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First in Fieldbus

TP303

MAR / 10
TP303
VERSION 1



OPERATION, MAINTENANCE
AND INSTRUCTIONS MANUAL

PROFIBUS PA POSITION TRANSMITTER



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INTRODUCTION

The **TP303** is from the first generation of Profibus-PA devices. It is a transmitter for position measurements. It can measure displacement or movement of rotary or linear type. The digital technology and communication provide an easy interface between the field and control room and several interesting features that considerably reduce the installation, operation and maintenance costs.

The **TP303** is versatile and reliable, and has very high accuracy. It may be used for control valve stem position measurement, or in any other position sensing application such as louvers, dampers, crushers, etc.

Since the **TP303** uses a non-contact magnetic coupling for position sensing, it is less sensitive to vibration than other solutions, resulting in longer operational life. Deadband due to mechanical imprecision is avoided. The **TP303** mounts to any linear or rotary valve, actuator or a variety of other devices through the use as VDI/VDE and IEC/NAMUR etc.

The **TP303** is very versatile; users can standardize one position indicator for all different kinds of control valves and other machines, keeping spares and training to a minimum.

The **TP303** is part of Smar's complete 303 line of Profibus-PA devices.

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

The system controls variable sampling, algorithm execution and communication to optimize the usage of the network, not losing time. Thus, high closed loop performance is achieved.

Using Profibus 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.

The **TP303**, like the rest of the 303 family, has some Function Blocks built in, like Analog Input and Totalizer Block.

The need for implementation of Fieldbus in small as well as large systems was considered when developing the entire 303 line of Profibus-PA devices. They have common features and can be configured locally using a magnetic tool, eliminating the need for a configurator or console in many basic applications.

The **TP303** is available as a product on its own, but also replaces the circuit board for the TP301. They use the same sensor board. Refer to the maintenance section of this manual for instructions on upgrading. The **TP303** uses the same hardware and housing for the TP302. The **TP303** is part of Smar's 303 Series of Profibus-PA devices.

The **TP303**, like its predecessor TP301, has some built-in blocks, eliminating the need for a separate control device. The communication requirement is considerably reduced, and that means less dead time and tighter control is achieved, not to mention the reduction in cost. They allow flexibility in control strategy implementation.

Get the best results of the **TP303** by carefully reading these instructions.

NOTE

This Manual is compatible with version 1.XX, where 1 denotes software version and XX software release. The indication 1.XX means that this manual is compatible with any release of software version 1.

Waiver of responsibility

The contents of this manual abides by the hardware and software used on the current equipment version. Eventually there may occur divergencies between this manual and the equipment. The information from this document are periodically reviewed and the necessary or identified corrections will be included in the following editions. Suggestions for their improvement are welcome.

Warning

For more objectivity and clarity, this manual does not contain all the detailed information on the product and, in addition, it does not cover every possible mounting, operation or maintenance cases.

Before installing and utilizing the equipment, check if the model of the acquired equipment complies with the technical requirements for the application. This checking is the user's responsibility.

If the user needs more information, or on the event of specific problems not specified or treated in this manual, the information should be sought from Smar. Furthermore, the user recognizes that the contents of this manual by no means modify past or present agreements, confirmation or judicial relationship, in whole or in part.

All of Smar's obligation result from the purchasing agreement signed between the parties, which includes the complete and sole valid warranty term. Contractual clauses related to the warranty are not limited nor extended by virtue of the technical information contained in this manual.

Only qualified personnel are allowed to participate in the activities of mounting, electrical connection, startup and maintenance of the equipment. Qualified personnel are understood to be the persons familiar with the mounting, electrical connection, startup and operation of the equipment or other similar apparatus that are technically fit for their work. Smar provides specific training to instruct and qualify such professionals. However, each country must comply with the local safety procedures, legal provisions and regulations for the mounting and operation of electrical installations, as well as with the laws and regulations on classified areas, such as intrinsic safety, explosion proof, increased safety and instrumented safety systems, among others.

The user is responsible for the incorrect or inadequate handling of equipments run with pneumatic or hydraulic pressure or, still, subject to corrosive, aggressive or combustible products, since their utilization may cause severe bodily harm and/or material damages.

The field equipment referred to in this manual, when acquired for classified or hazardous areas, has its certification void when having its parts replaced or interchanged without functional and approval tests by Smar or any of Smar authorized dealers, which are the competent companies for certifying that the equipment in its entirety meets the applicable standards and regulations. The same is true when converting the equipment of a communication protocol to another. In this case, it is necessary sending the equipment to Smar or any of its authorized dealer. Moreover, the certificates are different and the user is responsible for their correct use.

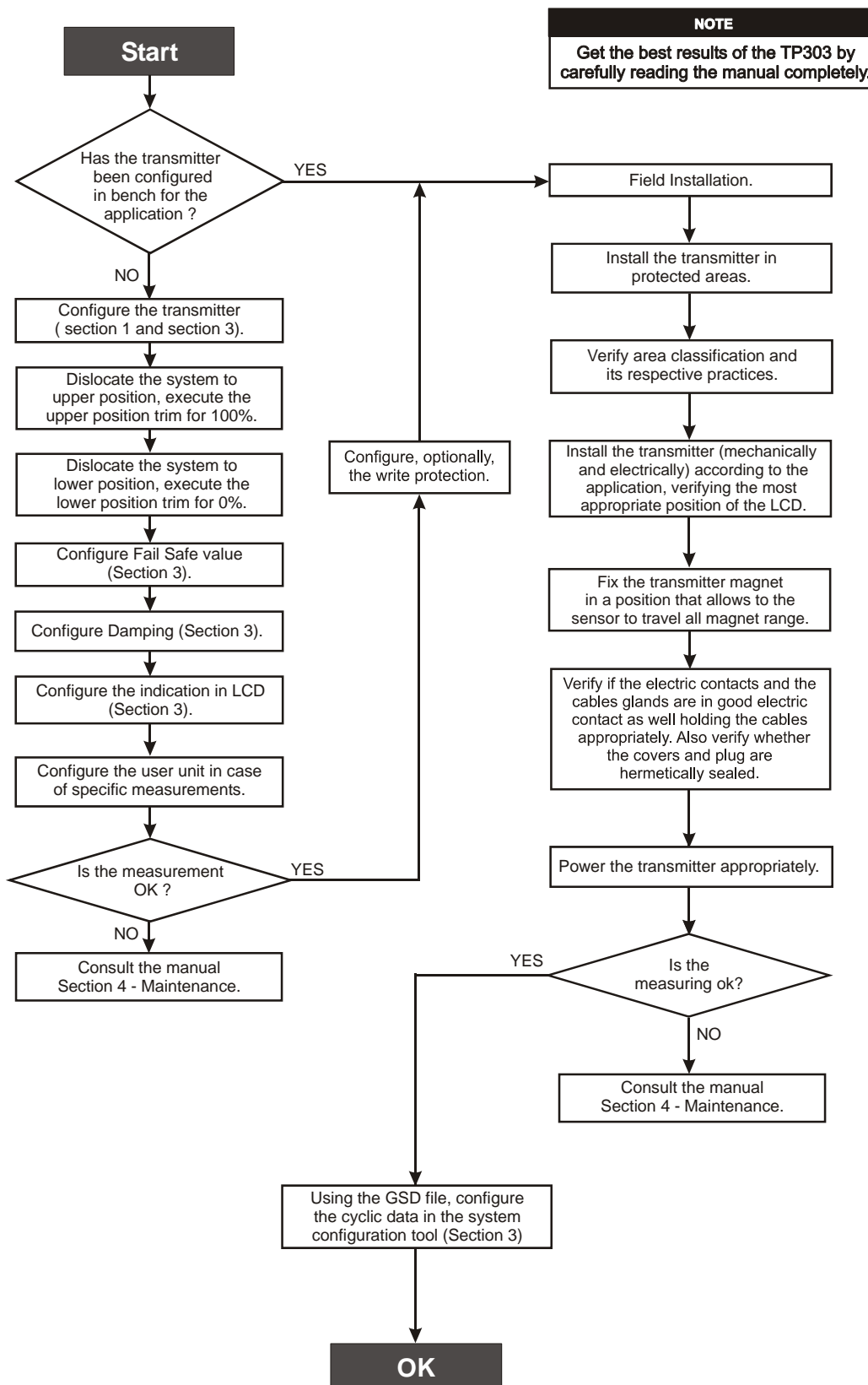
Always respect the instructions provided in the Manual. Smar is not responsible for any losses and/or damages resulting from the inadequate use of its equipments. It is the user's responsibility to know and apply the safety practices in his country.

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Installation Flowchart

Quick Installation Guide



INSTALLATION

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 of reducing the effects of temperature, humidity and vibration.

In warm environments, the transmitter 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 transmitter 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 re-moved; the circuits are exposed to the humidity. A humidity proof coating protects the electronic circuit, but frequent exposures to humidity may affect the protection provided. It is also important to keep the covers tightened in place. Every time they are re-moved, the threads are exposed to corrosion, since painting cannot protect these parts. Code approved sealing methods on conduit entering the transmitter should be employed.

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

General

MOUNTING

The mounting of transmitter **TP303** will depend on type movement, if it is linear or rotary. Two supports are required for mounting, one for the magnet and the other for the transmitter itself. Smart may supply then both since they are specified in the order code (See page 4.7)

Rotary Movement

Install the magnet on the valve stem using the magnet support (See figure 1.2). Install the transmitter support on the actuator. Should the actuator 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 transmitter **TP303** 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 transmitter when the system is in mid travel. In case the installation of the transmitter or magnet is altered, or should there be any other modification, the transmitter will require a recalibration.

Linear Movement

Install the magnet on the valve stem using the magnet support (See figure 1.3). Install the transmitter 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 transmitter on the support and tighten the four screws in the threaded bores located on the side opposite to the sensor (Figure 1.3). Use lock washers in order to prevent screw slackening.

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

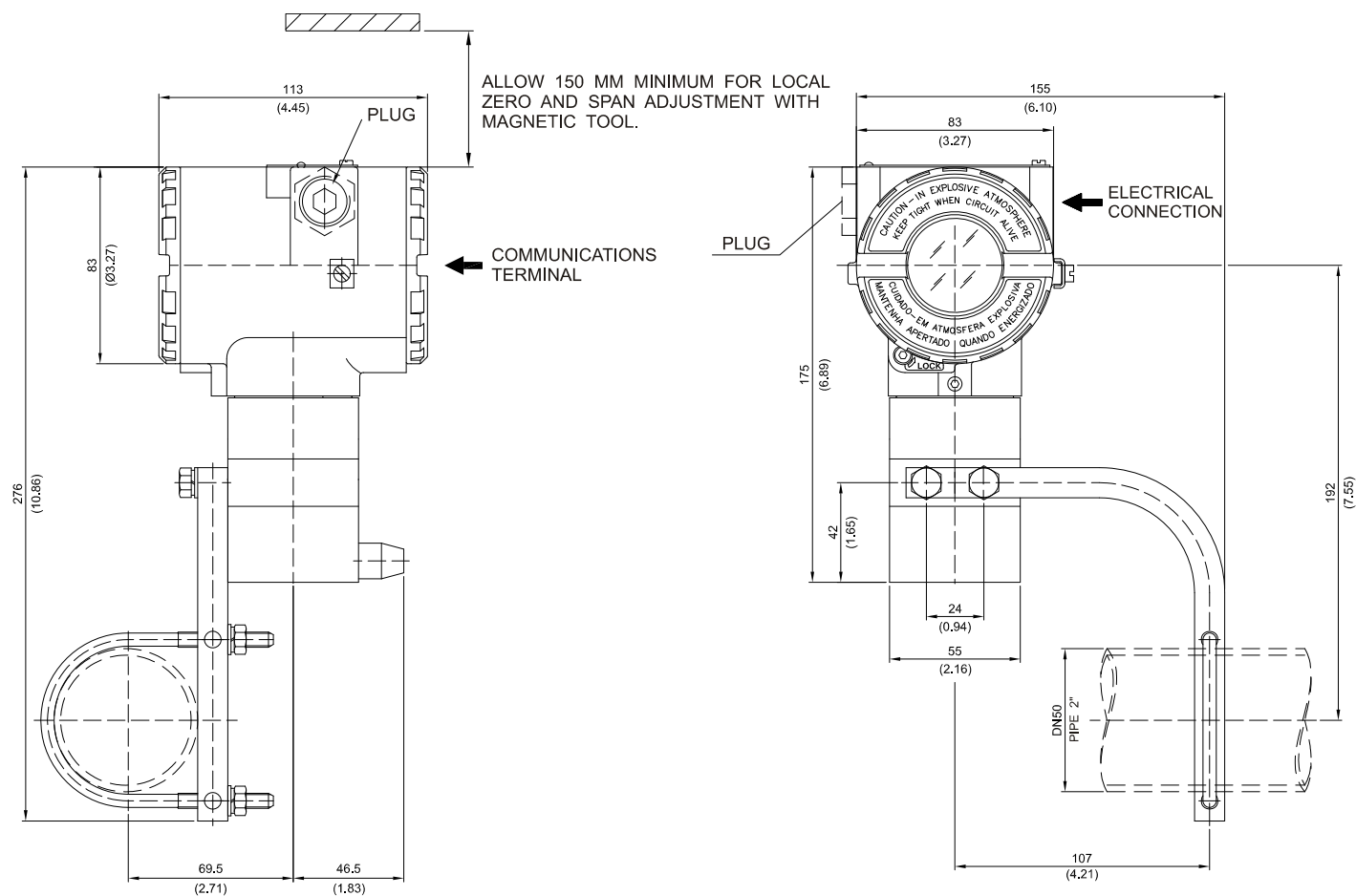
NOTE

Make sure that arrow engraved on the magnet coincides with the arrow engraved on the position transmitter when the system is in mid travel. The magnet mounting in relation to the hall sensor:

1. Must not have attrict between the internal magnet face and the hall sensor salience during the travel (rotary or linear), through the magnet.
2. The magnet and the salience of hall sensor must not be distant.

A minimum distance of 2mm and a maximum distance of 4mm is recommended between the magnet external face and the position transmitter face.

Should the installation of the transmitter or magnet be altered, or should there be any other modification, the transmitter will require a re-calibration.



LINEAR MAGNET

ROTARY MAGNET

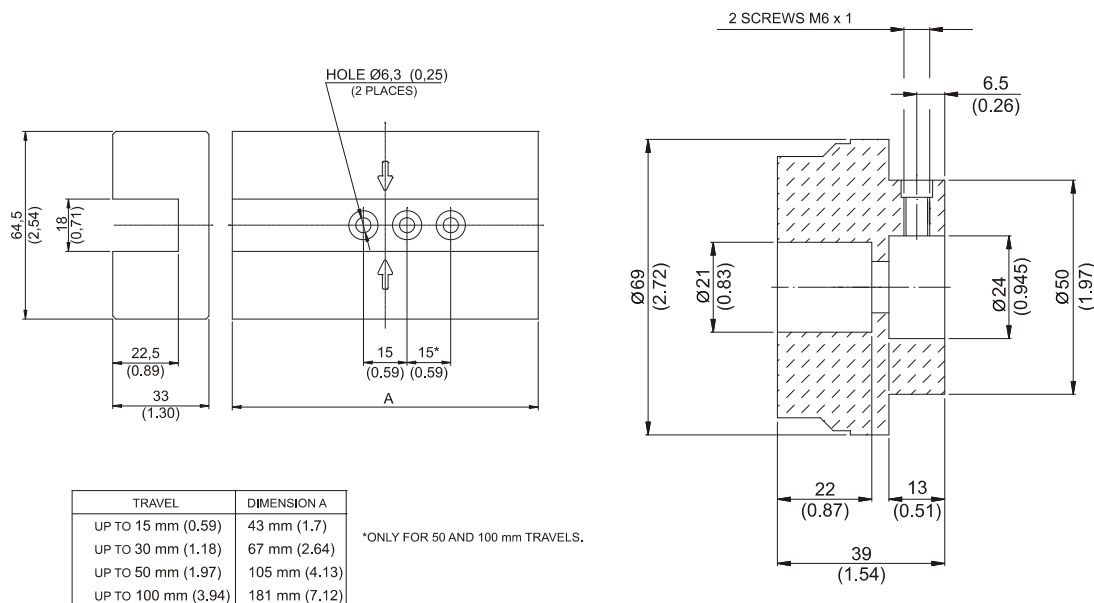


Figure 1.1 – TP303 and Magnet Dimensional Drawing

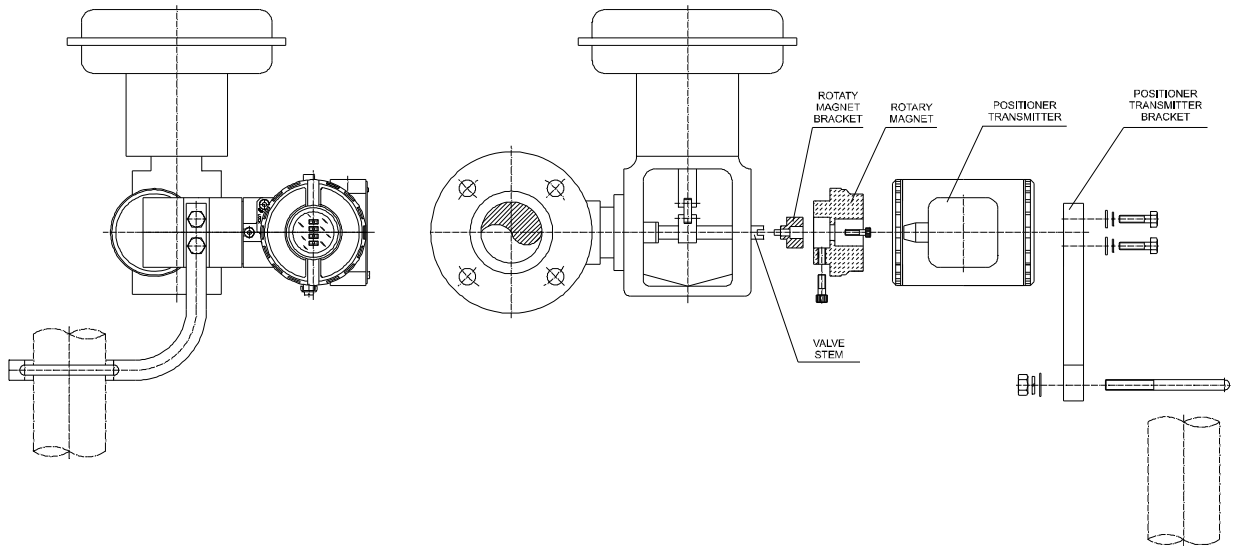


Figure 1.2 – Transmitter on the Rotary Actuator

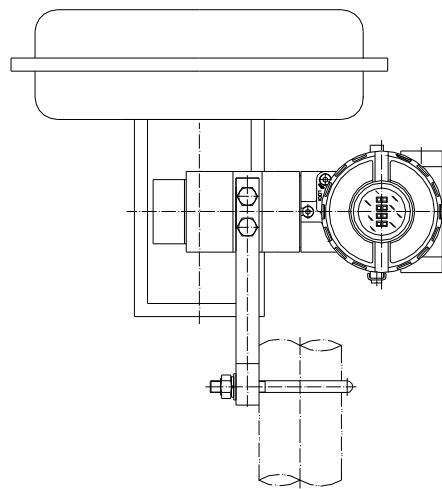


Figure 1.3 – Transmitter on the Linear Actuator

Housing Rotation

The electronic housing can be rotated in order to better position the digital display. To rotate it, uses the housing rotation set screw, see figure 1.4.

