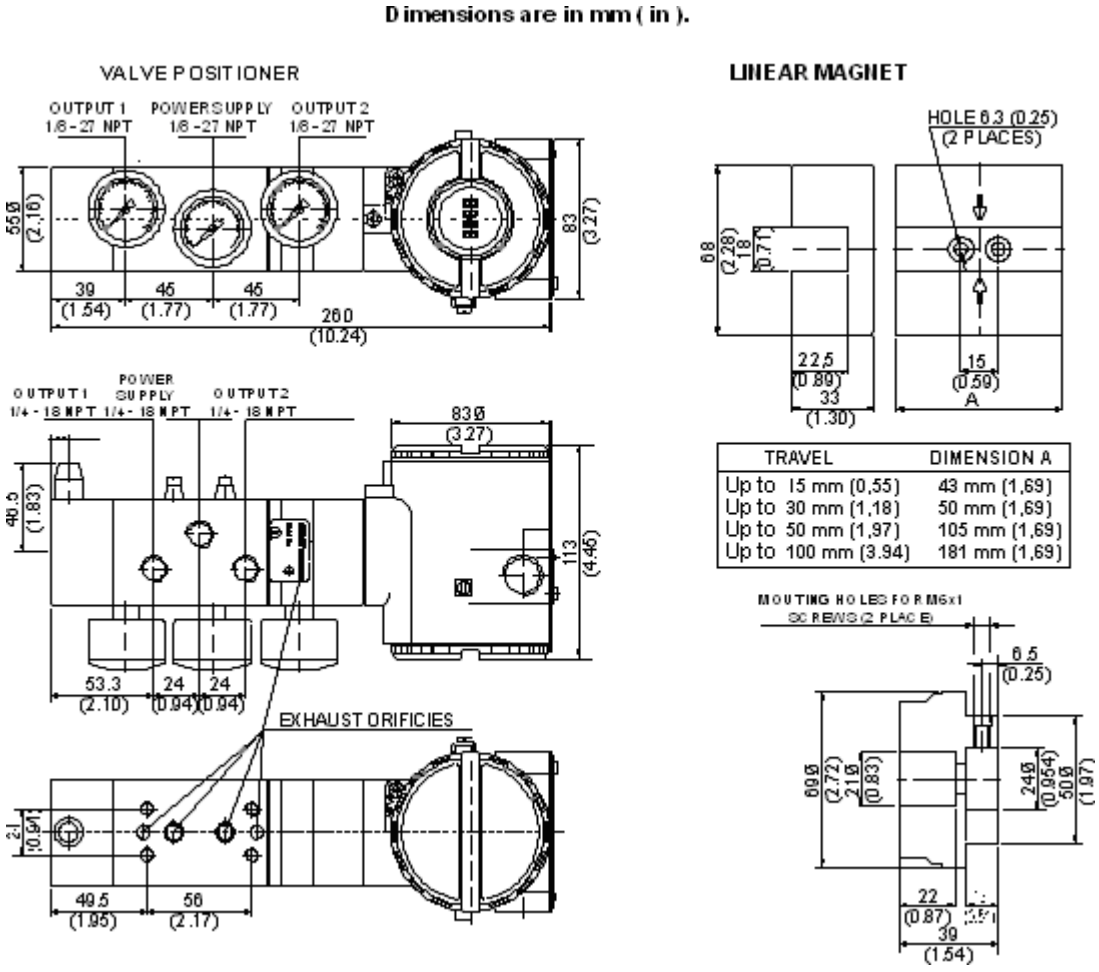


Figure 1.1 - SP302 Dimensional Drawing

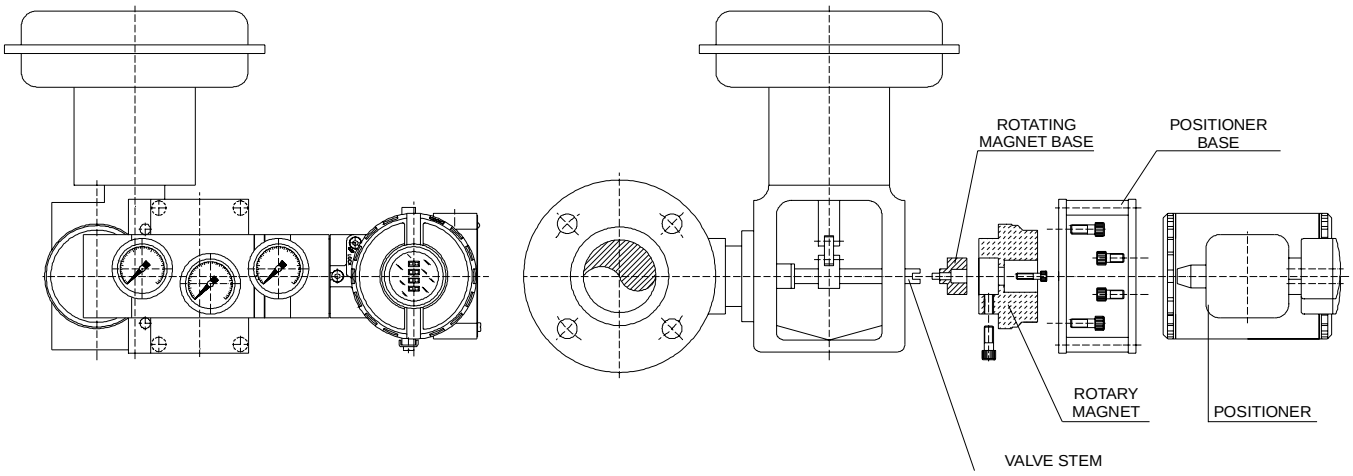


Figure 1.2 - Positioner on Rotary Actuator

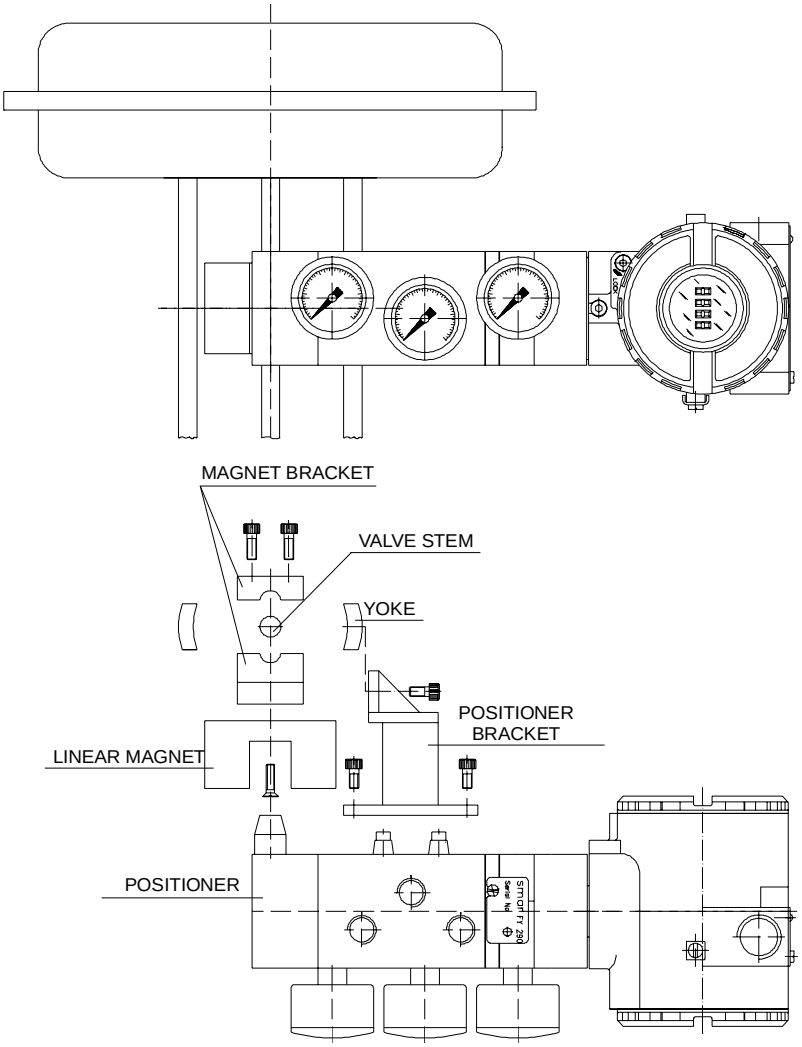


Figure 1.3 - Positioner on Linear Actuator

Electronic Housing Rotating

The electronic housing can be rotated in order to have a better position of the digital display. To rotate it, use the Housing Rotation SetScrew. (See
Figure 1.4 - Cover Locking and Housing Rotation Set Screw).

The local indicator itself can also be rotated. (See Figure 2.4 – Rotating the position of the LCD Display).

Electric Wiring

Reach the wiring block by removing the Electrical Connection Cover. This cover can be locked by the cover locking screw. To release the cover, rotate the locking screw clockwise.
The wiring block has screws on which fork or ring-type terminals can be fastened.
(See Figure 1.5 – Wiring Block).

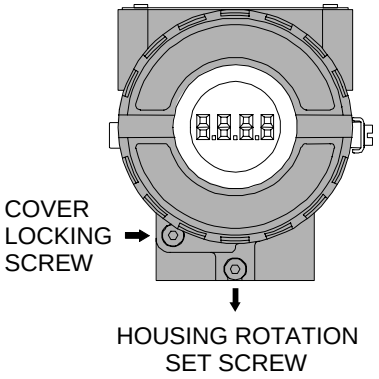


Figure 1.4 - Cover Locking and Housing Rotation Set Screw

For convenience there are two ground terminals: one inside the cover and one external, located close to the conduit entries. (See Figure 1.5 – Wiring Block).

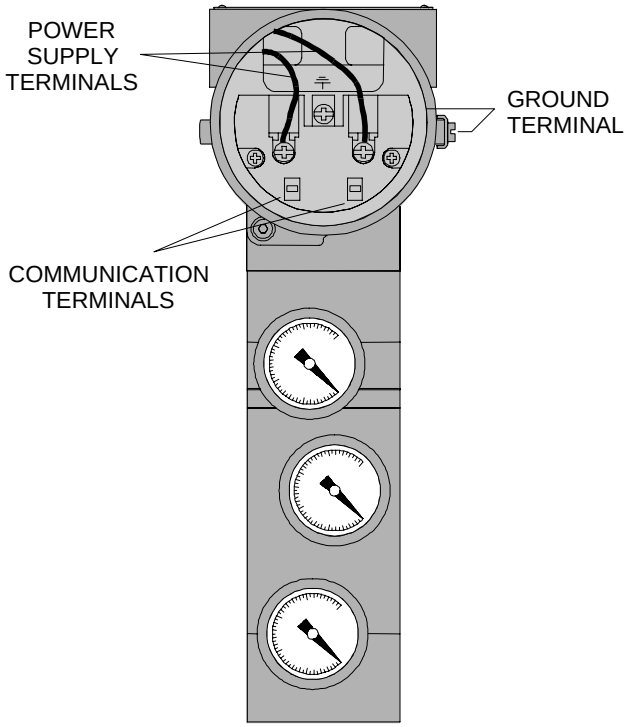


Figure 1.5 - Wiring Block

WARNING

In hazardous areas with explosion proof requirements, the covers must be tightened with at least 8 turns. In order to avoid the penetration moisture or corrosive gases, tighten the O'ring until feeling the O'ring touching the housing. Then, tighten more 1/3 turn (120°) to guarantee the sealing. Lock the covers using the locking screw.

In hazardous zones with intrinsically safe or non incendive requirements, the circuit entity parameters and applicable installation procedures must be observed.

Cable access to wiring connections is obtained by the two conduit outlets. Conduit threads should be sealed by means of code-approved sealing methods. The unused outlet connection should be plugged and sealed accordingly.

Should other certifications be necessary, refer to the certification or specific standard for installation limitations.

The Figure 1.6 - Conduit Installation Diagram, shows the correct installation of the conduit, in order to avoid penetration of water, or other substance, which may cause malfunctioning of the equipment.

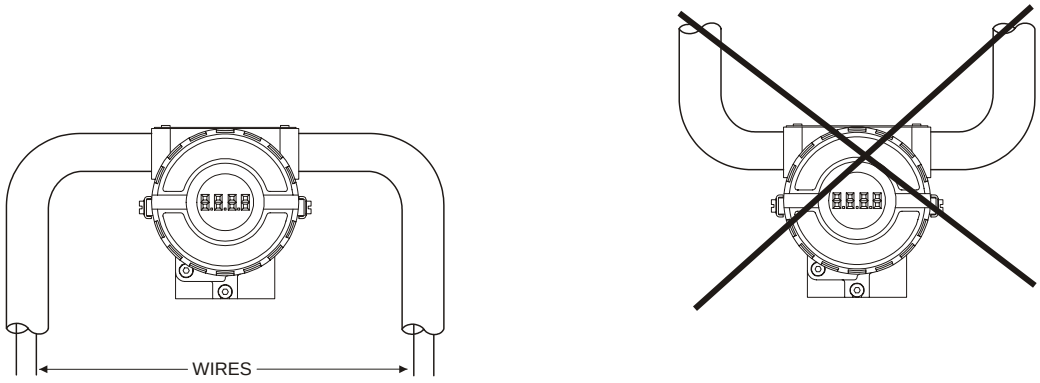


Figure 1.6 - Conduit Installation Diagram.

NOTE

Please refer to the General Installation, Operation and Maintenance Manual for more details.

Topology and Network Configuration

Bus topology (See Figure 1.7 - Bus Topology) and tree topology (See Figure 1.8 - Tree Topology) are supported. Both types have a trunk cable with two terminations. The devices are connected to the trunk via spurs. The spurs may be integrated in the device giving zero spur length. A spur may connect more than one device, depending on the length. Active couplers may be used to extend spur length.

Active repeaters may be used to extend the trunk length.

The total cable length, including spurs, between any two devices in the Fieldbus should not exceed 1900m.

The connection of couplers should be kept less than 15 per 250m.

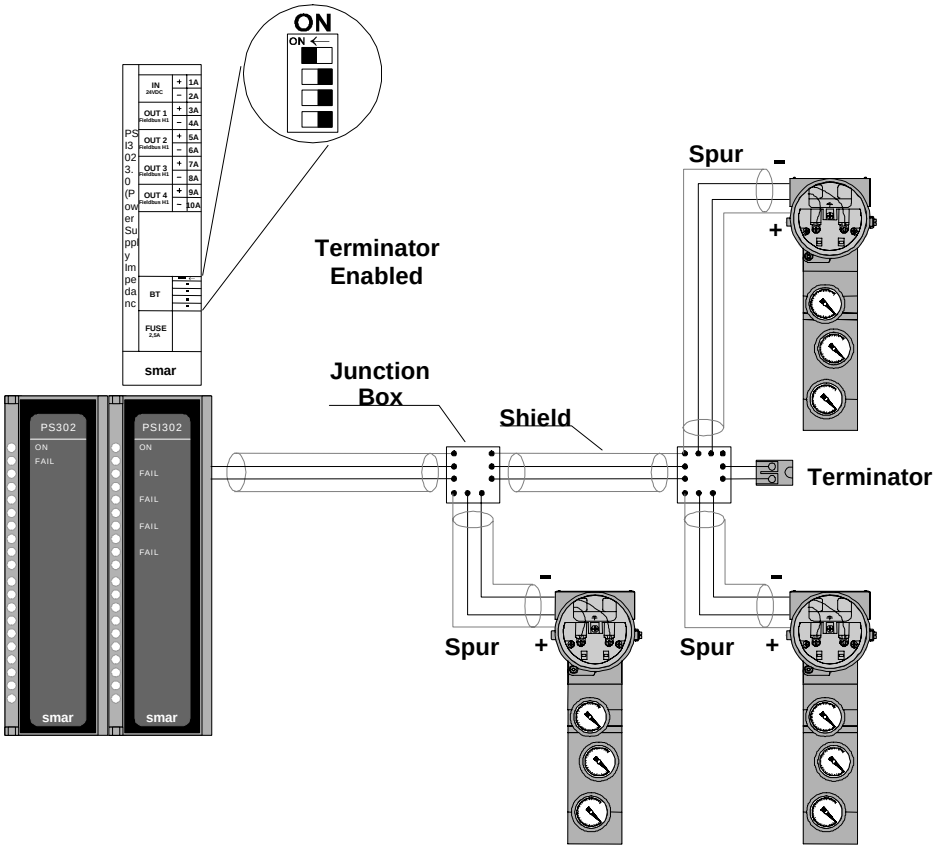


Figure 1.7 - Bus Topology

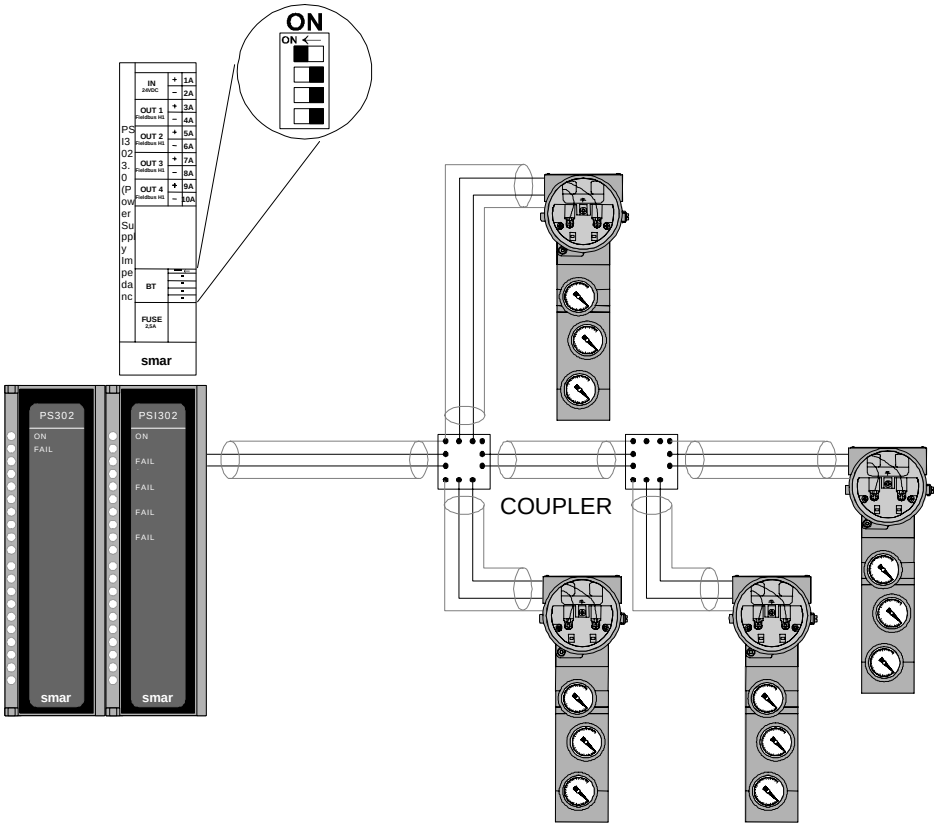


Figure 1.8 - Tree Topology

Intrinsic Safety Barrier

When the Fieldbus is in an area requiring intrinsic safety, a barrier must be inserted on the trunk between the power supply and the power supply end terminator.

Use of **SB302** is recommended.

Jumper Configuration

In order to work properly, the jumpers J1 and W1 located in the **SP302** main board must be correctly configured (See Table 1.1 - Description of the Jumpers).

J1	This jumper enables the simulation mode parameter in the AO block.
W1	This jumper enables the local adjustment programming tree.

Table 1.1 - Description of the Jumpers

Power Supply

The **SP302** receives power from the bus via the signal wiring. The power supply may come from a separate unit or from another device such as a controller or DCS.

The voltage should be between 9 to 32 Vdc for non-intrinsic safe applications.

A special requirement applies to the power supply used in an intrinsically safe bus and depends on the type of barrier used.

Use of **PS302** is recommended as power supply.

Recommendations for an Instrument Air System

Instrument air quality shall be superior to that of industrial compressed air. Humidity, airborne particles and oil may impair the instrument operation, either temporarily or permanently in case of internal parts wearing.

