smar - TP303

OPERATION, MAINTENANCE AND INSTRUCTIONS MANUAL

PROFIBUS PA POSITION TRANSMITTER

JUL / 16

TP303

VERSION 3

PROFIBUS®

TP303ME

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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 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 loosing 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 too 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
In case of using Simatic PDM as the configuration and parameterization tool, Smar recommends that the user does not apply the option "Download to Device". This function can improperly configure the field device. Smar recommends that user make the use of the option "Download to PG / PC" and then selecting the Device Menu, use the menus of the transducer, function and display blocks acting specifically, according to each menu and method for reading and writing.

NOTE
This Manual is compatible with version 3.XX, 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.

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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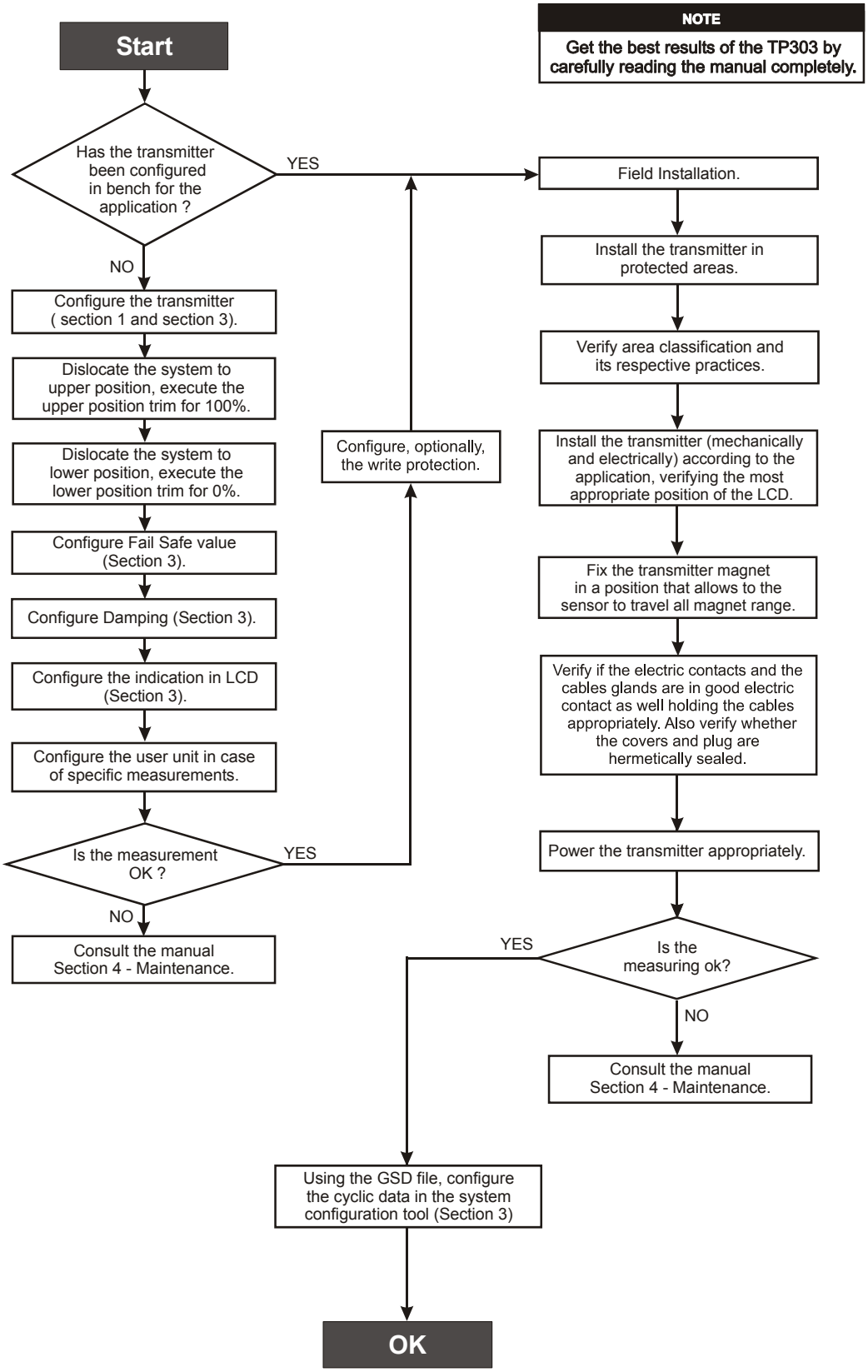
Installation Flowchart

Quick Installation Guide



Section 1

INSTALLATION

General

NOTE
The installation carried out in hazardous areas should follow the recommendations of the IEC60079-14 standard.

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.

Mounting

The **TP303** mounting depends on the type movement, linear or rotary. Two brackets are required for mounting, one for the magnet and the other for the transmitter itself.

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. When mounting the the Position Transmitter, consider that: 1 . There is no attrict between the internal magnet face and the position sensor salience all over the travel (rotary or linear). 2. A minimum distance of 2 mm to of 4 mm distance is recommended between the magnet external face and the Position Transmitter face.

Should the transmitter installation change, or magnet change, or should any other modification, the transmitter will require a re-calibration.

IMPORTANT
If the self diagnostics detect a transmitter failure, for example the loss of the power, the analog signal will go to 3.9 mA or to 21.0 mA to alert the user (High or low alarm signal is user selectable).

The following Figures 1.1 and 1.3 show both linear and rotary typical mounting:

Rotary Movement
Install the magnet on the valve stem using the magnet mounting bracket.

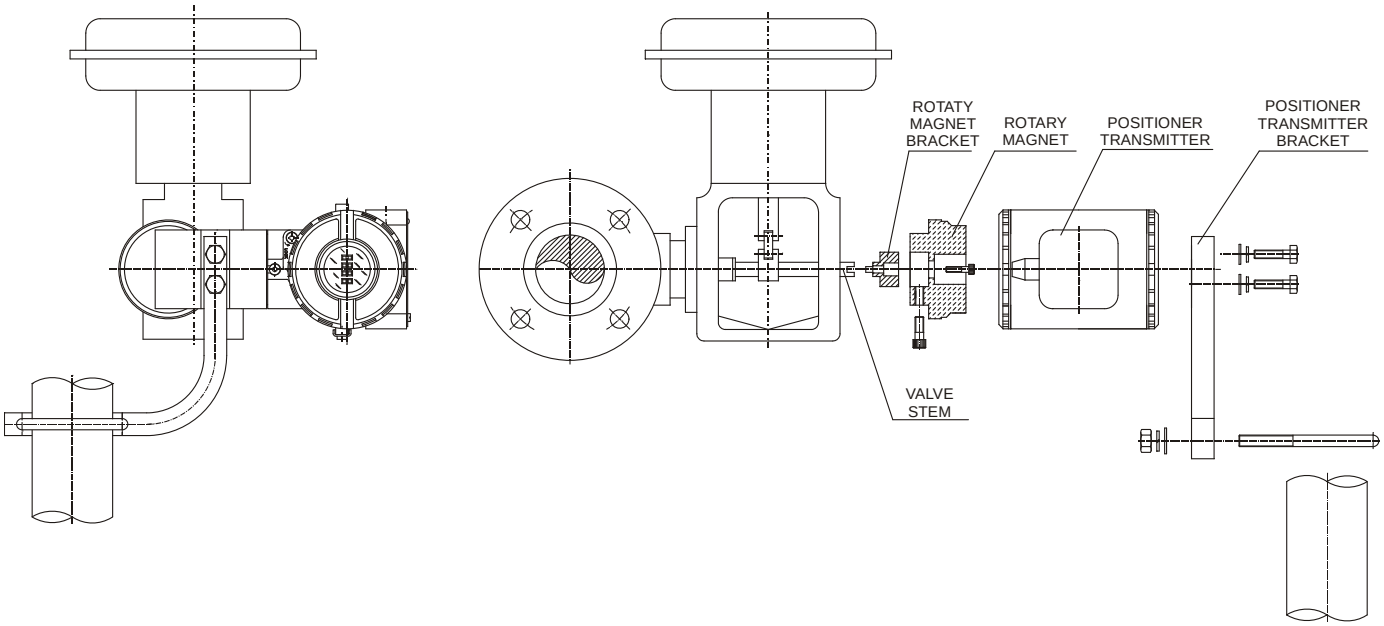


Figure 1.1 – Transmitter on a Rotary Actuator

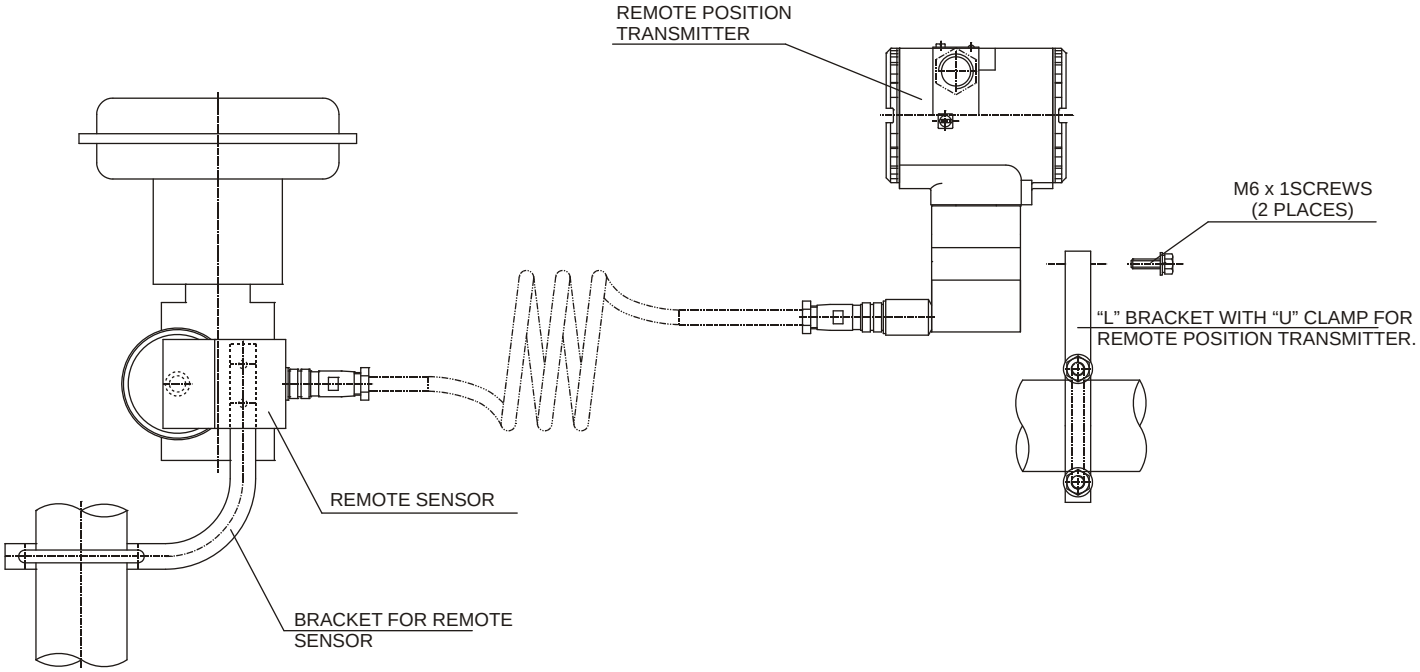


Figure 1.2 – Position Transmitter on Rotary Actuator with Remote Position Sensor

Linear Movement
Install the magnet on the valve stem using the magnet mounting bracket.

The linear magnet movement must be orthogonal in relation to the main axis of the position transmitter. For example, if the linear magnet movement is vertical, the transmitter main axis must be horizontal, as show in Figure 1.3.