The local indicator itself can also be rotated. See section 5, figure 5.2.

Electric Wiring

Reach the wiring block by removing the electrical connection cover (figure 1.4). This cover can be locked closed by the cover locking screw. To release the cover, rotate the locking screw clockwise.

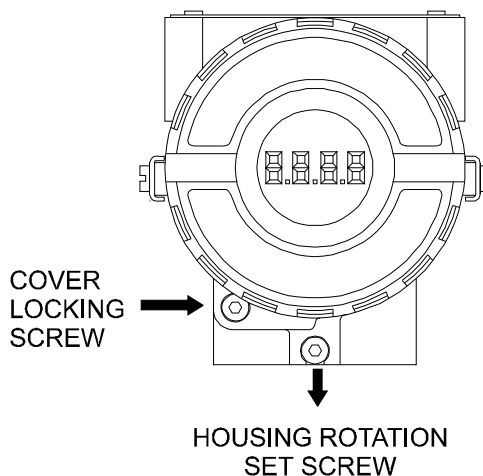


Figure 1.4 – Cover Locking and Housing Rotation Set Screw

The wiring block has screws on which fork or ring-type terminals can be fastened. See figure 1.5.

For convenience there are two ground terminals: one inside the cover and one external, located close to the conduit entries.

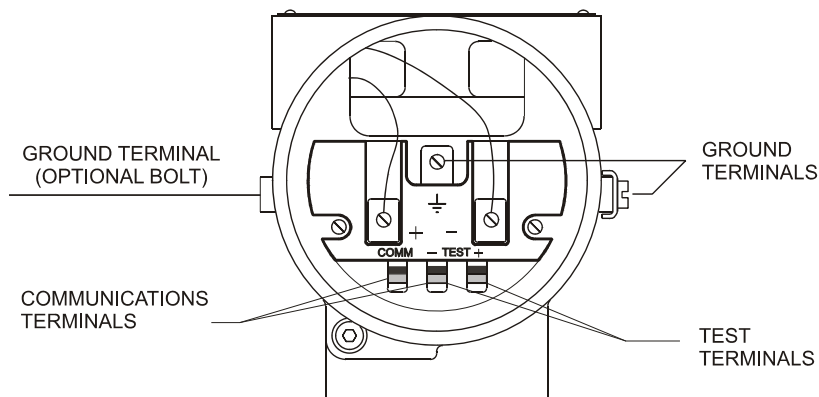


Figure 1.5 – Wiring Block

The **TP303** uses the 31.25 kbit/s voltage mode option for the physical signaling. All other devices on the same bus must use the same signaling. All devices are connected in parallel along the same pair of wires.

Various types of Fieldbus devices may be connected on the same bus.

The **TP303** is powered via the bus. The limit for such devices is according to DP/PA coupler limitations for one bus for non-intrinsically safe requirement.

In hazardous area, the number of devices may be limited by intrinsically safe restrictions, according to the DP/PA couples and barriers limitations.

The **TP303** is protected against reverse polarity, and can withstand ± 35 VDC without damage, but it will not operate when in reverse polarity.

WARNING

HAZARDOUS AREAS

In hazardous zones with explosion proof requirements the covers must be tightened with at least 7 turns. In order to avoid moisture or corrosive gases, hand tighten the covers until the O-rings are compressed. Lock the covers closed with the locking screw.

In hazardous zones with intrinsically safe or non-incentive 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.

Bus Topology and Network Configuration

Bus and 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.

In following figures, the DP/PA link depends on the application needs.

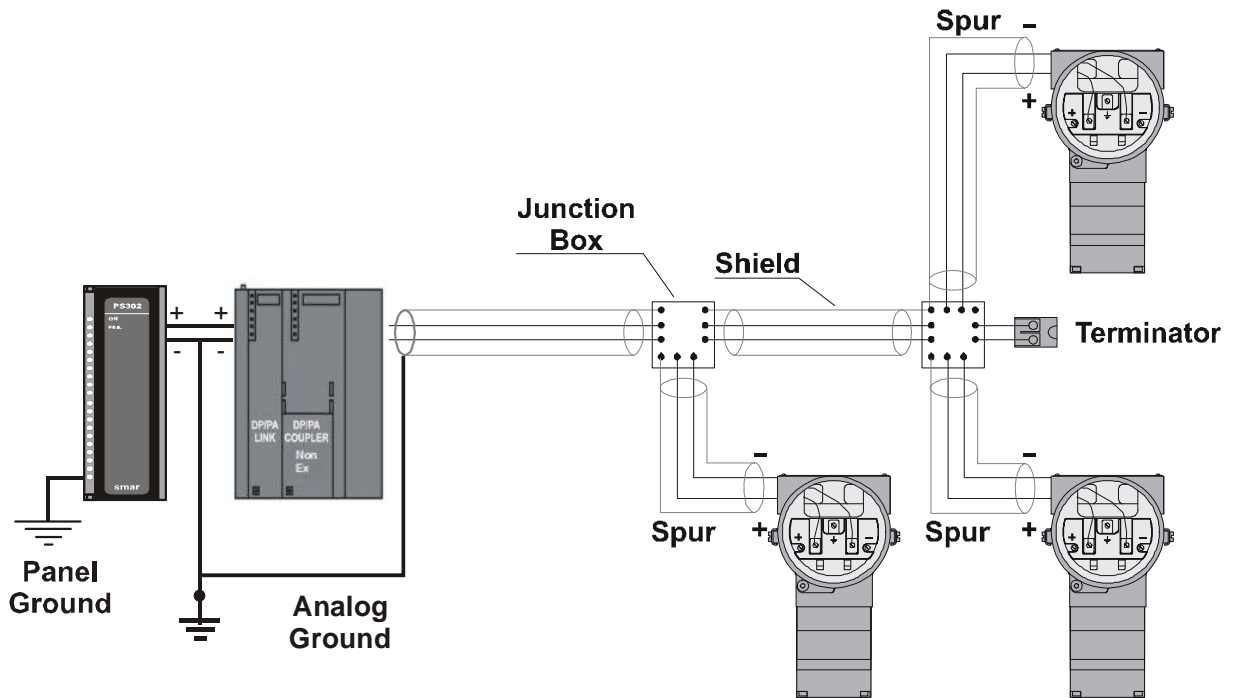


Figure 1.6 - Bus Topology

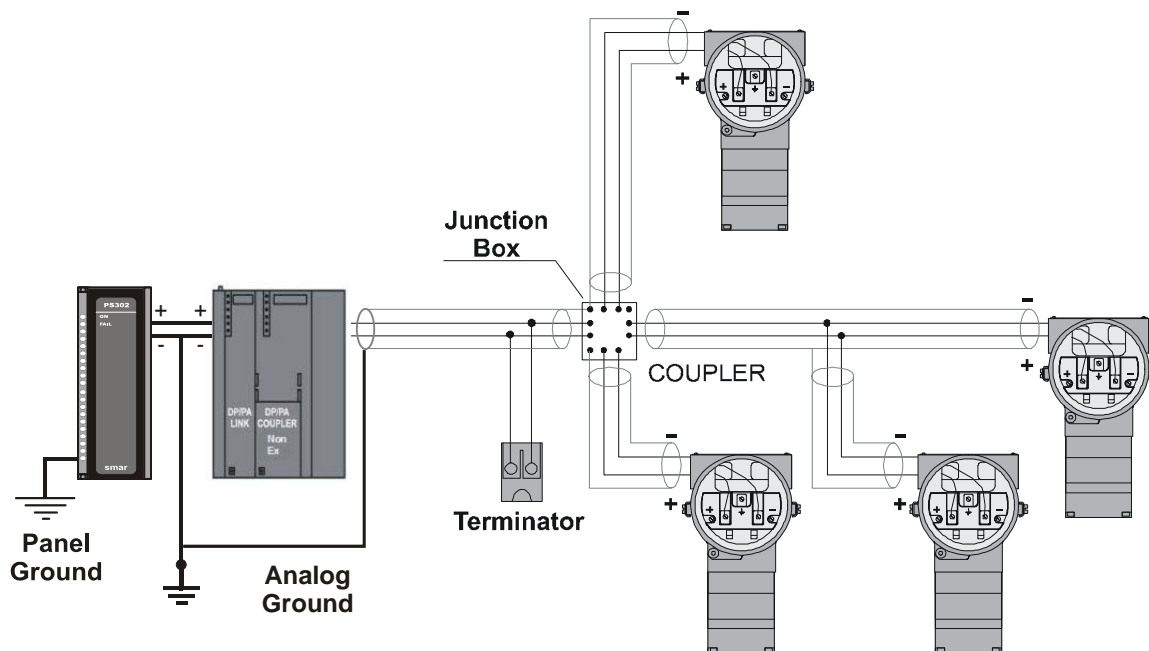


Figure 1.7 - Tree Topology

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 DP/PA coupler, when it is Non-Ex type.

Use of DF47 is recommended.

Jumper Configuration

In order to work properly, the jumpers J1 and W1 located in the **TP303** main board must be correctly configured.

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

Table 1.1 - Description of the Jumpers

Power Supply

The **TP303** 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.

Remote Hall Sensor

The remote Hall magnetic sensor is recommended for applications where there are high temperatures and extreme vibrations applications. It prevents excessive wear of the equipment and, consequently, the reduction of its useful lifetime.

The electric signals on the remote sensor's connection cable are of low intensity. Therefore, it is recommended to install the cable inside a conduit (maximum length 20 meters) away from possible sources of induction and/or electromagnetic interferences. The cable supplied by Smar is shielded in order to protect it against electromagnetic interferences. Despite this protection, it is not recommended for the cable to share the same conduit with other cables. The parts for the sensor's connection cable are:

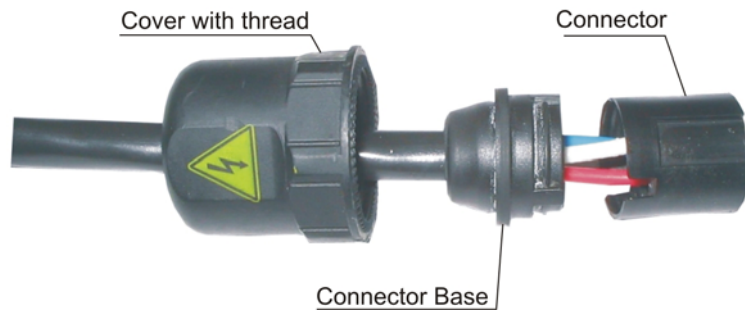


Figure 1.08 – Hall Sensor Cable and Accessories

Disassembly Procedure

Figures 1.09 to 1.12 show the correct disassembling order for the Hall sensor. The steps for disassembling are:

1. Unscrew the cover, by turning it on counter-clockwise direction (direction of the arrow) for the remote Hall side according to figure 1.09.
2. Pull the cable following the arrow as in figure 1.10,
3. Pull the cable connector base, to release it from the block connector, according to figures 1.11 and 1.12.



Figure 1.09 – Disconnecting the cover of the Hall sensor cable



Figure 1.10 – Disconnecting the Hall sensor cable



Figure 1.11 – Unfastened Connector



Figure 1.12 – Connector with the cable's wires maintained in their orifices



Figure 1.13 – Wires position in the connector



Figure 1.14 – Release the cables' connector

Assembly Procedure

Mount the components following the sequence:

1. Pass the cable through the cover orifice (Figure 1.15);
2. Pass the cable through the base connector orifice (Figure 1.16);
3. The red, white, and black wires should be inserted in the base connector orifice marked by numbers beside them, look at figure 1.17 e 1.18.



Figure 1.15 – Assembling the cover



Figure 1.16 – Assembling the wire bracket



Figure 1.17 – Inserting the wires in the connector

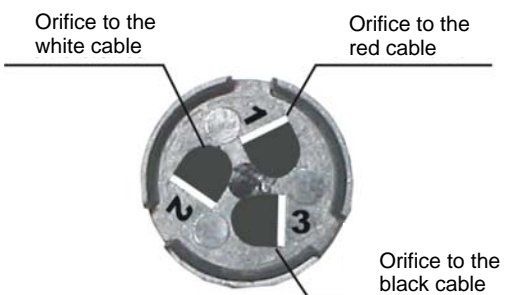


Figure 1.18 – Orifice Cable's Connector with numbers beside them

Insert the cable connector in the remote Hall's block connector as figure 1.19. The block connector has internal saliencies that perfectly fit the groove, in order to prevent errors in the assembly. The cutting pins inside of the block connector will cut the wire insulators and press against them, thus establishing the electric contact between the cable and the hall sensor's circuit. To finish, fasten the cover to the Hall sensor's connection (figure 1.20).



Figure 1.19 – Fasten the cover to the remote Hall



Figure 1.20 – Assembly finished

Section 2

OPERATION

Functional Description – Hall Sensor

Sensor Hall supplies an output voltage proportional to the applied magnetic field. This magnetic sensor is ideal for use in system of sensor of linear or rotative position. The mechanical vibrations do not affect Sensor Hall.

Functional Description – Electronics

Refer to the block diagram. The function of each block is described below.

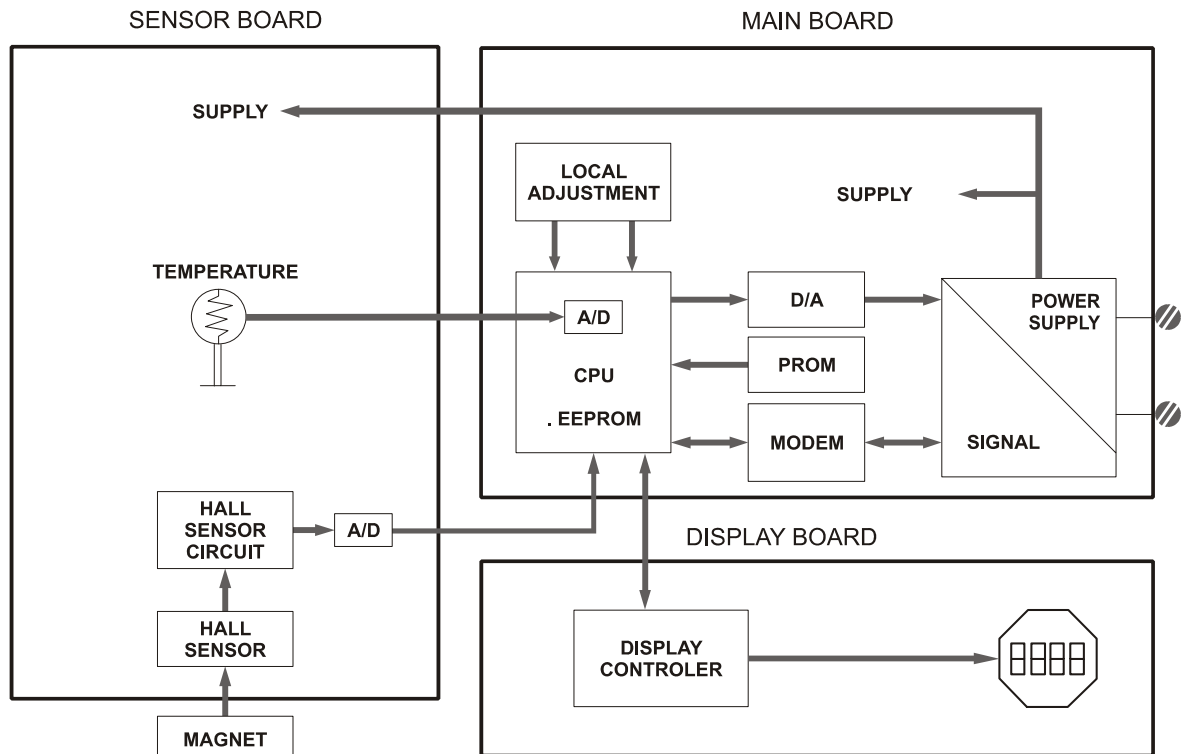


Figure 2.1 - TP303 Block Diagram Hardware

Oscillator

This oscillator generates a frequency as a function of sensor capacitance.