As per standard *ANSI/ISA S7.3 - Quality Standard for Instrument Air*, instrument air shall the following characteristics:

Dew point	10°C below minimum plant temperature
Size of particles (airborne)	3 μm (maximum)
Oil content	1 ppm w/w (maximum)
Contaminants	free from toxic flammable gases

Table 1.2 - Quality Standard for Instrument Air

Standard *ISA RP7.7 - Recommended Practice for Producing Quality Instrument Air* contains general instructions for air production within the quality parameters defined in standard ANSI/ISA S7.3. This standard recommends that the compressor intake be located in an area free from process spills and fitted with and adequate filter. It also recommends the use of non-lubricated type compressors, in order to prevent air contamination by lubricating oil. Where lubricated type compressors are adopted, there shall be used means to make the air oil free.

The Figure 1.9 - Air Supply System and Figure 1.10 - Air Quality Conditioning System show a typical system for Air Supply and Air Quality Conditioning.

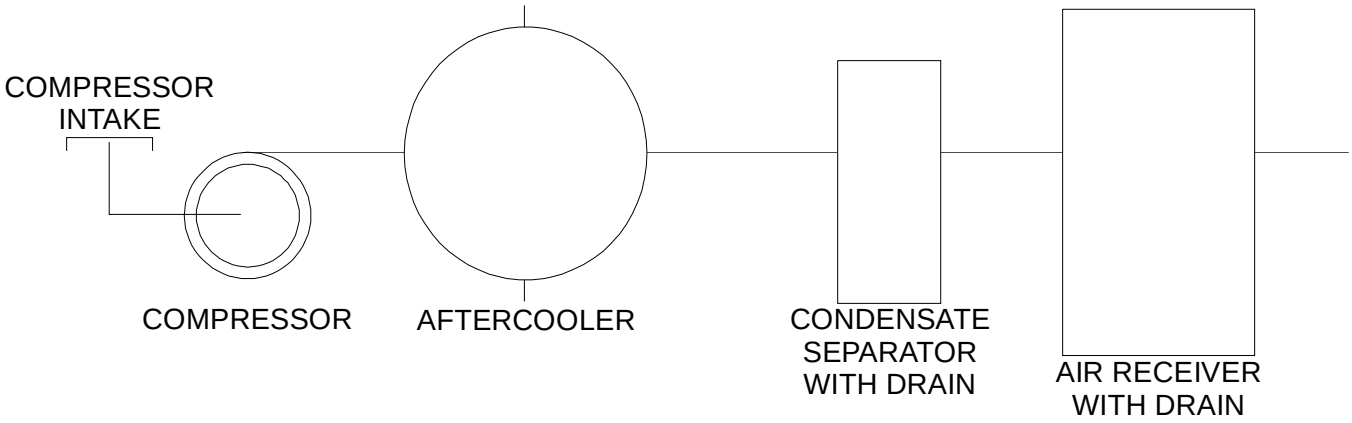


Figure 1.9 - Air Supply System

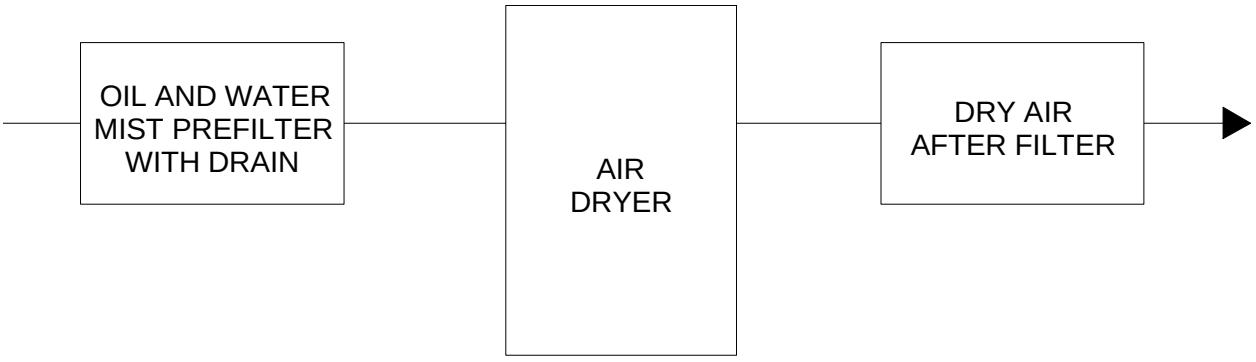


Figure 1.10 - Air Quality Conditioning System

Section 2

Operation

Functional Description - Output Module

The main parts of the output module are the pilot, servo, Hall effect sensor and the output control circuit. (See *Figure 2.1 - Pneumatic Transducer Schematic*).

The control circuit receives a digital setpoint signal from the CPU and a feedback signal from the Hall effect sensor.

The pneumatic circuit is based on a well-known and widely adopted technology, which is described on item Nozzle-and-Vane and Spool.

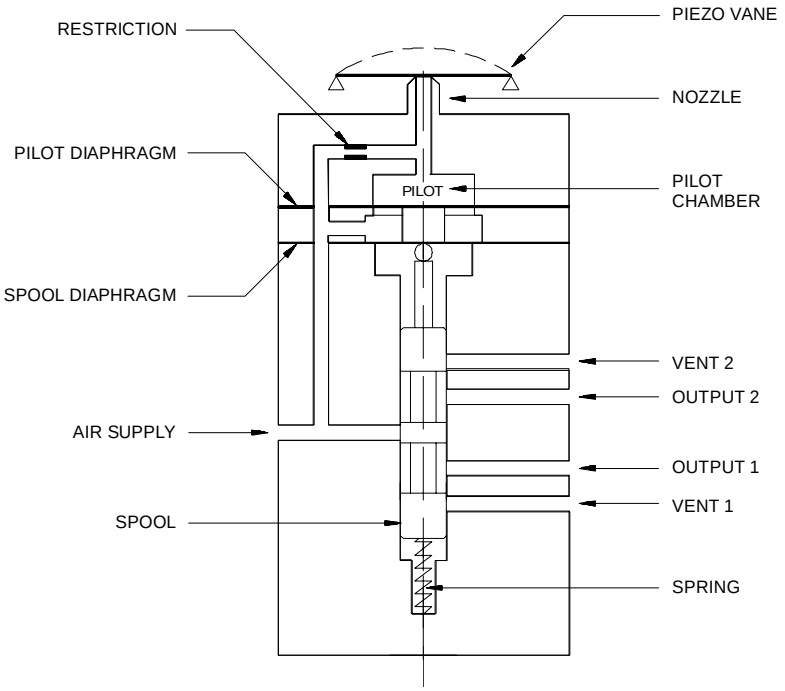


Figure 2.1 - Pneumatic Transducer Schematic

A piezoelectric disk as flapper in the pilot stage. The flapper is deflected when the control circuit applies a voltage. A small stream of air flowing through the nozzle is obstructed causing an increase in pressure in the pilot chamber, this is called the pilot pressure.

The pilot pressure is too low, with flowing capacity, and for this reason it must be amplified in the servo section. The servo section includes a diaphragm in the pilot chamber and a smaller one in the spool chamber. The pilot pressure applies a force at the pilot chamber's diaphragm which, in the equilibrium state, will be equal to the force applied by the spool valve at the smaller diaphragm which is in the spool chamber.

Therefore, upon every position change caused by the positioner, the pilot pressure increases or decreases as explained in the pilot stage section; such change in pilot pressure causes an upward or downward valve travel wich alters the pressure at output 1 and output 2 until a new equilibrium is reached, which results in a new valve position.

Functional Description-Electronics

Refer to the block diagram (See *Figure 2.2 - SP302 Block Diagram*). The function of each block is described below.

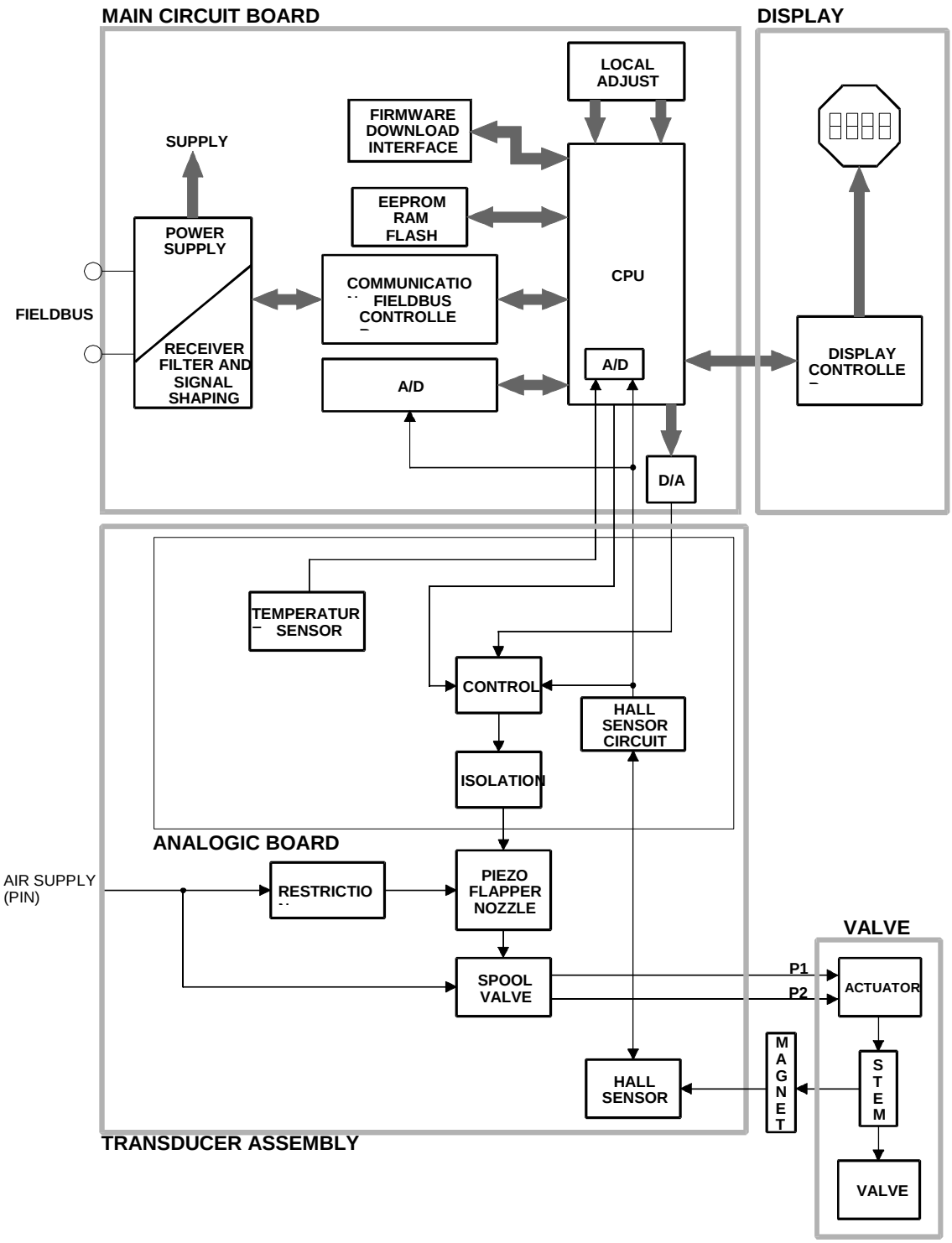


Figure 2.2 - SP302 Block Diagram

D/A
Receives the signal from the CPU and converts it to an analog voltage proportional the desired position, used by the control.

Control
Controls the valve position according to the data received from the CPU and the Hall effect sensor feedback.

A/D
Receives the signal from the Hall Sensor and converts it to a digital value proportional to the actual valve position.

Hall Effect Sensor
Measures the position actual and feedback to the control and CPU.

Temperature Sensor
Measures the temperature of the Transducer Assembly.

Isolation
Its function is to isolate the fieldbus signal from the piezoelectric.

EEPROM
A non-volatile memory which stores configuration data as a backup.

Central Processing Unit (CPU), RAM, PROM and EEPROM
The CPU is the intelligent portion of the positioner, being responsible for the management and operation of block execution, self-diagnostics and communication. The program is stored in PROM. For temporary storage of data there is a RAM. The data in the RAM is lost if the power is switched off, however the device also has a nonvolatile EEPROM where data that must be retained is stored. Examples of such data are: calibration and valve configuration.

Communication Controller
A monitor line activity, modulates and demodulates communication signals and inserts and deletes start and end delimiters.

Power Supply
The positioner circuit receives supply from a 9 to 32 Vdc power supply. Use of **PS302** and **PSI302** is recommended.

Display Controller
Receives data from the CPU and drives the (LCD) Liquid Crystal Display.

Local Adjustment
Local adjustment is provided by means of two magnetic naturally actuated switches with no external electric or mechanical contact, by using a magnetic screwdriver.

Piezo Flapper Nozzle
The unit flapper nozzle converts the movement of piezoelectric into a pneumatic signal to control pressure in the pilot chamber.

Restriction
The restriction and the nozzle form a pressure-divided circuit. Air is supplied to the nozzle through a restriction.

Spool
The spool ensures a quick valve positioning by providing a greater air flow than one provided by the restriction.

Introduction to Fieldbus Application

From a Fieldbus point of view, the **SP302** is not an assembly of electronics, housing and sensor forming a positioner, but a network node containing function blocks.

Basically, it contains one output transducer block, one resource block and one display transducer block and various function blocks.

These blocks are models of the functionality that the **SP302** provides for a control system. They can loosely be said to make up part of the application that is performed in the **SP302**. Generally these blocks can be said to use an algorithm and contained parameters to process input parameters producing output parameters.

Function Blocks

Models the basic user configurable functionality of the device. Typically these functionality were previously available in individual devices, but now several are included in a single device. As example of function blocks available on each device are:

PID control block
This is block, which makes the PID controller operational, this enabling the **SP302** to function as a PID servo.

Analog output block
Provides the functionality of what is known as a positioner. It makes the Fieldbus signal available to the **SP302** output hardware. It also optionally performs output reversing.

Splitter/Output Selector block
Split range, sequencing and output selection applications are provided with this block.

Arithmetic block
Implements the most useful calculations used in an application.

Input Selector block
Selects one of three inputs according to an algorithm chosen by the user.

All information regarding to them and others are available on the "*Function Blocks Manual*".

Transducer Blocks

These are responsible for the interface between the function blocks and the **SP302** output channel hardware.

Output transducer block
It is responsible for the processing of the output signal, such as output characterization and trim.

Display transducer block
It is responsible for the display and local adjustment.

Resource Block

It is responsible for monitoring the operation of the device. It also contains device information such as serial equipment number.

The Local Indicator

The local indicator is required for signaling and operation in local adjustment. The parameters desired by the user to be viewed on the LCD display should be configured in the display block.

Normal Indicator
During normal operation, the **SP302** remains in the monitoring mode and the display will always indicate the variable of monitoring configured in the display block. It is recommend to configure the position of the valve in % (percentage). The local programming mode is activated by the Magnetic tool, by inserting it in orifice Z.

The possible configuration and monitoring operation are shown on.

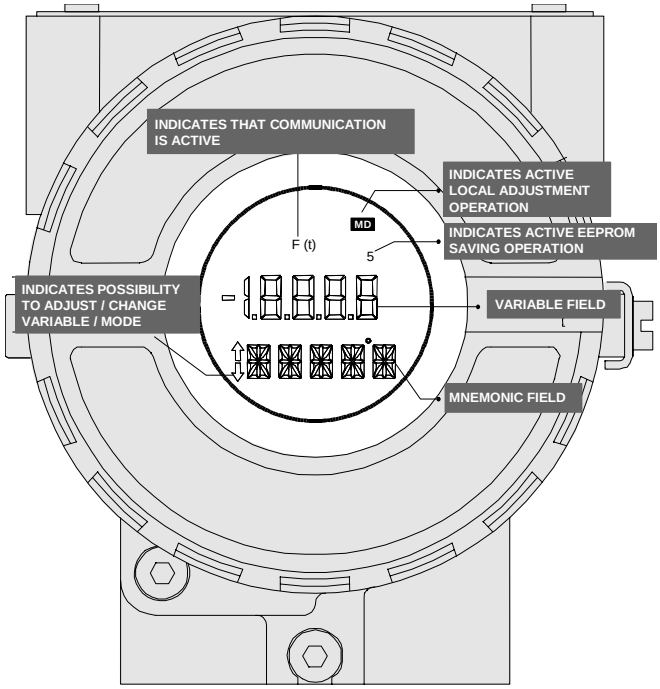


Figure 2.3 - Local Indicator

Upon receiving power, the **SP302** initializes the position indication on the display, by showing model **SP302** and its software version (X.XX). The indication should be higher than ±19999 it will be displayed as two digits and an exponent.

Monitoring
During normal operation, **SP302** remains in the monitoring mode.

The display simultaneously shows readout and some other information.

Normal displaying is interrupted when the magnetic tool is placed in orifice marked as **Zero** (See **Errore. L'origine riferimento non è stata trovata.**) and the indicator **MD** is showed on the display. After this, withdraw the magnetic tool off the orifice **Z** and put it in the orifice marked with the **S** letter. With the tool in the orifice, wait for 3 seconds. Withdraw again the magnet tool and wait for 3 seconds. Put it now in the orifice **S** and it will appear the message of " LOC ADJ" (Local Adjust). Withdraw the tool and put it in the orifice **Z**. After this, you can browse to all the parameters configured in the display block.

Four Different Positions to the LCD Display

As you can see below, there are four different positions for attaching the LCD display on the device in order to adequate it for a better view of its information.

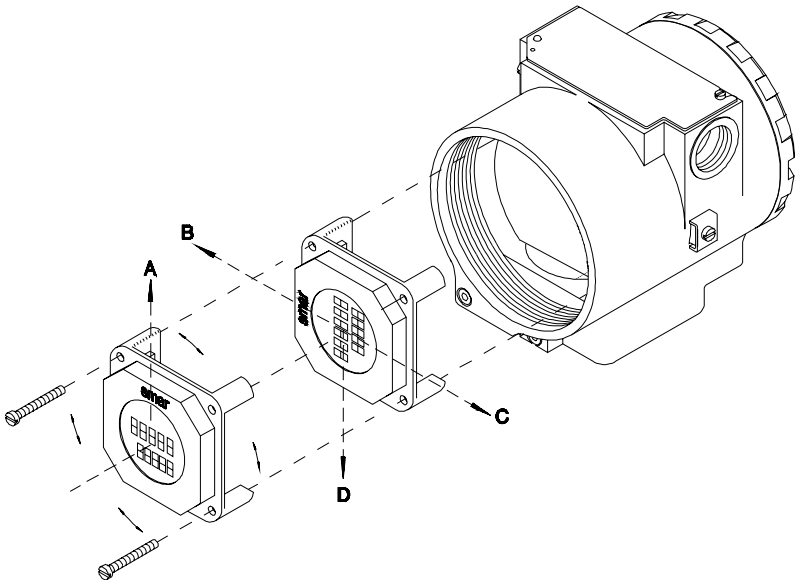


Figure 2.4 - Rotating the position of the LCD Display

Section 3

Configuration

One of the many advantages of Fieldbus is that device configuration is independent of the configurator. A third party terminal or operator console may configure the SP302. Any particular configurator is therefore not addressed here.

The **SP302** contains one output transducer block, one resource block, one display transducer block and function blocks.

Function Blocks are not covered in this manual. For explanation and details of function blocks, see the "*Function Blocks Manual*".

Transducer Block

Transducer block insulates function block from the specific I/O hardware, such as sensors, actuators. Transducer block controls access to I/O through manufacturer specific implementation. This permits the transducer block to execute as frequently as necessary to obtain good data from sensors without burdening the function blocks that use the data. It also insulates the function block from the manufacturer specific characteristics of certain hardware. By accessing the hardware, the transducer block can get data from I/O or passing control data to it. The connection between Transducer block and Function block is called channel. These blocks can exchange data from its interface.

Normally, transducer blocks perform functions, such as linearization, characterization, temperature compensation, control and exchange data to hardware.

Transducer Block Diagram

See transducer block diagram below.