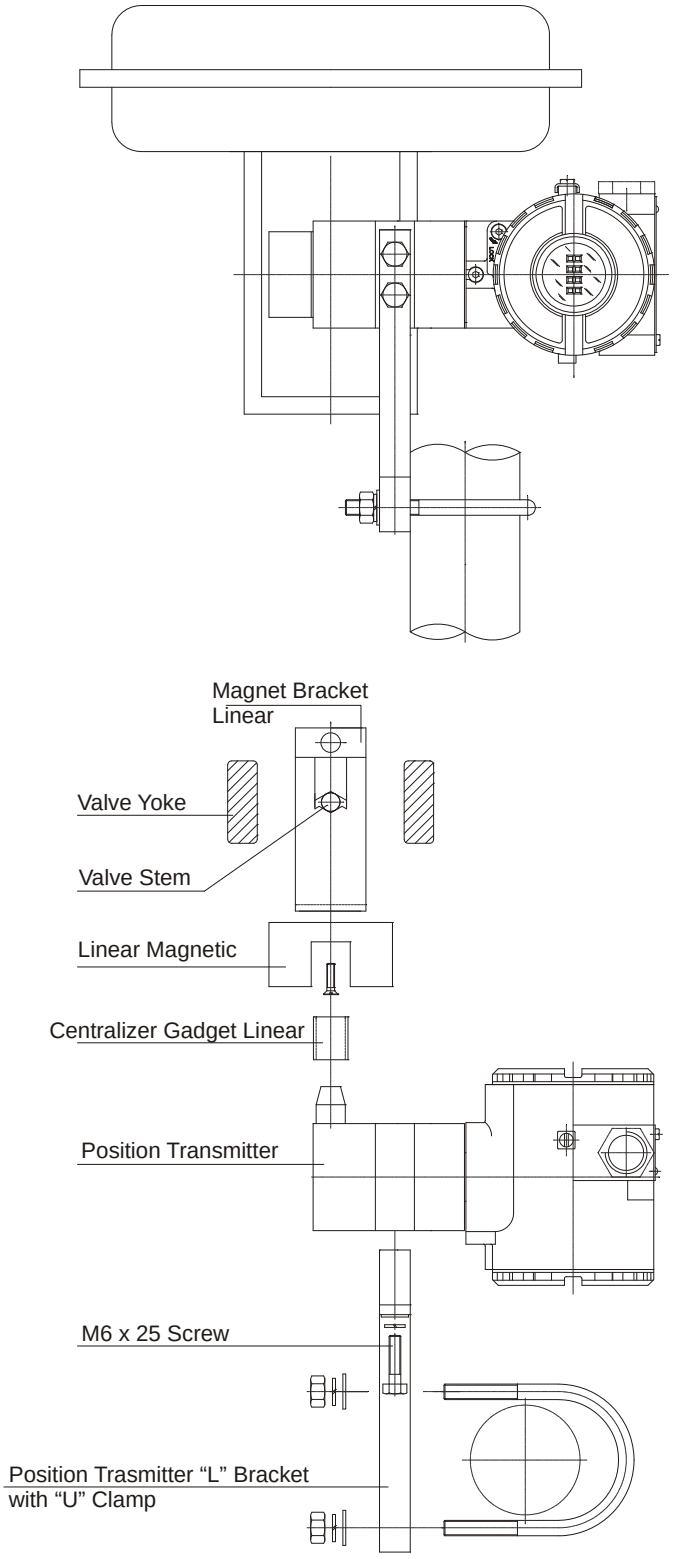


Figure 1.3 - Transmitter on a Linear Actuator

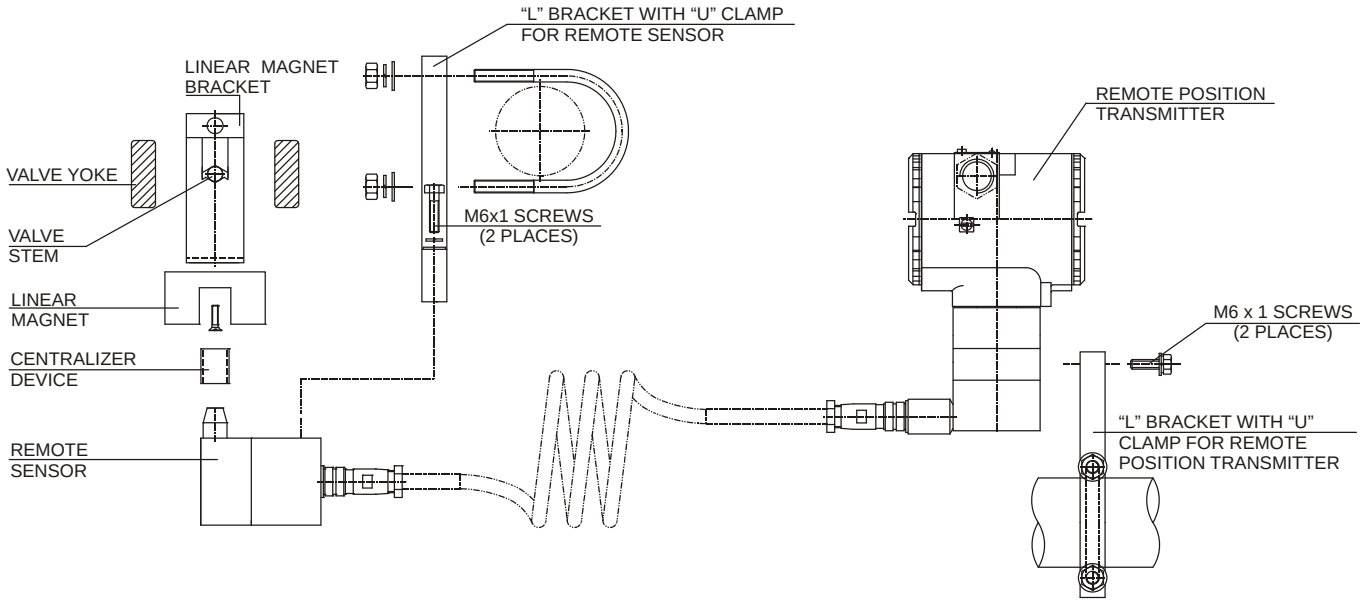
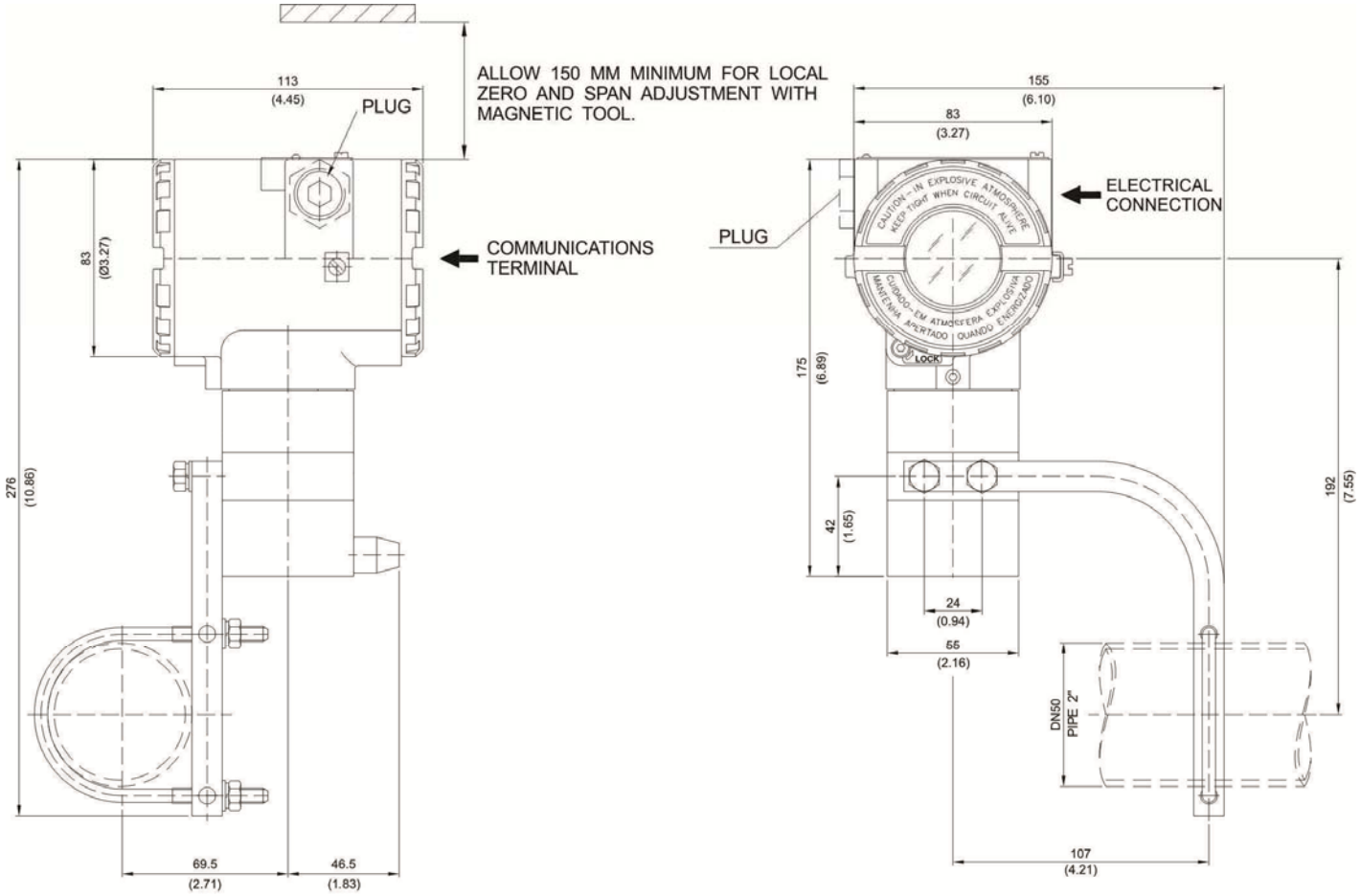
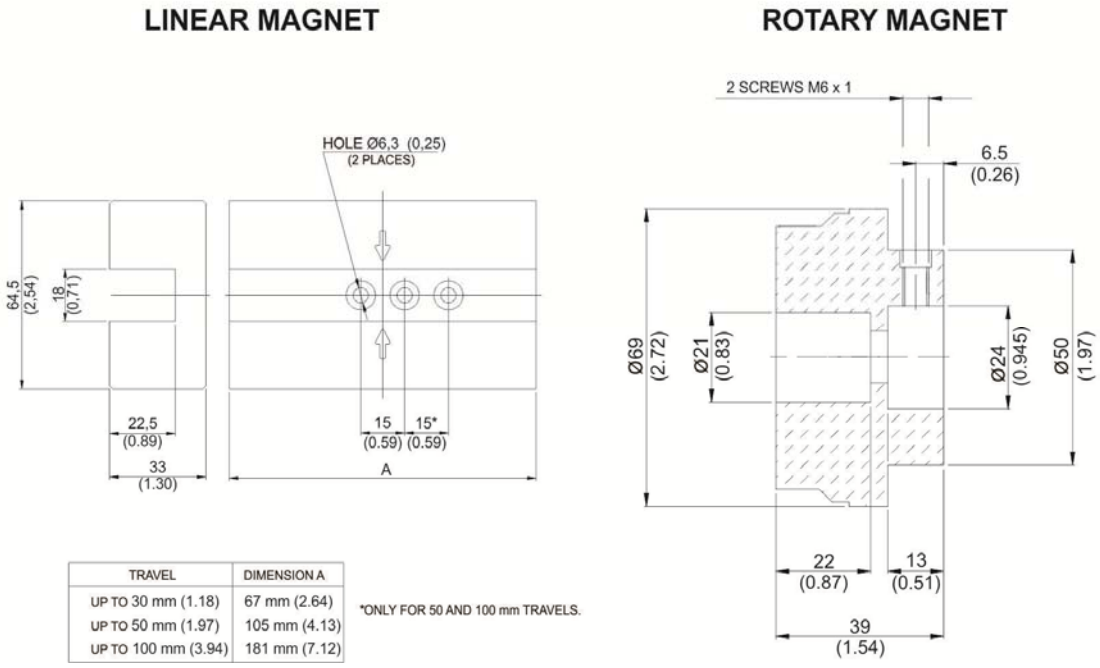


Figure 1.4 – Position Transmitter on Linear Actuator with Remote Position Sensor

See below the **TP303** and magnets dimensional drawings.





TRAVEL	DIMENSION A
UP TO 30 mm (1.18)	67 mm (2.64)
UP TO 50 mm (1.97)	105 mm (4.13)
UP TO 100 mm (3.94)	181 mm (7.12)

*ONLY FOR 50 AND 100 mm TRAVELS.