Signal Isolator

The control signals from the CPU and the signal from the oscillator are isolated to avoid ground loops.

Central Processing Unit (CPU), RAM, FLASH and EEPROM

The CPU is the intelligent portion of the transmitter, being responsible for the management and operation of measurement, block execution, self-diagnostics and communication. The program is stored in a flash memory for easy upgrade and saving data on power-down event occurrence. For temporary storage of data, there is a RAM. The data in the RAM is lost if the power is switched off, however the main board has a nonvolatile EEPROM memory where the static data configured that must be retained is stored. Examples of such data are the following: calibration, links and identification data.

Fieldbus Modem

Monitors line activity, modulate and demodulate communication signals; inserts and deletes start and end delimiters, and check integrity of frame received.

Power Supply

Takes power of the loop-line to power the transmitter circuitry.

Power Isolation

Isolates the signals to and from the input section, the power to the input section must be isolated.

Hall Effect Sensor

Measures the position actual to the CPU.

Display Controller

Receives data from the CPU identifying which segments on the liquid crystal display use to turn on. The controller drives the backplane and the segment control signals.

Local Adjustment

There are two switches that are magnetically activated. The magnetic tool without mechanical or electrical contact can activate them.

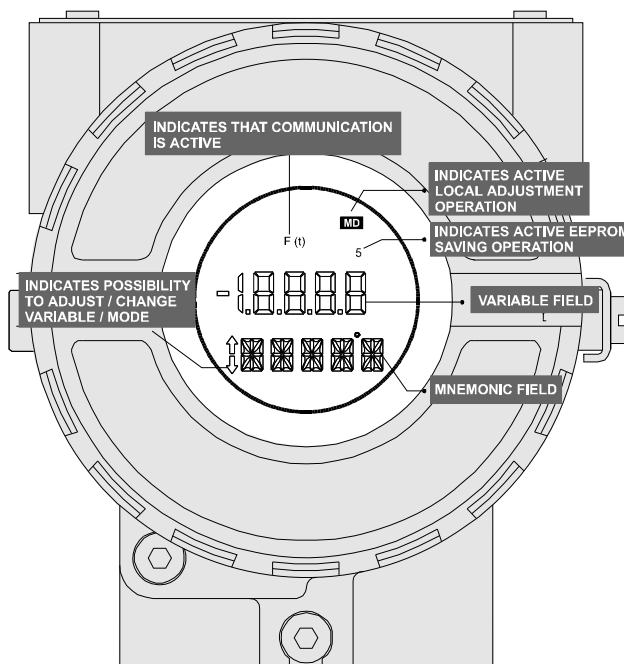


Figure 2.2 - LCD Indicator

Section 3

CONFIGURATION

This section describes the characteristics of the blocks in the **TP303**. They follow the Profibus PA specifications, but in terms of transducer blocks, the input transducer block and display, they have some special features on top of this.

The 303 Smar family is integrated in Simatic PDM, from Siemens. It is possible to integrate any 303 Smar device into any configuration tool for Profibus PA devices. It is necessary to provide a device description or drive according to the configuration tool. In this manual is taken several examples using Simatic PDM.

Offline Configuration

1. First run "Download to PG/PC" option to assure valid values.
2. Run after the Menu Device option to configure the required parameters using the related menus.

NOTE

It is not advisable to use the "Download to Device" option. This function can misconfigure the equipment.

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 for Position Transmitter

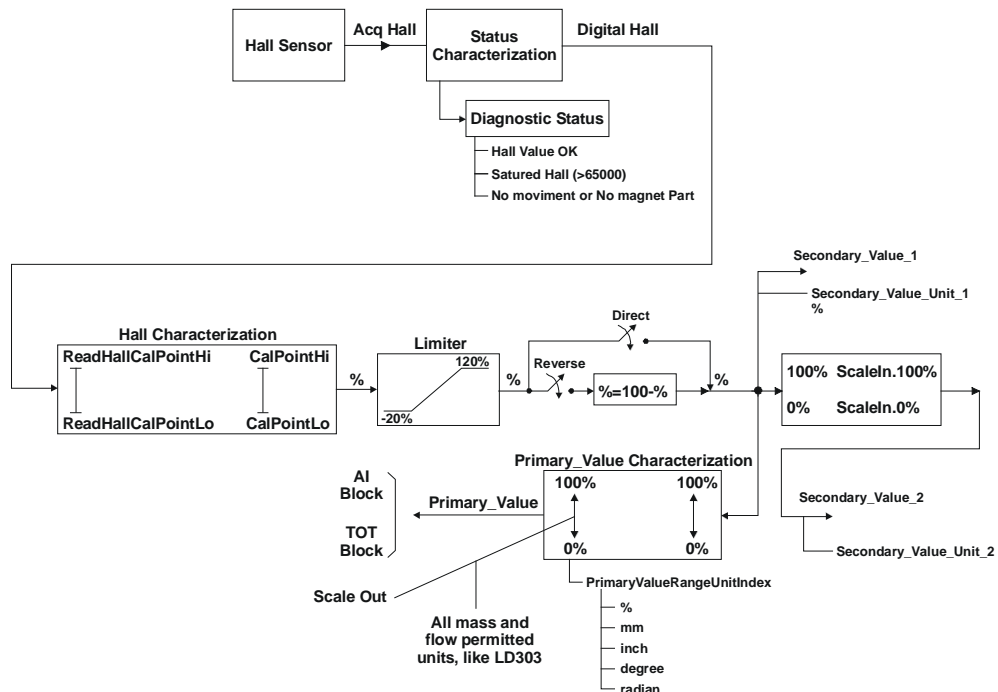


Figure 3.1 - Transducer Block Diagram for Position Transmitter

Transducer Block Parameter Description

Parameter	Description
SENSOR_VALUE	This parameter contains the raw sensor value. The uncalibrated measurement value from the sensor. Unit derives from SENSOR_UNIT.
SENSOR_HI_LIM	This parameter contains the sensor upper limit value. Unit derives from SENSOR_UNIT.
SENSOR_LO_LIM	This parameter contains the sensor lower limit value. Unit derives from SENSOR_UNIT.
CAL_POINT_HI	This parameter contains the highest calibrated value. For calibration of the high limit point you give the high measurement value to the sensor and transfer this point as HIGH to the transmitter. Unit derives from SENSOR_UNIT.
CAL_POINT_LO	This parameter contains the lowest calibrated value. For calibration of the low limit point you give the low measurement value to the sensor and transfer this point as LOW to the transmitter. Unit derives from SENSOR_UNIT.
CAL_MIN_SPAN	This parameter contains 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. Unit derives from SENSOR_UNIT.
MAINT_DATE	The date of last maintenance.
SENSOR_UNIT	This parameter contains the engineering units index code for the calibration values. In this case the unit code is %.
SENSOR_SN	The serial number of sensor.
TRIMMED_VALUE	This parameter contains the sensor value after trim processing. Unit derives from SENSOR_UNIT.
PRIMARY_VALUE	This parameter contains the measured value and status available to the function block. The unit of PRIMARY_VALUE is the PRIMARY_VALUE_UNIT.
PRIMARY_VALUE_TYPE	This parameter contains the application of the device. (> 128: manufacture specific)
PRIMARY_VALUE_UNIT	This parameter contains the engineering units index code for the primary value. In this case the unit code is % or mass or flow units (m ³ /s, m ³ /h, L/s, L/h, CFM, CFD, GPM, gal/d, bbl/d, g/min, Kg/s, Kg/h, t/min, t/d, lb/min, lb/d, m ³ /min, m ³ /d, L/min, CFS, CFH, gal/s, gal/h, bbl/s, bbl/h, g/s, g/h, Kg/min, Kg/d, t/h, lb/s, lb/h).
SECONDARY_VALUE_1	This parameter contains the value and status available to the function block.
SECONDARY_VALUE_1_UNIT	This parameter contains the units of the SECONDARY_VALUE_1.
SECONDARY_VALUE_2	This parameter contains the measured value after input scaling and status available to the function block. The related unit is the SECONDARY_VALUE_UNIT_2.
SECONDARY_VALUE_2_UNIT	This parameter contains the units of the SECONDARY_VALUE_2 defined by the manufacturer
SCALE_IN	This is the input conversion of the current into PRIMARY_VALUE using the high and low scale. The related unit is the PRIMARY_VALUE_UNIT.
SCALE_OUT	This is the output conversion value using the high and low scale. The related unit is the PRIMARY_VALUE_UNIT.
MAX_SENSOR_VALUE	Holds the maximum process SENSOR_VALUE. A write access to this parameter resets to the momentous value. The unit is defined in SENSOR_UNIT.
MIN_SENSOR_VALUE	Holds the minimum process SENSOR_VALUE. A write access to this parameter resets to the momentous value. The unit is defined in SENSOR_UNIT.
SECONDARY_VALUE	Indicates the temperature value and status.
SECONDARY_VALUE_UNIT	The secondary value unit. In this case is always Celsius.
CAL_TEMPERATURE	The calibration point for temperature sensor.
DIGITAL_HALL	Digital value and status for Hall sensor.
DIAGNOSTIC_STATUS	Indicates the status for transducer block: 0x0001, "None" 0xfffe, "Ok" 0x0002, "Saturated Hall" 0xfffd, "Hall is Ok" 0x0004, "No mov. or no magnetic part" 0xfffb, "Magnet part is ok" 0x0008, "Burn out" 0xff7, "No burn out" 0x0010, "Temperature out of work range" 0xffef, "Temp is Ok"

Parameter	Description
READ_HALL_CAL_POINT_HI	The calibration point high for Hall sensor.
READ_HALL_CAL_POINT_LO	The calibration point high for Hall sensor.
ACTION_TYPE	Select the direct or reverse action: 0 = direct 1 = reverse
BACKUP_RESTORE	This parameter allows to save and to restore data according to factory and user calibration procedures. It has the following options: 1, "Factory Cal Restore", 2, "Last Cal Restore", 3, "Default Data Restore", 4, "Shut-Down Data Restore", 5, "Sensor Data Restore", 11, "Factory Cal Backup", 12, "Last Cal Backup", 14, "Shut-Down Data Backup", 15, "Sensor Data Backup", 0, "None".
XD_ERROR	Indicates the condition of calibration process according to: {16, "Default value set"}, {22, "Applied process out of range"}, {26, "Invalid configuration for request"}, {27, "Excess correction"}, {28, "Calibration failed"}
MAIN_BOARD_SN	Main board serial number
EEPROM_FLAG	Indicate that the device is saving data in EEPROM memory: 0 = false 1 = true
ORDERING_CODE	Indicates information about the sensor and control from production factory.

Table 3.1 - Transducer Block Parameter Description

Transducer Block Parameter Attributes

Relative Index	Parameter Mnemonic	Object Type	Data Type	Store	Size	Access	Parameter usage/ Type of transport	Default value	Download Order	Mandatory Optional (Class)
... Standard Parameter										
Additional Parameter for Transducer Block										
8	SENSOR_VALUE	Simple	Float	D	4	r	C/a	0	-	M (B)
9	SENSOR_HI_LIM	Simple	Float	N	4	r	C/a	0	-	M (B)
10	SENSOR_LO_LIM	Simple	Float	N	4	r	C/a	0	-	M (B)
11	CAL_POINT_HI	Simple	Float	N	4	r,w	C/a	100.0	-	M (B)
12	CAL_POINT_LO	Simple	Float	N	4	r,w	C/a	0.0	-	M (B)
13	CAL_MIN_SPAN	Simple	Float	N	4	r	C/a	0	-	M (B)
14	MAINT_DATE	Simple	Octet String	S	16	w,w	C/a			O(B)
15	SENSOR_UNIT	Simple	Unsigned 16	N	2	r,w	C/a	1342	-	M (B)
16	SENSOR_SN	Simple	Unsigned 32	N	4	r,w	C/a		-	M (B)
17	TRIMMED_VALUE	Record	DS-33	D	5	r	C/a	0.0	-	M (B)
18	PRIMARY_VALUE	Record	DS-33	D	5	r	C/a	0.0	-	M (B)
19	PRIMARY_VALUE_UNIT	Simple	Unsigned 16	N	2	r,w	C/a	-	-	M (B)
20	PRIMARY_VALUE_TYPE	Simple	Unsigned 16	N	2	r,w	C/a	255	-	M (B)
21	SECONDARY_VALUE_1	Record	DS-33	D	5	r	C/a	0.0	-	O (B)
22	SECONDARY_VALUE_1_UNIT	Simple	Unsigned 16	N	2	r,w	C/a	E.U.	-	O (B)
23	SECONDARY_VALUE_2	Record	DS-33	D	5	r	C/a	0	-	O (B)
24	SECONDARY_VALUE_2_UNIT	Simple	Unsigned 16	N	2	r,w	C/a	%	-	O (B)
25	SCALE_IN	Array	Float	S	8	r,w	C/a	100.0 0.0	-	O(B)
26	SCALE_OUT	Array	Float	S	8	r,w	C/a	100.0 0.0	-	O(B)
27	MAX_SENSOR_VALUE	Simple	Float	N	4	r,w	C/a	0.0	-	O (B)
28	MIN_SENSOR_VALUE	Simple	Float	N	4	r,w	C/a	0.0	-	O (B)
29	SECONDARY_VALUE	Record	DS-33	D	5	r	C/a	0.0	-	O (B)
30	SECONDARY_VALUE_UNIT	Simple	Unsigned 16	N	2	r	C/a	Celsius	-	O (B)
31	CAL_TEMPERATURE	Simple	Float	N	4	r,w	C/a	Celsius		O (B)
32	DIGITAL_HALL	Record	DS-33	D	5	r	C/a	0.0	-	O (B)
33	DIAGNOSTIC_STATUS	Simple	Unsigned 16	D	2	r	C/a	0x0001	-	O (B)
34	READ_HALL_CAL_POINT_HI	Simple	Float	N	4	r	C/a			O (B)
35	READ_HALL_CAL_POINT_LO	Simple	Float	N	4	r	C/a			O (B)
36	ACTION_TYPE	Simple	Unsigned 8	S	1	r,w	C/a	direct	-	O (B)
37	BACKUP_RESTORE	Simple	Unsigned 8	S	1	r,w	C/a	0	-	O (B)
38	XD_ERROR	Simple	Unsigned 8	D	1	r	C/a	0x10	-	O (B)
39	MAIN_BOARD_SN	Simple	Unsigned 32	S	4	r,w	C/a	0	-	O (B)
40	EEPROM_FLAG	Simple	Unsigned 8	D	1	r	C/a	FALSE	-	O (B)
41	ORDERING_CODE	Array	Unsigned 8	S	50	r,w	C/a	-	-	O (B)

Table 3.2 - Transducer Block Parameter Attributes

Transducer Block View Object

Relative Index	Parameter Mnemonic	View_1	View_2	View_3	View_4
1	ST_REV	2			
2	TAG_DESC				
3	STRATEGY				
4	ALERT_KEY				
5	TARGET_MODE				
6	MODE_BLK	3			
7	ALARM_SUM	8			
8	SENSOR_VALUE				
9	SENSOR_HI_LIM				
10	SENSOR_LO_LIM				
11	CAL_POINT_HI				
12	CAL_POINT_LO				
13	CAL_MIN_SPAN				
14	MAINT_DATE				
15	SENSOR_UNIT				
16	SENSOR_SN				
17	TRIMMED_VALUE				
18	PRIMARY_VALUE	5			
19	PRIMARY_VALUE_UNIT				
20	PRIMARY_VALUE_TYPE				
21	SECONDARY_VALUE_1				
22	SECONDARY_VALUE_1_UNIT				
23	SECONDARY_VALUE_2				
24	SECONDARY_VALUE_2_UNIT				
25	SCALE_IN				
26	SCALE_OUT				
27	MAX_SENSOR_VALUE				
28	MIN_SENSOR_VALUE				
29	SECONDARY_VALUE				
30	SECONDARY_VALUE_UNIT				
31	CAL_TEMPERATURE				
32	DIGITAL_HALL				
33	DIAGNOSTIC_STATUS				
34	READ_HALL_CAL_POINT_HI				
35	READ_HALL_CAL_POINT_LO				
36	ACTION_TYPE				
37	BACKUP_RESTORE				
38	XD_ERROR				
39	MAIN_BOARD_SN				
40	EEPROM_FLAG				
41	ORDERING_CODE				
	TOTAL	13 + 5 = 18 bytes			

Table 3.3 - View Objects

How to Configure the Transducer Block

The transducer block has an algorithm, a set of contained parameters and a channel connecting it to a function block.

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 manufacturer's specific ones are defined only for its manufacturer. As common manufacturer specific parameters, we have calibration settings, material information, linearisation 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 guideline to help the user to make common tasks. The configuration tool identifies each method associated to the parameters and enables the interface to it.

The Simatic PDM (Process Device Manager) configuration software from Siemens, for example, can configure many parameters of the input transducer block.

The device was created as TP303.

Here, you can see all blocks instantiated. the transducer and display are treated as special type of function blocks, called transducer Blocks.