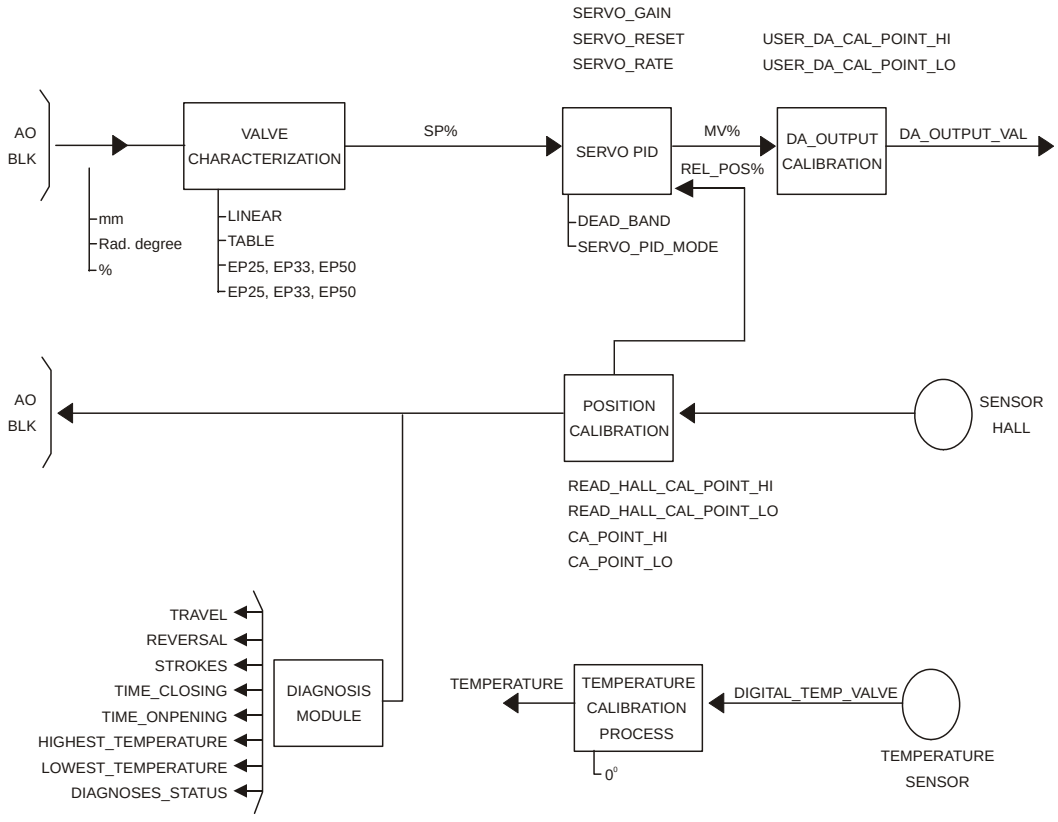


Figure 3.1 – Transducer Block Diagram

Transducer Block Parameter Description

Parameter	Description
ST_REV	Indicates the level of static data.
TAG_DESC	Description of Transducer Block.
STRATEGY	This parameter is not checked and processed by Transducer Block.
ALERT_KEY	Number of identification in the plant.
MODE_BLK	Indicates the operation mode of Transducer Block.
BLOCK_ERR	Indicates the status associated with hardware or software in the Transducer.
UPDATE_EVT	It is the alert for any static data.
BLOCK_ALM	It is used for configuration, hardware and other fails.
TRANSDUCER_DIRECTORY	It is used to select several Transducer Blocks.
TRANSDUCER_TYPE	Indicates the type of Transducer according to its class.
XD_ERROR	It is used to indicate calibration status.
COLLECTION_DIRECTORY	Specifies the number of transducer index into Transducer Block.
FINAL_VALUE	It is the value and status used by channel 1.
FINAL_VALUE_RANGE	The High and Low range limit values, the engineering unit code and the number of digits to the right of the decimal point to be used for Final Value.
FINAL_VALUE_CUTTOF_HI	If the FINAL_VALUE is more positive than this value is forced to its maximum high value (fully opened).
FINAL VALUE_CUTTOF_LO	If the FINAL_VALUE is more negative than this value is forced to its maximum low value (fully closed).
FINAL_POSITION_VALUE	The actual valve position and status could be used at the READBACK_VALUE in an AO block.
SERVO_GAIN	The servo PID gain valve.
SERVO_RESET	The servo PID reset valve.
SERVO_RATE	The servo PID rate valve.
ACT_FAIL_ACTION	Specifies the action the actuator takes in case of failure.
ACT_MAN_ID	The actuator manufacturer identification number.
ACT_MODEL_NUM	The actuator model number.
ACT_SN	The actuator serial number.
VALVE_MAN_ID	The valve manufacturer identification number.
VALVE_MODEL_NUM	The valve model number.
VALVE_SN	The valve serial number.
VALVE_TYPE	The type of the valve.
XD_CAL_LOC	The location of the last positioned calibration. This describes the physical location at which the calibration was performed.
XD_CAL_DATE	The date of last positioner calibration.
XD_CAL_WHO	The name of the person responsible for the last positioner calibration.
CAL_POINT_HI	The highest calibrated point.
CAL_POINT_LO	The lowest calibrated point.
CAL_MIN_SPAN	The minimum calibration span value allowed. This minimum span information is necessary to ensure that when calibration is done, the two calibrated points (high and low) are not too close together.
CAL_UNIT	Engineering units code for the calibration values.
CAL_METHOD	The method of last sensor calibration.
SECONDARY_VALUE	The secondary value related to the sensor.
SECONDARY_VALUE_UNIT	The engineering units to be used with the secondary value related to the sensor
BACKUP_RESTORE	This parameter is used to do backup or to restore configuration data.
POS_PER	The percent position.
SERVO_PID_BYPASS	Enable and disable the servo PID.
SERVO_PID_DEAD_BAND	The dead band error for servo PID.
SERVO_PID_ERROR_PER	The percent error value for the servo PID.
SERVO_PID_INTEGRAL_PER	The percent integral value for the servo PID.
SERVO_PID_MV_PER	The percent measured value for the servo PID.
MODULE_SN	The module manufacturer identification number.
COEFF_HALL_POL0	The polynomial Hall coefficient 0.
COEFF_HALL_POL1	The polynomial Hall coefficient 1.
COEFF_HALL_POL2	The polynomial Hall coefficient 2.
COEFF_HALL_POL3	The polynomial Hall coefficient 3.
COEFF_HALL_POL4	The polynomial Hall coefficient 4.
COEFF_HALL_POL5	The polynomial Hall coefficient 5.
COEFF_HALL_POL6	The polynomial Hall coefficient 6.
COEFF_HALL_POL7	The polynomial Hall coefficient 7.
COEFF_HALL_POL8	The polynomial Hall coefficient 8.
COEFF_HALL_POL9	The polynomial Hall coefficient 9.

Parameter	Description
COEFF_HALL_POL10	The polynomial Hall coefficient 10.
POLYNOMIAL_HALL_VERSION	The polynomial Hall version.
USER_HALL_CAL_POINT_HI	The highest calibrated point.
USER_HALL_CAL_POINT_LO	The lowest calibrated point.
READ_HALL_CAL_POINT_HI	The highest calibrated point for Hall sensor.
READ_HALL_CAL_POINT_LO	The lowest calibrated point for Hall sensor.
COEFF_SENS_TEMP_POL0	The polynomial temperature coefficient 0.
COEFF_SENS_TEMP_POL1	The polynomial temperature coefficient 1.
COEFF_SENS_TEMP_POL2	The polynomial temperature coefficient 2.
COEFF_SENS_TEMP_POL3	The polynomial temperature coefficient 3.
COEFF_SENS_TEMP_POL4	The polynomial temperature coefficient 4.
POLYNOMIAL_SENS_TEMP_VERSION	The polynomial temperature version.
CAL_TEMPERATURE	The temperature value used to calibrate the temperature.
CAL_DIGITAL_TEMPERATURE	The cal digital temperature value.
CHARACTERIZATION_TYPE	Select the characterization type.
CHARACTERIZATION _BYPASS	Enable and disable the curve type.
CURVE _LENGTH	The curve length of table characterization.
CURVE _X	Input points of characterization curve.
CURVE _Y	Output points of characterization curve.
CAL_POINT_HI_ BACKUP	Indicates the backup for highest calibration point.
CAL_POINT_LO_ BACKUP	Indicates the backup lowest calibration point.
CAL_POINT_HI_FACTORY	Indicates the factory for highest calibration point.
CAL_POINT_LO_FACTORY	Indicates the factory for lowest calibration point.
SETUP	Enable self-calibration.
FEEDBACK _CAL	The position value used to correct a calibration.
CAL_CONTROL	Enable and disable a calibration method.
RETURN	The actual valve position and status could be used at the READBACK_VALUE in an AO block.
POT_KP	The servo gain value by hardware.
POT_DC	The DC constant value for the piezo sensor.
MAGNET_SIZE	Features of Magnet.
ANALOG_LATCH	Analog Switch used by hardware.
MAIN_LATCH	Air to Open/Close.
DIGITAL_TEMPERATURE	The digital temperature value.
PIEZO_ANALOG_VOLTAGE	The piezo analog voltage value.
PIEZO_DIGITAL_VOLTAGE	The piezo digital voltage value.
DA_OUTPUT_VALUE	Digital analog output value.
USER_DA_CAL_POINT_HI	Digital analog value for output in a highest calibration point.
USER_DA_CAL_POINT_LO	Digital analog value for output in a lowest calibration point.
DIGITAL_HALL_VALUE	Digital Hall value.
HALL_OFFSET_CONTROL	Enable self-Offset Hall (Hall) calibration.
HALL_OFFSET	The value after done self offset Hall calibration for Hall sensor value.
ORDERING_CODE	Indicates information about the sensor and control from factory production.
TRAVEL_ENABLE	Enables the travel action
TRAVEL_DEADBAND	It's the magnitude value of the valve movement, in percent of ranged travel (full stroke), necessary to increment the Travel
TRAVEL_LIMIT	It's the value of the Travel, in
TRAVEL	It is the number of equivalent ranged travel (full stroke). The Travel value is incremented when the magnitude of the changing exceeds the Travel Dead band
REVERSAL_ENABLE	Enables the reversal action
REVERSAL_DEADBAND	It is the magnitude value of the valve movement, in percent of ranged travel, necessary to increment the Reversal
REVERSAL_LIMIT	It is the value of the Reversal, which, when exceeded, an Alert is generated. The alert is cleared by entering a new Reversal value lower than the Reversal Limit.
REVERSAL	It is the number of times the valve changes direction. The Reversal is incremented when there is a changing in the direction and the movement exceeds the Reversal Dead band.
DEVIATION_ENABLE	Enables the deviation action
DEVIATION_DEADBAND	It's the magnitude value of the valve deviation, in percent of ranged travel.
DEVIATION_TIME	It's the time in seconds, that the valve must exceed the Deviation Dead band before the alert is generated.
STROKES	It is number of the times that the valve reached its maximum and minimum position.
TIME_CLOSING	The time in seconds it took to stroke the valve from fully open to fully closed
TIME_OPENING	The time in seconds it took to stroke the valve from fully closed to fully open
HIGHEST_TEMPERATURE	Indicates the highest environment temperature
LOWEST_TEMPERATURE	Indicates the lowest environment temperature
DIAGNOSES_STATUS	Show the device status (fails and warnings)
SENSOR_PRESS_UNIT	Pressure unit

Parameter	Description
SENSOR_CAL_SELECTED	Selects between the three sensor pressure
SENSOR_CAL_POINT_HI	The highest calibrated point for the sensor pressure.
SENSOR_CAL_POINT_LO	The lowest calibrated point for the sensor pressure.
SENSOR_PRESS_IN	The reading of input sensor pressure
SENSOR_PRESS_OUT1	The reading of out1 sensor pressure
SENSOR_PRESS_OUT2	The reading of out2 sensor pressure
SENSOR_PRESS_LO_LIM	The maximum limit value for the input pressure
SENSOR_PRESS_HI_LIM	The minimum limit value for the input pressure
SENSOR_PRESS_INSTALLED	Says if there are sensor pressure installed
SENSOR_PRESS_STATUS	Show the sensor pressure status

Table 3.1 Transducer Block Parameter Description

Transducer Block Parameter Attributes

Relative Index	Parameter Mnemonic	Object Type	Data Type	Store	Size	Access	Default Value
1	ST_REV	Simple	Unsigned16	S	2	R/W	0
2	TAG_DESC	Simple	VisibleString	S	32	R/W	TRD BLOCK
3	STRATEGY	Simple	Unsigned16	S	2	R/W	0
4	ALERT_KEY	Simple	Unsigned8	S	1	R/W	0
5	MODE_BLK	Record	DS-69	S	4	R/W	O/S,AUTO
6	BLOCK_ERR	Simple	Bit String	D	2	R/W	
7	UPDATE_EVT	Record	DS-73	D	5	R/W	
8	BLOCK_ALM	Record	DS-72	D	13	R/W	
9	TRANSDUCER_DIRECTORY	Simple	Array of Unsigned16	N	Variable	R/W	
10	TRANSDUCER_TYPE	Simple	Unsigned16	N	2	R/W	65535
11	XD_ERROR	Simple	Unsigned8	D	1	R	16
12	COLLECTION_DIRECTORY	Simple	Array of Unsigned 32	S	Variable	R	
13	FINAL_VALUE	Record	DS-65	D	5	R	
14	FINAL_VALUE_RANGE	Record	DS-68	S	11	R	0.0-100.0%
15	FINAL_VALUE_CUTTOF_HI	Simple	Float	S	4	R/W	100.0%
16	FINAL VALUE_CUTTOF_LO	Simple	Float	S	4	R/W	0.0%
17	FINAL_POSITION_VALUE	Record	DS-65	D	5	XD_SCALE	0.0%
18	SERVO_GAIN	Simple	Float	S	4	None	43.0
19	SERVO_RESET	Simple	Float	S	4	FVRU/Sec	2.0
20	SERVO_RATE	Simple	Float	S	4	FVRU/sSec	0.0
21	ACT_FAIL_ACTION	Simple	Unsigned8	S	1	None	0
22	ACT_MAN_ID	Simple	Unsigned32	N	4	None	0
23	ACT_MODEL_NUM	Simple	VisibleString	N	32	None	NULL
24	ACT_SN	Simple	VisibleString	N	32	None	0
25	VALVE_MAN_ID	Simple	Unsigned32	N	4	None	0
26	VALVE_MODEL_NUM	Simple	VisibleString	N	32	None	NULL
27	VALVE_SN	Simple	VisibleString	N	32	None	0
28	VALVE_TYPE	Simple	Unsigned8	N	1	None	Linear
29	XD_CAL_LOC	Simple	VisibleString	S	32	none	NULL
30	XD_CAL_DATE	Simple	Time of Day	S	7	none	
31	XD_CAL_WHO	Simple	VisibleString	S	32	none	NULL
32	CAL_POINT_HI	Simple	Float	S	4	R/W	100.0
33	CAL_POINT_LO	Simple	Float	S	4	R/W	0.0
34	CAL_MIN_SPAN	Simple	Float	S	4	R	1.0
35	CAL_UNIT	Simple	Unsigned16	S	2	R	1342
36	CAL_METHOD	Simple	Unsigned8	S	1	R	103
37	SECONDARY_VALUE	Record	DS-65	D	5	R	0
38	SECONDARY_VALUE_UNIT	Simple	Unsigned16	S	2	R	°C(1001)
39	BACKUP_RESTORE	Simple	Unsigned8	S	1	R/W	0
40	POS_PER	Record	DS-65	D	5	R	0
41	SERVO_PID_BYPASS	Simple	Unsigned8	S	1	R/W	False
42	SERVO_PID_DEAD_BAND	Simple	Float	S	4	R/W	10.0
43	SERVO_PID_ERROR_PER	Record	DS-65	D	5	R	0

Relative Index	Parameter Mnemonic	Object Type	Data Type	Store	Size	Access	Default Value
44	SERVO_PID_INTEGRAL_PER	Record	DS-65	D	5	R	0
45	SERVO_PID_MV_PER	Record	DS-65	D	5	R	0
46	MODULE_SN	Simple	Unsigned32	N	4	R/W	0
47	COEFF_HALL_POL0	Simple	Float	S	4	R/W	35331.0
48	COEFF_HALL_POL1	Simple	Float	S	4	R/W	24999.0
49	COEFF_HALL_POL2	Simple	Float	S	4	R/W	0
50	COEFF_HALL_POL3	Simple	Float	S	4	R/W	0
51	COEFF_HALL_POL4	Simple	Float	S	4	R/W	0
52	COEFF_HALL_POL5	Simple	Float	S	4	R/W	0
53	COEFF_HALL_POL6	Simple	Float	S	4	R/W	0
54	COEFF_HALL_POL7	Simple	Float	S	4	R/W	0
55	COEFF_HALL_POL8	Simple	Float	S	4	R/W	0
56	COEFF_HALL_POL9	Simple	Float	S	4	R/W	0
57	COEFF_HALL_POL10	Simple	Float	S	4	R/W	0
58	POLYNOMIAL_HALL_VERSION	Simple	Unsigned8	S	1	R/W	0
59	USER_HALL_CAL_POINT_HI	Simple	Float	S	4	R	100.0
60	USER_HALL_CAL_POINT_LO	Simple	Float	S	4	R	0.0
61	READ_HALL_CAL_POINT_HI	Simple	Float	S	4	R	50810.0
62	READ_HALL_CAL_POINT_LO	Simple	Float	S	4	R	2400.0
63	COEFF_SENS_TEMP_POL0	Simple	Float	S	4	R/W	-70.5
64	COEFF_SENS_TEMP_POL1	Simple	Float	S	4	R/W	0.7774
65	COEFF_SENS_TEMP_POL2	Simple	Float	S	4	R/W	-0.0001072
66	COEFF_SENS_TEMP_POL3	Simple	Float	S	4	R/W	0
67	COEFF_SENS_TEMP_POL4	Simple	Float	S	4	R/W	0
68	POLYN_SENS_TEMP_VERSION	Simple	Unsigned8	S	1	R/W	10H
69	CAL_TEMPERATURE	Simple	Float	S	4	R/W	25.0
70	CAL_DIGITAL_TEMPERATURE	Simple	Float	S	4	R	125.606
71	CHARACTERIZATION_TYPE	Simple	Unsigned8	S	1	R/W	255
72	CHARACTERIZATION _BYPASS	Simple	Unsigned8	S	1	R/W	False
73	CURVE _LENGTH	Simple	Unsigned8	S	1	R/W	8
74	CURVE _X	Simple	Array of Float	S	21	R/W	
75	CURVE _Y	Simple	Array of Float	S	21	R/W	
76	CAL_POINT_HI_ BACKUP	Simple	Float	S	4	R	100.0
77	CAL_POINT_LO_ BACKUP	Simple	Float	S	4	R	0.0
78	CAL_POINT_HI_FACTORY	Simple	Float	S	4	R	100.0
79	CAL_POINT_LO_FACTORY	Simple	Float	S	4	R	0.0
80	SETUP	Simple	Unsigned8	N	1	R/W	Disable
81	FEEDBACK _CAL	Simple	Float	S	4	R/W	0
82	CAL_CONTROL	Simple	Unsigned8	S	1	R/W	Disable
83	RETURN	Record	DS-65	D	5	R	0
84	POT_KP	Simple	Unsigned8	S	1	R	
85	POT_DC	Simple	Unsigned8	S	1	R/W	128
86	MAGNET_SIZE	Simple	Unsigned8	S	1	R/W	
87	ANALOG_LATCH	Simple	Unsigned8	S	1	R/W	12
88	MAIN_LATCH	Simple	Unsigned8	S	1	R/W	
89	DIGITAL_TEMPERATURE	Record	DS-65	D	5	R	0
90	PIEZO_ANALOG_VOLTAGE	Record	DS-65	D	5	R	0
91	PIEZO_DIGITAL_VOLTAGE	Record	DS-65	D	5	R	0
92	DA_OUTPUT_VALUE	Record	DS-65	D	5	R	0
93	USER_DA_CAL_POINT_HI	Record	Float	S	4	R	12000
94	USER_DA_CAL_POINT_LO	Record	Float	S	4	R	4000
95	DIGITAL_HALL_VALUE	Simple	Unsigned16	D	2	R	0
96	HALL_OFFSET_CONTROL	Simple	Unsigned8	D	1	R/W	Disable
97	HALL_OFFSET	Simple	float	D	4	R	0
98	ORDERING_CODE	Simple	Array of Unsigned8	S	50	R/W	NULL
99	TRAVEL_ENABLE	Simple	Unsigned8	S	1	R/W	False
100	TRAVEL_DEADBAND	Simple	Float	S	4	R/W	0
101	TRAVEL_LIMIT	Simple	Float	S	4	R/W	0
102	TRAVEL	Simple	Float	D	4	R/w	0
103	REVERSAL_ENABLE	Simple	Unsigned8	S	1	R/W	False
104	REVERSAL_DEADBAND	Simple	Float	S	4	R/W	0
105	REVERSAL_LIMIT	Simple	Float	S	4	R/W	0
106	REVERSAL	Simple	Float	D	4	R/w	0
107	DEVIATION_ENABLE	Simple	Unsigned8	S	1	R/W	False
108	DEVIATION_DEADBAND	Simple	Float	S	4	R/W	0