Figure 1.5 – TP303 Dimensional Drawing / Magnets Dimensional Drawing

REMOTE SENSOR

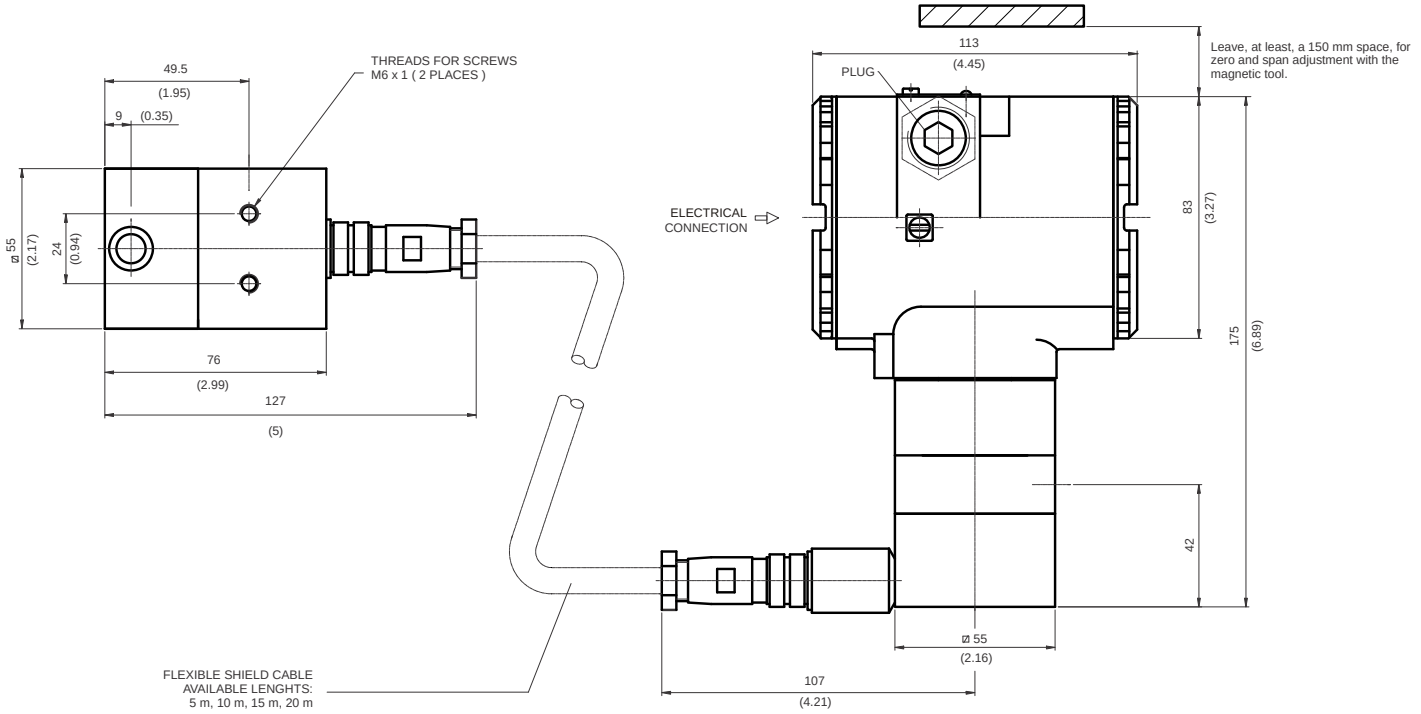
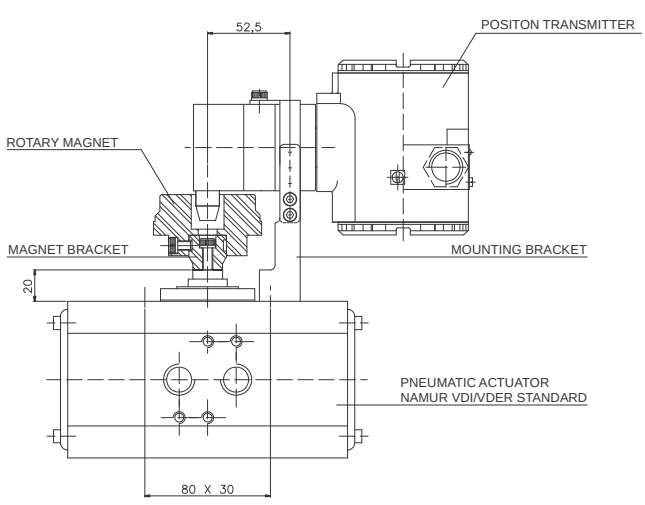


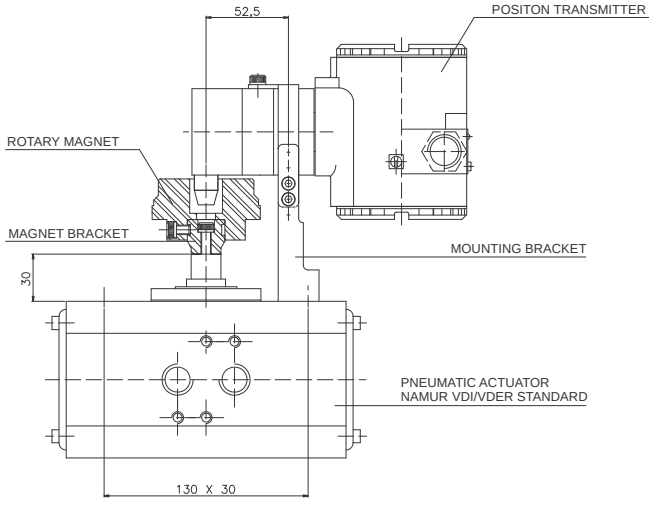
Figure 1.5.a – Remote Sensor Dimensional Drawing

SPECIAL MOUNTING BRACKET – ROTARY VDI / VDE NAMUR

Mounting bracket of the position transmitter for rotary valves actuated via type actuators rack and pinion, designed to comply with NAMUR VDI/VDE.



Mounting 80 mm between centers, 20 mm stem height.



Mounting 130 mm between centers, 30 mm stem height.

Figure 1.5.b – Special Mounting Bracket Dimensional Drawing - Rotary VDI / VDE NAMUR

Electronic Housing Rotation

The electronic housing rotates for a better digital display reading. To rotate it, release the housing rotation screw.

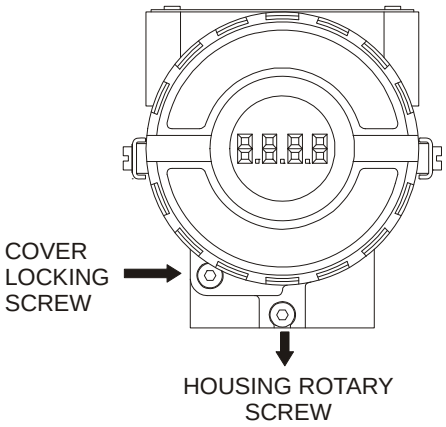


Figure 1.6 – Cover Locking and Housing Rotation Set Screw

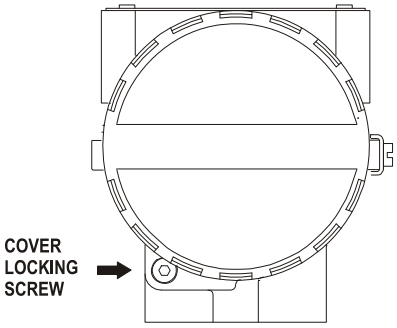


Figure 1.7 - Cover Locking Screw

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.

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.

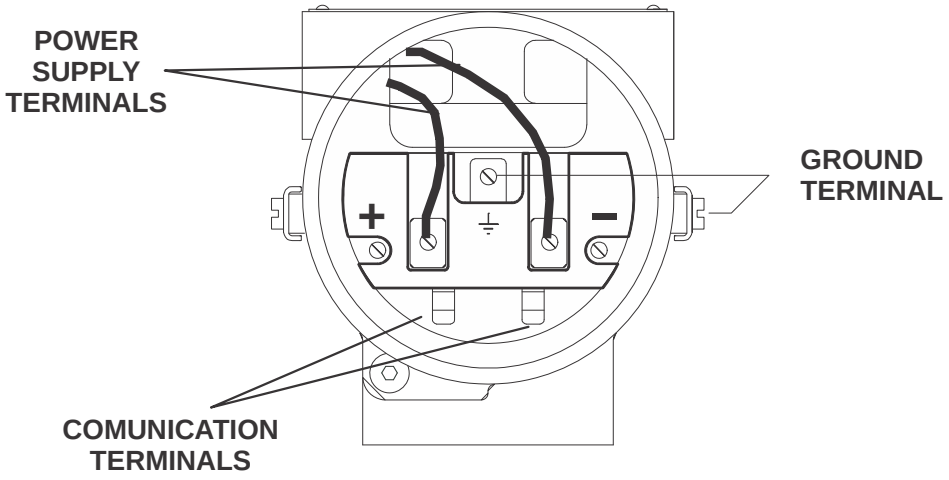


Figure 1.8 – Wiring Block

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.

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.

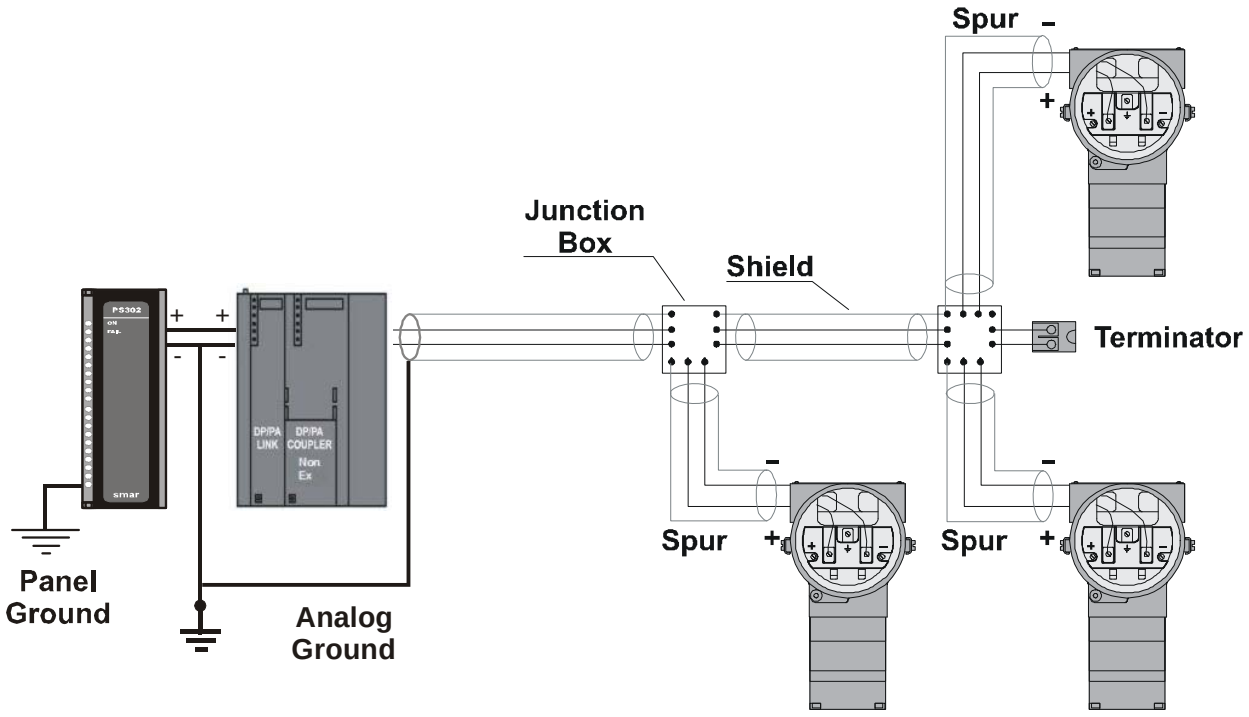


Figure 1.6 - Bus Topology

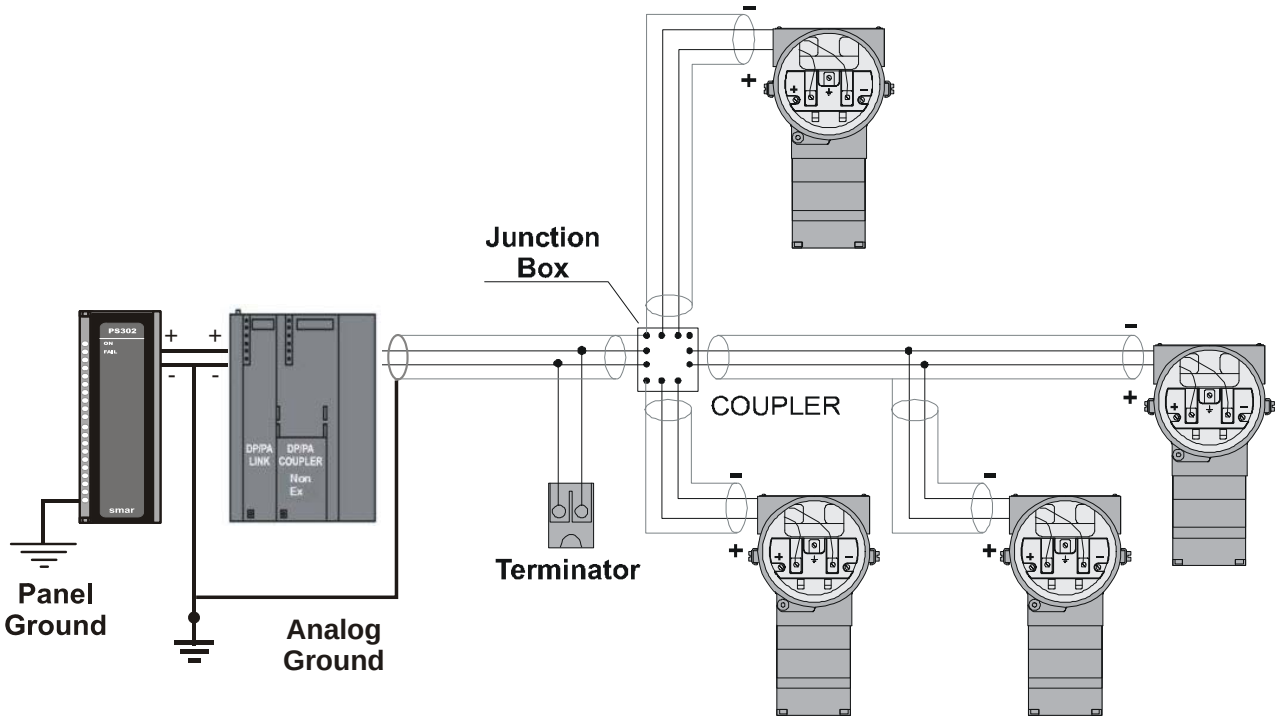


Figure 1.7 - Tree Topology

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.