Parameter	Value	Unit	Status
TP303 (Offline)			
» Device Info			
» » Manufacture Info			
Manufacturer	Smar		Loaded
Device ID	800902		Loaded
» » Define Device Block Tags			
Physical Tag	PHYSICAL BLOCK		Loaded
Transducer Tag	TRANSDUCER BLOCK - TP303		Loaded
Analog Input Tag	ANALOG INPUT BLOCK		Loaded
Totalizer Tag	TOTALIZER BLOCK		Loaded
Display Tag	DSP BLOCK		Loaded
» » Descriptor, Message and Date			
Descriptor			Loaded
Message			Loaded
Installation Date			Loaded
Ordering Code			Loaded
» » Serial Numbers			
Serial Number	509999104		Loaded
Sensor Serial Number	0		Loaded
Main Board Serial #	65636		Loaded
» » Device Revisions			

Press F1 for help. Specialist Connected NUM

Figure 3.2 - Function and Transducers Blocks

To make the configuration of transducer block, we need to select Device - Offline Configuration - Transducer on the main menu:

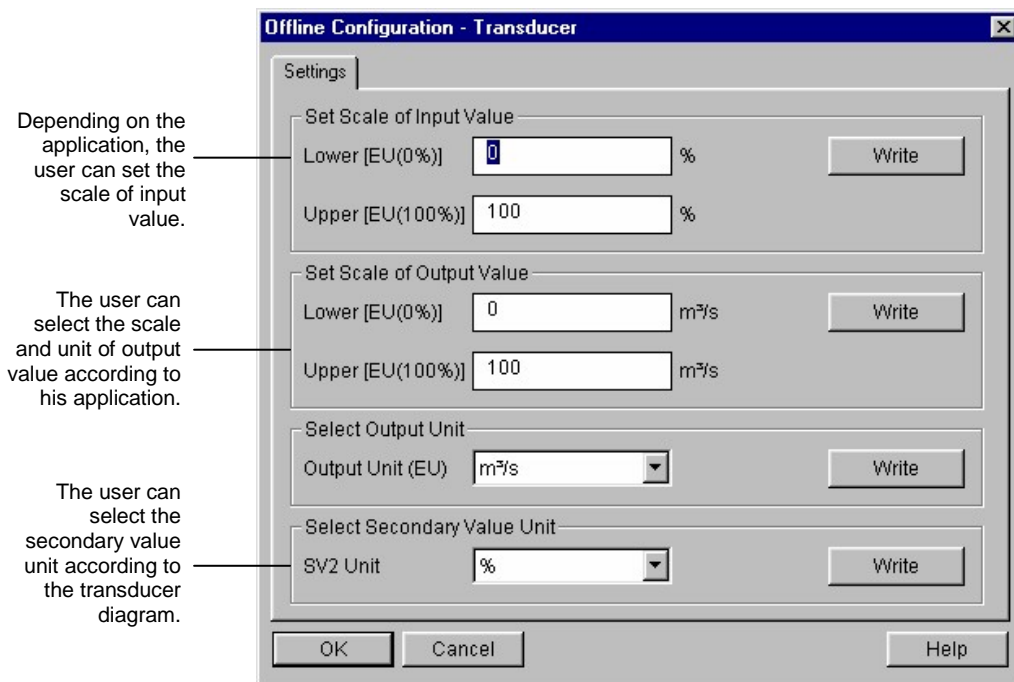


Figure 3.3 - Simatic PDM - Offline Configuration - Transducer

How to Configure the Analog Input Block

The analog input block takes the input data from the transducer block, selected by channel number, and makes it available to other function blocks at its output. The transducer block provides the input unit of the analog input, and when the unit is changed in the transducer, the PV_SCALE unit is changed too. Optionally, a filter may be applied in the process value signal, whose time constant is PV_FTIME. Considering a step change to the input, this is the time in seconds to the PV reaches 63,2% of the final value. If the PV_FTIME value is zero, the filter is disabled. For more details, please, see the Function Blocks Specifications.

To configure the analog input block in offline mode, please, go to the main menu and select Device Offline Configuration - Analog Input Block. Using this window, the user can configure the block mode operation, selects the channel, scales and unit for input and output value and the damping.

NOTE
TP303 has damping function implemented.

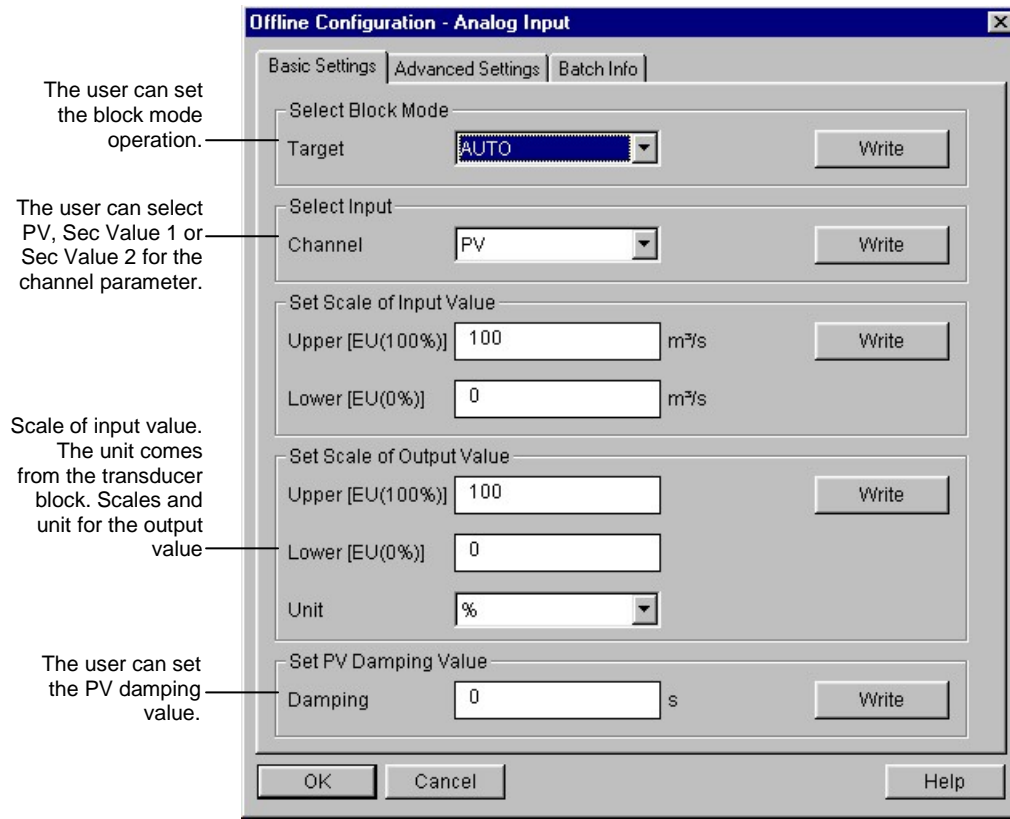


Figure 3.4 - Simatic PDM - Basic Settings for Analog Input Block

Selecting the page "Advanced Settings", the user can configure the conditions for alarms and warnings, as well the fail safe condition. Please, see the window:

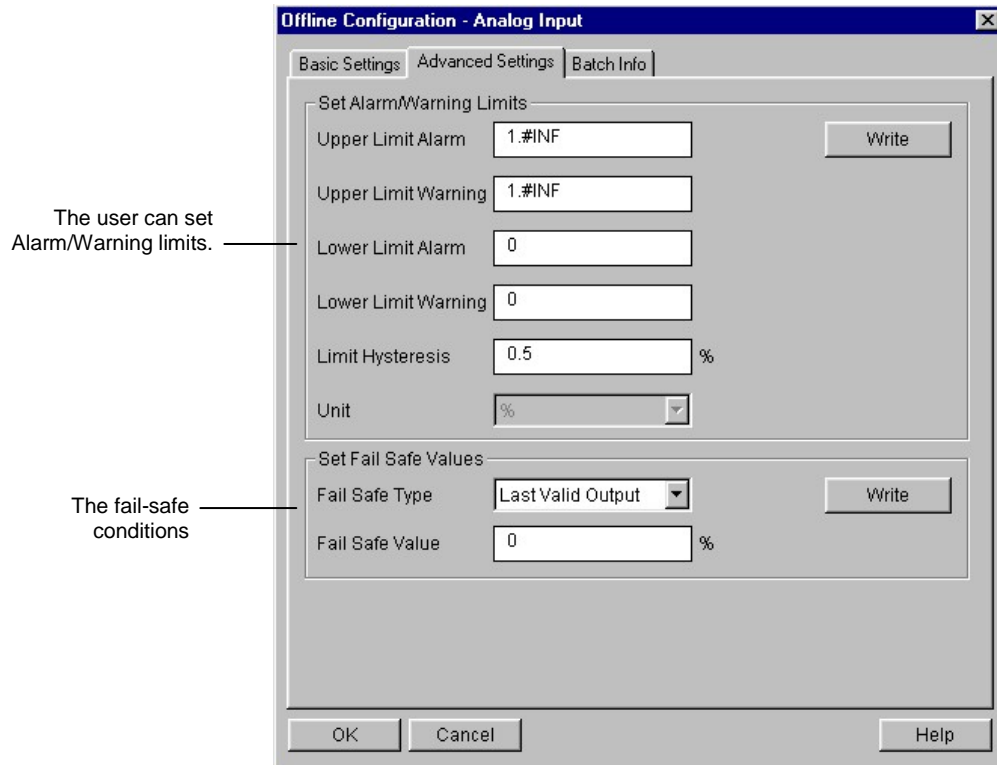


Figure 3.5 - Simatic PDM - Advanced Settings for Analog Input Block

In terms of online configuration for the Analog Input Block, please, go to the main menu and select "Device - Online Configuration - Analog Input - Block Mode":

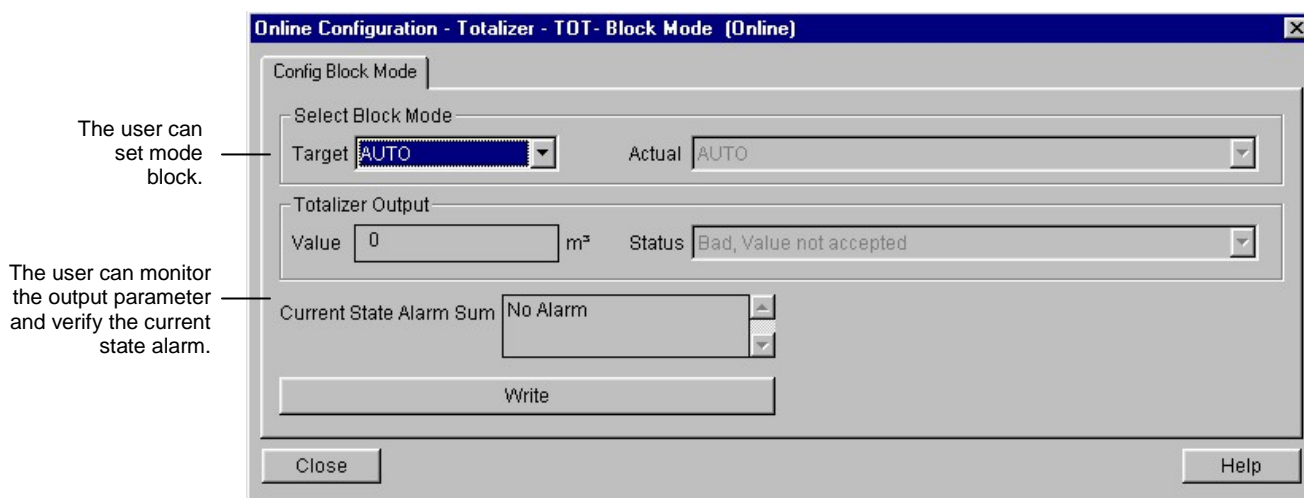


Figure 3.6 - Simatic PDM - Online Configuration for Analog Input Block

TP303 Cyclical Configuration

Profibus-DP as well as Profibus-PA foresees protocol mechanisms against communication failures and errors and, as an example, during the initialization, several errors sources are verified.

After the power up the field equipments (slaves), they are ready for the cyclical data exchange with the class1 master, but, for that, the master parameterization for the correspondent slave must be correct. This information is obtained through the GSD files, which should be one for each device.

Through the commands below, the master executes every initialization process with Profibus-PA devices:

- § Get_Cfg: carries the slaves' configuration and verifies the net configuration;
- § Set_Prm: writes in the slaves' parameters and executes net parameterization services;
- § Set_Cfg: configures the slaves according to inputs and outputs;
- § Get_Cfg: a second command, where the master will verify the slaves' configuration.

All these services are based on the information obtained of GSD slaves' files.

The GSD file of **TP303** presents details of hardware revision and software, bus timing of the device and information on cyclical data exchange. **TP303** has 2 function blocks: 1 AI and 1 Totalizer. Besides this, **TP303** has the empty module for applications that configure only some function blocks. The following cyclical order of blocks must be considered: AI, TOT. In case of using only the AI block, must configure in this order: AI, EMPTY_MODULE.

Most of the Profibus configurators use two directories. These directories must have the GSD's and bitmap's files of several manufacturers. The GSD and bitmap's files for Smar devices can be purchased via internet in www.smar.com.

See below a typical example with the necessary steps to the integration of a **TP303** device in a PA system and that can be extended for any device:

1. Copy the GSD file of the device for the search directory of the Profibus configurator, usually named GSD.
2. Copy the bitmap file of the device for the search directory of the Profibus configurator, usually named BMP.
3. Once the master is chosen, the communication rate must be chosen, remembering that when we had the couplers, we can have the following rates: 45.45 kbits/s (Siemens), 93.75 kbits/s (P+F) and 12 Mbits/s (P+F, SK2) .If we had the link device, it can be up to 12 Mbits/s.
4. Add the **TP303**, specifying the address in the bus.
5. Choose the cyclical configuration via parameterization with the GSD file, dependent of the application, as indicated previously.

6. For the AI block, **TP303** will supply the master the value of the process variable in 5 bytes. The four first bytes in float point format and the fifth byte the status that carries information about measurement quality.
7. When using the TOT block, is possible to choose the totalization value (Total), and also, the integration is made considering the operation mode (Mode_Tot), where is possible to define how the totalization can be made (only positive flow values, only negative flow values, both values). Is also possible to reset the totalization and configure a preset value through the parameter (Set_Tot). The reset option is very used in batch processes.
8. The watchdog condition can also be activated, where after the communication loss detection for the slave device with the master; the equipment can change to a fail-safe condition.

How to Configure the Totalizer Block

The totalizer function block takes the input data from the transducer block, selected by channel number, and integrates over the time. This block is normally used to totalize flow, giving total mass or volume over a certain time, or totalize power, giving the total energy.

The totalizer function block integrates a variable (e.g. flow rate or power) in function of the time to the corresponding quantity (e.g., volume, mass or distance). The rate unit of the Totalizer is providing by the transducer block. Internally, the time units are converted in rate units per second. Each rate, multiplied by the block execution time, gives the mass, volume or energy increment per block execution.

The total is the totalized quantity. The engineering unit used in the output is the UNIT_TOT. The unit of the output must be compatible with the unit of the input provided by the transducer by the channel. Then, if the input the rate is mass flow (like Kg/s, g/min, ton/h) the unit of the output must be mass (like kg, g, ton, lb, etc.).

For more details, please, see the Function Blocks Specifications.

To configure the totalizer block in offline mode, please, go to the main menu and select Device Offline Configuration - Totalizer Block. Using this window, the user can configure the block mode operation, selects the channel, totalizer mode and unit for the total:

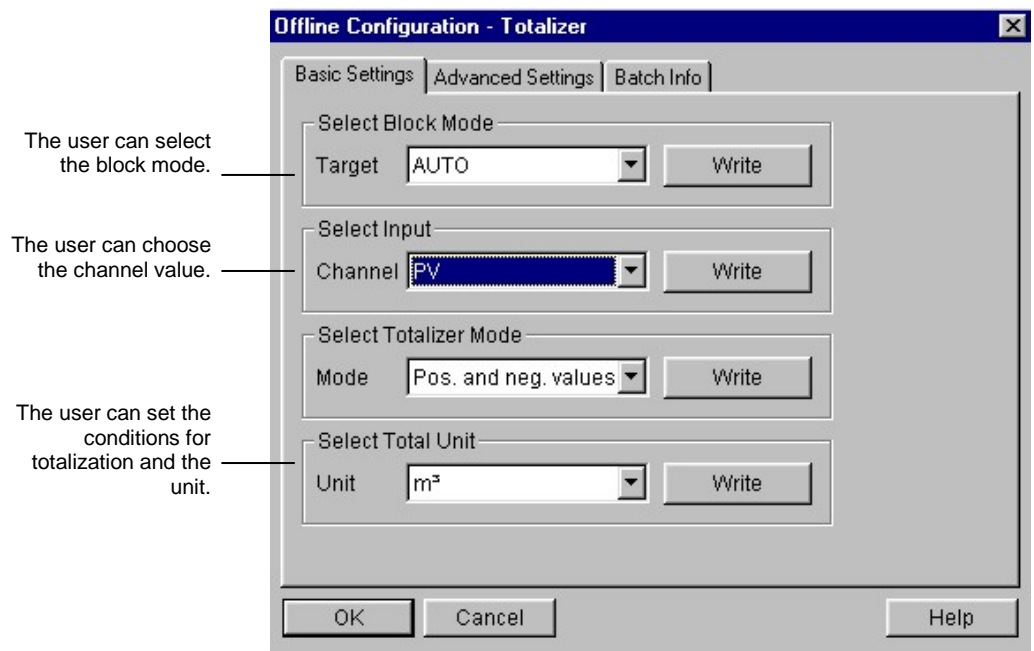


Figure 3.7 - Simatic PDM - Online Configuration - Basic Settings for Totalizer Block

Choosing the Advanced Settings window, the user can set alarm and warning limits, as well the fail-safe condition:

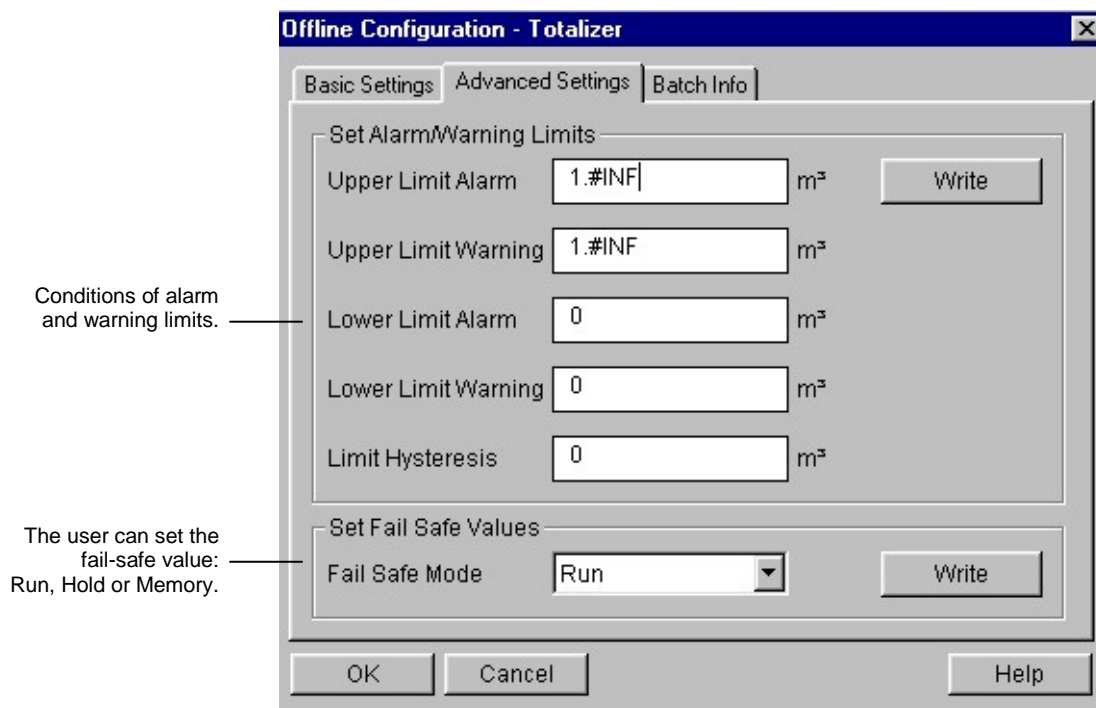


Figure 3.8 - Simatic PDM - Offline Configuration - Advanced Settings for Totalizer Block

In terms of online configuration for the Totalizer Block, please, go to the main menu and select "Device - Online Configuration - Totalizer ", we have the following windows:

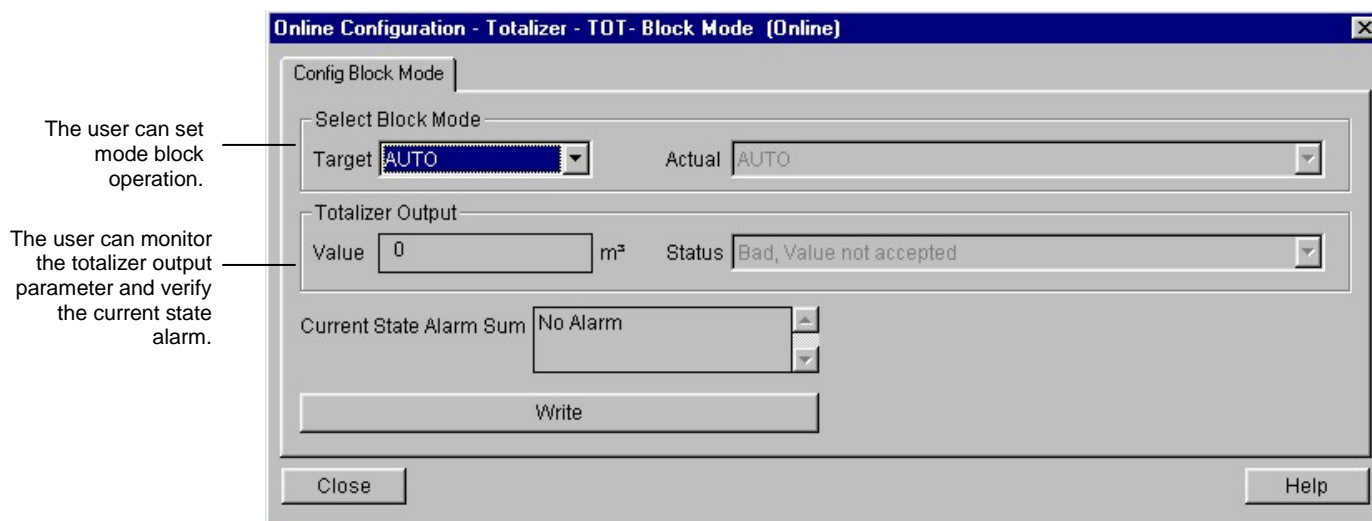


Figure 3.9 - Simatic PDM - Online Configuration - Block Mode for Totalizer Block

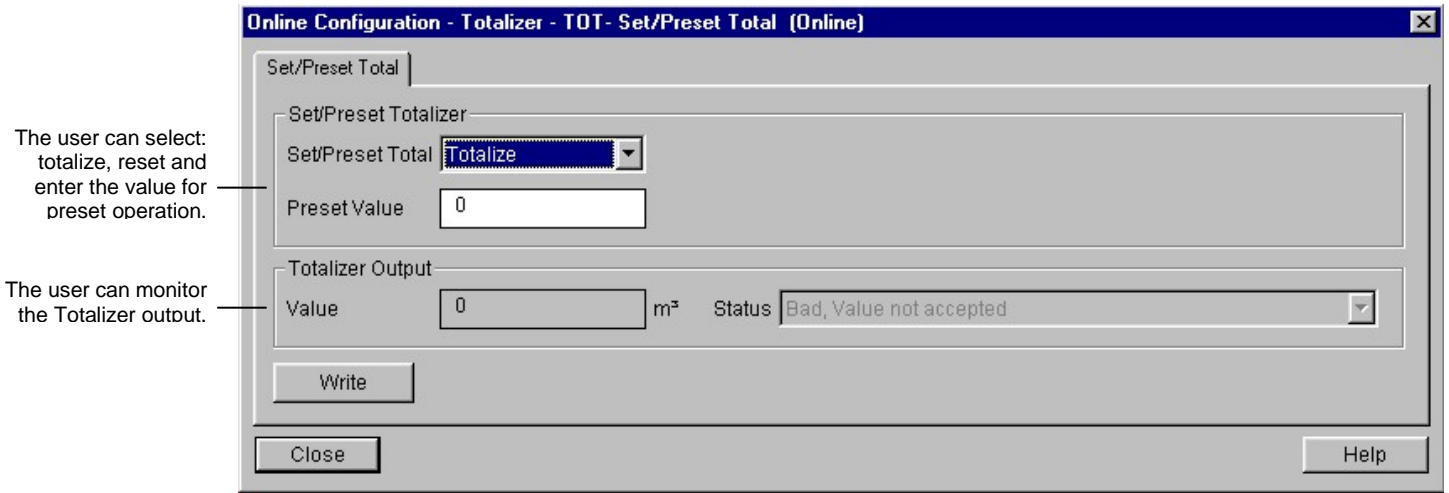


Figure 3.10 - Simatic PDM - Online Configuration - Set/Preset for Totalizer Block

Lower and Upper Trim

This information is provided to recommend parameters for a common user calibration method for position device.

The calibration process is used to match the channel value reading with the applied position input. Six parameters are defined to configure this process: CAL_POINT_HI, CAL_POINT_LO, CAL_MIN_SPAN, SENSOR_UNIT, SENSOR_HI_LIM and SENSOR_LO_LIM. The CAL_* parameters define the highest and lowest calibrated values for this sensor, and the minimum allowable span value for calibration. SENSOR_UNIT allows the user to select different units for calibration purposes than the units defined by PRIMARY_VALUE_UNIT.

The SENSOR_HI_LIM and SENSOR_LO_LIM parameter defines the maximum and minimum values the sensor is capable of indicating, according to SENSOR_UNIT used as it can be seen at figure below.

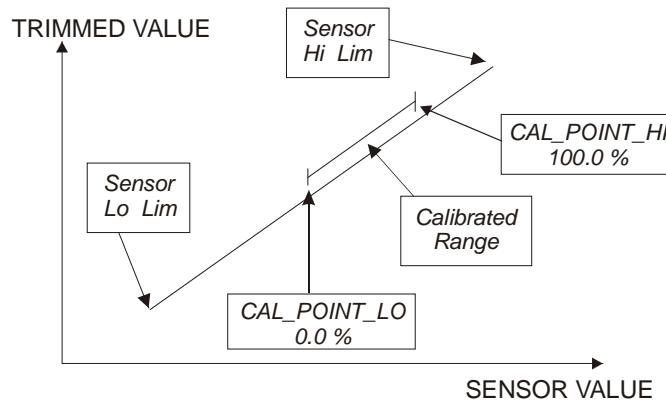


Figure 3.11 - Hall Sensor Calibration

The trim is used to match the reading value with the applied position.

Lower Trim: It is used to trim the reading at the lower range. The operator informs to the TP303 the correct reading for the position.

Upper Trim: It is used to trim the reading at the upper range. The operator informs to the TP303 the correct reading for the position.

Using a configurator is possible to calibrate the converter by means of parameters CAL_POINT_LO and CAL_POINT_HI. This engineering unit is configured by SENSOR_UNIT parameter. The unit code is %. The calibrated value can be read by means TRIMMED_VALUE.

Position Trim - TP303

Via Simatic PDM

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

The engineering unit for the calibration is always. Using the device menu, select the calibration menu. Then, select zero/ lower calibration menu. Apply to the input position 0.0% or the lower position value and wait until the readout of parameter TRIMMED_VALUE stabilizes. Write 0.0 or the lower value in the parameter CAL_POINT_LO.

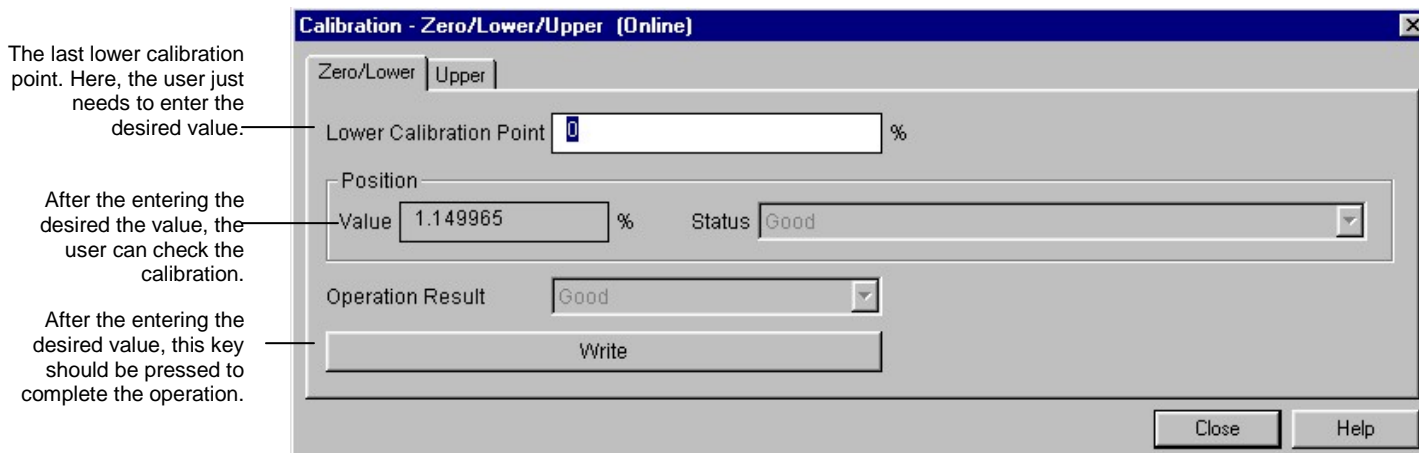


Figure 3.12 - TP303 Simatic PDM - Lower Position Calibration

For each value written a calibration is performed at the desired point. This value must be inside of the sensor range limits allowed.

Then, select upper calibration menu. Apply to the input position 100.0% or the upper position value and wait until the readout of parameter TRIMMED_VALUE stabilizes. Write 100.0 or the upper value in the parameter CAL_POINT_HI.

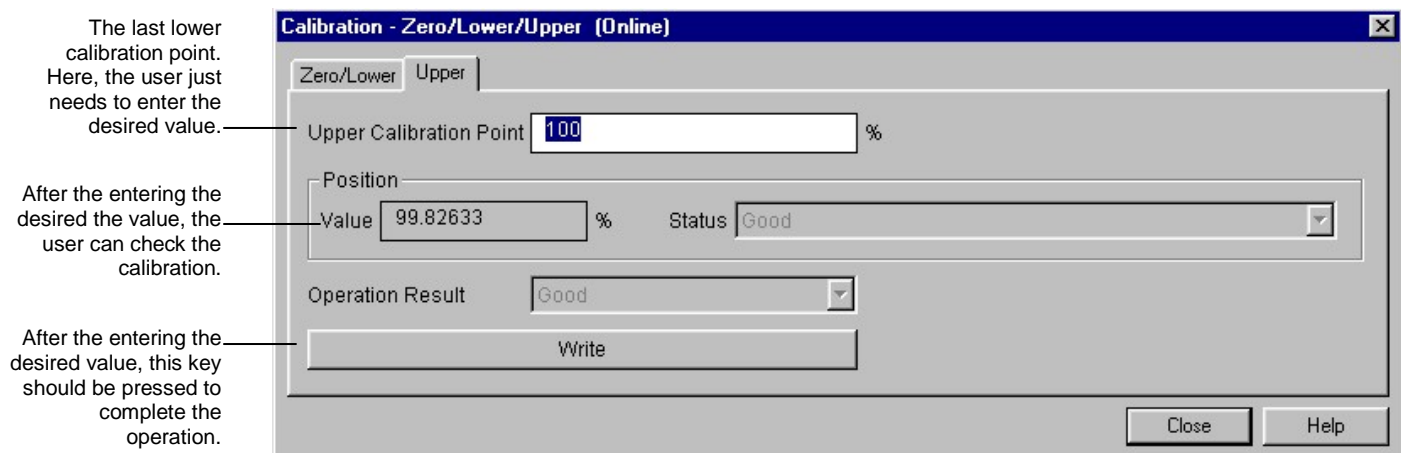


Figure 3.13 - TP303 Simatic PDM – Lower Position Calibration

WARNING

It is recommendable, for every new calibration, to save existing trim data, by means of parameter BACKUP_RESTORE, using option "Last Cal Backup".

Via Local Adjustment

In order to enter the local adjustment mode; place the magnetic tool in office “Z” until flag “MD” lights up in the display. Remove the 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”. Let’s take the upper value as an example:

Let’s take the upper value as an example:

Apply to the input a position of 100.0%

Wait until the current of readout of parameter P_VAL (PRIMARY_VALUE) stabilizes and then actuates parameter UPPER until it reads 100.0%.

Let’s take the lower value as an example:

Apply to the input a position of 0.0%.

Wait until the current of readout of parameter P_VAL (PRIMARY_VALUE) stabilizes and then actuates parameter LOWER until it reads 0.0%

Limit Conditions for Calibration

Upper:

-10.0% <= CAL_POINT_HI <= 110.0%

CAL_POINT_HI#CAL_POINT_LO

CAL_MIN_SPAN = 1.0%.

Otherwise, Invalid calibration request.

Lower:

-10.0% <= CAL_POINT_HI <= 110.0%

CAL_POINT_HI#CAL_POINT_LO

CAL_MIN_SPAN = 1.0%.

Otherwise, invalid calibration request.

If all limit conditions are according to these rules, we will get successful in the performed operation.

NOTE

Trim mode exit via local adjustment occurs automatically should the magnetic tool not be used during some seconds. Keep in that even when parameters LOWER or UPPER already present the desired value, they must be actuated so that calibration is performed.

NOTE

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

Temperature Trim

Write in parameter CAL_TEMPERATURE any value in the range -40°C to +85°C. After that, check the calibration performance using parameter TEMPERATURE. The user can select the unit using the parameter TEMPERATURE_UNIT. Normally, its operation is done by a method in the factory.

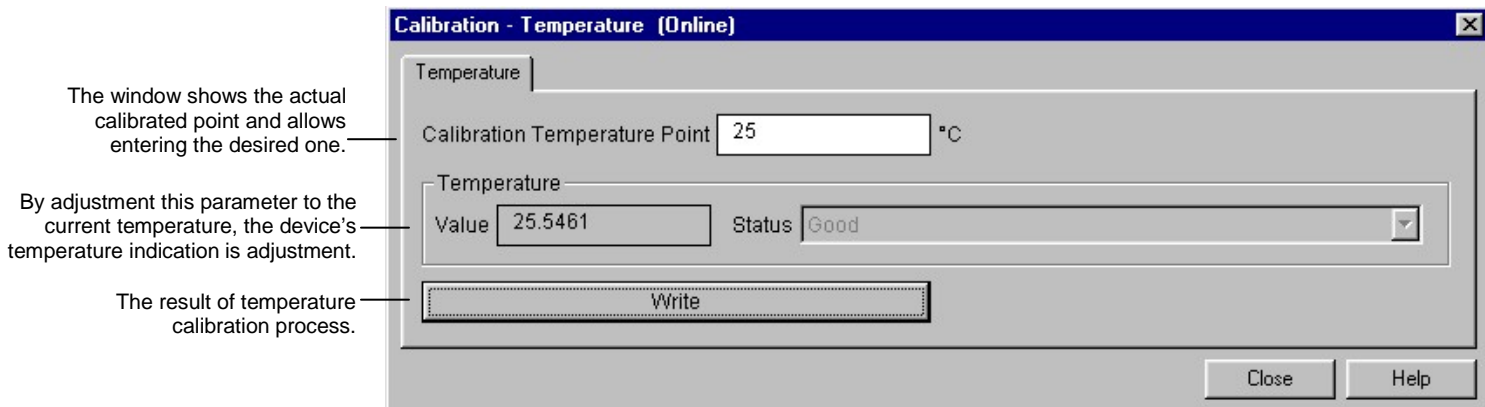


Figure 3.14 - Temperature Trim Configuration Screen

Backup Restore

Through the parameter Backup_Restore, the user can recover default data from factory about sensor and last saved calibration settings, as well as making the rescue of calibrations. We have the following options:

- **Factory Cal Restore:** Recover last calibration settings made at factory;
- **Last Cal Restore:** Recover last calibration settings made by user and saved as backup;
- **Default Data Restore:** Restore all data as default;
- **Factory Cal Backup:** Copy the actual calibration settings to the factory ones;
- **Last Cal Backup:** Copy the actual calibration settings to the backup ones;
- **None:** Default value, no action is done.