Relative Index	Parameter Mnemonic	Object Type	Data Type	Store	Size	Access	Default Value
109	DEVIATION_TIME	Simple	Float	S	4	R/W	0
110	STROKES	Simple	Float	D	4	R/W	0
111	TIME_CLOSING	Simple	Float	S	4	R/W	0
112	TIME_OPENING	Simple	Float	S	4	R/W	0
113	HIGHEST_TEMPERATURE	Simple	Float	S	4	R/W	0
114	LOWEST_TEMPERATURE	Simple	Float	S	4	R/W	0
115	DIAGNOSES_STATUS	Simple	Unsigned8	D	1	R/W	0
116	SENSOR_PRESS_UNIT	Simple	Unsigned16	S	2	R/W	psi
117	SENSOR_CAL_SELECTED	Simple	Unsigned8	S	1	R/W	input
118	SENSOR_CAL_POINT_HI	Simple	Float	S	4	R/W	100
119	SENSOR_CAL_POINT_LO	Simple	Float	S	4	R/W	0
120	SENSOR_PRESS_IN	Record	DS-65	D	5	R	0
121	SENSOR_PRESS_OUT1	Record	DS-65	D	5	R	0
122	SENSOR_PRESS_OUT2	Record	DS-65	D	5	R	0
123	SENSOR_PRESS_LO_LIM	Simple	Float	S	4	R/W	0
124	SENSOR_PRESS_HI_LIM	Simple	Float	S	4	R/W	100
125	SENSOR_PRESS_INSTALLED	Simple	Unsigned8	N	1	R/W	Not Installed
126	SENSOR_PRESS_STATUS	Simple	Unsigned8	D	1	R/W	0

Table 3.2 Transducer Blocks Parameter Attributes

Transducer Block View Object

Relative Index	Parameter Mnemonic	View_1	View_2	View_3	View_4
1	ST_REV	2	2	2	2
2	TAG_DESC				
3	STRATEGY				2
4	ALERT_KEY				1
5	MODE_BLK	4		4	
6	BLOCK_ERR	2		2	
7	UPDATE_EVT				
8	BLOCK_ALM				
9	TRANSDUCER_DIRECTORY				
10	TRANSDUCER_TYPE	2	2	2	2
11	XD_ERROR	1		1	
12	COLLECTION_DIRECTORY				
13	FINAL_VALUE	5		5	
14	FINAL_VALUE_RANGE		11		
15	FINAL_VALUE_CUTTOF_HI				4
16	FINAL VALUE_CUTTOF_LO				4
17	FINAL_POSITION_VALUE	5		5	
18	SERVO_GAIN				4
19	SERVO_RESET				4
20	SERVO_RATE				4
21	FAIL_ACTION				
22	MAN_ID				
23	ACT_MODEL_NUM				
24	ACT_SN				
25	VALVE_MAN_ID				
26	VALVE_MODEL_NUM				
27	VALVE_SN				
28	VALVE_TYPE				1
29	XD_CAL_LOC				
30	XD_CAL_DATE				
31	XD_CAL_WHO				
32	CAL_POINT_HI		4		4
33	CAL_POINT_LO		4		4
34	CAL_MIN_SPAN				
35	CAL_UNIT				
36	CAL_METHOD				
37	SECONDARY_VALUE	5		5	
38	SECONDARY_VALUE_UNIT		2		
39	BACKUP_RESTORE				1

Relative Index	Parameter Mnemonic	View_1	View_2	View_3	View_4
40	POS_PER			5	
41	SERVO_PID_BYPASS		1		1
42	SERVO_PID_DEAD_BAND				4
43	SERVO_PID_ERROR_PER			5	4
44	SERVO_PID_INTEGRAL_PER			5	
45	SERVO_PID_MV_PER			5	
46	MODULE_SN				4
47	COEFF_HALL_POL0				4
48	COEFF_HALL_POL1				4
49	COEFF_HALL_POL2				
50	COEFF_HALL_POL3				
51	COEFF_HALL_POL4				
52	COEFF_HALL_POL5				
53	COEFF_HALL_POL6				
54	COEFF_HALL_POL7				
55	COEFF_HALL_POL8				
56	COEFF_HALL_POL9				
57	COEFF_HALL_POL10				
58	POLYNOMIAL_HALL_VERSION				
59	USER_HALL_CAL_POINT_HI				
60	USER_HALL_CAL_POINT_LO				
61	READ_HALL_CAL_POINT_HI				4
62	READ_HALL_CAL_POINT_LO				4
63	COEFF_SENS_TEMP_POL0				
64	COEFF_SENS_TEMP_POL1				
65	COEFF_SENS_TEMP_POL2				
66	COEFF_SENS_TEMP_POL3				
67	COEFF_SENS_TEMP_POL4				
68	POLYNOMIAL_SENS_TEMP_VERSION				
69	CAL_TEMPERATURE				
70	CAL_DIGITAL_TEMPERATURE			5	
71	CHARACTERIZATION_TYPE		1		
72	CHARACTERIZATION _BYPASS		1		
73	CURVE _LENGTH		1		
74	CURVE _X				
75	CURVE _Y				
76	CAL_POINT_HI_ BACKUP		4		
77	CAL_POINT_LO_ BACKUP		4		
78	CAL_POINT_HI_FACTORY				
79	CAL_POINT_LO_FACTORY				
80	SETUP				
81	FEEDBACK _CAL				4
82	CAL_CONTROL				1
83	RETURN			5	
84	POT_KP			4	
85	POT_DC			4	
86	MAGNET_SIZE				
87	ANALOG_LATCH				1
88	MAIN_LATCH				
89	DIGITAL_TEMPERATURE			5	
90	PIEZO_ANALOG_VOLTAGE			5	
91	PIEZO_DIGITAL_VOLTAGE			5	
92	DA_OUTPUT_VALUE			5	
93	USER_DA_CAL_POINT_HI				4
94	USER_DA_CAL_POINT_LO				4
95	DIGITAL_HALL_VALUE			5	
96	HALL_OFFSET_CONTROL				1
97	HALL_OFFSET				4
98	ORDERING_CODE				
99	TRAVEL_ENABLE				
100	TRAVEL_DEADBAND				
101	TRAVEL_LIMIT				
102	TRAVEL				
103	REVERSAL_ENABLE				
104	REVERSAL_DEADBAND				
105	REVERSAL_LIMIT				
106	REVERSAL				

Relative Index	Parameter Mnemonic	View_1	View_2	View_3	View_4
107	DEVIATION_ENABLE				
108	DEVIATION_DEADBAND				
109	DEVIATION_TIME				
110	STROKES				
111	TIME_CLOSING				
112	TIME_OPENING				
113	HIGHEST_TEMPERATURE				
114	LOWEST_TEMPERATURE				
115	DIAGNOSES_STATUS				
116	SENSOR_PRESS_UNIT				
117	SENSOR_CAL_SELECTED				
118	SENSOR_CAL_POINT_HI				
119	SENSOR_CAL_POINT_LO				
120	SENSOR_PRESS_IN				
121	SENSOR_PRESS_OUT1				
122	SENSOR_PRESS_OUT2				
123	SENSOR_PRESS_LO_LIM				
124	SENSOR_PRESS_HI_LIM				
125	SENSOR_PRESS_INSTALLED				
126	SENSOR_PRESS_STATUS				
	TOTALS	26	37	89	85

Table 3.3 Transducer Block View Object

How to Configure a Transducer Block

The transducer block has an algorithm and a set of contained parameters.

The algorithm describes the behavior of the transducer as a data transfer function between the I/O hardware and other function block. The set of contained parameters, it means, you are not able to link them to other blocks and publish the link via communication, defines the user interface to the transducer block. They can be divided into Standard and Manufacturer Specific.

The standard parameters will be present for such class of device, as pressure, temperature, actuator, etc., whatever is the manufacturer. Oppositely, the manufacturers specific ones are defined only for its manufacturer. As common manufacturer specific parameters, we have calibration settings, material information, linearization curve, etc.

When you perform a standard routine as a calibration, you are conducted step by step by a method. The method is generally defined as guide line to help the user to make common tasks. The SYSCON identifies each method associated to the parameters and enables the interface to it.

Auto-Setup

This process is necessary to find the position values at which the valve is considered fully open or close. This operation can be done using the **SYSCON** or the Local Adjustment. The **SP302** automatically finds the fully open and closed positions of a valve, but the user may also set a narrower range of operation should he like to. Before making the Auto-Setup, select the type of valve through the parameter VALVE_TYPE choosing between "Linear or Rotary" options.

The setup operation can be started writing "Enable" on the parameter SETUP, so the positioner will execute immediately the operation of auto-setup for approximately 2 to 5 minutes depending on the type of valve, other configured parameters and function blocks used in the positioner.

The process will be finished when the SETUP parameter will indicate "Disable" automatically during the operation of reading.

NOTE
This operation should be performed off-line or with the process shut down to be sure that the plant operation is not disturbed, due the valve will be moved between the fully open and close points in order to reach the better adjustment.

After the AUTO-SETUP operation the user should adjust the ZERO and SPAN positions, writing on the parameters CAL_POINT_LO and CAL_POINT_HI.

NOTE

In case of oscillation, decrease the gain of valve, acting on the SERVO_GAIN parameter.
If the valve could be out-of-control after its operation, please, repeat the Auto-Setup operation again.

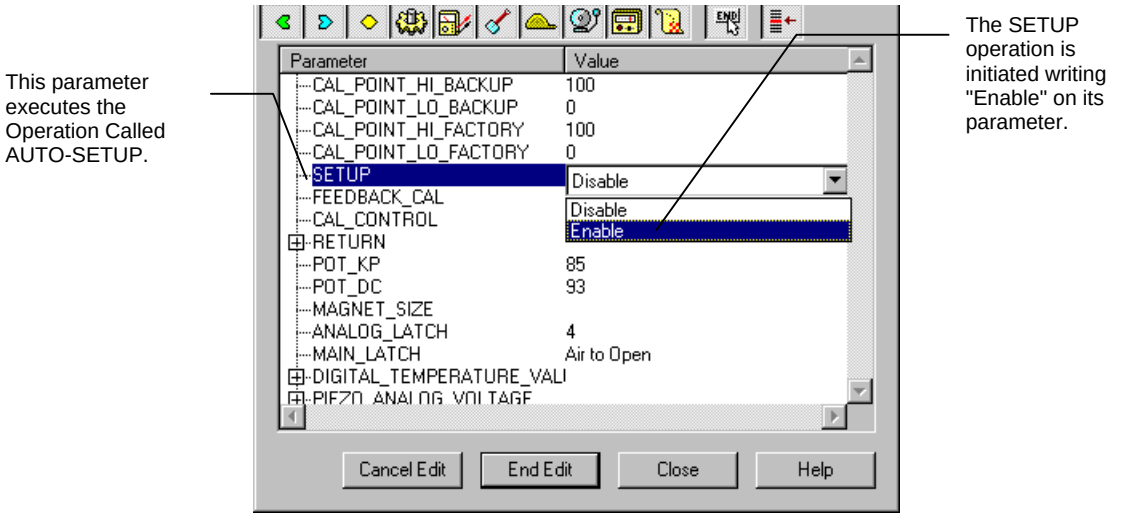


Figure 3.2 - Enabling the Auto-Setup Operation

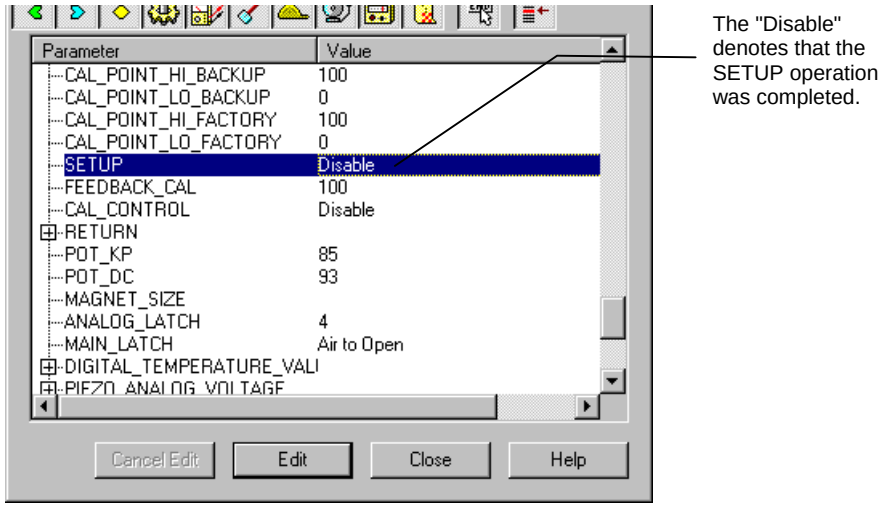


Figure 3.3 - Disabling the Auto-Setup Operation

The setup progress can be followed by watching the parameters SETUP_PROGRESS. It goes from 0 to 100%.

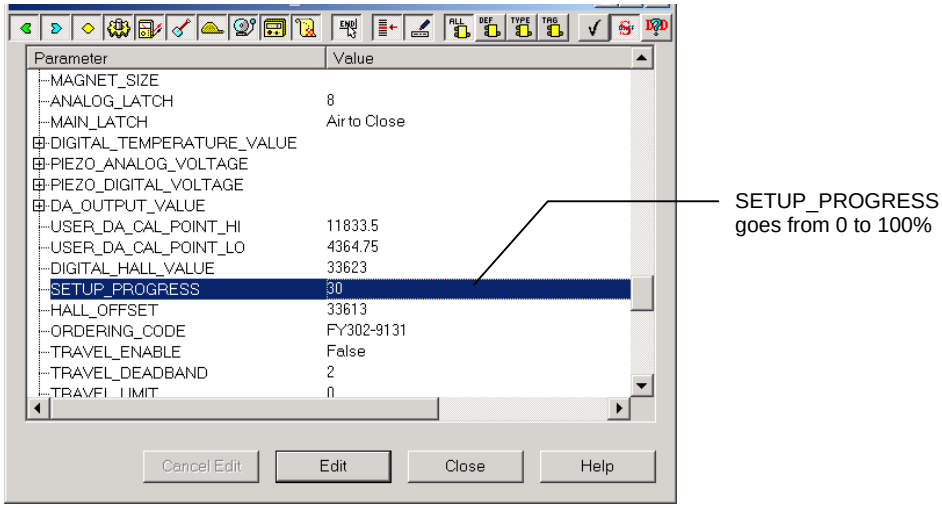


Figure 3.4 - Setup Progress

The setup process stuck sometimes because of wrong parameter configuration or a problem in the positioner assembly. Bellow there is a list of the maintenance procedure according to the SETUP_PROGRESS value.

Setup Progress	*Probably Problem Cause*
40%	No air supply, spool stuck or lower proportional value
60%	Lower proportional value (SERVO_GAIN)
70%	Higher proportional value (SERVO_GAIN)
80%	Higher proportional value (SERVO_GAIN)

Also the display positioner can show some error messages.

Display Message	*Probably Problem Cause*
Fail Press	No air supply, spool stuck or lower proportional value
Fail Mgnt	No magnet installed or it was not well assembly
Fail Hall	Problem with Hall sensor or flat cable disconnected

Calibration

It is a specific method to make the calibration operation. It is necessary to match the source of reference applied to or connected to the device with the desired value. At least four parameters should be used to configure this process: CAL_POINT_HI, CAL_POINT_LO, CAL_MIN_SPAN, and CAL_UNIT. Those parameters define the highest and lowest calibrated values for this device, the minimum allowable span value for calibration (if necessary) and the engineering unit selected for calibration purposes.

NOTE
98% of the valves after setup process are well calibrated, therefore the calibration is not necessary.

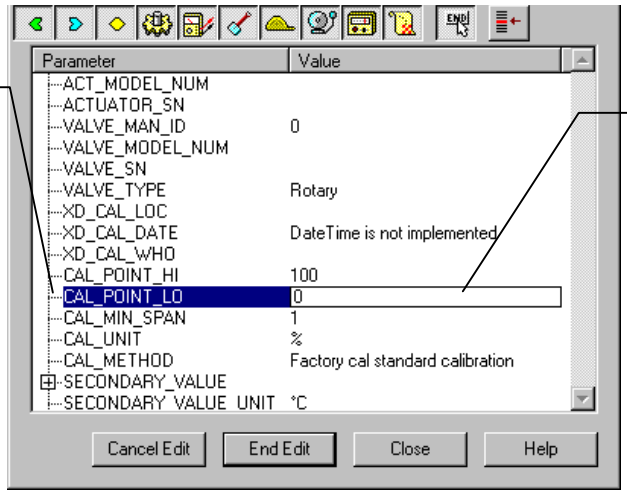
Position Trim

Via SYSCON

It is possible to calibrate the positioner by means of parameters CAL_POINT_LO and CAL_POINT_HI.

Let's take the lower value as an example:
Write 0% in parameter CAL_POINT_LO. For **SP302** it should be always 0%.
Simply by writing in this parameter, the trim procedure is initialized.

This parameter indicates where the positioner should be when the setpoint lower value is 0%.

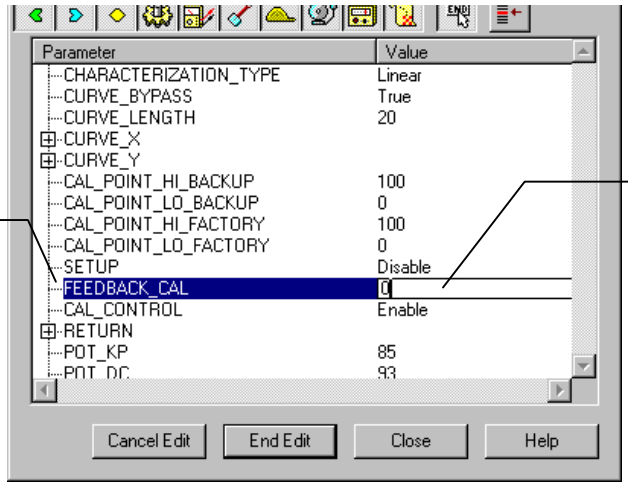


The desired value should be entered.

Figure 3.5 - Calibrating Low Range Value Point

Check the position showed in the local indicator and if it is different of 0% write it in the parameter FEEDBACK_CAL. Repeat this operation until it reads 0%.

This parameter should be set with the actual position of valve during the calibration procedure.



The value should be entered here. Note that its value can be a negative number depending on the actual position of valve.

Figure 3.6 - Calibrating of Trim 0%

You should finalize the calibration method writing "Disable" in the parameter CAL_CONTROL.