Recommendations for mounting Approved Equipments with the IP66/68 W certifications (“W" indicates certification for use in saline atmospheres)

NOTE
This **TP303** certification is valid for stainless steel transmitter manufactured, approved with the certification IP66/68 W. All transmitter external material, such as plugs, connections etc., should be made in stainless steel. The electrical connection with 1/2” – 14NPT thread must use a sealant. A non-hardening silicone sealant is recommended. The instrument modification or replacement parts supplied by other than authorized representative of Smar is prohibited and will void the certification.

Rotary and Linear Magnet

The Figure 1.12 shows typical shapes for both magnets. For better transmitter performance, the linear magnet is presented with different lenghts. Consult the ordering code table for the best choice.

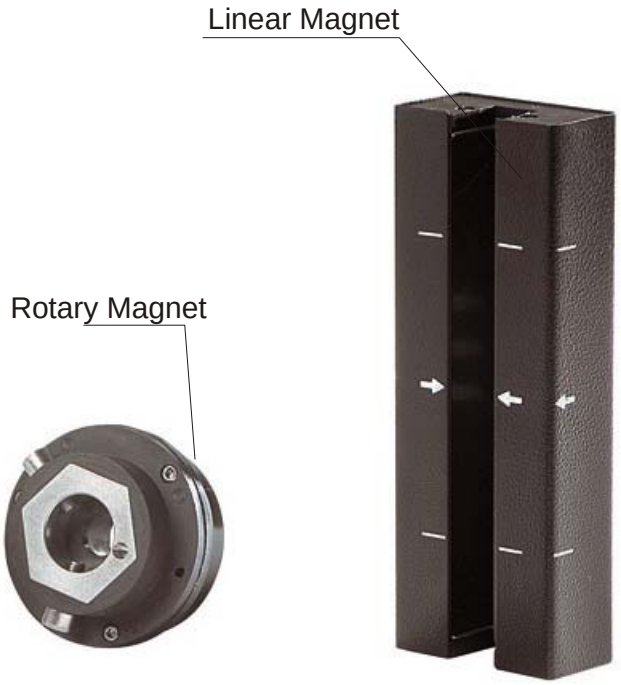


Figure 1.12 – Linear and Rotary Magnet Models

Remote Position Sensor

The remote magnetic position sensor, based on hall effect, is recommended for high temperature or extreme vibration applications. It prevents excessive wear of the equipment and, consequently, increasing the transmitter lifetime.

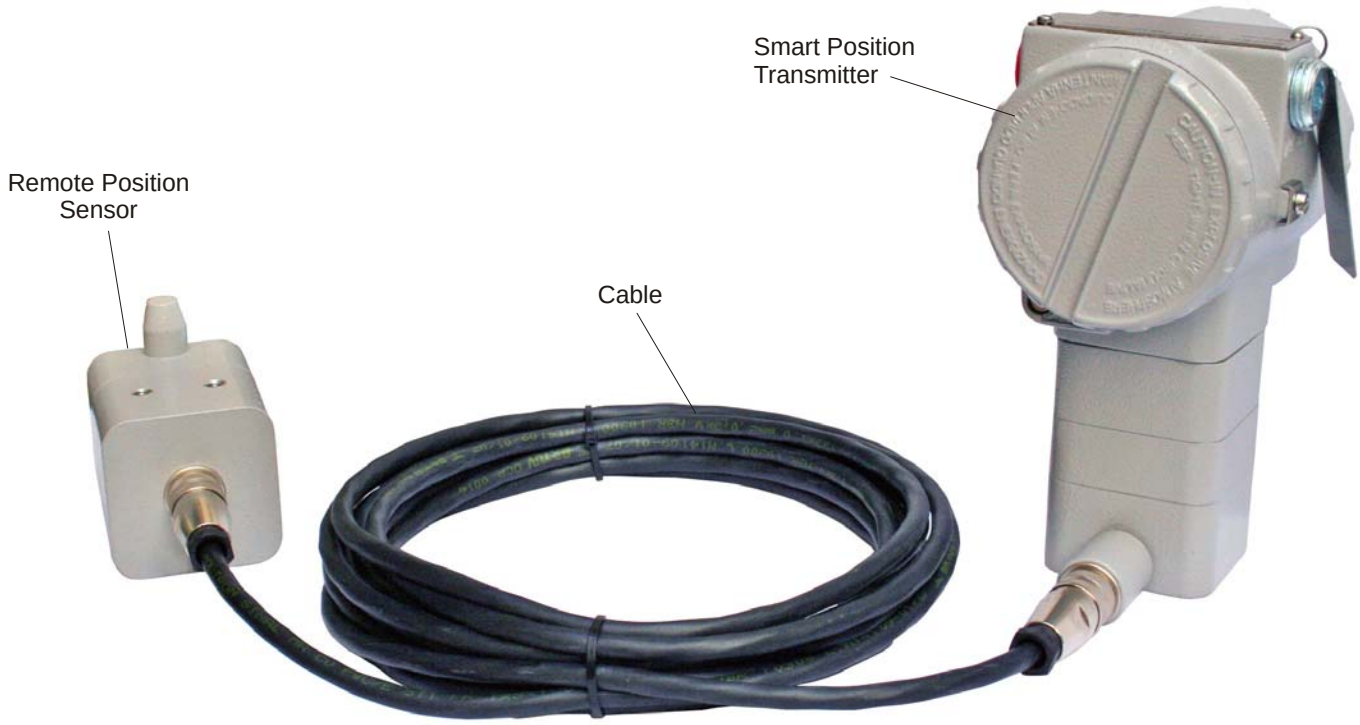


Figure 1.13 - Remote Position Sensor

The electric signals on the remote sensor's cable and connections are of low intensity. Therefore, when installing the cable inside the conduit (maximum limit 20 (meters) length), keep it away from possible sources of induction and/or magnetic interference. The cable supplied by Smar is shielded with excellent protection against electromagnetic interference, but despite of this protection, it is recommended to avoid the cable sharing the same conduit with other cables.

The connector for Remote Position Sensor is easy to handle and simple to install.

See the installation procedure:

Figure 1.14 - Connecting the Cable to the Remote Position Sensor

Figure 1.15 - Connecting the Cable to the Position Transmitter

Installation in Hazardous Areas

WARNING
Explosions could result in death or serious injury, besides financial damage. Installation of this transmitter in explosive areas must be carried out in accordance with the local standards and the protection type adopted .Before continuing the installation make sure the certificate parameters are I n accordance with the classified area where the equipment will be installed. The instrument modification or parts replacement supplied by other than authorized representative of Smar is prohibited and will void the certification. The transmitters are marked with options of the protection type. The certification is valid only when the protection type is indicated by the user. Once a particular type of protection is selected, any other type of protection can not be used. The electronic housing and the sensor installed in hazardous areas must have a minimum of 6 fully engaged threads. Lock the housing using the locking screw (Figure 1.6). The cover must be tighten with at least 8 turns to avoid the penetration of humidity or corrosive gases. The cover must be tighten until it touches the housing. Then, tighten more 1/3 turn (120°) to guarantee the sealing. Lock the covers using the locking screw (Figure 1.6). Consult the Appendix A for further information about certification.

Explosion/Flame Proof

WARNING
Only use Explosion Proof/Flameproof certified Plugs, Adapters and Cable glands. In Explosion-Proof installations the cable entries must be connected or closed using metal cable gland and metal blanking plug, both with at least IP66 and Ex-d certification. The standard plugs provided by Smar are certified according to CEPEL certificate. If the plug needs to be replaced, a certified plug must be used. The electrical connection with NPT thread must use waterproofing sealant. A non-hardening silicone sealant is recommended. Cable entries must be connected or closed using metal cable gland and metal blanking plug, both with at least IP66 and Ex-d certification or any appropriate ATEX approved metal cable gland and metal blanking plug. Do not remove the transmitter covers when power is ON.

Intrinsically Safe

WARNING
In hazardous zones with intrinsically safe or non-incendive requirements, the circuit entity parameters and applicable installation procedures must be observed. To protect the application the transmitter must be connected to a barrier. Match the parameters between barrier and the equipment (Consider the cable parameters). Associated apparatus ground bus shall 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. It is not recommended to remove the transmitter cover when the power is ON.

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.

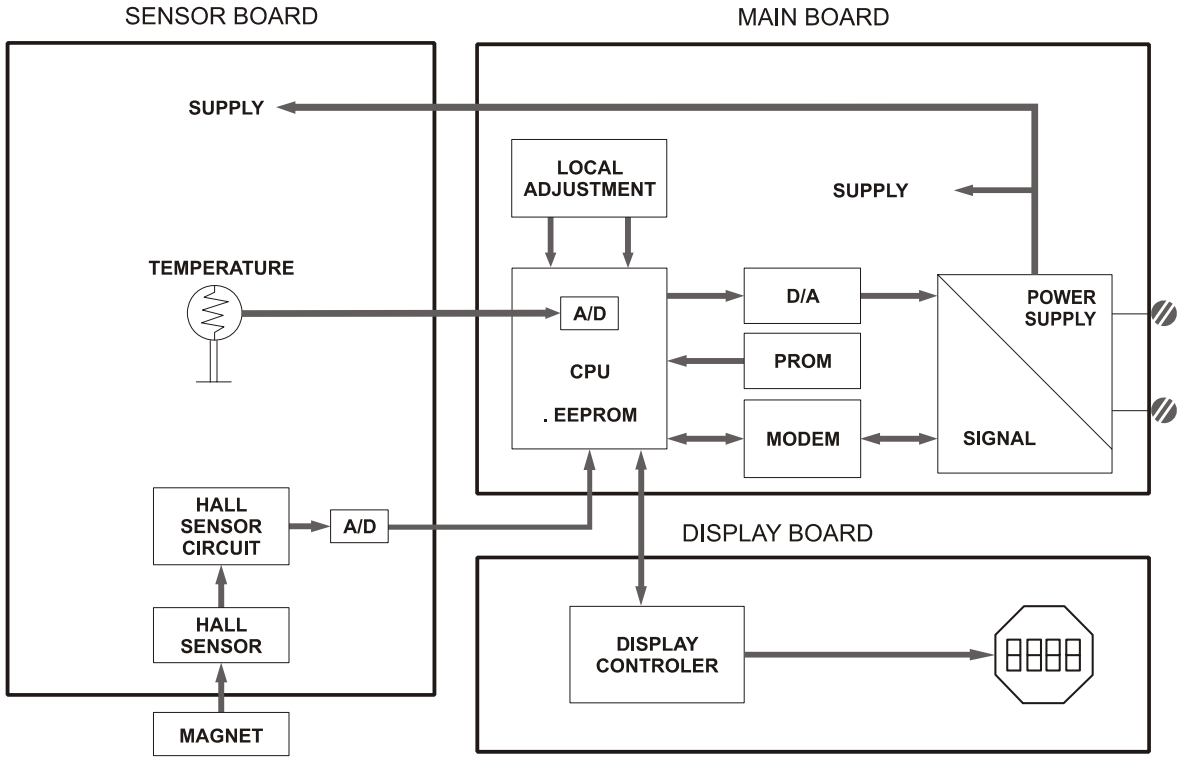


Figure 2.1 - TP303 Block Diagram Hardware

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.