On the main menu, selecting Device Factory - Backup/ Restore, the user can select backup and restore operations:

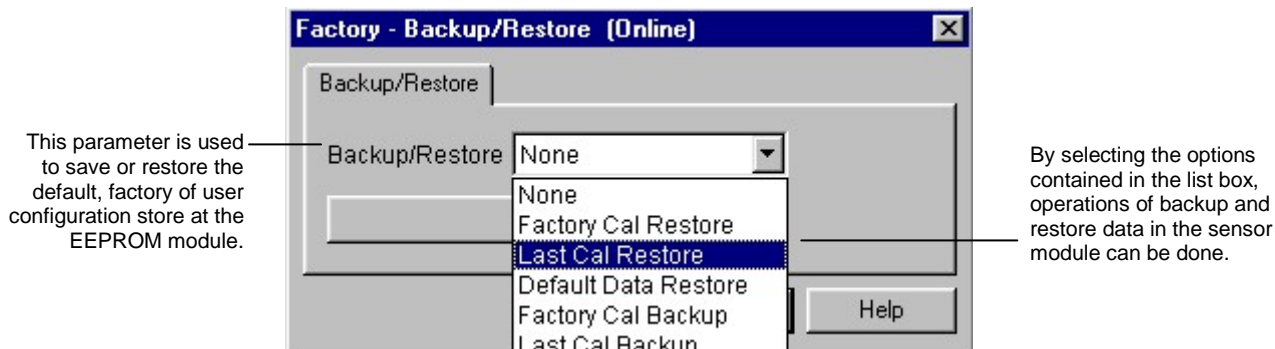


Figure 3.15 - Transducer Block - Backup/Restore

Transducer Display – Configuration

Using the Simatic PDM or any other configuration tool is possible to configure the display transducer block. As the name described it is a transducer due the interfacing of its block with the LCD hardware.

The transducer display is treated as a normal block by any configuration tool. It means, this block has some parameters and those ones can be configured according to customer's needs.

The customer can choose up to six parameters to be shown at LCD display, they can be parameters just for monitoring purpose or for acting locally in the field devices by using a magnetic tool. The seventh parameter is used to access the physical device address. The user can change this address according to his application. To access and configure the display block, please, go to the main menu; select Device online Configuration - Display Block:

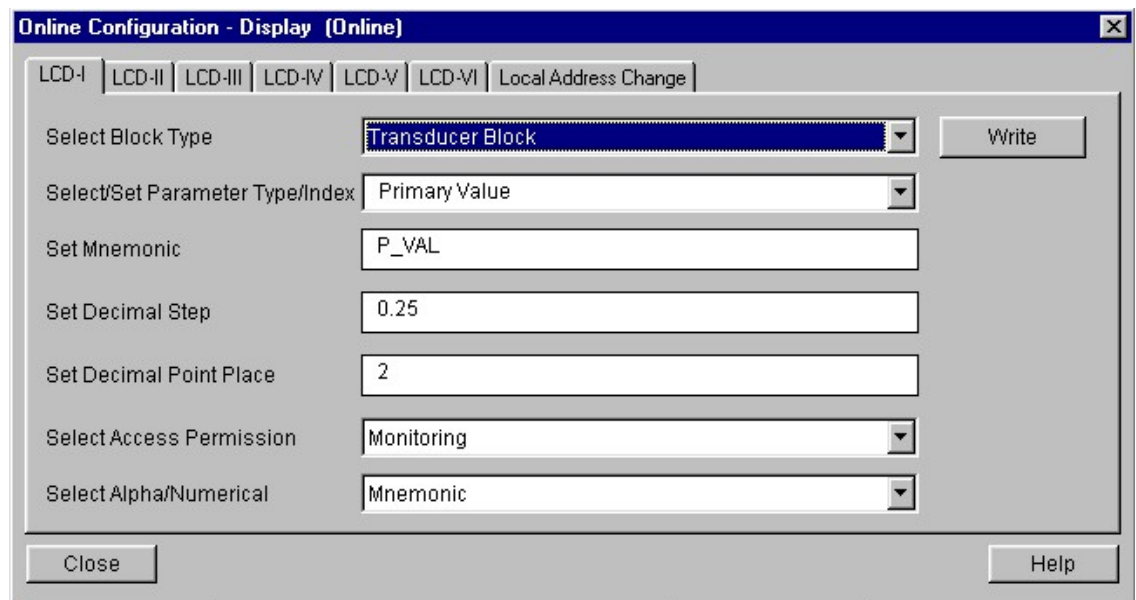


Figure 3.16 - Display Block and Simatic PDM

Display Transducer Block

The local adjustment is completely configured by Simatic PDM or any configuration tool. 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 Simatic PDM or configuration tool, 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 user is described in the section related to "Programming Using Local Adjustment". It is significantly the resources on this transducer display, also all the 303 series field devices from Smar has 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 Smar.

All function block and transducers defined according Profibus-PA have a description of their features written on binary files by the Device Description Language.

This feature permits that third party configuration tools enabled by Device Description Service technology can interpret these features and make them accessible to configure. The function blocks and 303 series transducers have been defined rigorously according to Profibus-PA specifications in order to be interoperable to other parties.

In order to able the local adjustment using the magnetic tool, it is necessary to previously prepare the parameters related with this operation via Syscon.

There are six groups of parameters, which may be pre-configured by the user in order to able, 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 select None in the parameter Select Block Type. Doing this, the device will not take the parameters related (indexed) to its block as a valid parameter.

Definition of Parameters and Values

Select Block Type

This is the type of the block where the parameter is located. The user can choose: Transducer Block, Analog Input Block, Totalizer Block, Physical Block or None.

Select/Set Parameter Type/Index

This is the index related to the parameter to be actuated or viewed (0, 1, 2...). For each block, there are some pre-defined indexes. Refer to the Function Blocks Manual to know the desired indexes and then just enter the desired index.

Set 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.

Set Decimal Step

It is the increment and decrement in decimal units when the parameter is Float or Float Status value, or integer, when the parameter is in whole units.

Set Decimal Point Place.

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

Set Access Permission

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.

Set Alpha Numerical

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.

For devices where the software version is higher or equal to 1.10, please see the configuration of local adjustment using the local adjustment, in the installation, operation and maintenance procedures manual.

In case you wish to visualize a certain tag, opt for the index relative equal to "tag". To configure other parameters just select LCD-II up to LCD-VI windows:

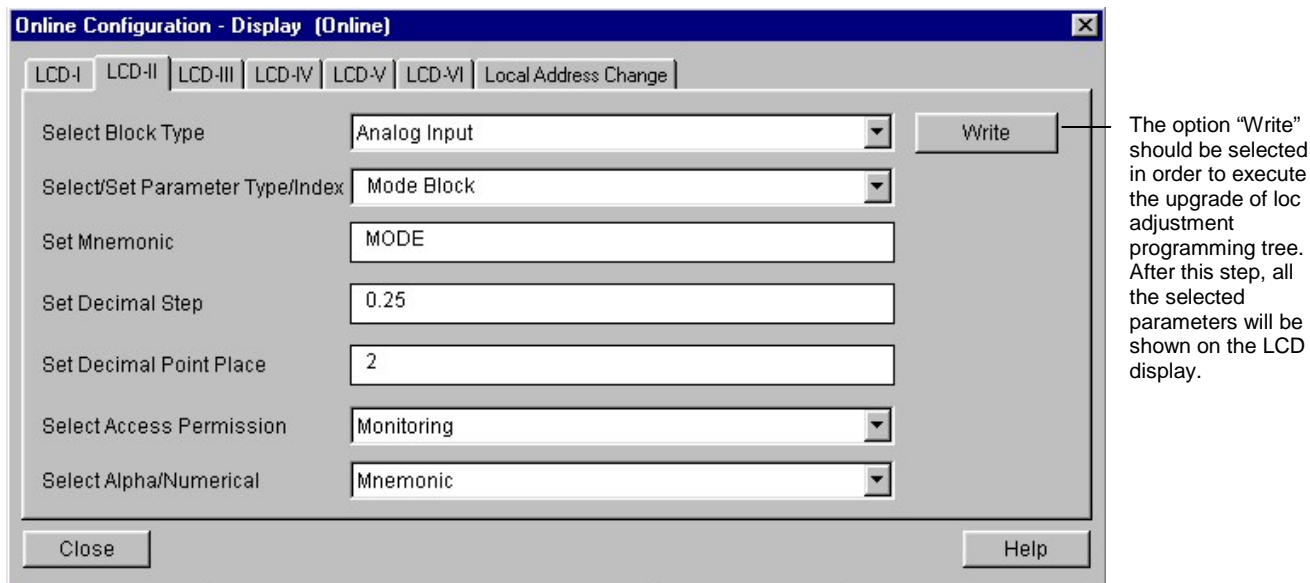


Figure 3.17 - Parameters for Local Adjustment Configuration

The Local Address Change window allows the user to enable/disable the access to changing the physical device address.

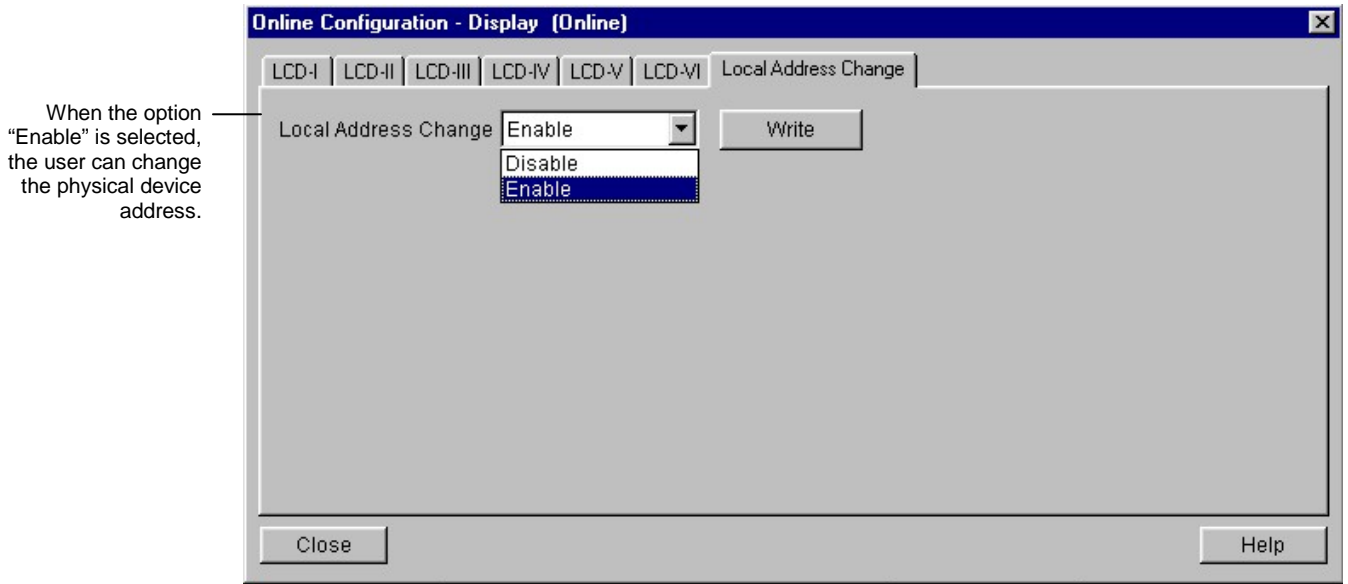


Figure 3.18 - Parameters for Local Adjustment Configuration

When the user enter into the local adjustment and rotate the parameters using the magnetic tool, after escaping to normal operation, e.g., the monitoring, if the parameter when the magnetic tool is removed has "Access Permission equal to "monitoring", then this last parameter will be shown at the LCD.

Always on the LCD interface will be shown two parameters at the same time, switching between the configured parameter at the LCD-II and the last monitoring parameter. If the user do not want to show two parameters at the same time, it is only necessary to opt for "none" when configure the LCD-II:

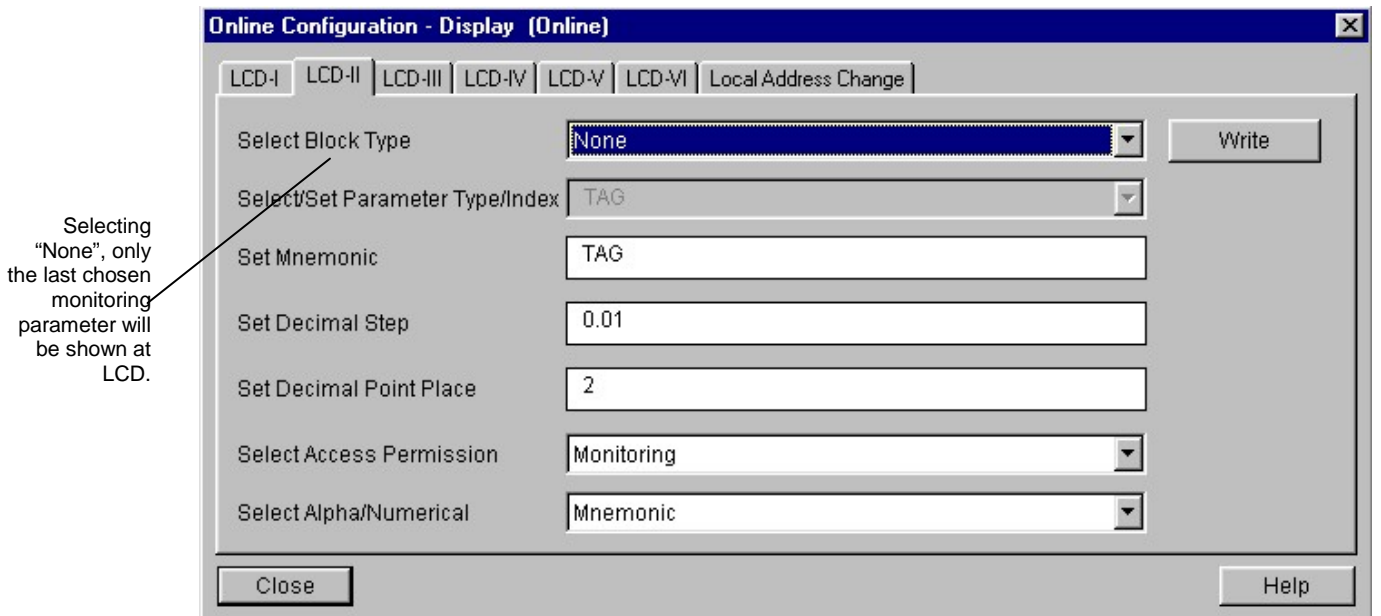


Figure 3.19 - Parameters for Local Adjustment Configuration

The user can select the Mode Block parameter at the LCD. In this case is necessary to select the index equal to Mode Block:

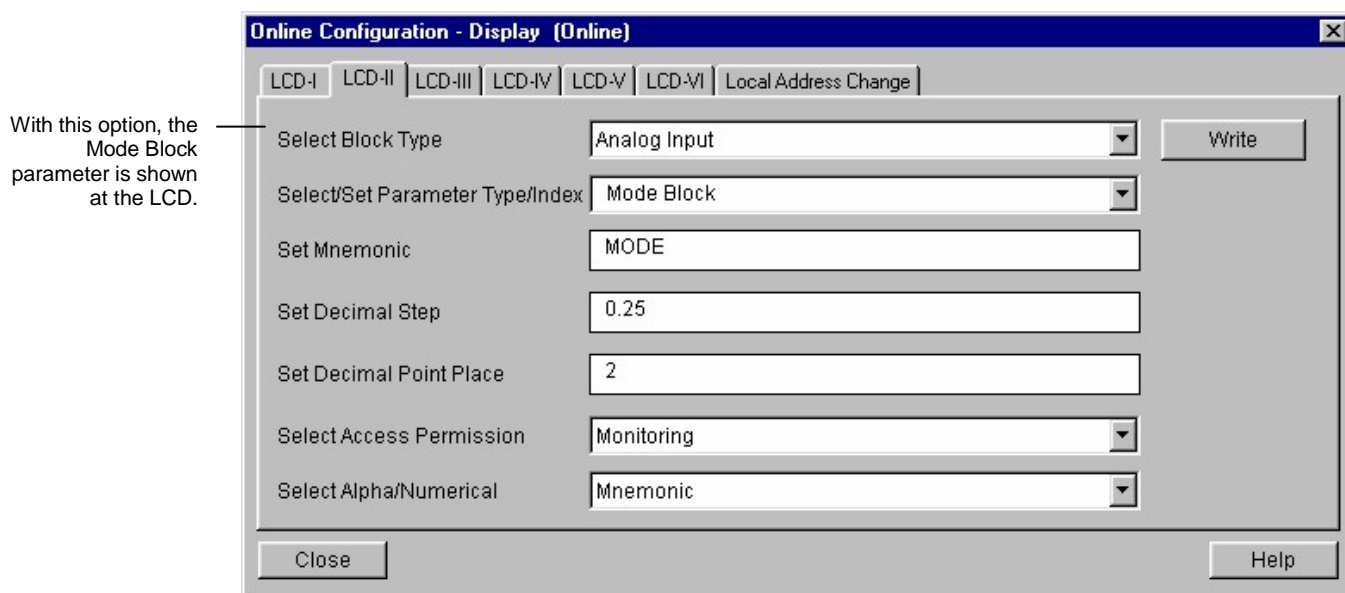


Figure 3.20 - Parameters for Local Adjustment Configuration

Programming Using Local Adjustment

The local adjustment is completely configured by **Simatic PDM or any other configuration tool**. 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 **configuration tool**, 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 user is also described very detailed this manual in the chapter related to "Programming Using Local Adjustment". It is significantly the resources on this transducer display, also all the Series 303 field devices from Smar has 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 Smar. This Local adjustment configuration is a suggestion only. The user may choose his preferred configuration via configuration toll, simply configuring the display block).