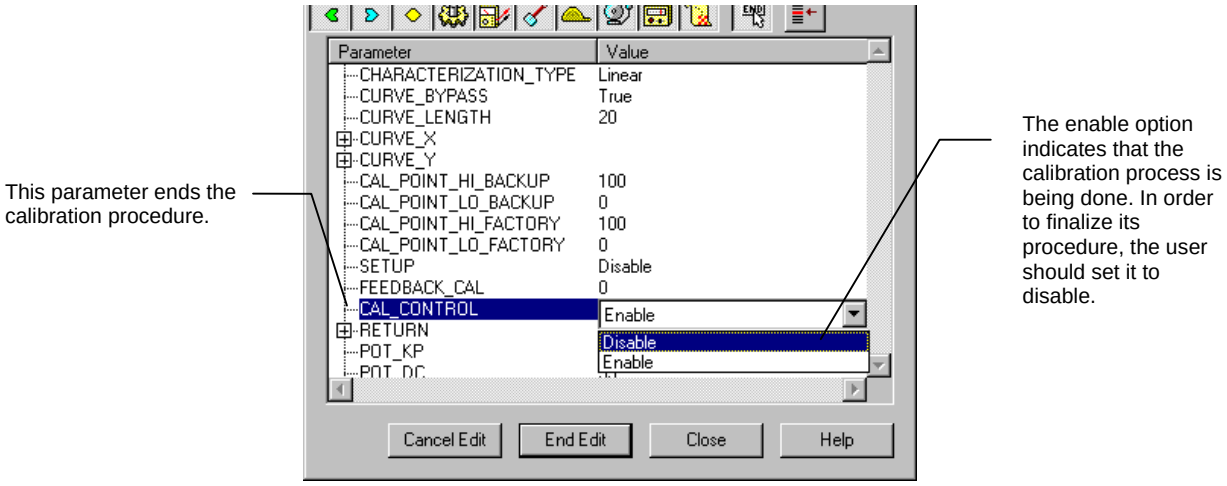


Figure 3.7 – Ending Finishing Calibration Procedure

For the upper value, for example:
Write 100% in parameter CAL_POINT_HI. For **SP302** it should be always 100%.
Always keep in mind that, simply by writing in this parameter, the trim procedure is initialized.

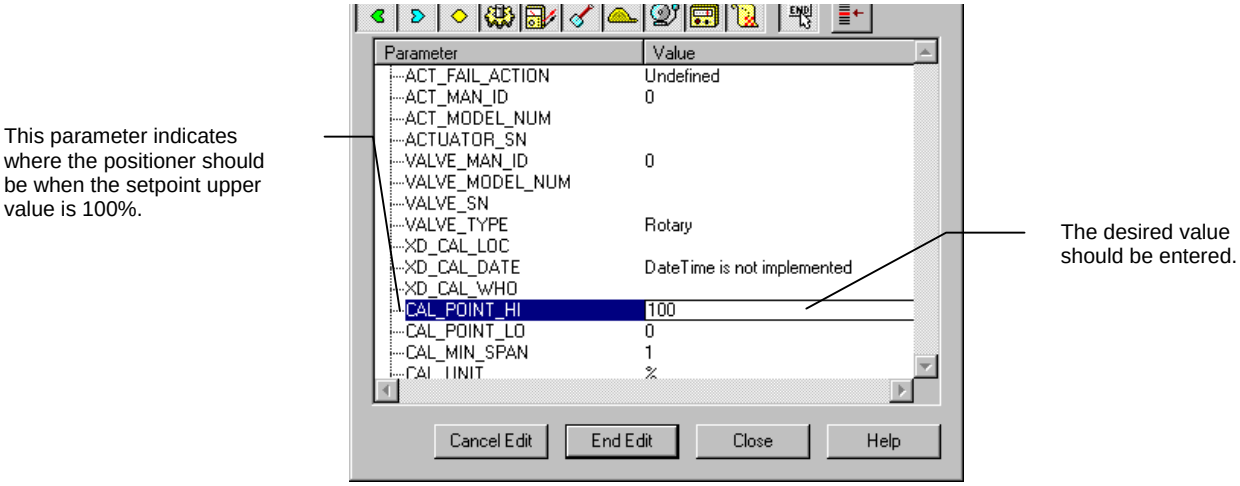
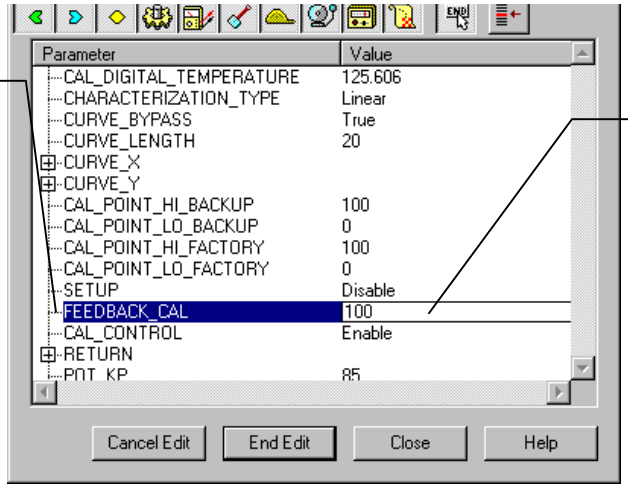


Figure 3.8 - Calibrating High Range Value Point

Check the position showed on the local indicator and if it is different of 100% write it in the parameter FEEDBACK_CAL. Repeat this operation until it reads 100%.

This parameter should be set with the actual position of valve during the calibration procedure.

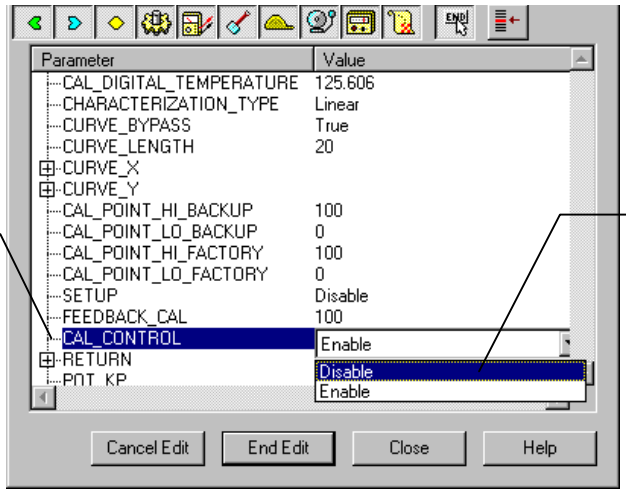


The value should be entered here. Note that its value is a positive value only and indicates the actual valve position.

Figure 3.9 - Calibrate of Trim 100%

In order to end the trim procedure, select disable in parameter CAL_CONTROL

This parameter ends the calibration procedure.



The enable option indicates that the calibration process is being done. In order to finalize its procedure, the user should set it to disable.

Figure 3.10 - Ending the Trim procedure

NOTE

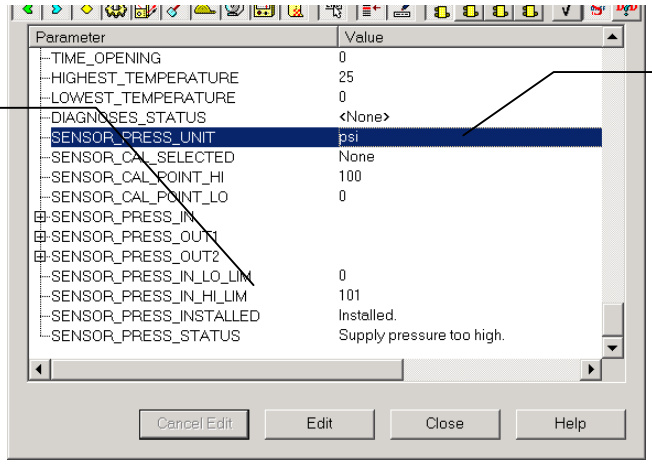
It is convenient to choose the unit to be used in parameter XD_SCALE of the Analog Output Block, considering that positioner limits shall be observed, it means 0% and 100%.

It is also recommendable, for every new calibration, to save the existing trim data in the parameters CAL_POINT_LO_BACKUP and CAL_POINT_HI_BACKUP, by means of parameter BACKUP_RESTORE, using option LAST_CAL_ BACKUP.

Sensor Pressure

Some positioner SP302 has three sensors that work individually to monitor input and output pressures. Those pressure values can be used by a maintenance supervisory system, such as Asset View, for diagnosis procedure.
.

If the input pressure is outside this range an alarm will appears in the SENSOR_PRESS_STATUS

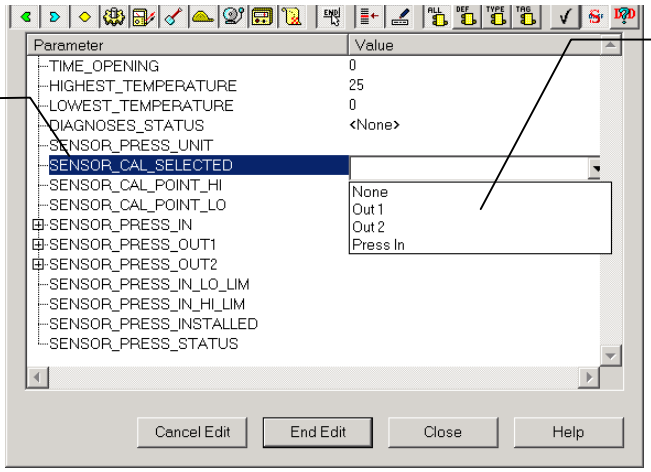


Sensor Pressure unit can be: atm, bar, ftH20(68°F),g/cm2, inH20(4°C), in H20(68°F), in Hg(0°C), Kg/cm2, kPa, mbar, mmH20(4°C), mm 20(68°F), mmHg(0°C), psi, Mpa, Pa, torr

Figure 3.11 - Sensor Pressure Parameters

The sensor pressure trim is done through the SENSOR_CAL_SELECTED, SENSOR_CAL_POINT_HI and SENSOR_CAL_POINT_LO parameters.
The SENSOR_CAL_SELECTED allow to choose among the three pressure sensor (input, out1 and out2). After the sensor selection the calibration is done using two points, one can be without pressure (CAL_POINT_LO) and the other using the system pressure.
In order to make a good calibration, the valve should be opened totally (out1 with maximum pressure) for the sensor out1 trim and the valve should be closed totally (out2 with maximum pressure_ for sensor out2 trim.

Enter here the measured pressure



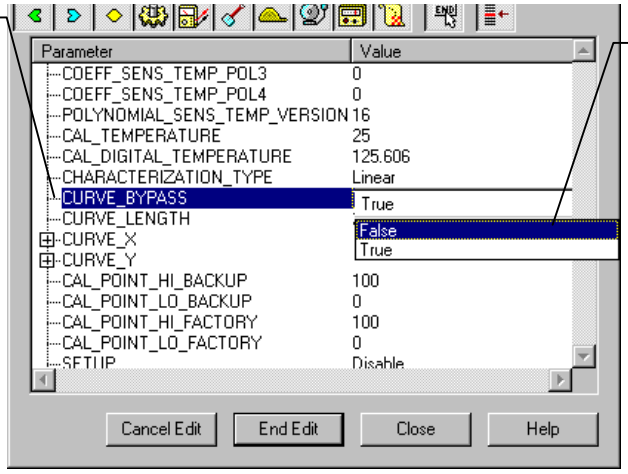
Select here the sensor for trim.

Figure 3.12 - Sensor Pressure Trim

Flow Characterization

The desired flow characteristics may be changed using this function. E.g. If a valve with linear inherent flow characteristic is used and equal percentage applied flow characteristic is selected, the valve will be act as an equal percentage valve.
The adjacent number is the rangeability of the valve. The rangeability of the valve may be found in the manufacturer's documentation. The options for applied flow characterization are: **LINEAR, TABLE , EP25, EP33, EP50, QO25, QO33, QO50**

The user can select the best flow characterization curve for each type of valve.



The value of “False” indicates that the Flow Characterization curve is enabled.

Figure 3.13 - Choosing the Flow Characterization Curve

In case of flow characterization selected to be TABLE, the user can configure up to 20 points in percentage. The number of points should be configured writing the parameter CURVE_LENGTH and its curve can be enabled by writing on the parameter CURVE_BYPASS.

The equation resulting from its curve is:

Y[%] = (100*(X[%]/100))/(L+(1-L)*(X[%]/100)),

Where:

Y[%] = Value after the flow characterization curve calculation and X[%] = Position value before entering in the curve calculation.

L = Characterization Factor

TIPO	L
LINEAR	1.0
EP25	3.5
EP33	4.1
EP50	5.1
QO25	0.27
QO33	0.24
QO50	0.19

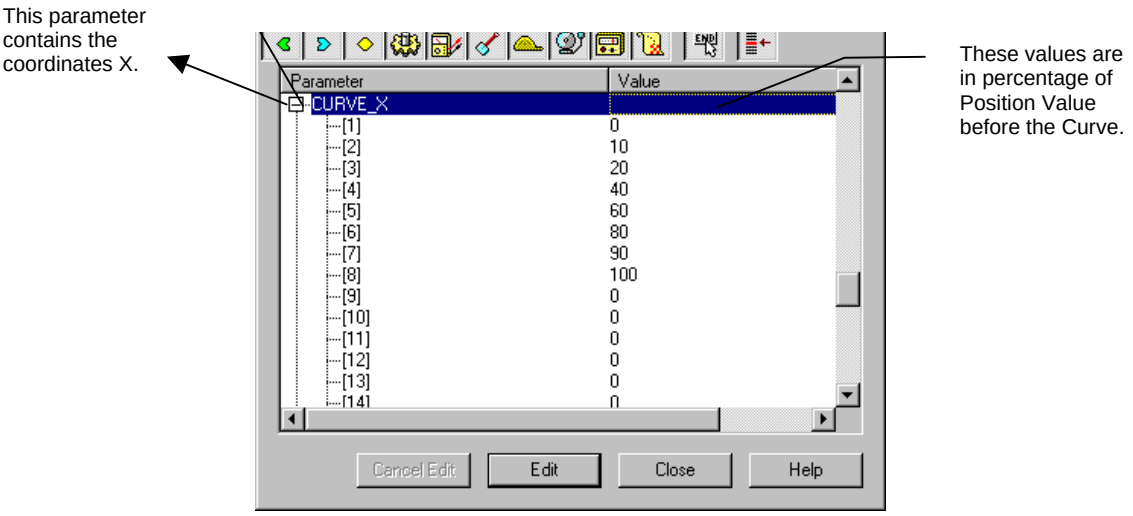


Figure 3.14 - Configuring the Table for Flow Characterization - X points

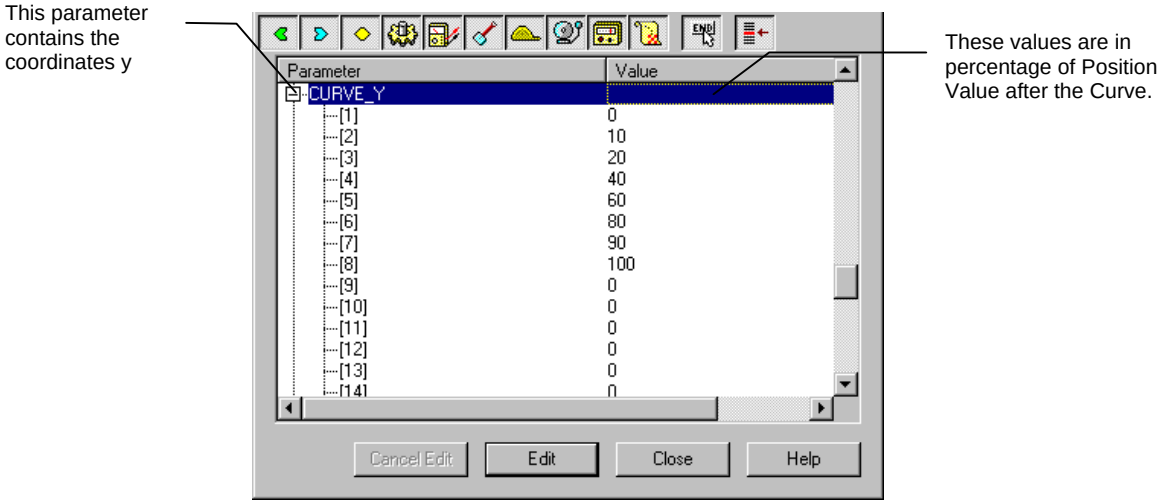


Figure 3.15 - Configuring the Table for Flow Characterization - Y points

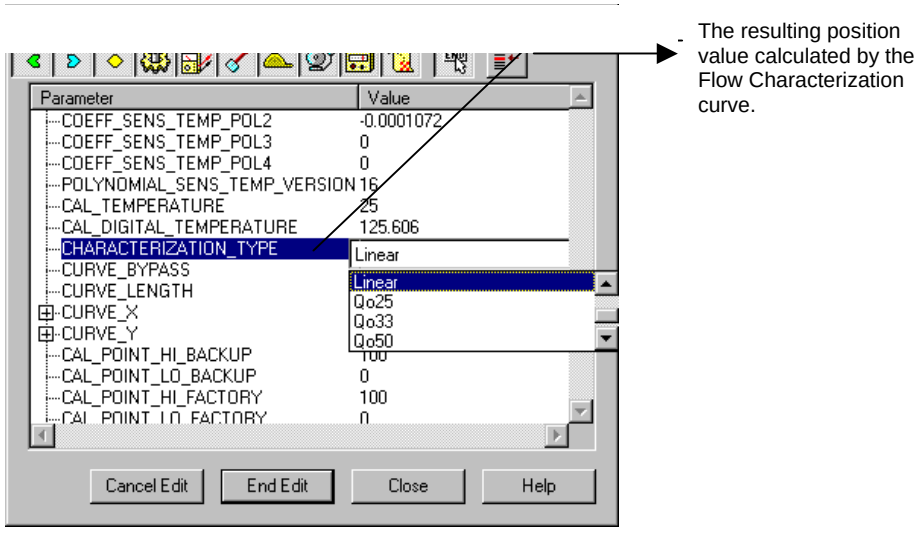


Figure 3.16 - Enabling the Flow Characterization of Type Table

Temperature Calibration

The parameter CAL_TEMPERATURE can be used to trim the temperature sensor located at the body of positioner in order to improve the accuracy of temperature measurement done by its sensor. The range accepts from -40°C to +85 °C. The parameter SECONDARY_VALUE indicates the value of such measurement.

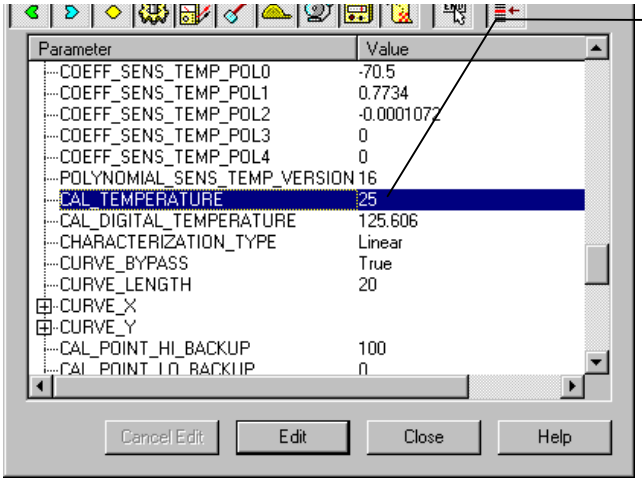


Figure 3.17 - Calibrating the Temperature Sensor

Display Transducer Block

The local adjustment is completely configured by SYSCON. It means the user can select the best options to fit his application. From factory, it is configured with the options to set the Upper and Lower trim, for monitoring the input transducer output and check the Tag. Normally, the transmitter is much better configured by SYSCON, but the local functionality of the LCD permits an easy and fast action on certain parameters, since it does not rely on communication and network wiring connections. Among the possibilities by Local Adjustment, the following options can be emphasized: Mode block, Outputs monitoring, Tag visualization and Tuning Parameters setting.

The interface between the users is described very detailed on the "General Installation, Operation and Maintenance Procedures Manual". Please, read carefully at this manual in the chapter related to "Programming Using Local Adjustment". It is significantly the resources on this transducer display, also all the Series 302 field devices from SPIRAX SARCO have the same methodology to handle with it. So, since the user has learned once, he is capable to handle all kind of field devices from SPIRAX SARCO.