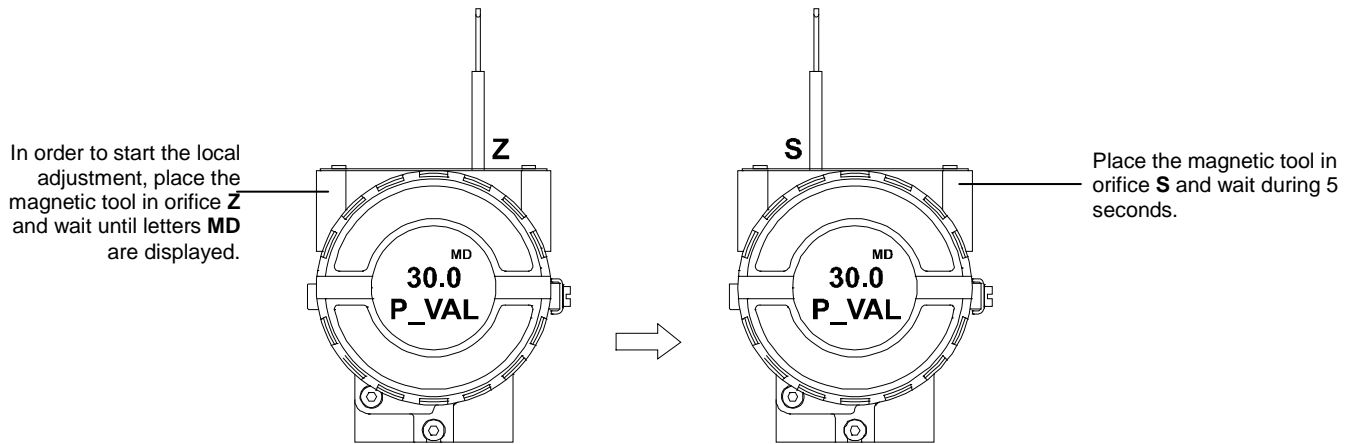


Figure 3.21 – Step 1 – TP303

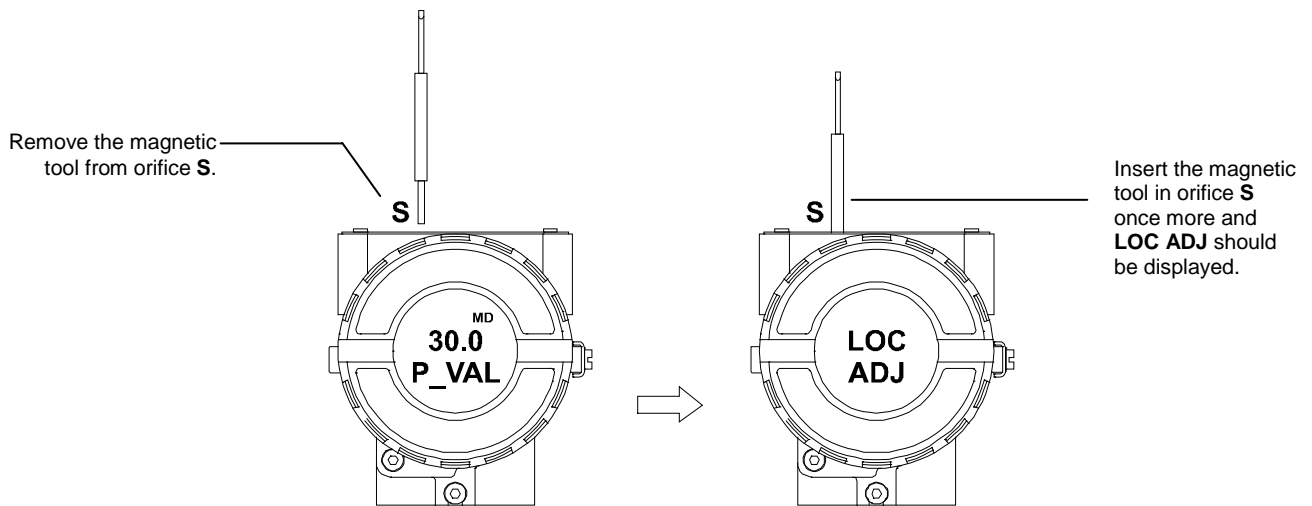


Figure 3.22 – Step 2 – TP303

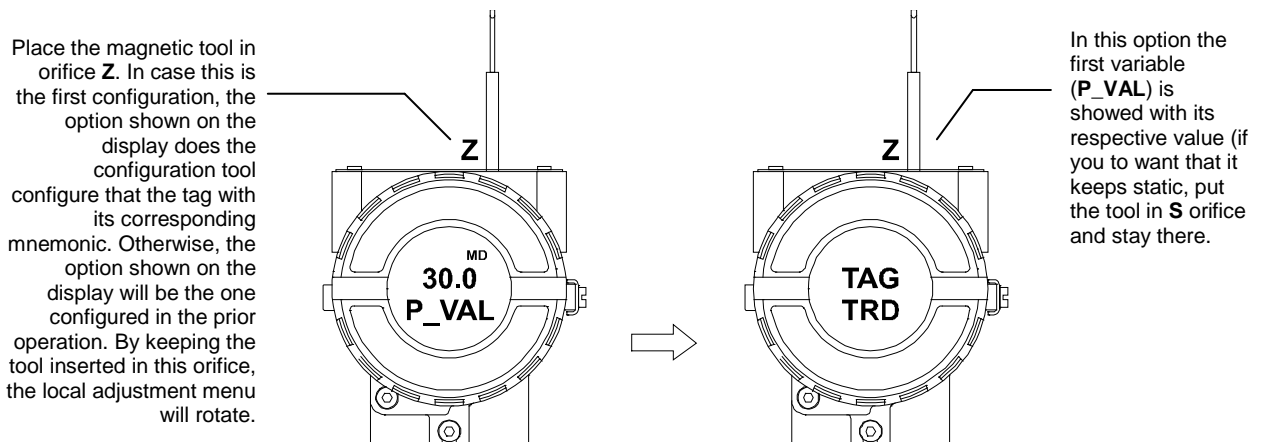
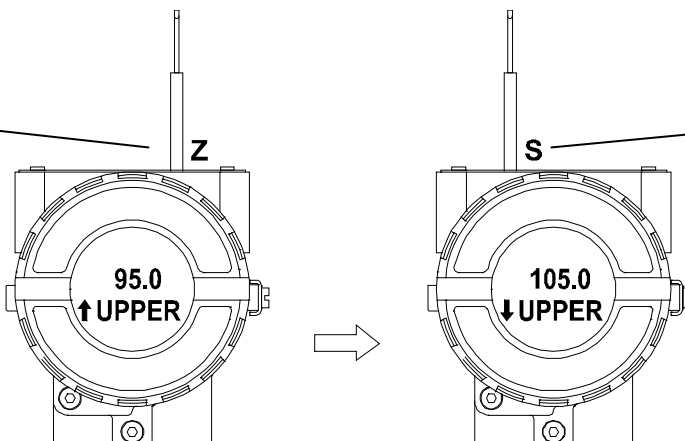


Figure 3.23 – Step 3 – TP303

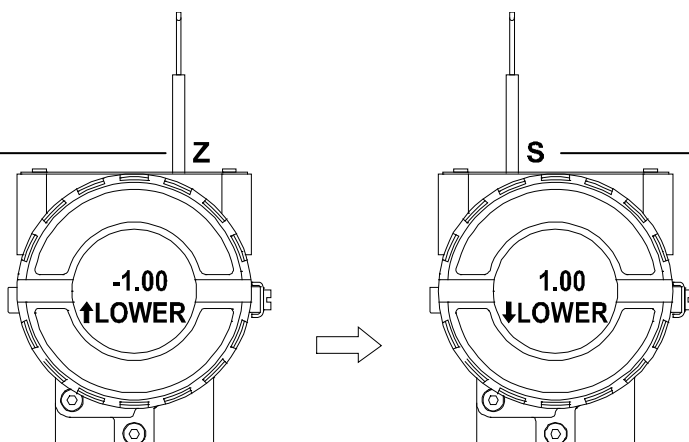
In order to range the upper value (lower); simply insert the magnetic tool in orifice **S** as soon as UPPER is shown on display. An arrow pointing upward (↑) increments the value and an arrow pointing downward (↓) decrements the value. In order to increment the value, keep the tool inserted in **S** up to set the value desired.



In order to decrement the upper value, 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 upper value.

Figure 3.24 – Step 4 – TP303

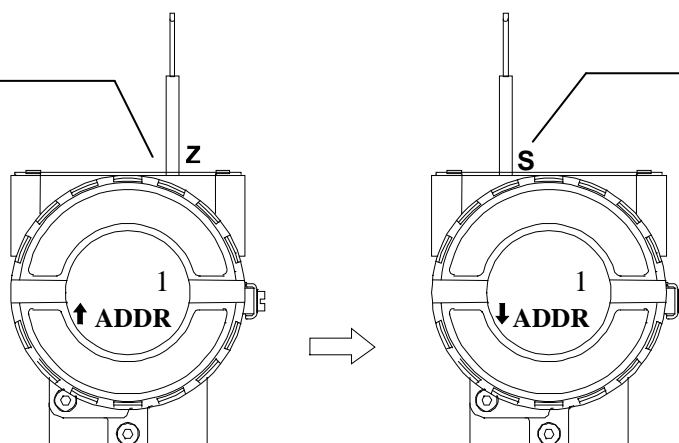
In order to range the lower value (lower); simply insert the magnetic tool in orifice **S** as soon as LOWER is shown on display. An arrow pointing upward (↑) increments the value and an arrow pointing downward (↓) decrements the value. In order to increment the value, keep the tool inserted in **S** up to set the value desired.



In order to decrement the lower value, 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 value.

Figure 3.25 – Step 5 – TP303

In order to change the address value, simple take off the magnetic tool from orifice **Z** as soon as ADDR is shown on display. An arrow pointing upward (↑) increments the address and arrow pointing downward (↓) decrements the address. In order to increment the address; insert the tool in **S** up to set the value desired.



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

Figure 3.26 – Step 6 – TP303

Section 4

MAINTENANCE PROCEDURES

General

Smar **TP303** Position Transmitters 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 being made by the end user, if necessary.

In general, it is recommended that end users do not try to repair printed circuit boards. Spare circuit boards may be ordered from Smar whenever necessary. Refer to the item "Returning Materials" at the end of this section.

The table 4.1 shows the messages of errors and potential cause.

SYMPTOM	PROBABLE SOURCE OF PROBLEM
NO COMMUNICATION	<p>Transmitter Connections Check wiring polarity and continuity. Check for shorts or ground loops. Check if the power supply connector is connected to main board. Check if the shield is not used as a conductor. It should be grounded at one end only.</p>
	<p>Power Supply Check power supply output. The voltage must be between 9 - 32 Vdc at the TP303 terminals. Noise and ripple should be within the following limits: a) 16 mV peak to peak from 7.8 to 39 KHz. b) 2 V peak to peak from 47 to 63 Hz for non-intrinsic safety applications and 0.2 V for intrinsic safety applications. c) 1.6 V peak to peak from 3.9 MHz to 125 MHz.</p>
	<p>Network Connection Check that the topology is correct and all devices are connected in parallel. Check that two terminators are in good conditions and correctly positioned. Check that the coupler connections are in good conditions and correctly positioned. Check that the terminators are according to the specifications. Check length of trunk and spurs. Check spacing between couplers.</p>
	<p>Network Configuration Make sure that device address is configured correctly.</p>
	<p>Electronic Circuit Failure Check the main board for defect by replacing it with a spare one.</p>
INCORRECT READING	<p>Transmitter Connections Check for intermittent short circuits, open circuits and grounding problems. Check if the sensor is correctly connected to the TP303 terminal block.</p>
	<p>Noise, Oscillation Adjust damping Check grounding of the transmitters housing. Check that the shielding of the wires between transmitter / panel is grounded only in one end.</p>
	<p>Sensor Check the sensor operation; it shall be within its characteristics. Check sensor type; it shall be the type and standard that the TP303 has been configured to. Check if process is within the range of the sensor and the TP303.</p>

Table 4.1 - Messages of Errors and Potential Cause

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 effect. 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 "S" symbol on the right upper corner of the display to unlit, thus indicating the end of the operation.

This procedure makes effective all factory configuration and will eliminate eventual problems with the function blocks or with the equipment communication.

Disassembly Procedure

Refer to **TP303** Exploded View figure (Figure 4.3). Make sure to disconnect power supply before disassembling the position transmitter.

NOTE

The numbers indicated between parentheses refer to Figure 4.3 – Exploded View.

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.

Electronic Circuit

To remove the circuit board **(5)** and indicator **(4)**, first loose the cover locking **(6)** on the side not marked Field Terminals, then unscrew the cover **(1)**.

CAUTION

Do not rotate the electronic housing more than 270° without disconnecting the electronic circuit from the power supply.

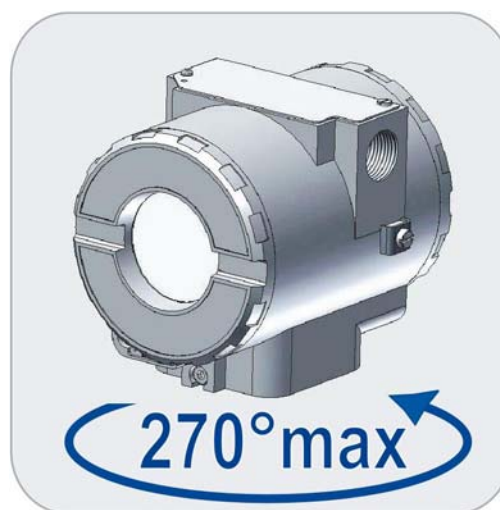


Figure 4.1 - Sensor Rotation

WARNING

The board has 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.

Pull the main board out of the housing and disconnect the power supply and the sensor connectors.

Reassembly Procedure

WARNING

Do not assemble the main board with power on.

Electronic Circuit

Plug sensor connector and power supply connector to main board.

Attach the display to the main board. Observe the four possible mounting positions. The Smar mark indicates up position.

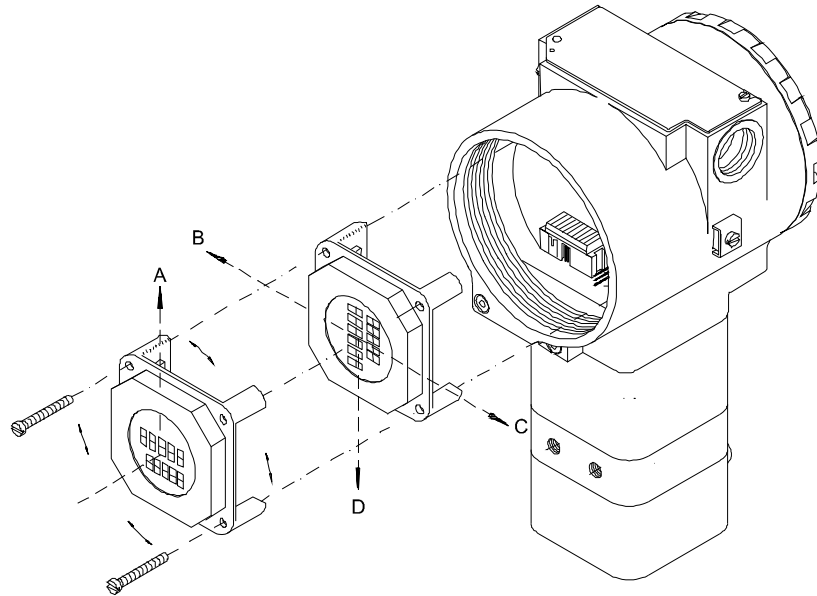


Figure 4.2 - Four Possible Positions of the Display

Upgrading TP301 to TP303

The sensor and casing of the TP301 is the same as the **TP303**. By changing the circuit board of the TP301 it becomes a **TP303**. The display on TP301 version 1.XX, is the same as on **TP303** and can therefore be used with the **TP303** upgrade circuit board.

Upgrading the TP301 to a **TP303** is therefore very much the same as the procedure for replacing the main board described above.

To remove the circuit board (5), loosen the two screws (3) that anchor the board.

Caution with the circuit boards must be taken as mentioned above.

Pull the TP301 main board out of the housing and disconnect the power supply and the sensor connectors.

Put in the **TP303** main board reversing the procedure for removing the TP301 circuit.

ACCESSORIES	
ORDERING CODE	DESCRIPTION
SD1	Magnetic Tool for Local Adjustment
BC1	Fieldbus/RS232 Interface
PS302	Power Supply
FDI302	Field Device Interface
BT302	Terminator
DF47	Intrinsic Safety Barrier
DF48	Fieldbus Repeater

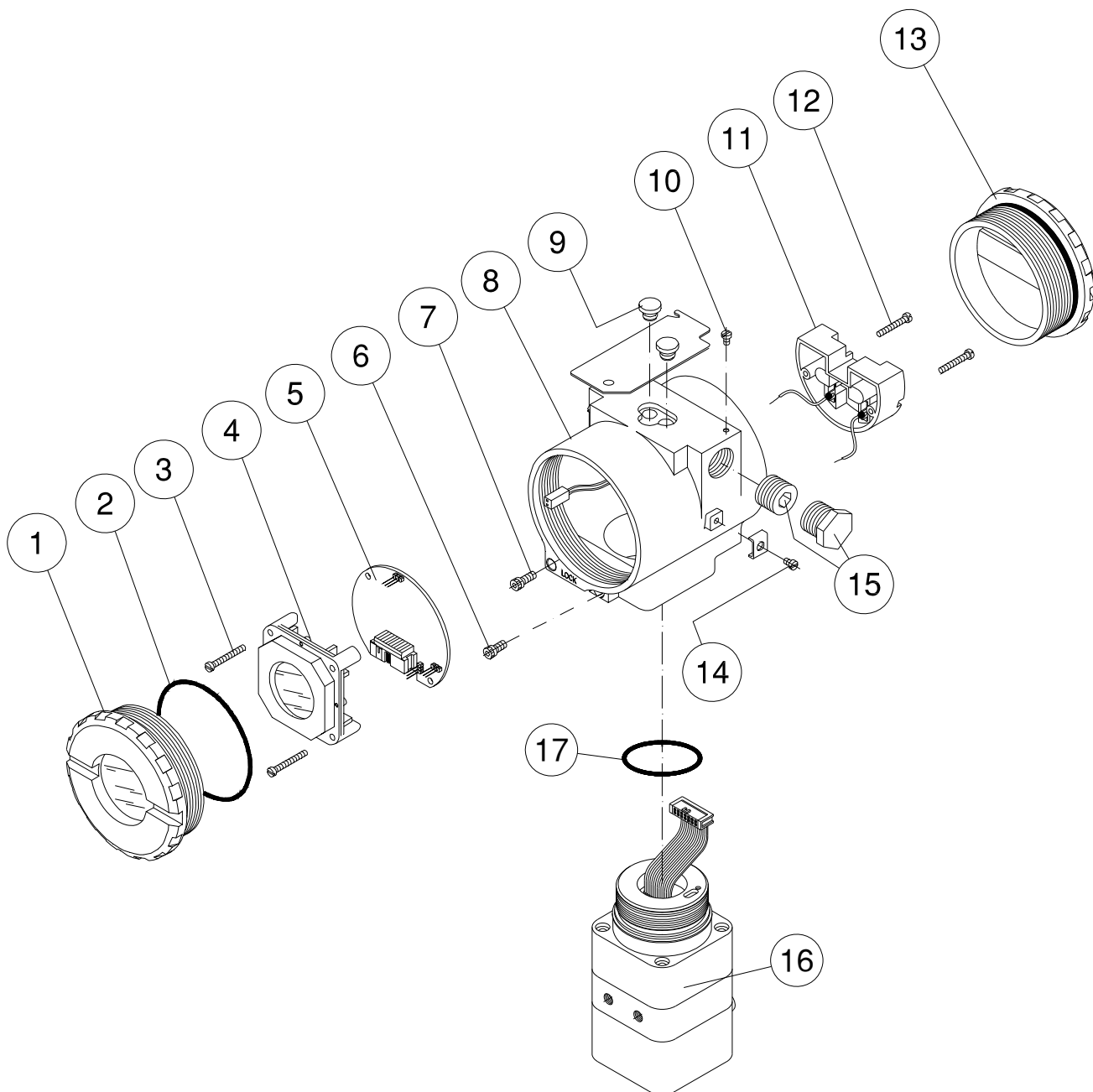


Figure 4.3 – TP303 Exploded View

SPARE PARTS LIST			
DESCRIPTION OF PARTS	POSITION	CODE	CATEGORY (NOTE 1)
HOUSING, Aluminum (NOTE 2)			
. ½ - 14 NPT	8	400-0263	
. M20 x 1.5	8	400-0264	
. PG 13.5 DIN	8	400-0265	
HOUSING, 316 SS (NOTE 2)			
. ½ - 14 NPT	8	400-0266	
. M20 x 1.5	8	400-0267	
. PG 13.5 DIN	8	400-0268	
COVER (INCLUDES O-RING)			
. Aluminum	1 and 13	204-0102	
. 316 SS	1 and 13	204-0105	
COVER WITH WINDOW FOR INDICATION (INCLUDES O-RING)			
. Aluminum	1	204-0103	
. 316 SS	1	204-0106	
COVER LOCKING SCREW	7	204-0120	
SENSOR LOCKING SCREW			
. M4 Screw	6	204-0121	
. M6 Without Head Screw	6	400-1121	
EXTERNAL GROUND SCREW	14	204-0124	
IDENTIFICATION PLATE FIXING SCREW	10	204-0116	
DIGITAL INDICATOR	4	214-0108	
TERMINAL INSULATOR	11	400-0059	
MAIN ELECTRONIC CIRCUIT BOARD	5	400-0269	A
ANALOG BOARD (GLL 1016)		400-0637	
O-RINGS (NOTE 3)			
. Cover, Buna-N	2	204-0122	B
. Neck, Buna-N	17	204-0113	
TERMINAL HOLDING SCREW			
- HOUSING IN ALUMINUM	12	304-0119	
- HOUSING IN 316 STAINLESS STEEL	12	204-0119	
MAIN BOARD SCREW HOUSING IN ALUMINUM			
- Units with indicator	3	304-0118	
- Units without indicator	3	304-0117	
MAIN BOARD SCREW HOUSING IN 316 STAINLESS STEEL			
- Units with indicator	3	204-0118	
- Units without indicator	3	204-0117	
1/2" NPT INTERNAL SOCKET SET PLUG IN BICHROMATIZED CARBON STEEL	15	400-0808	
1/2" NPT INTERNAL SOCKET SET PLUG IN 304 SST	15	400-0809	
M20 X 1.5 EXTERNAL SOCKET SET PLUG IN 316 SST	15	400-0810	
PG13.5 EXTERNAL SOCKET SET PLUG IN 316 SST	15	400-0811	
3/4 NPT ADAPTER IN 316 SST	15	400-0812	
TRANSDUCER	16	400-0038	B
LOCAL ADJUSTMENT PROTECTIONS CAP	9	204-0114	
LINEAR MAGNET UP TO 15 mm	-	400-0034	
LINEAR MAGNET UP TO 50 mm	-	400-0035	
LINEAR MAGNET UP TO 100 mm	-	400-0036	
ROTARY MAGNET	-	400-0037	

NOTE

Note 1: For category A, it is recommended to keep, in stock, 25 parts installed for each set, and for category B, 50.

Note 2: Includes terminal block, bolts, caps and identification plate without certification.

Note 3: O-rings and backup rings are packaged in packs of 12 units.

TECHNICAL CHARACTERISTICS

Functional Specifications

Travel

Linear Motion: 3 -100 mm.

Rotary Motion: 30 -120° rotation angle.

Output Signal

Digital only. Fieldbus, 31.25 kbit/s voltage mode with bus power.

Power Supply

Bus power 9 - 32 VDC.

Current consumption quiescent 12 mA.

Output impedance: nonintrinsic safety from 7.8 kHz - 39 kHz should be greater or equal to 3 kOhm.

Intrinsic safety output impedance (assuming an IS barrier in the power supply) from 7.8 kHz - 39 kHz should be greater or equal to 400 Ohm.

Indicator

Optional 4½-digit numerical and 5-character alphanumeric LCD indicator.

Hazardous Area Certifications

Explosion proof, weather proof and intrinsically safe (CENELEC and FM standards).

Temperature Limits

Ambient: -40 to 85 °C (-40 to 185°F)

Process: -40 to 100 °C (-40 to 212°F)

Storage: -40 to 100 °C (-40 to 212°F)

Display: -10 to 60 °C (14 to 140 °F) operation.

-40 to 85 °C (-40 to 185 °F) without damage.

Turn-on Time

Performs within specifications of less than 5.0 seconds after power is applied to the transmitter.

Configuration

Basic configuration may be done using local adjustment magnetic tool if device is fitted with display.

Complete configuration is possible using remote configurator (E.g.: Simatic PDM).

Humidity Limits

0 to 100% RH.

Performance Specifications

Reference conditions: range starting at zero, temperature 25°C (77°F), power supply of 24 Vdc.

Accuracy

Linearity, hysteresis and repeatability effects are included.

Resolution

≤ 0.1% F.S.

Repeatability

≤ 0.5% F.S.

Hysteresis

≤ 0.2% F.S.

Stability

± 0.1% of F.S. for 12 months.

Temperature Effect

± 0.8%/20°C of F.S.

Power Supply Effect

± 0.005% of calibrated F.S. per volt.

Electro-Magnetic Interface Effect

Designed to comply with IEC 801 and European Standards EN50081 and EN50082.

Physical Specifications

Hardware

Physical: according to IEC 61158-2 and conformity with the FISCO model.

Electrical Connection

½ - 14 NPT, Pg 13.5, or M20 x 1.5 metric.

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).

Mounting Bracket

Plated carbon steel with polyester painting or 316 SST.

Identification Plate

316 SST.

Approximate Weights

Without display and mounting bracket: 0.80 kg.

Add for LCD display: 0.13 kg.

Add for mounting bracket: 0.60 kg.

Ordering Code

MODEL	PROFIBUS PA POSITION TRANSMITTER				
	COD.	LOCAL INDICATOR			
	1	With Digital Indicator			
	COD.	MOUNTING BRACKET			
	0	Without Bracket			
	1	With Bracket			
	COD.	ELECTRICAL CONNECTIONS			
	0	1/2 - 14 NPT			
	A	M20 x 1.5			
	B	PG 13.5 DIN			
	COD.	TYPE OF MOTION			
	1	Rotary			
	3	Linear stroke up to 15 mm			
	5	Linear stroke up to 50 mm			
	7	Linear stroke up to 100 mm			
	Z	Others (specify)			
	COD.	OPTIONAL ITEMS*			
	H0	Housing - Aluminum (IP/Type)			
	H1	Housing - 316 Stainless Steel (IP/Type)			
	H2	Housing - Aluminum for saline atmosphere (IPW/Type X)			
	H3	Housing - 316 Stainless Steel for saline atmosphere (IPW/Type X)			
	H4	Housing - Copper Free Aluminum (IPW/Type X)			
	R1	Remote sensor - 5 m. Cable (**)			
	R2	Remote sensor - 10 m. Cable (**)			
	R3	Remote sensor - 15 m. Cable (**)			
	R4	Remote sensor - 20 m. Cable (**)			
	ZZ	With special features (specify)			
TP303	1	0	0	1	*

Typical Model


* Leave it blank for no optional items.
 ** Consult Smar for applications in classified areas.

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.

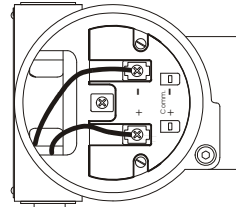
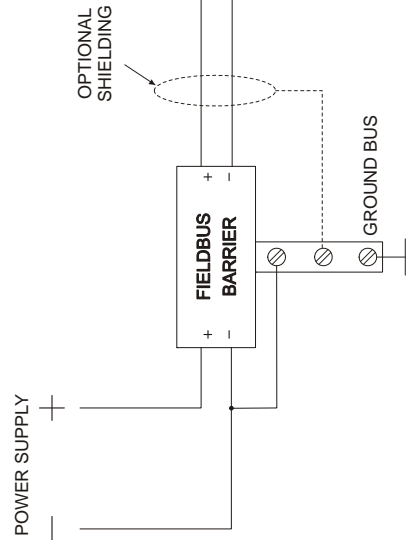
HAZARDOUS AREA

REQUIREMENTS:

- 1 - INSTALLATION TO BE IN ACCORDANCE WITH ANSI/ISA RP12-6.
- 2 - CONVERTER SPECIFICATION MUST BE IN ACCORDANCE TO  APPROVAL LISTING.
- 3 - ASSOCIATED APPARATUS GROUND BUS TO BE INSULATED FROM PANELS AND MOUNTING ENCLOSURES.
- 4 - WIRES: TWISTED PAIR, 22AWG OR LARGER.
- 5 - SHIELD IS OPTIONAL IF USED, BE SURE TO INSULATE THE END NOT GROUNDED.
- 6 - CABLE CAPACITANCE AND INDUCTANCE PLUS C_i AND L_i MUST BE SMALLER THAN C_a AND L_a OF THE ASSOCIATED APPARATUS.

INTRINSICALLY SAFE APPARATUS
 ENTITY VALUES: $C_i = 5nF$ $L_i = 12\mu H$
 $V_{max} \leq 24V$
 $I_{max} \leq 250mA$

ASSOCIATED APPARATUS



COMPONENTS CAN NOT BE SUBSTITUTED WITHOUT PREVIOUS MANUFACTURER APPROVAL.

ENTITY PARAMETERS FOR ASSOCIATED APPARATUS

CLASS I,II,III DIV/1,

GROUPS A,B,C,D,E,F & G

$C_a \geq$ CABLE CAPACITANCE + 5nF

$L_a \geq$ CABLE INDUCTANCE + 12 μH

FIELDBUS

OPTION 1 $\left\{ \begin{array}{l} V_{oc} \leq 24V \\ I_{sc} \leq 250mA \\ P_o \leq 1,2W \end{array} \right.$

OPTION 2 $\left\{ \begin{array}{l} V_{oc} \leq 16V \\ I_{sc} \leq 250mA \\ P_o \leq 2W \end{array} \right.$

CLASS I,II,III DIV/1, GROUPS A,B,C,D,E,F & G
 MODEL TP302 & TP303 - SERIES
 POSITIONER



APPROVED

APPROVAL CONTROLLED BY C.A.R.				DRAWN	CHECKED	PROJECT	APPROVAL
	/ /	/ /		MOACIR 08 / 11 / 00	SINASTRE 08 / 11 / 00	BASÍLIO 08 / 11 / 00	MISSAWA 08 / 11 / 00
01	MOACIR 04 / 05 / 03	CIRO 08 / 05 / 03	ALT - DE 0043/03	EQUIPMENT: TP302 / TP303 CONTROL DRAWING			
REV	BY	APPROVAL	DOC				

smar

NUMBER 102A0605	REV 01
SCALE	SHEET 01 / 01

Appendix A



SRF – Service Request Form

TP Position Transmitter

GENERAL DATA

Model: TP290 () Firmware Version: _____ TP301 () Firmware Version: _____
 TP302 () Firmware Version: _____ TP303 () Firmware Version: _____

Serial Number: _____ **Sensor Number:** _____

TAG: _____

Remote Position Sensor? Yes () No ()

Action: Rotary () Linear ()

Travel: 15 mm () 30 mm () 50 mm () 100 mm () Other: _____ mm

Configuration: Magnetic Tool () Palm () Psion () PC () Software: _____ Version: _____

INSTALLATION DATA

Type: Valve + Atuador () Other: _____

Size: _____

Travel: _____

Manufacturer: _____

Model: _____

PROCESS DATA

Hazardous Area Classification Non-Classified () Chemical () Explosive () Other: _____

Interference Types Vibration () Temperature () Electromagnetic () Others: _____

SITUATION DESCRIPTION

SERVICE SUGGESTION

Adjustment () Cleaning () Preventive Maintenance () Update / Up-grade ()

Other: _____

USER INFORMATION

Company: _____

Contact: _____

Title: _____

Section: _____

Phone: _____ **Extension:** _____

E-mail: _____ **Date:** ____/____/____

For warranty or non-warranty repair, please contact your representative.
 Further information about address and contacts can be found on www.smar.com/contactus.asp.

Returning Materials

Should it become necessary to return the transmitter and/or configurator to **SMAR**, simply contact our office, informing the defective instrument serial number, and return it to our factory.

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

Instruments returned or to be revised outside the guarantee term should be accompanied by a purchase order or a quote request.

По вопросам продаж и поддержки обращайтесь:

Архангельск (8182)63-90-72	Казань (843)206-01-48	Новокузнецк (3843)20-46-81	Смоленск (4812)29-41-54
Астана +7(7172)727-132	Калининград (4012)72-03-81	Новосибирск (383)227-86-73	Сочи (862)225-72-31
Астрахань (8512)99-46-04	Калуга (4842)92-23-67	Омск (3812)21-46-40	Ставрополь (8652)20-65-13
Барнаул (3852)73-04-60	Кемерово (3842)65-04-62	Орел (4862)44-53-42	Сургут (3462)77-98-35
Белгород (4722)40-23-64	Киров (8332)68-02-04	Оренбург (3532)37-68-04	Тверь (4822)63-31-35
Брянск (4832)59-03-52	Краснодар (861)203-40-90	Пенза (8412)22-31-16	Томск (3822)98-41-53
Владивосток (423)249-28-31	Красноярск (391)204-63-61	Пермь (342)205-81-47	Тула (4872)74-02-29
Волгоград (844)278-03-48	Курск (4712)77-13-04	Ростов-на-Дону (863)308-18-15	Тюмень (3452)66-21-18
Вологда (8172)26-41-59	Липецк (4742)52-20-81	Рязань (4912)46-61-64	Ульяновск (8422)24-23-59
Воронеж (473)204-51-73	Магнитогорск (3519)55-03-13	Самара (846)206-03-16	Уфа (347)229-48-12
Екатеринбург (343)384-55-89	Москва (495)268-04-70	Санкт-Петербург (812)309-46-40	Хабаровск (4212)92-98-04
Иваново (4932)77-34-06	Мурманск (8152)59-64-93	Саратов (845)249-38-78	Челябинск (351)202-03-61
Ижевск (3412)26-03-58	Набережные Челны (8552)20-53-41	Севастополь (8692)22-31-93	Череповец (8202)49-02-64
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