All function block and transducers defined according Foundation Fieldbus™ have a description of their features written on binary files, by the Device Description Language. This feature permits that third parties configurator enabled by Device Description Service technology can interpret these features and make them accessible to configure. The Function Blocks and Transducers of Series 302 have been defined rigorously according the Foundation Fieldbus specifications in order to be interoperable to other parties.

In order to enable the local adjustment using the magnetic tool, it is necessary to previously prepare the parameters related with this operation via **SYSCON** (System Configuration).

The Figure 3.18 - Parameters for Local Adjustment Configuration and the Figure 3.19 - Parameters for Local Adjustment Configuration show all parameters and their respective values, which shall be configured in accordance with then necessity of being locally adjusted by means of the magnetic tool. All values shown on the display are default values.

There are seven groups of parameters, which may be pre-configured by the user in order to enable, a possible configuration by means of the local adjustment. As an example, let's suppose that you don't want to show some parameters; in this case, simply write an invalid Tag in the parameter, Block_Tag_Param_X. Doing this, the device will not take the parameters related (indexed) to its Tag as a valid parameters.

Definition of Parameters and Values

Block_Tag_Param
This is tag of the block to which the parameter belongs. Use up to a maximum of 32 characters.

Index_Relative
This is the index related to the parameter to be actuated or viewed (0, 1, 2…). Refer to the Function Blocks Manual to know the desired indexes, or visualize them on the **SYSCON** opening the desired block.

Sub_Index
In case you want to visualize a certain tag, opt for the index relative equal to zero, and for the sub-index equal to one (refer to paragraph Structure Block in the Function Blocks Manual).

Mnemonic
This is the mnemonic for the parameter identification (it accepts a maximum of 16 characters in the alphanumeric field of the display). Choose the mnemonic, preferably with no more than 5 characters because, this way, it will not be necessary to rotate it on the display.

Inc_Dec
It is the increment and decrement in decimal units when the parameter is Float or Float Status type, or integer, when the parameter is an integer type.

Decimal_Point_Numb.
This is the number of digits after the decimal point (0 to 3 decimal digits).

Access
The access allows the user to read, in the case of the “Monitoring” option, and to write when "Action" option is selected, then the display will show the increment and decrement arrows.

Alpha_Num
These parameters include two options: value and mnemonic. In option value, it is possible to display data both in the alphanumeric and in the numeric fields; this way, in the case of a data higher than 10000, it will be shown in the alphanumeric field.
In option mnemonic, the display may show the data in the numeric field and the mnemonic in the alphanumeric field.

In case you wish to visualize a certain tag, opt for the index relative equal to zero, and for the sub-index equal to one (refer to paragraph Structure Block in the Function Blocks Manual).

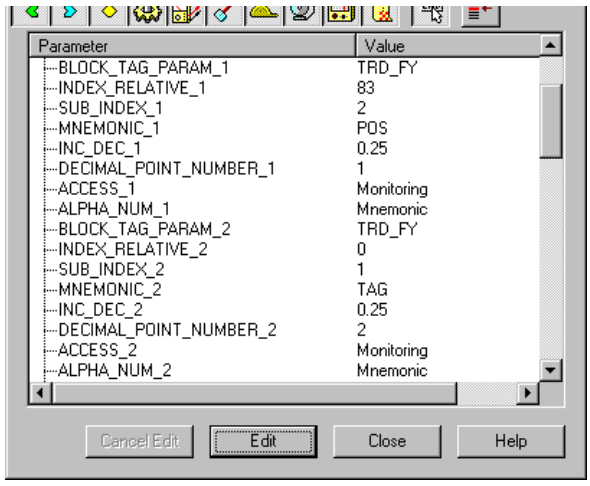


Figure 3.18 - Parameters for Local Adjustment Configuration

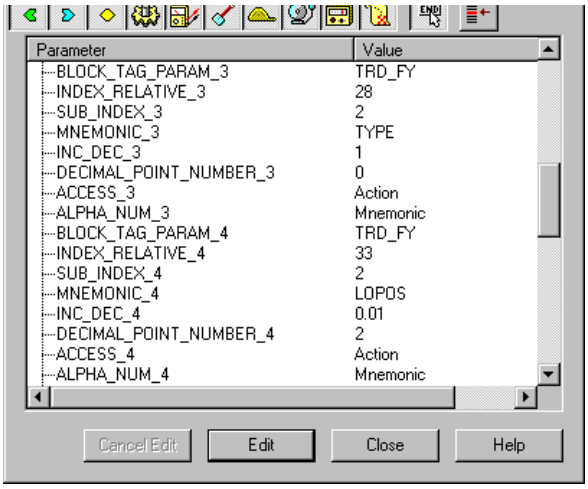


Figure 3.19 - Parameters for Local Adjustment Configuration

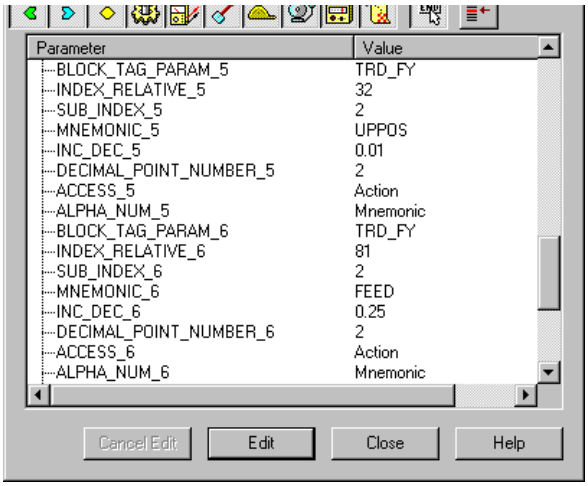
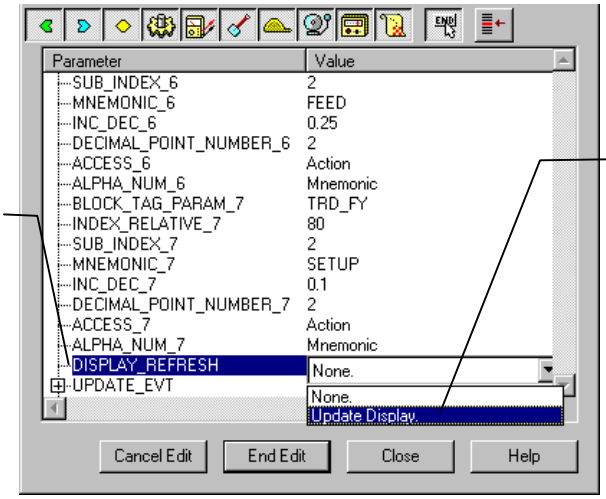


Figure 3.20 - Parameters for Local Adjustment Configuration

This parameter updates the local adjustment programmning tree configured on each device.



The option “update” should be selected in order to execute the update of local adjustment programming tree. After its operation all the parameters selected will be shown on the LCD display.

Figure 3.21 - Parameters for Local Adjustment Configuration

Calibrating Via Local Adjustment

The positioner has two holes for magnetic switches, located under the identification plate (See the section "*Programming Using Local Adjustment*"). These magnetic switches are activated by one magnetic tool.

This magnetic tool enables adjustment of the most important parameters of the blocks. It also enables pre-configuration of the communication.

The jumper J1 on top of the main circuit board must be in place and the positioner must be fitted with the digital display for access to the local adjustment. Without the display the local adjustment is not possible.

In order to calibrate via Local Adjustment some parameters has to be previous configured. They are:

Parametro (Nome)	Parametro (Índice Relativo)	Item(Elemento)	Mnemônicc
CAL_POINT_LO	33	--	LOPOS
CAL_POINT_HI	32	--	UPPOS
FEEDBACK_CAL	81	--	FEED
SETUP	80	--	SETUP

To enter the local adjustment mode, place the magnetic tool in orifice “Z” until flag “MD” lights up in the display. Removes magnetic tool from “Z” and place it in orifice “S”. Remove and reinsert the magnetic tool in “S” until the message “LOC ADJ” is displayed.
The message will be displayed during approximately 5 seconds after the user removes the magnetic tool from “S”. By placing the magnetic tool in “Z” the user will be able to access the local adjustment/monitoring tree.

Browse to parameter “LOPOS”. After that in order to start the calibration, the user shall activate parameter “LOPOS” with the help of the magnetic tool placed in “S”. For example, it is possible to enter 0%. When the magnetic tool is removed from “S”, the output will be set to a value close to the desired value. The user shall then browse the tree up to parameter FEED (FEEDBACK_CAL), and actuate this parameter by placing the magnetic tool in “S” until reaching the value obtained from the position reference.

The user shall continue to write in this parameter until it reads 0% or the desired lower position value. Browse up to parameter “UPPOS”. After that, in order to start the calibration, the user shall actuate parameter “UPPOS” by placing the magnetic tool in “S”. For example, it is possible to enter 100%. When the magnetic tool is removed from “S”, the output will be set to a value close to the desired value. The user shall them browse the tree up to parameter FEED (FEEDBACK_CAL), and actuate this parameter by placing the magnetic tool in “S” until reaching the desired value.

The user shall write in this parameter until it reads 100% or the desired upper position value.
The LOWER and UPPER should be different.

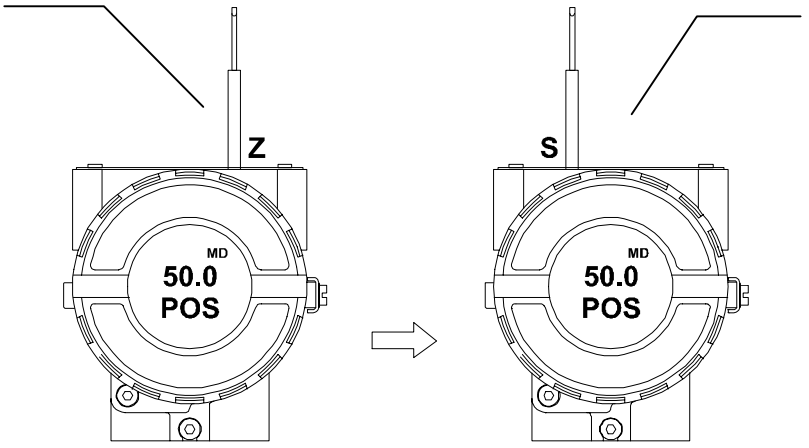
LIMIT CONDITIONS OF CALIBRATION	
LOPOS (Lower Position)	Always equal 0%
UPPOS (Upper Position)	Always equal 100%
FEED	- 10% =< FEED =< 110%, otherwise XD_ERROR = 22

NOTE

Codes for XD_ERROR:
16: Default Value Set
22: Out of Range
26: Invalid Calibration Request
27: Excessive Correction

Programming Using Local Adjustment

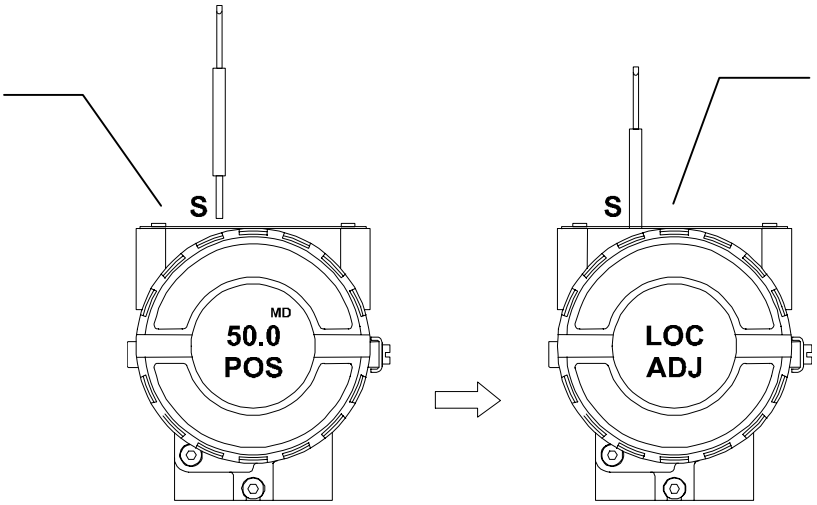
In order to start the local adjustment, place the magnetic tool in orifice **Z** and wait until letters MD are displayed.



Place the magnetic tool in orifice **S** and wait during 5 seconds.

Figure 3.22 - Step 1 - SP302

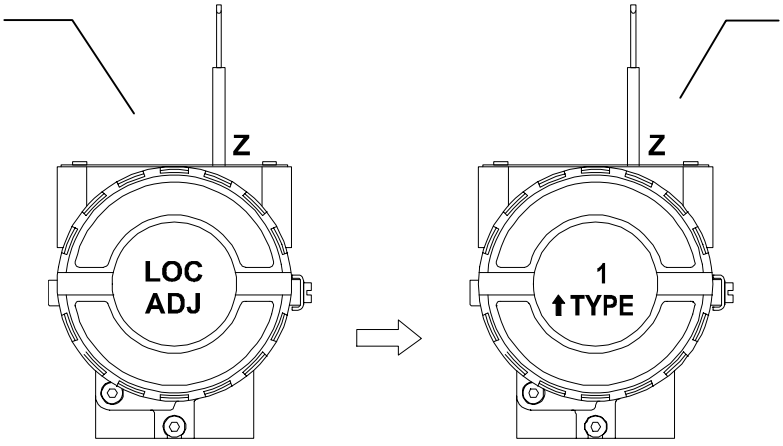
Remove the magnetic tool from orifice **S**.



Insert the magnetic tool in orifice **S** once more and **LOC ADJ** should be Displayed.

Figure 3.23 - Step 2 – SP302

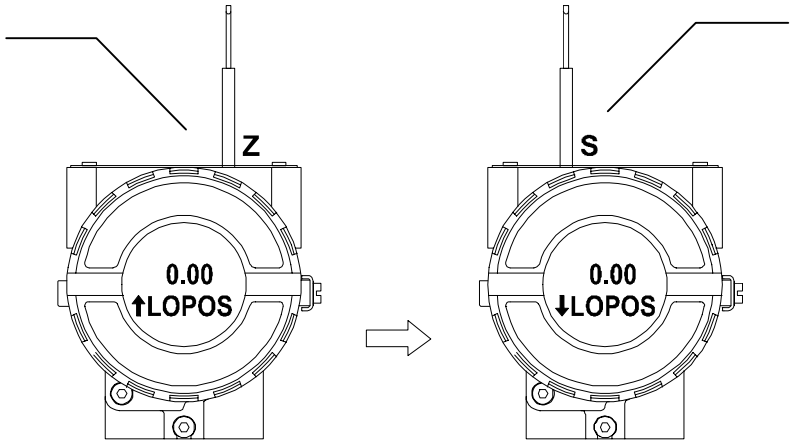
Place the magnetic tool in orifice **Z**. In case this is the first configuration, the option shown on the display is the TAG with its corresponding mnemonic configured by the SYSCOM. Otherwise, the option shown on the display will be the one configured in the prior operation. By keeping the tool inserted in this orifice, the local adjustment menu will rotate.



In this option TYPE, is indicated by the numbers 1 or 2, which respectively represent Linear or Rotary valves.

Figure 3.24 - Step 3 - SP302

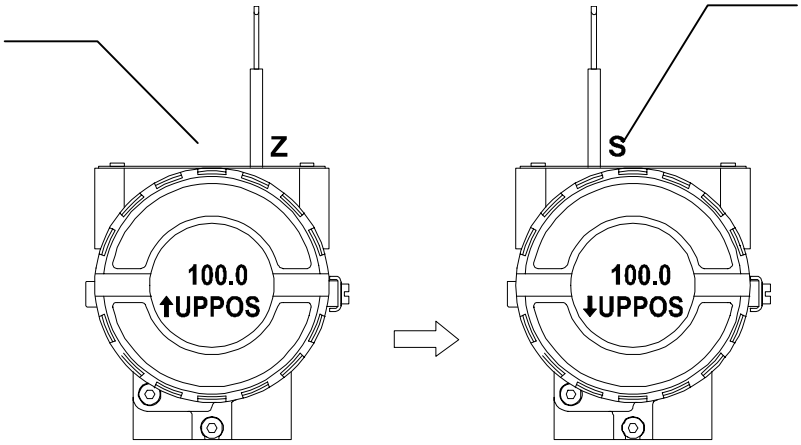
In order to start the LOPOS, simply insert the magnetic tool in orifice **S** as soon as LOPOS is shown on the display. An arrow pointing upward (↑) increments the valve and an arrow pointing downward (↓) decrements the valve. In order to increment the lower position valve, keep the tool inserted in **S**.



In order to decrement the lower position valve, place the magnetic tool in orifice **Z** to shift the arrow to the downward position and then, by inserting and keeping the tool in orifice **S**, it is possible to decrement the lower position valve.

Figure 3.25 - Step 4 – SP302

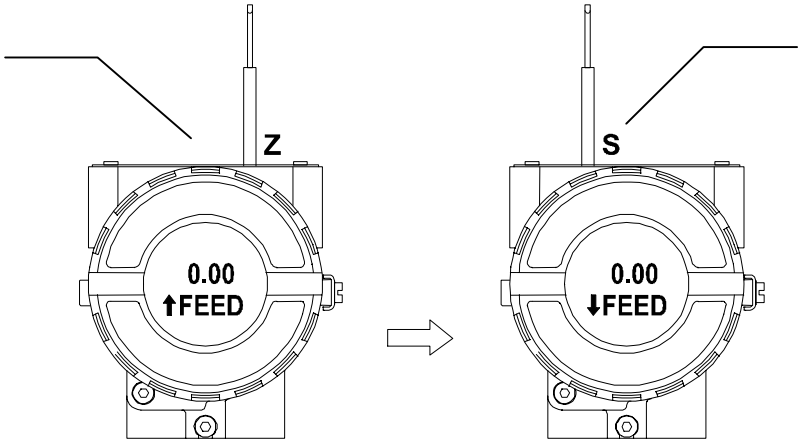
In order to start the UPPOS, simply insert the magnetic tool in orifice **S** as soon as UPPOS is shown on the display. An arrow pointing upward (↑) increments the valve and an arrow pointing downward (↓) decrements the valve. In order to increment the upper position valve, keep the tool inserted in **S**.



In order to decrement the upper position valve, place the magnetic tool in orifice **Z** to shift the arrow to the downward position an then, by insetting and keeping the tool in orifice **S**, it is possible to decrement upper position valve.

Figure 3.26 - Step 5 – SP302

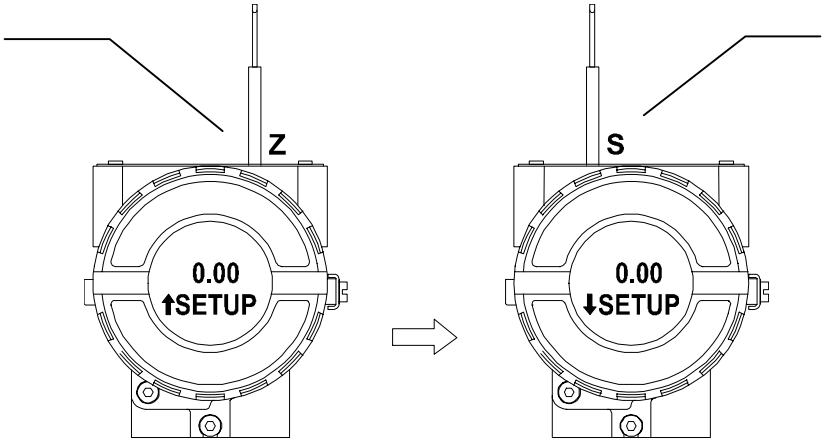
Option FEED allows the user to correct the valve calibration. In order to implement the correction, read the valve indicated by the valve and enter it in this option. This option makes it possible to correct LOPOS as well as UPPOS. An arrow pointing upward increments the position valve.



Place the magnetic tool in orifice **S** to shift the arrow to the downward position and decrement the calibration valve in accordance with the valve readout valve. An arrow pointing downward decrements the position valve.

Figure 3.27 - Step 6 - SP302

This option implements the auto setup of the valve, that is, the lower and upper position points of the valve. When setup displays 0 (zero), it indicates that the setup is disabled.



Insert the magnetic tool in orifice **S** and enter the value 1. After this, the auto setup will be started and a flashing message with the word SETUP will show in the display of the positioner. After this process finishes, the local adjustment returns to normal operation.

Figure 3.28 - Step 7 - SP302

NOTE

Every time the AUTO SETUP is used it is necessary to save it via SYSCON, and to write in the Backup-Restore parameter of the transducer block the sensor Data Backup option.

This Local adjustment configuration is a suggestion only. The user may choose his preferred configuration via SYSCON, simply configuring the display block. (refer to paragraph Display Transducer Block)

Section 4

Maintenance procedure

General

SPIRAX SARCO **SP302** Fieldbus to Valve Positioners are extensively tested and inspected before delivery to the end user. Nevertheless, during their design and development, consideration was given to the possibility of repairs by the end user, if necessary.

In general, it is recommended that the end user do not try to repair printed circuit boards. Instead, he should have spare circuit boards, which may be ordered from **SPIRAX SARCO** whenever necessary.

DIAGNOSTICS	
SYMPTOM	**PROBABLE ERROR SOURCE**
POSITION SHOWN ON DISPLAY	*Positioner Connections* Check wiring polarity and continuity. *Power Supply* Check the minimum voltage signal equal 9 Volts. *Electronics Failure* Check circuit boards for bad connections and replace them for spare boards.
NO COMMUNICATION	*Network Connection* Check network connections: equipment, power supply, terminators. *Network Impedance* Check network impedance (power supply and terminators impedance). *Positioner Configuration* Check the configuration of the positioner communication parameters. *Network Configuration* Check the network communication configuration. *Electronics Failure* Try spare parts in the positioner circuits.
NO RESPONSE TO INPUT SIGNAL	*Pressure Output Connections* Check up on air leaks. *Air Supply Pressure* Check the air supply pressure. The input pressure to **SP302** shall be between 20 psi and 100 psi. *Calibration* Check the positioner calibration points. *Obstructed Restriction and/or Blocked Output* Observe the following procedures described in this Manual: OUTPUT CONNECTIONS and RESTRICTION CLEANING.
OSCILLATING ACTUATOR	*Calibration* Adjust parameter Kp. Adjust parameter Tr.
SLOW ACTUATOR RESPONSE	*Adjustment Parameters are Too Low* Adjust parameter Kp.
TOO FAST ACTUATOR RESPONSE	*Adjustment Parameters are Too High* Adjust parameter Kp.

Table 4.1 - SP302 Diagnostics

If the problem is not presented in the table above follow the Note below:

NOTE
The Factory Init should be tried as a last option to recover the equipment control when the equipment presents some problem related to the function blocks or the communication. **This operation must only be carried out by authorized technical personnel and with the process offline, since the equipment will be configured with standard and factory data.** This procedure resets all the configurations run on the equipment, after which a partial download should be performed. Two magnetic tools should be used to this efect,. On the equipment, withdraw the nut that fixes the identification tag on the top of the housing, so that access is gained to the "S" and "Z" holes. The operations to follow are: 1) Switch off the equipment, insert the magnetic tools and keep them in the holes (the magnetic end in the holes); 2) Feed the equipment; 3) As soon as Factory Init is shown on the display, take off the tools and wait for the "5" symbol on the right upper corner of the display to unlit, thus indicating the end of the operation. This procedure makes effective all the factory configuration and will eliminate eventual problems with the function blocks or with the equipment communication.

Disassembly Procedure

Refer to *Figure 4.3 – Exploded View*. Make sure to disconnect power supply and supply pressure before disassembling the transmitter.

TRANSDUCER
To remove the transducer from the electronic housing, the electrical connections (in the field terminal side) and the main board connector must be disconnected.

Loosen the hex screw (6) and carefully unscrew the electronic housing from the transducer, observing that the flat cable is not excessively twisted.

NOTE
The positioners have a stopper that can be released to allow the transducer to rotate more than one turn. See *Figure 4.1 - Transducer Rotation Stopper*.

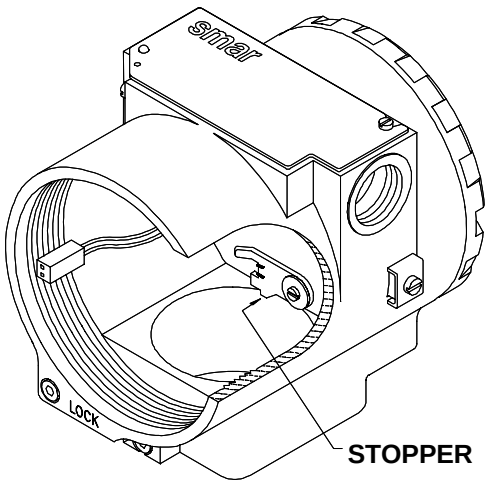


Figure 4.1 - Transducer Rotation Stopper

WARNING
Do not rotate the electronic housing more than 180º without disconnecting the electronic circuit from the power supply.

ELECTRONIC CIRCUIT
To remove the circuit board (5) and indicator (4), first loose the cover locking (13) on the side not marked “Field Terminals”, then unscrew the cover (1).

WARNING
The boards have CMOS components, which may be damaged by electrostatic discharges. Observe correct procedures for handling CMOS components. It is also recommended to store the circuit boards in electrostatic-proof cases.

Loosen the two screws (3) that anchors the indicator and the main circuit board. Gently pull out the indicator, and then the main board (5).

Reassembly Procedure

TRANSDUCER
Mount the transducer to the housing turning clockwise until it stops. Then turn it counterclockwise until it faces the square of electronic housing to the square of transducer. Tighten the hex screw (6) to lock the housing to the transducer.

CLEANING RESTRICTION
Air is supplied to the nozzle through a restriction. Poor quality instrument air can result in metal chips, dirt, etc, into the restriction.

A regular periodic check should be made to assure high quality performance of **SP302**. Make sure to disconnect supply pressure before remove the restriction (20) from the transducer. Cleaning by spraying it with a solvent. If necessary, restriction can be cleaned by inserting a drill with a maximum diameter of .011 in.

EXHAUST PORT
Air is vented to the atmosphere through the two exhausts ports located behind the transducer nameplate. A foreign object interfering or blocked exhaust port provides a way to increase the output. Cleaning by spraying it with a solvent.

NOTE
Never use oil or grease in the spool, otherwise the positioner performance will be impaired.

ELECTRONIC CIRCUIT
Plug transducer connector and power supply connector to main board.

Attach the display to the main board. Observe the four possible mounting positions (See *Figure 4.2 - Four Possible Position of the Local Indicator*). The ↑ mark indicates up position.

Anchor the main board and indicator with their screws (3).

After tightening the protective cover (1), mounting procedure is complete. The positioner is ready to be energized and tested.

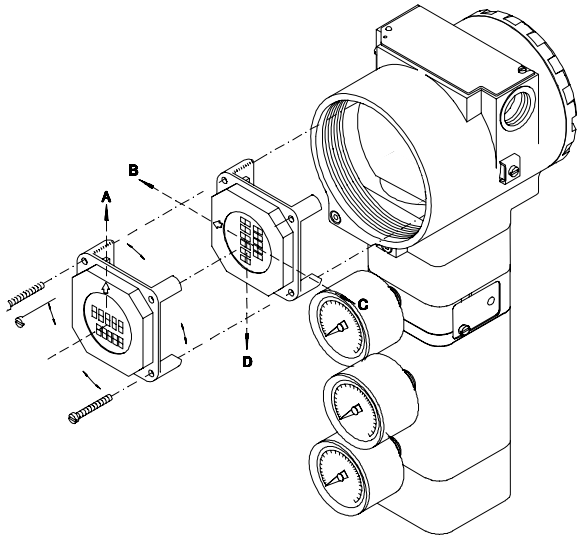


Figure 4.2 - Four Possible Position of the Local Indicator

INTERCHANGEABILITY
Main board can be changed and operate with the transducer. There is an EEPROM in the transducer part that keeps the trim.

RETURNING MATERIALS
Should it become necessary to return the positioner to SPIRAX SARCO, simply contact your local agent or SPIRAX SARCO office, informing the defective instrument's serial number, and return it to our factory.

In order to expedite analysis and solution of the problem, the defective item should be returned with a description of the failure observed, with as many details as possible. Other information concerning to the instrument operation, such as service and process conditions, is also helpful.

ACCESSORIES	
ORDERING CODE	**DESCRIPTION**
SD1	Magnetic Tool for Local Adjustment
SYSCON	System Configurator
PS302_1	Power Supply
PSI302_2 or PSI302_4	Power Supply Impedance
BT302	Terminator
PCI	Process Control Interface

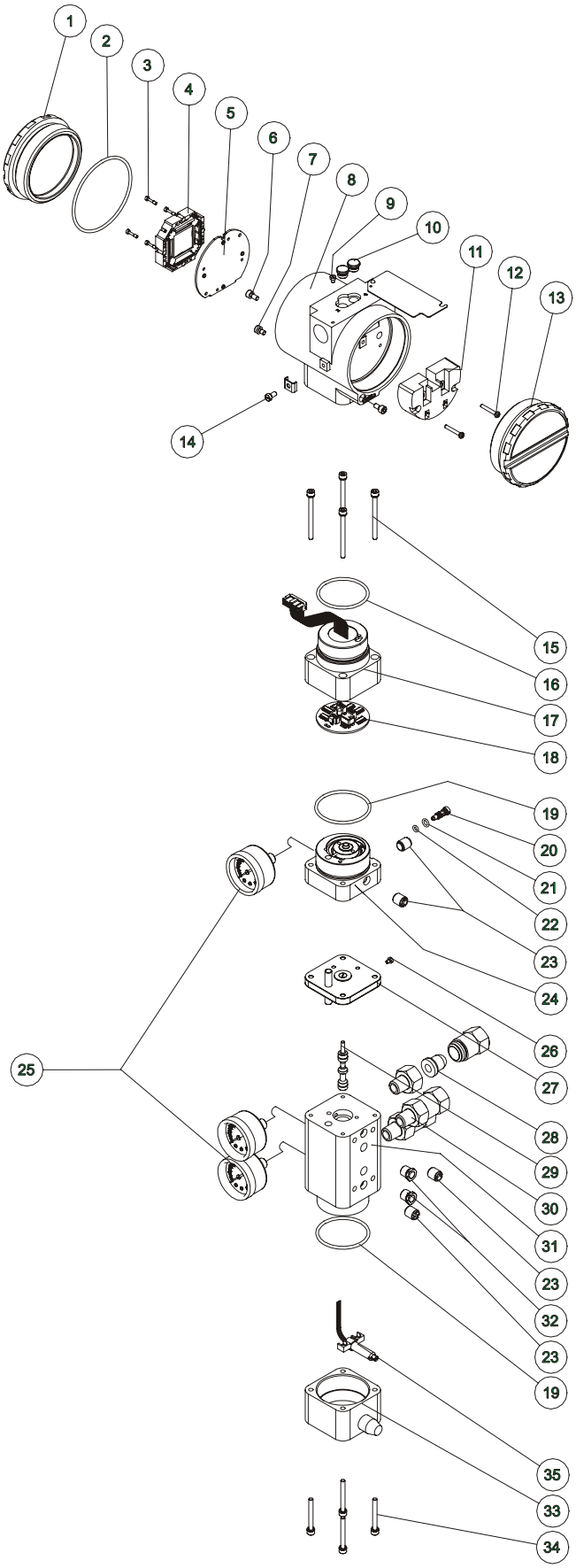


Figure 4.3 - Exploded View

SPARE PARTS LIST			
PARTS DESCRIPTION	**POSITION**	**CÓDE**	**CATEGORY (NOTE 4)**
HOUSING, Aluminum (**NOTE 1**)			
. 1/2 - 14 NPT	8		-
. M20 x 1.5	8		-
. PG 13.5 DIN	8		-
HOUSING, 316 SS (**NOTE 1**)			
. 1/2 - 14 NPT	8		-
. M20 x 1.5	8		-
. PG 13.5 DIN	8		-
COVER (INCLUDES O'RING)			
. Aluminum	1 e 13	204-0102	-
. 316 SS	1 e 13	204-0105	-
COVER WITH WINDOW FOR INDICATION (INCLUDES O' RING)			
. Aluminum	1	204-0103	-
. 316 SS	1	204-0106	-
COVER LOCKING BOLT	7		-
SENSOR LOCKING BOLT	6		-
EXTERNAL GROUND BOLT	14		-
IDENTIFICATION PLATE FIXING BOLT	9		-
DIGITAL INDICATOR	4	214-0108	A
TERMINAL INSULATOR	11		A
MAIN ELECTRONIC CIRCUIT BOARD	5	304-0650	A
0-RINGS COVER (**NOTE 2**)			
. Buna-N	2	204-0122	B
TERMINAL HOLDING BOLT HOUSING IN ALUMINUM			
Housing in 316 Stainless Steel	2		B
Housing in 316 Stainless Steel	12		B
MAIN BOARD BOLT HOUSING IN ALUMINUM			
Units with indicator	3		B
Units without indicator	3		B
MAIN BOARD BOLT HOUSING IN 316 STAINLESS STEEL			
Units with indicator	3		B
Units without indicator	3		B
ALUMINUM CONNECTION COVER	15,16,17 and 18		A
316 STAINLESS STEEL CONNECTION COVER	15,16,17 and 18		A
. Connection Cover Bolt	15		-
. Buna N Neck O-ring	16	204-0113	B
. Assembled Connection Cover - Aluminum	17		-
. Assembled Connection Cover - 316 Stainless Steel	17		-
. Analog PC Board GLL 1012	18		-
PIEZO BASE SET – ALUMINUM	19,20,21,22, 23,24 and 25		A
PIEZO BASE SET – 316 STAINLESS STEEL	19,20,21,22, 23,24 and 25		A
. Base and Block O'ring	19		B
. Restriction	20		B
. Restriction External O-ring	21	344-0155	B
. Restriction Internal O-ring	22	344-0150	B
. Syntherized Bushing	23		B
. Assembled Base – Aluminum	24		A
. Assembled Base – 316 Stainless Steel	24		A
. Analog indicator (Pressure gauge) – Carbon Steel	25		B
. Analog indicator (Pressure gauge) – 316 Stainless Steel	25		B

SPARE PARTS LIST			
PARTS DESCRIPTION	**POSITION**	**CÓDE**	**CATEGORY (NOTE 4)**
ALUMINUM INTERMEDIATE SET	26 and 27		A
316 STAINLESS STEEL INTERMEDIATE SET	26 and 27		A
. Identification tag bolt	26		-
. Assembled diaphragm – Aluminum	27		B
. Assembled diaphragm – 316 Stainless Steel	27		B
ALUMINUM BLOCK SET	19,23,25,28,29,30,31 and 32		A
316 STAINLESS STEEL BLOCK SET	19,23,25,28,29,30,31 and 32		A
. Base & Block O-ring	19		-
. Syntherized Bushing	23		-
. Analog indicator (Pressure gauge) – Carbon Steel	25		-
. Analog indicator (Pressure gauge) – 316 Stainless Steel	25		-
. Filtering Element	28		A
. Spool valve	29		-
. 304 Stainless steel Filter- 1/4" NPT	30		B
. Assembled Block– Aluminum	31		-
. Assembled Block – 316 Stainless Steel	31		-
. Vent Plug – Bronze	32		-
. Vent Plug - 316 Stainless Steel	32		-
ALUMINUM HALL COVER SET	33,34 and 35		A
316 STAINLESS STEEL HALL COVER SET	33,34 and 35		A
. Aluminum Hall Cover Set	33		-
. 316 Stainless Steel Hall Cover Set	33		-
. Hall Cover Bolt	34		-
. Hall Support + Hall Sensor + Flat cable	35		B
ALUMINUM TRANSDUCER SET	***NOTE 3***	209-0180	A
316 STAINLESS STEEL TRANSDUCER SET			A
LOCAL ADJUSTMENT PROTECTION COVER.	10		
MAGNETS			
. Linear magnet 15mm.	-	400-0034	-
. Linear magnet 30mm.	-	400-0038	-
. Linear magnet 50mm.	-	400-0035	-
. Linear magnet 100mm.	-	400-0036	-
. Rotative magnet.	-	400-0037	-

Table 4.2 - Spare Part List

Note: 1) Includes terminal isolator, bolts (cover locking, ground and terminal isolator) and identification plate without certification.
2) O' rings are packaged with 12 units.
3) Includes all transducer's spare parts.
4) For category **A**, it is recommended to keep, in stock, 25 parts installed for each set, and for category **B**, 50.

NOTE

1. It includes Terminal holder insulator, bolts (cover lock, grounding and terminal holder insulator) and identification plate without certification.
2. 0-Rings are packaged in packs of 12 units.
3. The 14 spare part include the 15, 17, 18, 19, 20 and 23 spare parts

TECHNICAL CHARACTERISTICS

Functional Specifications

Travel
Linear Motion: 3 - 100 mm.
Rotary Motion: 30 - 120° Rotation Angle.

Input Signal
Digital only. Fieldbus, 31.25 Kbits/s voltage mode with bus power.

Output
Output to actuator 0 -100% supply air pressure. Single or double-action.

Power Supply
Bus powered: 9-32 Vdc.
Output impedance (from 7.8 kHz - 39 kHz):
Non-intrinsic safety: ≥ 3 kΩ.
Intrinsic safety: ≥ 400 Ω (assuming an IS barrier in the power supply).

Pressure Supply
1.4 - 7 bar (20-100 psi) free of oil, dust and water.

Indication
Optional 4 ½ - digit numerical and 5-character alphanumerical LCD indicator.

Hazardous Location Certification
Explosion proof, weather proof and intrinsically safe CEPEL, FM, CSA, NEMKO and DMT standards (pending).

Temperature Limits
Operation: -40 to 85 ºC (-40 to 185 ºF).
Storage: -40 to 90 ºC (-40 to 194 ºF).
Display: -10 to 60 ºC (14 to 140 ºF) operation.
-40 to 85 ºC (-40 to 185 ºF) without damage.

Humidity Limits
0 to 100% RH.

Turn-on Time
Approximately 10 seconds.

Update Time
Approximately 0.5 second.

Flow Characterization
Linear, equal percentage, quick opening and customer configuration through fieldbus communication from e.g., a PC or by the local adjustment switches.

Gain
Through software. Locally adjustable.

Travel Time

Through software. Locally adjustable.

Actual Position Sensing
Magnet (Non-contact) via Hall Effect.

Performance Specifications

Resolution
≤ 0.1% F.S.

Repeatibility
≤ 0.1% F.S.

Hysteresis
≤ 0.2% F.S.

Consumption
0.25 Nm/h (0.15 SCFM) at 1.4 bar (20 psi) supply.
0.70 Nm/h (0.40 SCFM) at 5.6 bar (80 psi) supply.

Output Capacity
46.7 Nm/h (28 SCFM) at 5.6 (80 psi) supply.

Ambient Temperature Effect
0.8%/20 ºC do span.

Supply Pressure Effect
Negligible.

Vibration Effect
±0.3%/g of span during the following conditions:
5-15 Hz at 4 mm constant displacement.
15-150 Hz at 2g.
150-2000 HZ at 1g.
Reference SAMA PMC 31.1 - 1980, Sec. 5.3, Condition 3, Steady State.

Electro-Magnetic Interference Effect
Designed to comply with IEC 801 and European Standards EN50081 and EN50082.

Physical Specifications

Electrical Connection
1/2 -14 NPT, Pg 13.5 or M20 × 1.5.

Pneumatic Connections
Supply and output: 1/4 - 18 NPT

Gage: 1/8 - 27 NPT

Material of Construction
Injected low copper aluminum with polyester painting or 316 Stainless Steel housing, with Buna-N O-rings on cover (NEMA 4X, IP67).

Weight
Without display and mounting bracket: 2.7 kg.
Add for digital display: 0.1 kg.

SP30 — POSITIONER

COD.	Protocol
1	4-20 mA + Hart
***2**	Foundation Fieldbus
3	Profibus PA

COD.	Bracket Mounting Kit **
0	Without Kit
***1**	With Kit (bracket + magnet)

COD.	Electrical Connections
***0**	½ - 14 NPT
A	M20 x 1.5
B	PG 13.5 DIN

COD.	Type of Actuator **
***1**	Rotary – Single Action
2	Rotary – Double Action
***3**	Linear – Single Action
4	Linear – Double Action
5	Others Specify

COD.	Indication Gauge
0	Without Gauge
1	With Gauge – Input
2	With Gauge - Output 1
***3**	With 2 Gauges – Input and Output 1
4	With 2 Gauges – Output 1 and 2
5	With 3 Gauges
Z	Others Specify

COD.	Other features
H1	316 SST Housing and body
R1	Remote sensor
I2	Explosion Proof (ATEX)
***I4**	Intrinsically Safe (ATEX)
J1	Tag on label
SZ	Specify special application

SP30	-	2	-	1	-	0	3	3	-	I4	**Typical code number.**

* STANDARD

** Appropriate magnet to be specified on mounting kit

KMS	BRACKET/MAGNET KIT

COD	Bracket Kit
0	Without Positioner Bracket
1	Universal Rotary
2	Universal Linear (Yoke and Pillar)
***3**	Linear Spirax Sarco Valves
4	Rotary Spirax Sarco Valves
Z	Others – Specify

COD	Magnet
0	Rotary
***1**	Linear Up to 15 mm
***2**	Linear Up to 30 mm
***3**	Linear Up to 50 mm
4	Linear Up to 100 mm
Z	Others – Specify

COD	Mounting Bracket Material
***C**	Carbon Steel Bracket
I	316 Stainless Steel Bracket
Z	Others – Specify

COD	Optional Item
SYZ	Specify Actuator Model / Company

KMS	-	3	2	-	C	/	**	** Leave it blank for no optional item.

* STANDARD

Section 6

HAZARDOUS LOCATION INSTALLATION AND APPROVALS

INSTALLATION AND OPERATION

Warning:

General Rule:

- Installation in accordance with IEC 60079-14
- Match the certificate parameters according to the environmental classification

For Ex-d protection application:

- Only use Plugs, Adapters and Cable glands certified for Ex d.
- Do not use sealing in the threads of Plugs, Adapters and Cable glands
- Do not open in Hazardous Location when energized

For Ex-i protection application:

- Installation in accordance with IEC 60079-14
- The Transmitter must be connected to a barrier
- Match the parameters between barrier and the equipment (Consider the cable parameters)
- Associated apparatus ground bus to be insulated from panels and mounting enclosures
- Shield is optional if used, be sure to insulate the end not grounded
- Cable capacitance and inductance plus Ci and Li must be smaller than Co and Lo of the Associated Apparatus

Hazardous Location Approvals

FM Approval

Intrinsic Safety Protection (FM Report 3D9A2.AX)

Class I (Gases and Vapors)
Division 1 (Where ignitable concentrations of flammable gases, vapors or liquids can exist all of time or some of the time under normal conditions)
Groups A (Acetilene), B (Hydrogen), C (Ethylene) and D (Propane)

Class II (Dusts)
Division 1 (Where ignitable concentrations of combustible dusts can exist all of time or some of the time under normal conditions)
Groups E (Metal Dust), F (Coal Dust) and G (Grain Dust)

Class III (Fibers)
Division 1 (Where easily ignitable fibers or materials producing combustible flyings are handled, manufactured or used)

- Temperature Class T4 (Maximum Surface Temperature = 135ºC)
- Maximum Ambient Temperature: 60ºC
- Entity Parameters:
  Vmax = 24 Vdc Imax = 250 mA Pi = 1.2 W Ci = 5 nF Li = 12 uH
  Vmax = 16 Vdc Imax = 250 mA Pi = 2.0 W Ci = 5 nF Li = 12 uH
- Instalation Drawing: 102A-1014-00
- Valid Options:
  a = Local Indicator 0 or 1
  b = Mounting bracket 0, 1 or 2
  c = Electrical Connections 0, A or B
  d = Valve or 1
  e = Optio H1 or blank

Explosion Proof Protection (FM Report 3007267)

Class I (Gases and Vapors)
Division 1 (Where ignitable concentrations of flammable gases, vapors or liquids can exist all of time or some of the time under normal conditions)
Groups A (Acetilene), B (Hydrogen), C (Ethylene) and D (Propane)

- Temperature Class T4 (Maximum Surface Temperature = 135ºC)
- Maximum Ambient Temperature: 60ºC
- Valid Options:
  a = Local Indicator 0 or 1
  b = Mounting bracket 0 or 1
  c = Type of actuator (not part of Approval): single alpha-numeric designation
  d = Indication gauge: 0, 1, 2, 3, 4 or 5
  e = Option H1 or blank

Dust Ignition Proof Protection (FM Report 3D9A2.AX and FM Report 3007267)

Class II (Dusts)
Division 1 (Where ignitable concentrations of combustible dusts can exist all of time or some of the time under normal conditions)
Groups E (Metal Dust), F (Coal Dust) and G (Grain Dust)

Class III (Fibers)

Division 1 (Where easily ignitable fibers or materials producing combustible flyings are handled, manufactured or used)

- Temperature Class T4 (Maximum Surface Temperature = 135ºC)
- Maximum Ambient Temperature: 60ºC

Non Incendive Protection (FM Report 3D9A2.AX)

Class I (Gases and Vapors)
Division 2 (Where ignitable concentrations of flammable gases, vapors or liquids are not likely to exist under normal operating conditions)
Groups A (Acetilene), B (Hydrogen), C (Ethylene) and D (Propane)

- Temperature Class T4 (Maximum Surface Temperature = 135ºC)
- Maximum Ambient Temperature: 60ºC

Degree of Protection (FM Report 3D9A2.AX and FM Report 3007267)

Type 4X (Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt, rain, sleet, snow, windblown dust, splashing water, hose-directed water, and corrosion; and that will be undamaged by the external formation of ice on the enclosure. Ref: Nema 250)

CSA Approval

Hazardous Location (CSACertificate 1078546)

Class I (Gases and Vapors),
Division 1 (Where ignitable concentrations of flammable gases, vapors or liquids can exist all of time or some of the time under normal conditions)
Groups B (Hydrogen), C (Ethylene) and D (Propane)

Class II (Dusts)
Division 1 (Where ignitable concentrations of combustible dusts can exist all of time or some of the time under normal conditions)
Groups E (Metal Dust), F (Coal Dust) and G (Grain Dust)

Class III (Fibers)
Division 1 (Where easily ignitable fibers or materials producing combustible flyings are handled, manufactured or used)

- Input Supply 12-42Vdc, 4-20mA;
- Maximum Working Pressure 100psi

Class I (Gases and Vapors)
Division 2 (Where ignitable concentrations of flammable gases, vapors or liquids are not likely to exist under normal operating conditions)
Groups A (Acetilene), B (Hydrogen), C (Ethylene) and D (Propane)

Class II (Dusts)
Division 2 (Where ignitable concentrations of combustible dusts are not likely to exist under normal operating conditions)
Groups E (Metal Dust), F (Coal Dust) and G (Grain Dust)

Class III (Fibers)

- Input Supply 12-42Vdc, 4-20mA;
- Maximum Working Pressure 100psi

Intrinsically Safe Protection (CSACertificate 1078546)

Class I (Gases and Vapors)
Division 1 (Where ignitable concentrations of flammable gases, vapors or liquids can exist all of time or some of the time under normal conditions)
Groups A (Acetilene), B (Hydrogen), C (Ethylene) and D (Propane)

Class II (Dusts)
Division 1 (Where ignitable concentrations of combustible dusts can exist all of time or some of the time under normal conditions)
Groups E (Metal Dust), F (Coal Dust) and G (Grain Dust)

Class III (Fibers)
Division 1 (Where easily ignitable fibers or materials producing combustible flyings are handled, manufactured or used)

- Input Supply12-42V dc, 4-20mA;
- Intrinsically safe with entity parameters at terminal "+" and "-" of: Vmax = 24 V Imax = 250 mA Ci = 5 nF Li = 12 uH when connected as per Spirax Sarco Instalation Drawing 102A-1016-00
- Temperature Class T3C (Maximum Surface Temperature = 160 ºC)
- Maximum Ambient Temperature: 40ºC
- Maximum Working Pressure 100psi

Degree of Protection (CSACertificate 1078546)

Type 4X (Enclosures constructed for either indoor or outdoor use to provide a degree of protection to personnel against incidental contact with the enclosed equipment; to provide a degree of protection against falling dirt, rain, sleet, snow, windblown dust, splashing water, hose-directed water, and corrosion; and that will be undamaged by the external formation of ice on the enclosure. Ref: Nema 250)

NEMKO Approval

Explosion Proof Protection (Nemko 00ATEX305)

Group II (Other than mines)
Category 2 (for zone 1: Where igniable concentrations of flamable gases, vapors or liquids are likely to exist under normal operating conditions)
G (Gases, Vapours and Mist)
Method of Protection: EEx d (Explosion Proof)
Group IIC (Acetylene)
Temperature Class: T6 (Maximum Surface Temperature = 85º)

- Vmax = 32 Vdc Imax = 12 mA
- Pressure = 20 – 100 psi
- Ambient Temperature: 40ºC

Ingress Protection

IP67 (6: Dust-tight; 7: Effects of immersion)

DMT Approval

Intrinsic Safety Protection (DMT 01 ATEX E 011)

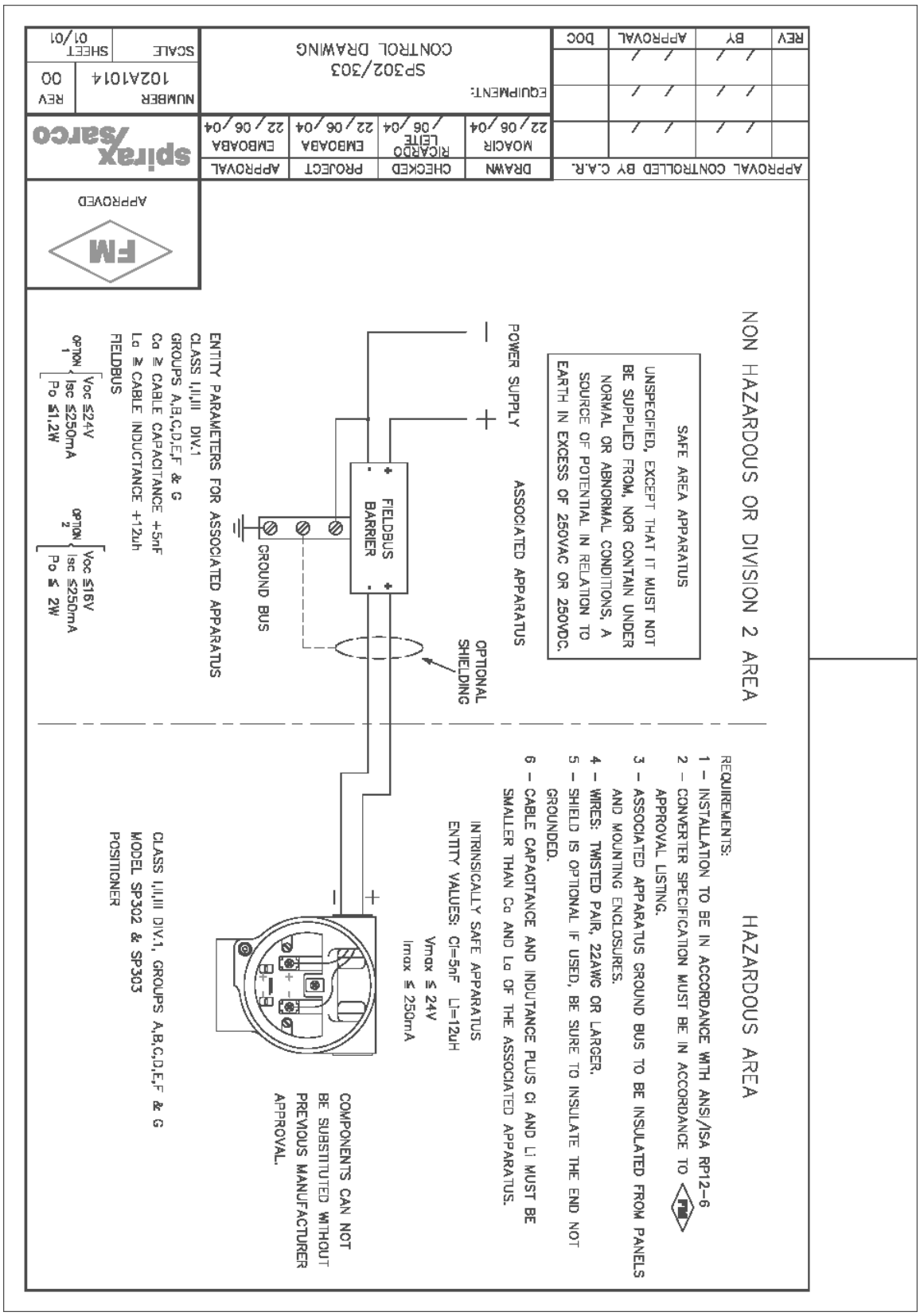
Group II (Other than mines)
Category 2 (for zone 1: Where igniable concentrations of flamable gases, vapors or liquids are likely to exist under normal operating conditions)
G (Gases, Vapours and Mist)
Method of Protection: EEx d [ia] (Intrisic Safety)
Group IIC (Acetylene)
Temperature Class T6 (Maximum Surface Temperature = 85º)

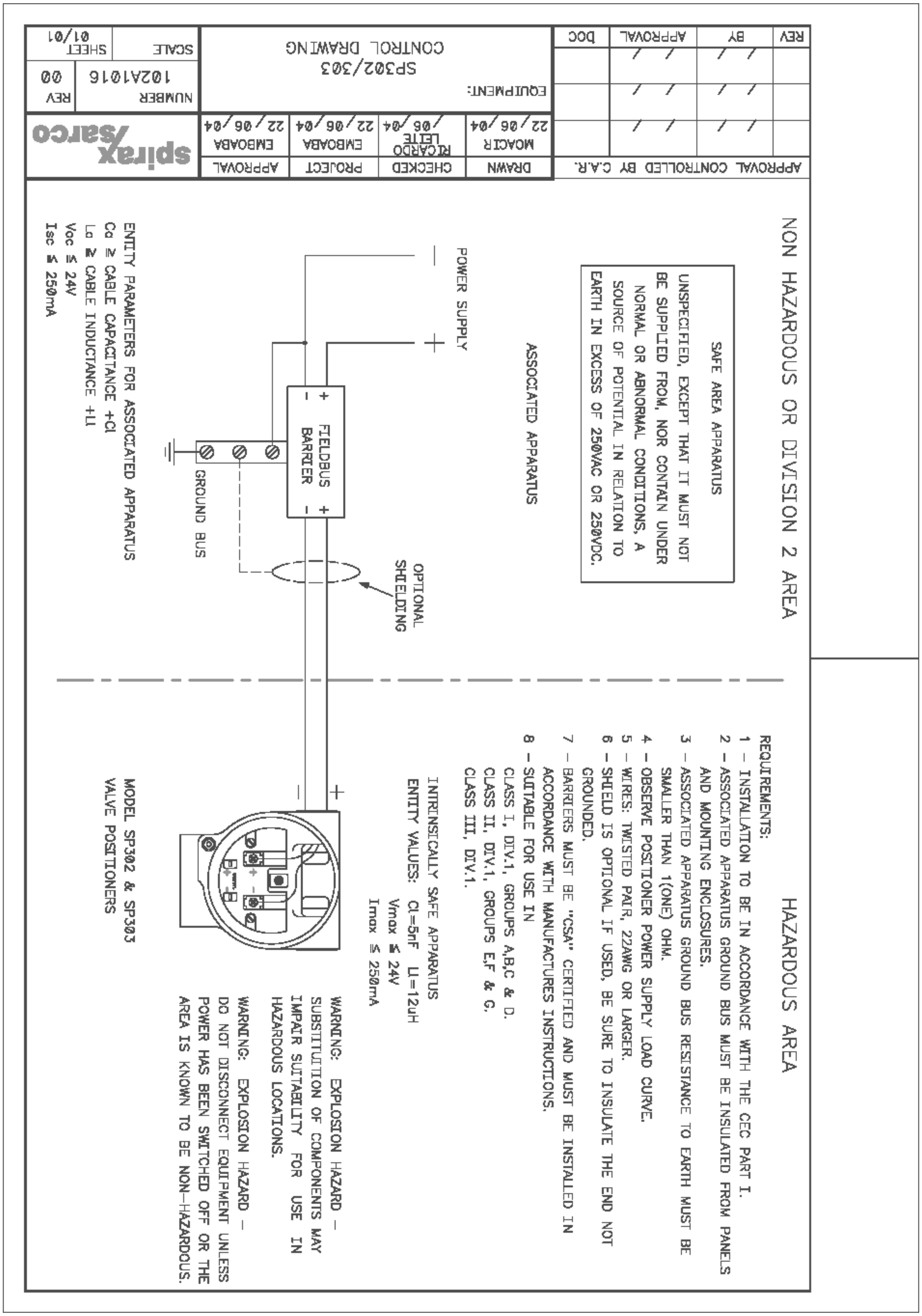
- Entity Parameters: Pi = 1500 mW Ui = 24 Vdc Ii = 250 mA Ci ≤ 5 nF Li = 0
- Ambient Temperature: -20º< Ta < 40ºC

Ingress Protection

IP65 (6: Dust-tight; 5: Water jets)

Control Drawings





NON HAZARDOUS OR DIVISION 2 AREA
SAFE AREA APPARATUS
UNSPECIFIED, EXCEPT THAT IT MUST NOT BE SUPPLIED FROM, NOR CONTAIN UNDER NORMAL OR ABNORMAL CONDITIONS, A SOURCE OF POTENTIAL IN RELATION TO EARTH IN EXCESS OF 250VAC OR 250VDC.
ASSOCIATED APPARATUS
POWER SUPPLY
FIELDBUS BARRIER
GROUND BUS
OPTIONAL SHIELDING
ENTITY PARAMETERS FOR ASSOCIATED APPARATUS
Ca ≥ CABLE CAPACITANCE +Ci
La ≥ CABLE INDUCTANCE +Li
Voc ≤ 24V
Isc ≤ 250mA
HAZARDOUS AREA
REQUIREMENTS:
1 – INSTALLATION TO BE IN ACCORDANCE WITH THE CEC PART I.
2 – ASSOCIATED APPARATUS GROUND BUS MUST BE INSULATED FROM PANELS AND MOUNTING ENCLOSURES.
3 – ASSOCIATED APPARATUS GROUND BUS RESISTANCE TO EARTH MUST BE SMALLER THAN 1(ONE) OHM.
4 – OBSERVE POSITIONER POWER SUPPLY LOAD CURVE.
5 – WIRES: TWISTED PAIR, 22AWG OR LARGER.
6 – SHIELD IS OPTIONAL IF USED, BE SURE TO INSULATE THE END NOT GROUNDED.
7 – BARRIERS MUST BE "CSA" CERTIFIED AND MUST BE INSTALLED IN ACCORDANCE WITH MANUFACTURES INSTRUCTIONS.
8 – SUITABLE FOR USE IN
CLASS I, DIV.1, GROUPS A,B,C & D.
CLASS II, DIV.1, GROUPS E,F & G.
CLASS III, DIV.1.
INTRINSICALLY SAFE APPARATUS
ENTITY VALUES: Ci=5nF Li=12uH
Vmax ≤ 24V
Imax ≤ 250mA
MODEL SP302 & SP303
VALVE POSITIONERS
WARNING: EXPLOSION HAZARD – SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR USE IN HAZARDOUS LOCATIONS.
WARNING: EXPLOSION HAZARD – DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.
REV
BY
APPROVAL
DOC
APPROVAL CONTROLLED BY C.A.R.
EQUIPMENT:
SP302/303
CONTROL DRAWING
DRAWN
MOACIR
22/06/04
CHECKED
RICARDO LEITE
/06/04
PROJECT
EMBOABA
22/06/04
APPROVAL
EMBOABA
22/06/04
SCALE
SHEET
01/01
NUMBER
102A1016
REV
00