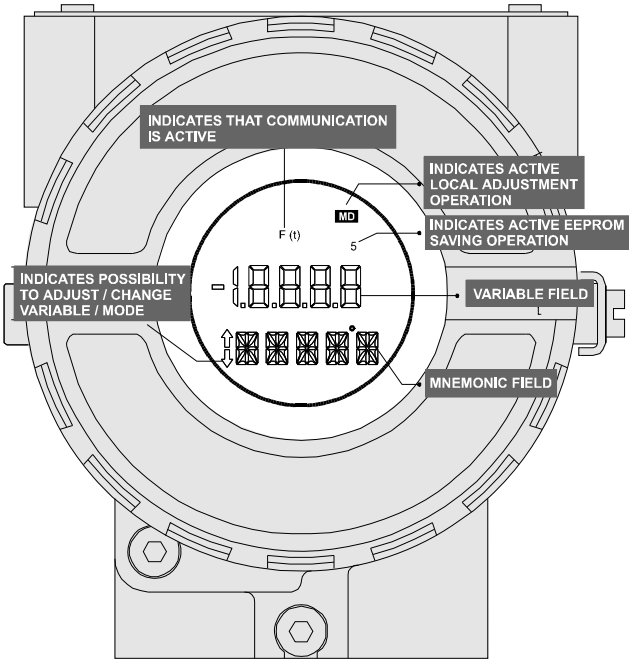


Figure 2.2 - LCD Indicator

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

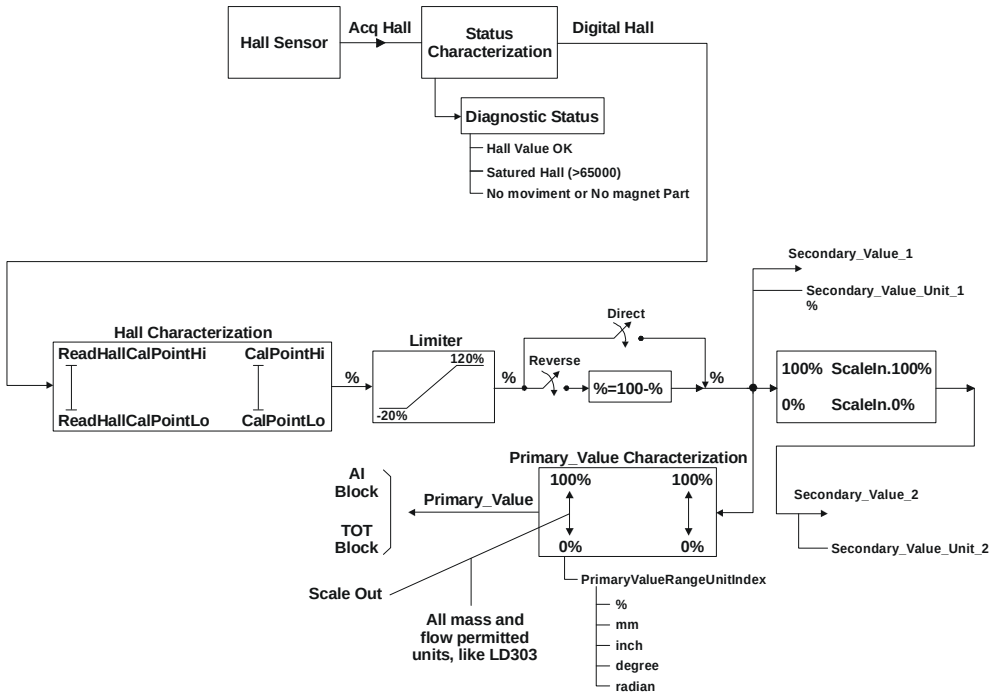


Figure 3.1 - Transducer Block Diagram for Position Transmitter

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” 0xfff7, “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.

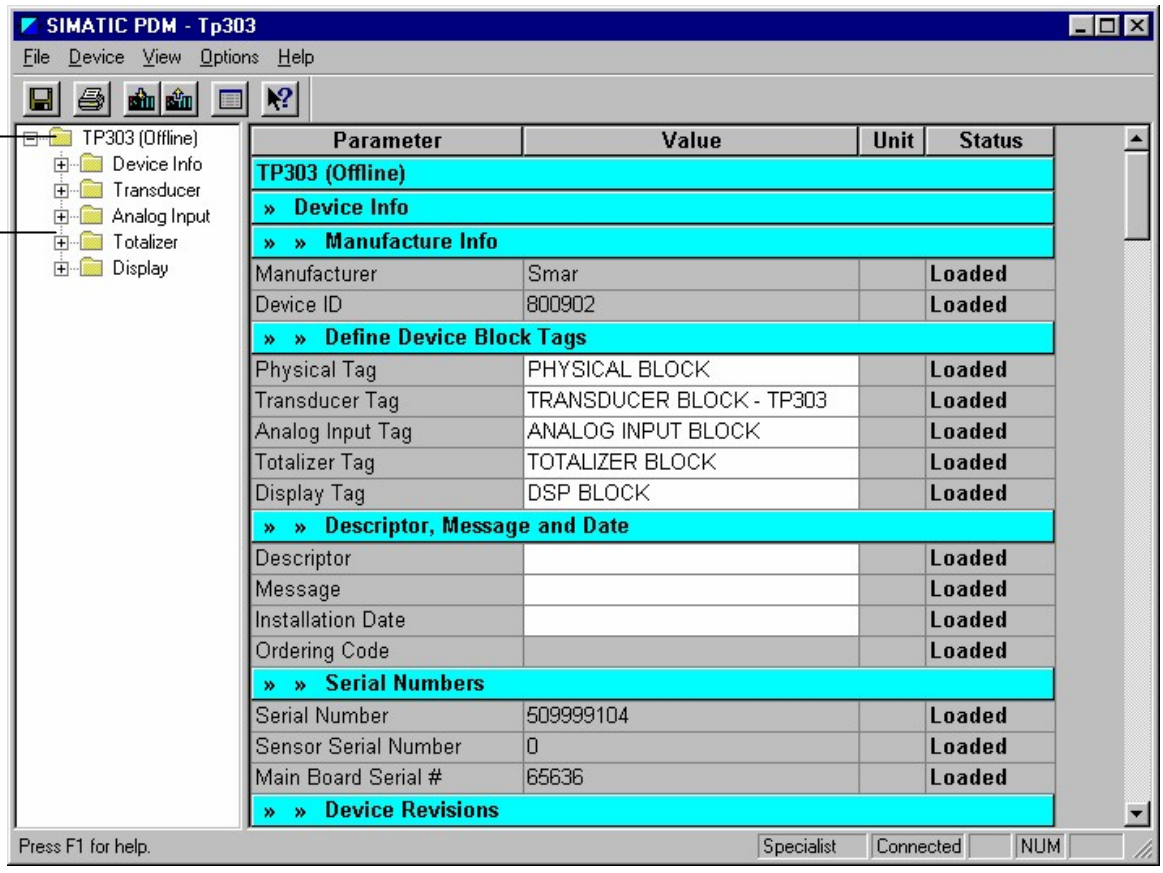


Figure 3.2 - Function and Transducers Blocks

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

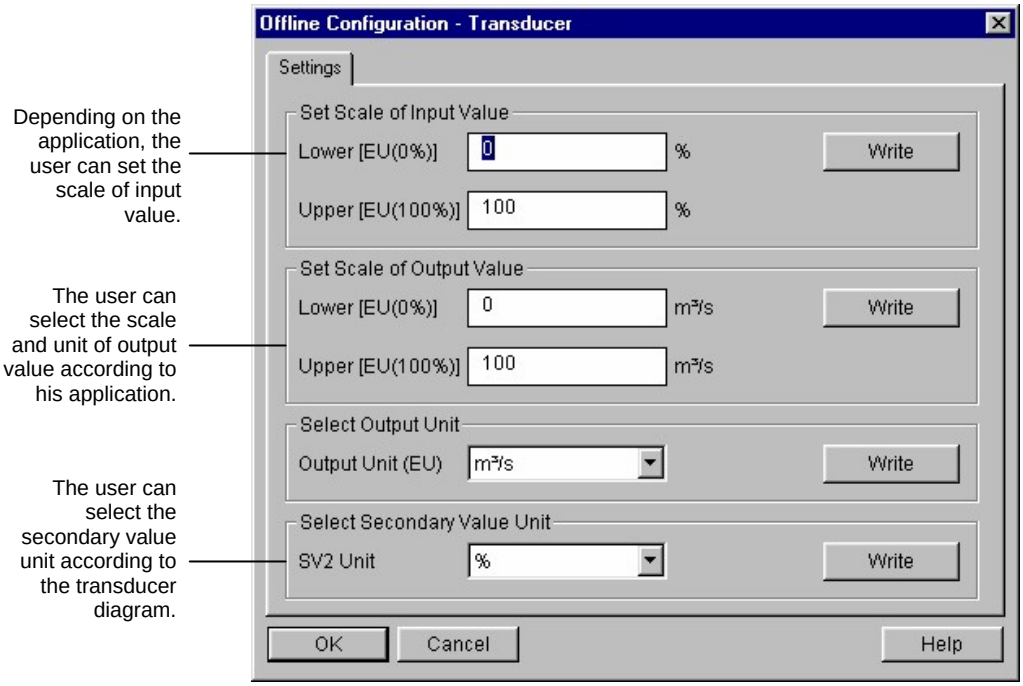


Figure 3.3 - Simatic PDM - Offline Configuration - Transducer

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.

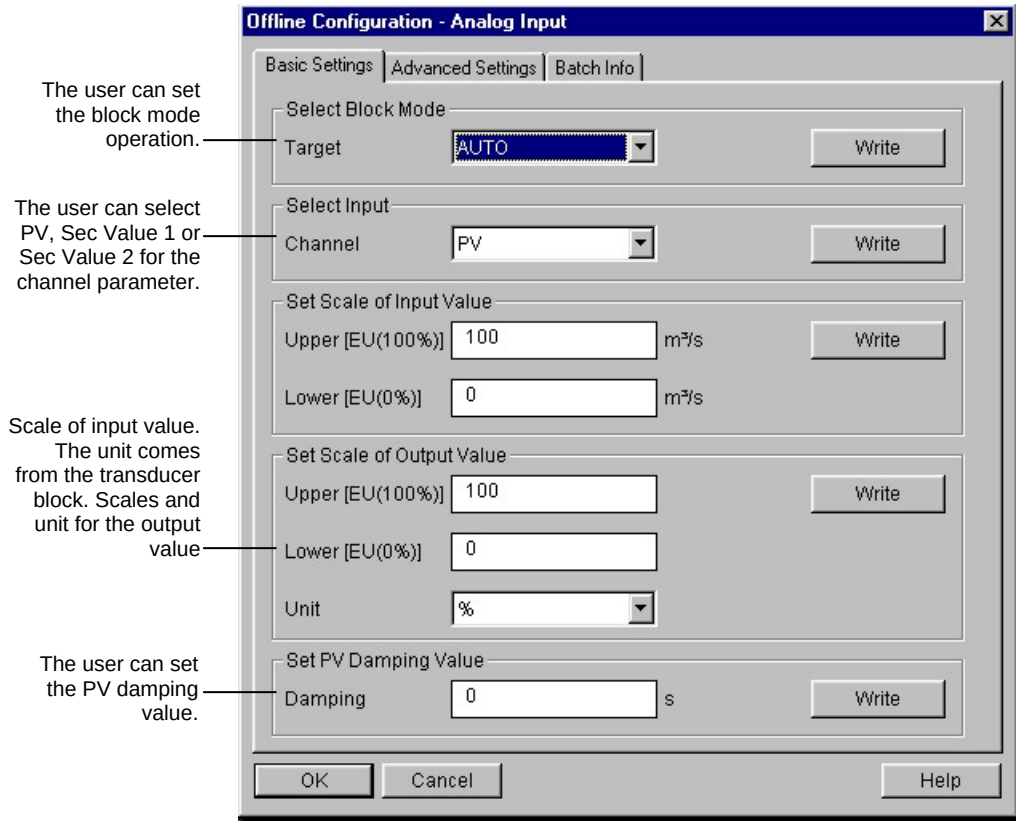


Figure 3.4 - Simatic PDM - Basic Settings for Analog Input Block

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:

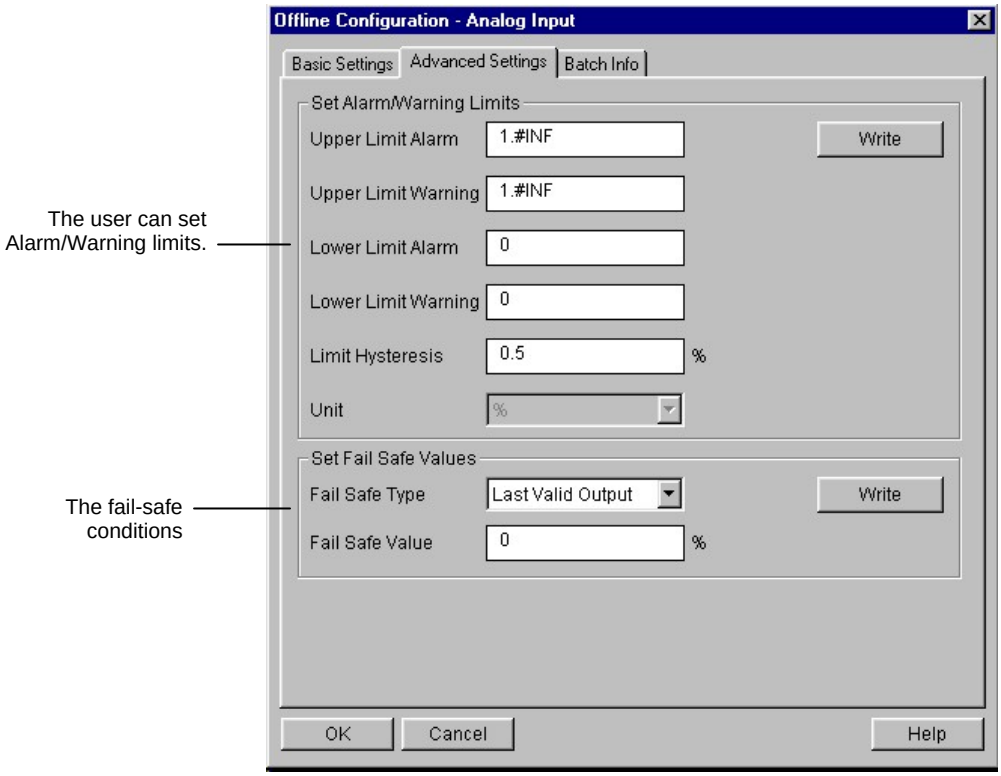


Figure 3.5 - Simatic PDM - Advanced Settings for Analog Input Block

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":

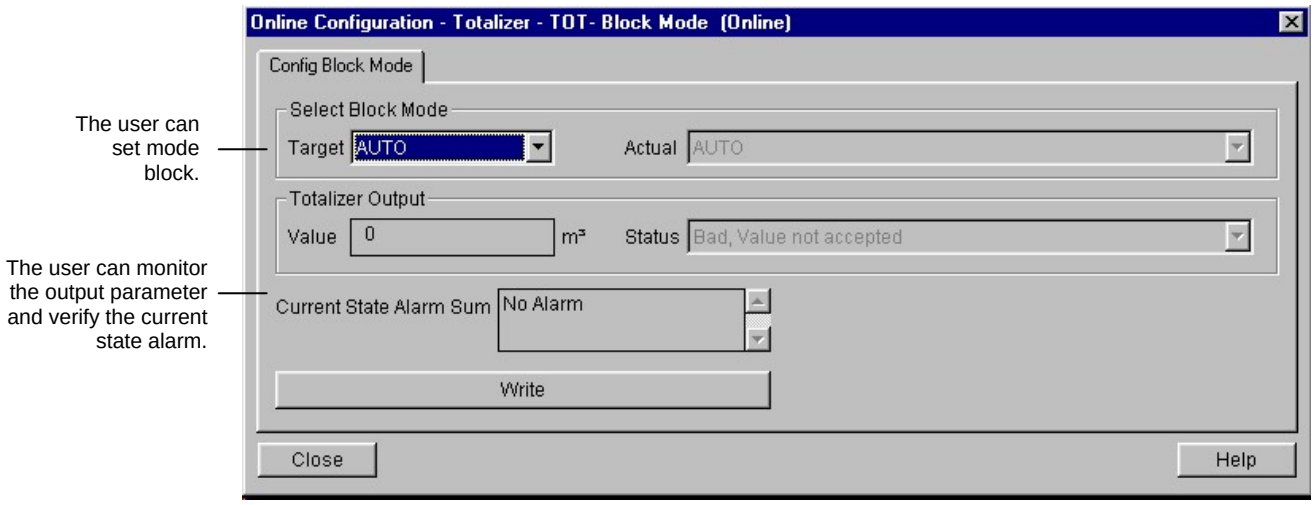


Figure 3.6 - Simatic PDM - Online Configuration for Analog Input Block

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:

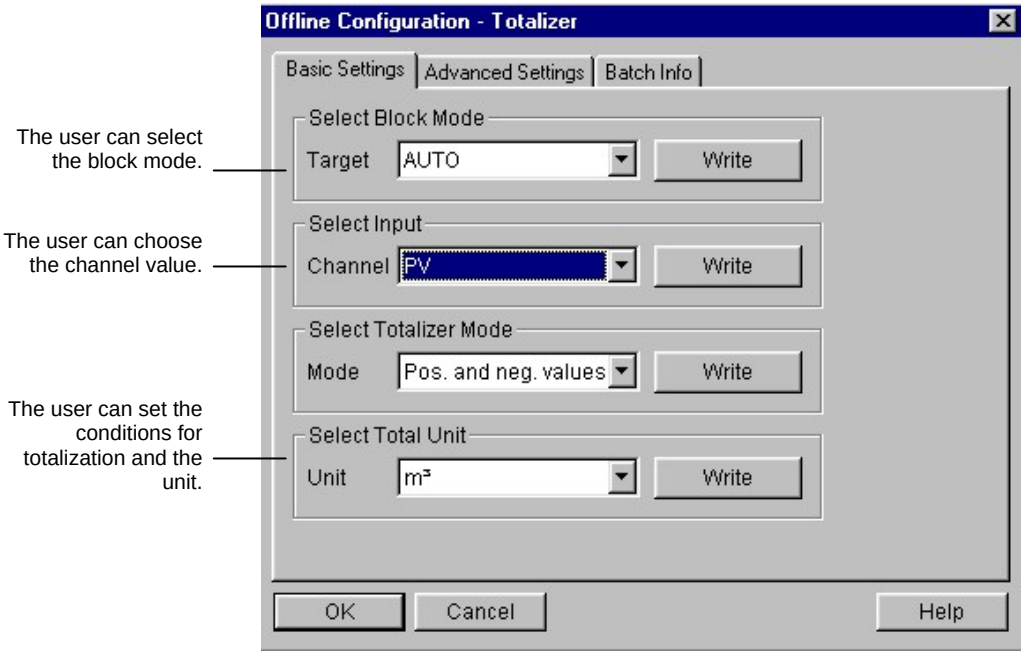


Figure 3.7 - Simatic PDM - Online Configuration - Basic Settings for Totalizer Block

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

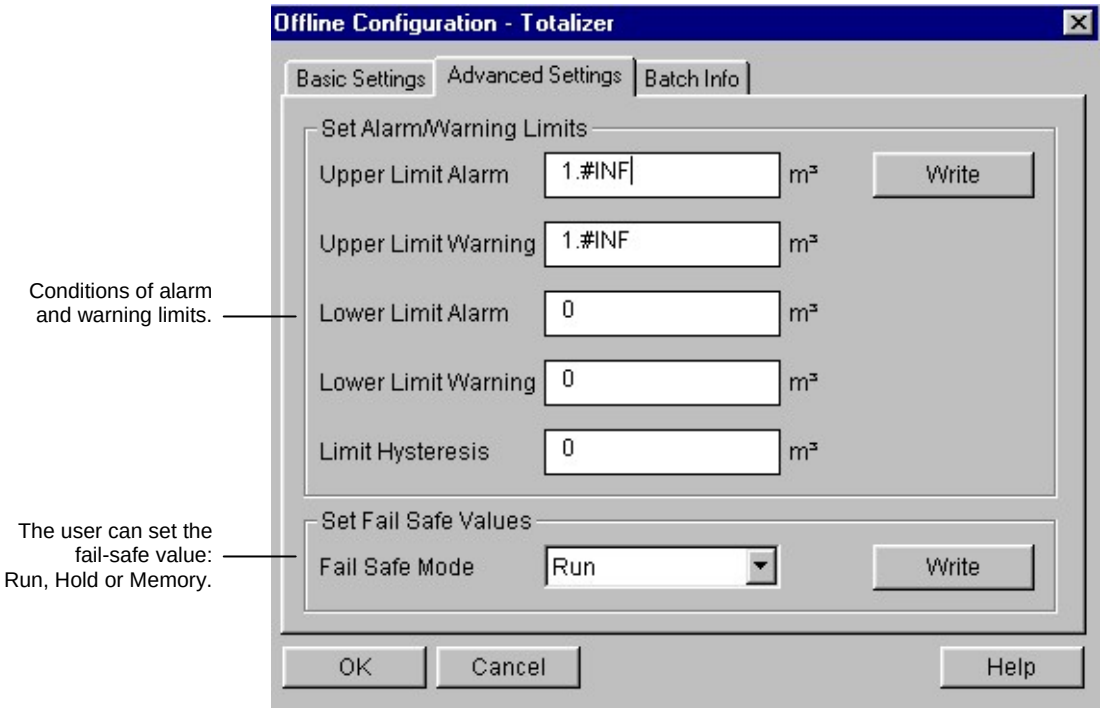


Figure 3.8 - Simatic PDM - Offline Configuration - Advanced Settings for Totalizer Block

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:

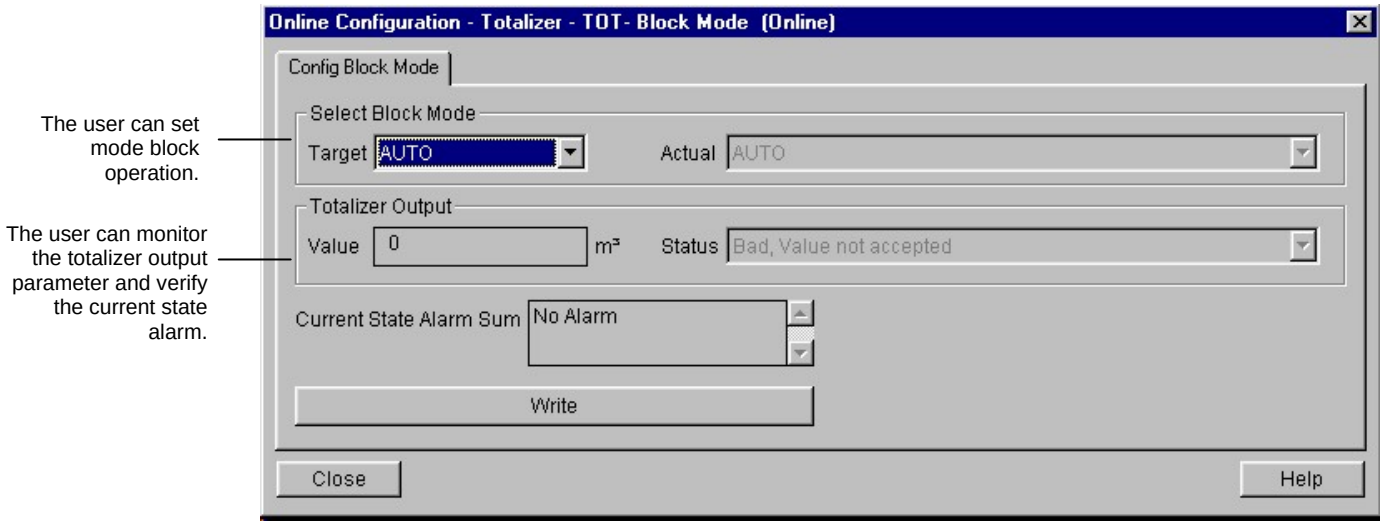


Figure 3.9 - Simatic PDM - Online Configuration - Block Mode for Totalizer Block

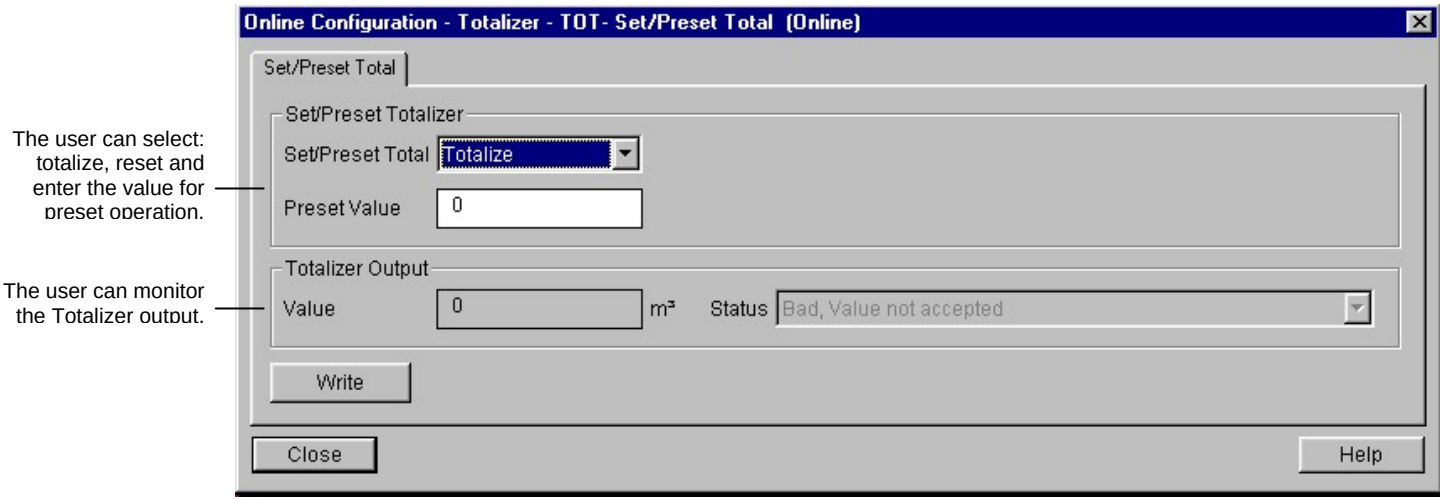


Figure 3.10 - Simatic PDM - Online Configuration - Set/Preset for Totalizer Block

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.

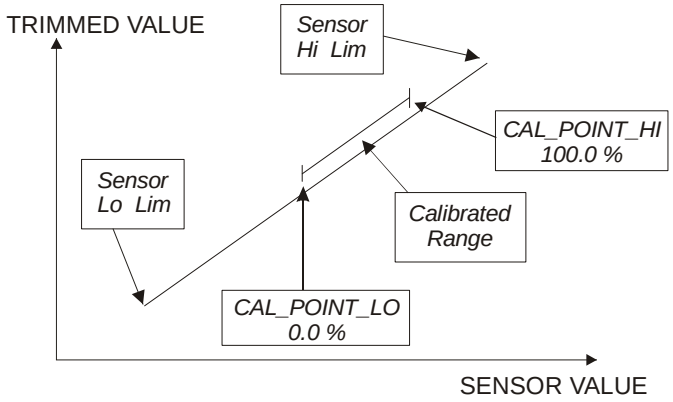


Figure 3.11 - Hall Sensor Calibration

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.

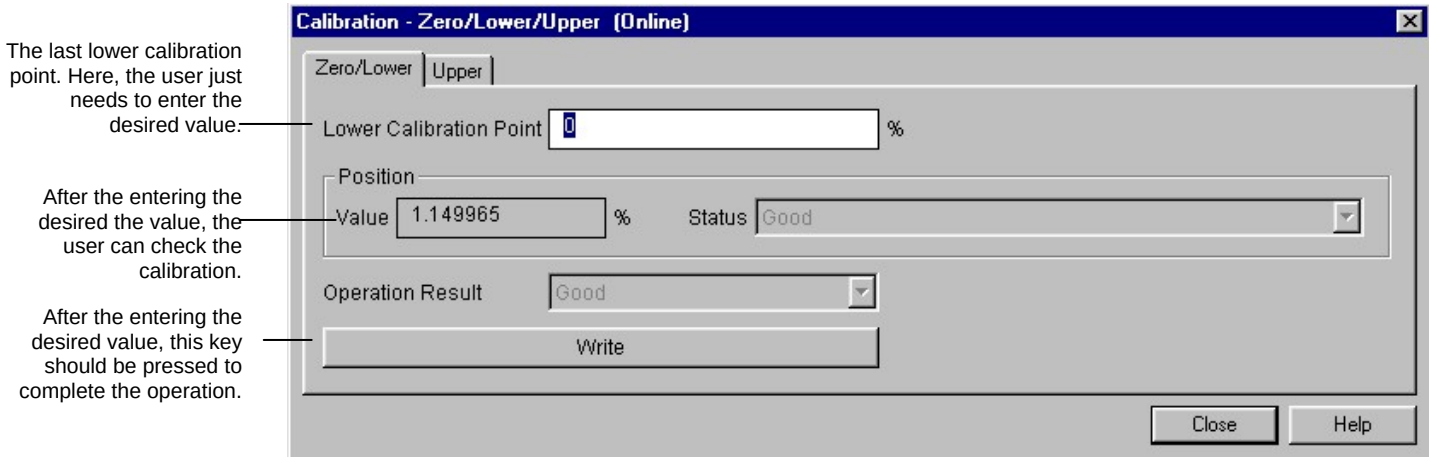


Figure 3.12 - TP303 Simatic PDM - Lower Position Calibration

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.

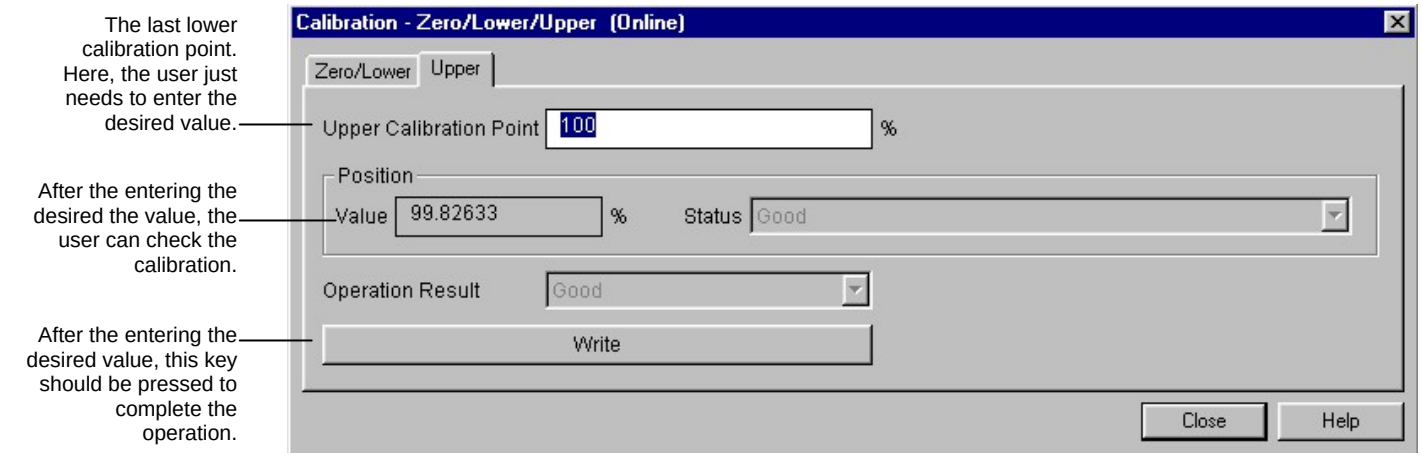


Figure 3.13 - TP303 Simatic PDM – Lower Position Calibration

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.

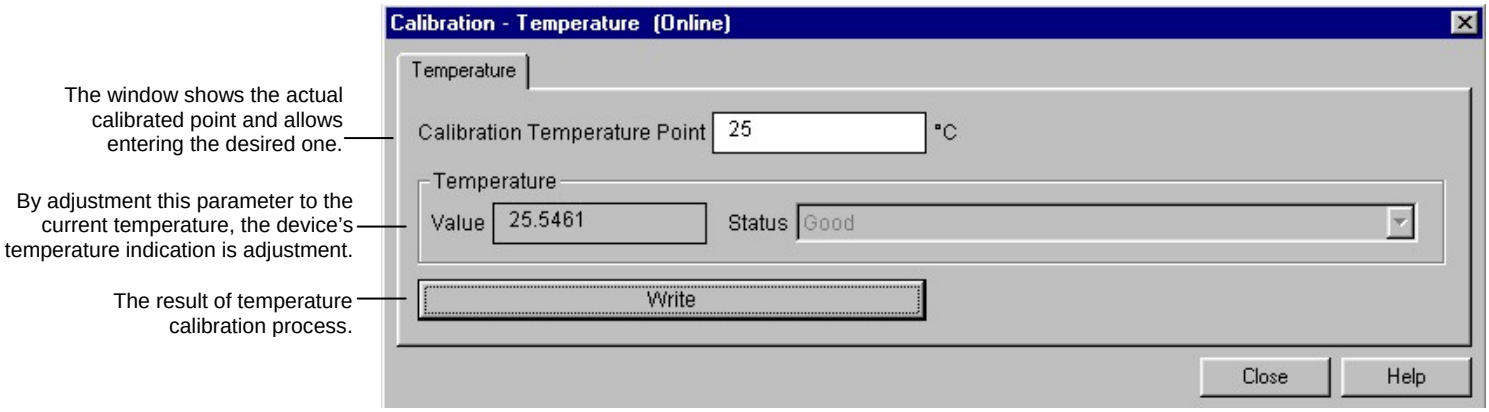


Figure 3.14 - Temperature Trim Configuration Screen

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:

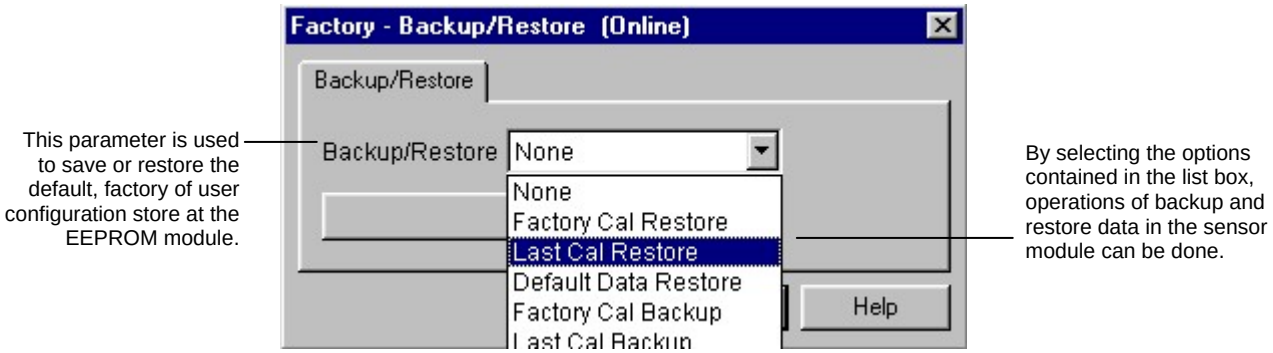


Figure 3.15 - Transducer Block - Backup/Restore

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:

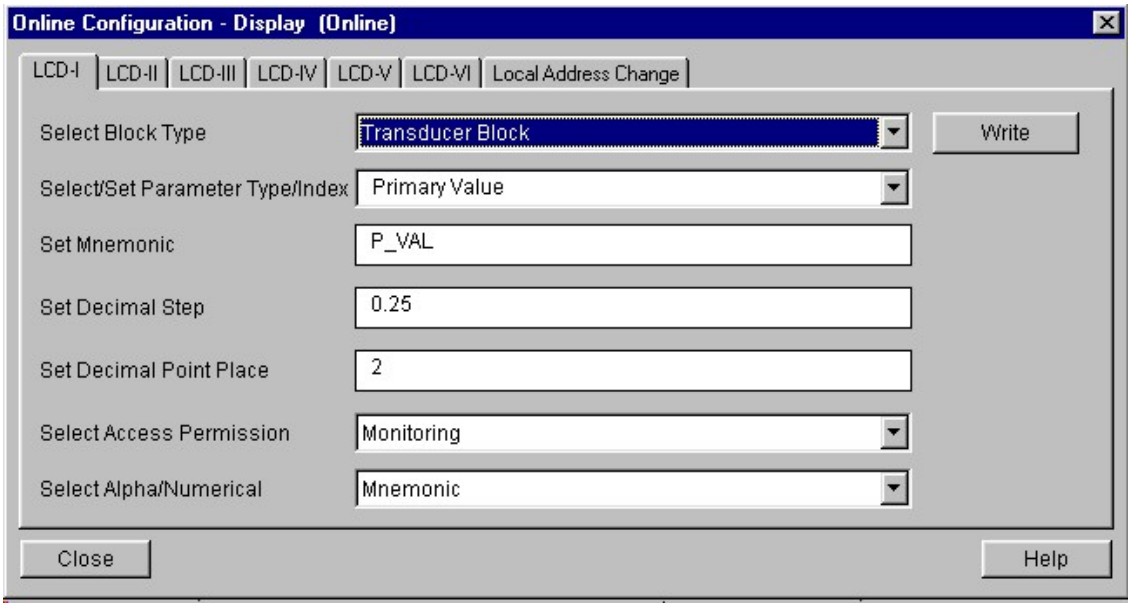


Figure 3.16 - Display Block and Simatic PDM

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:

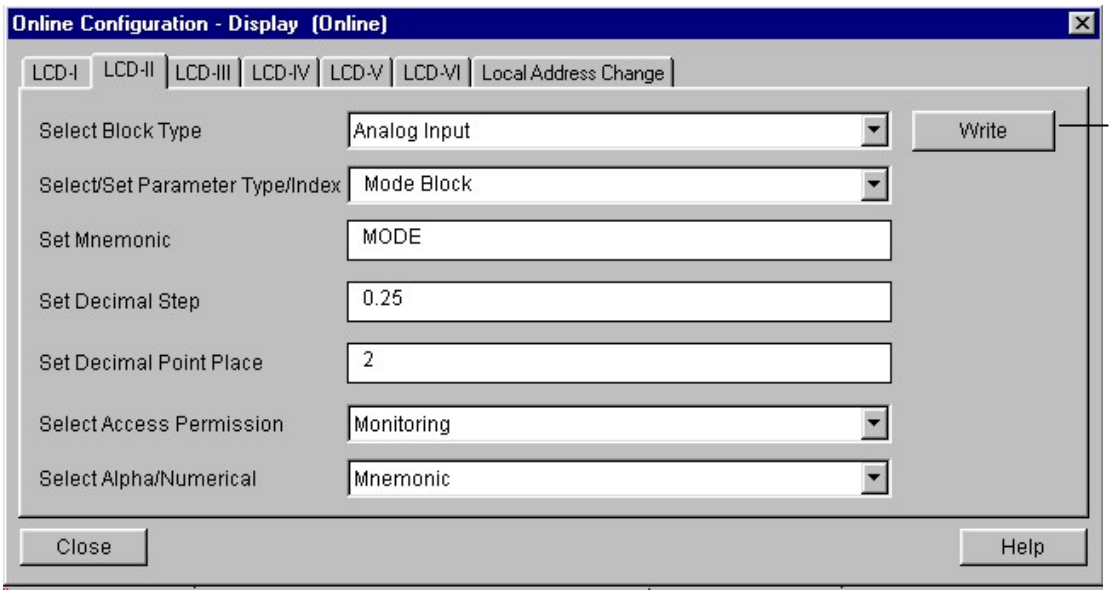


Figure 3.17 - Parameters for Local Adjustment Configuration

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

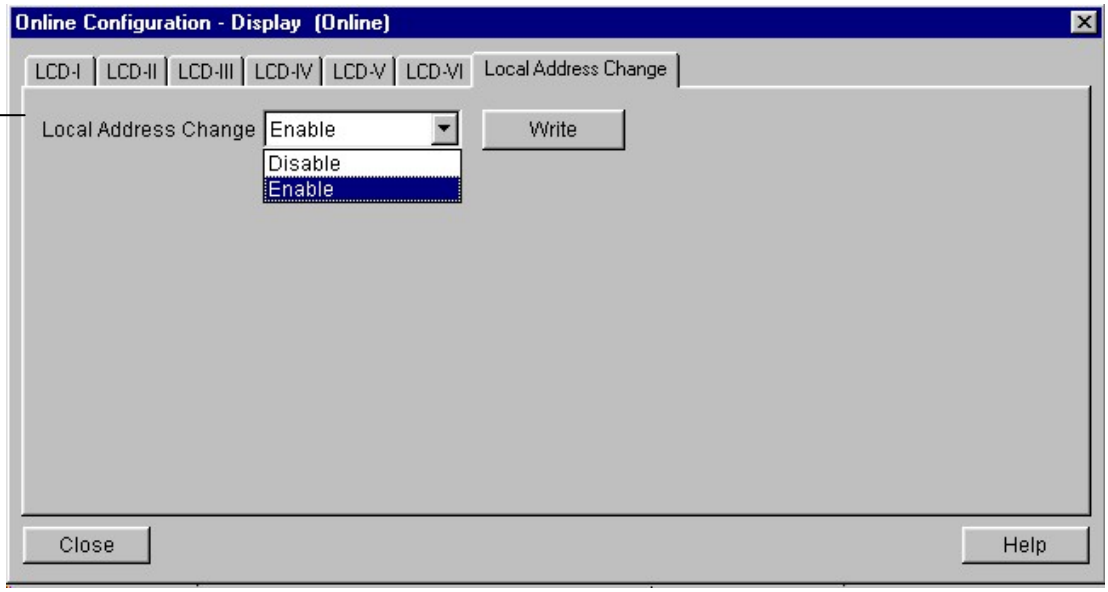


Figure 3.18 - Parameters for Local Adjustment Configuration

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:

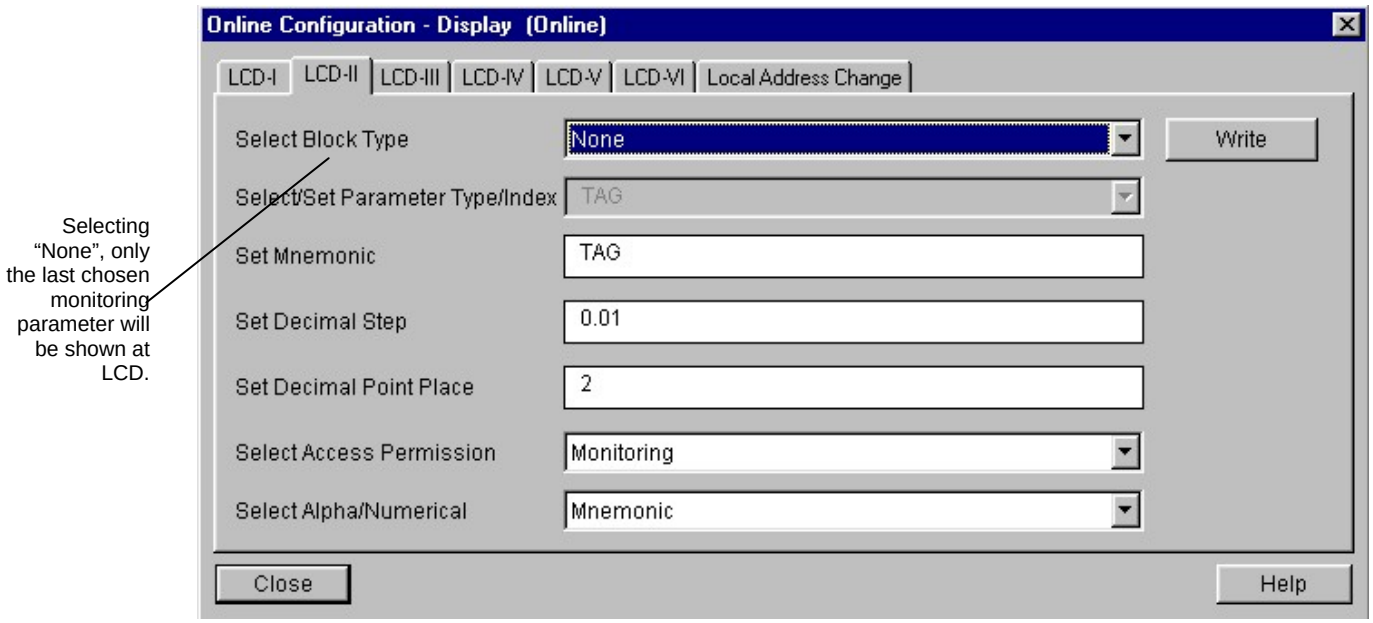


Figure 3.19 - Parameters for Local Adjustment Configuration

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

With this option, the Mode Block parameter is shown at the LCD.

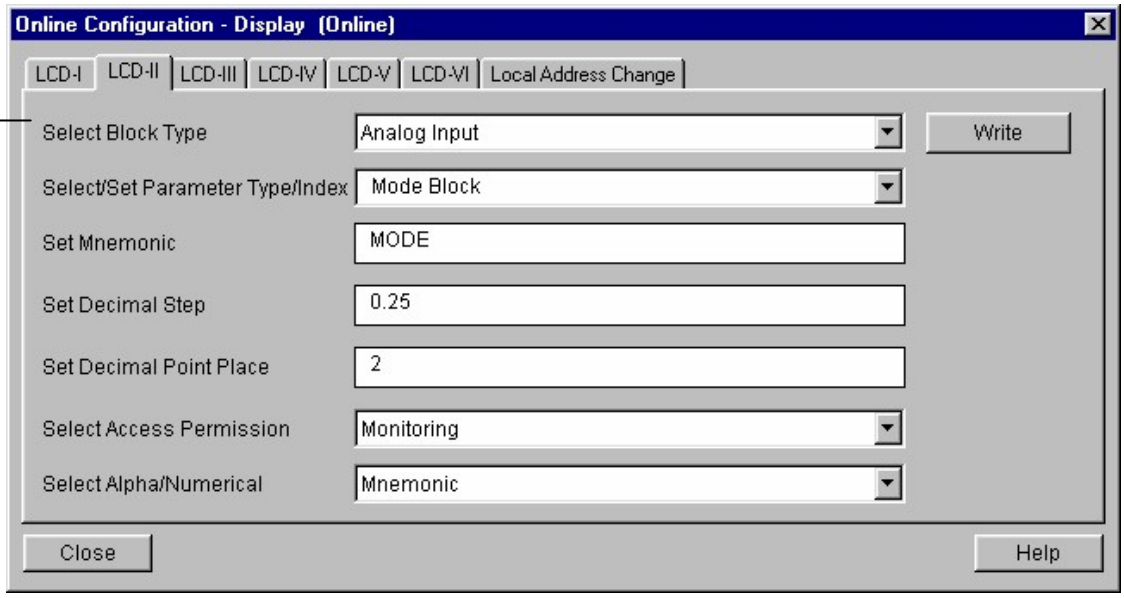


Figure 3.20 - Parameters for Local Adjustment Configuration

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).

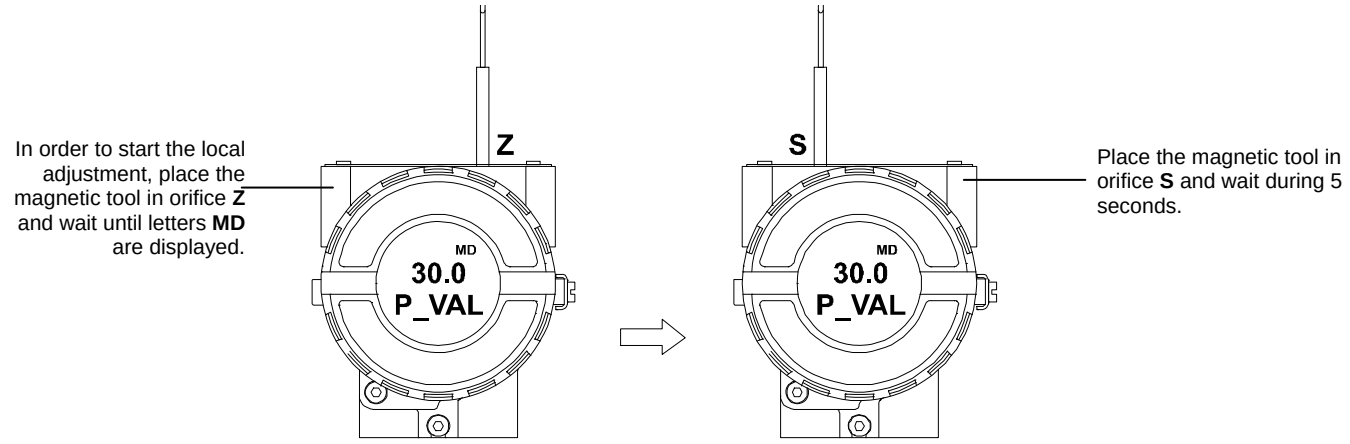


Figure 3.21 – Step 1 – TP303

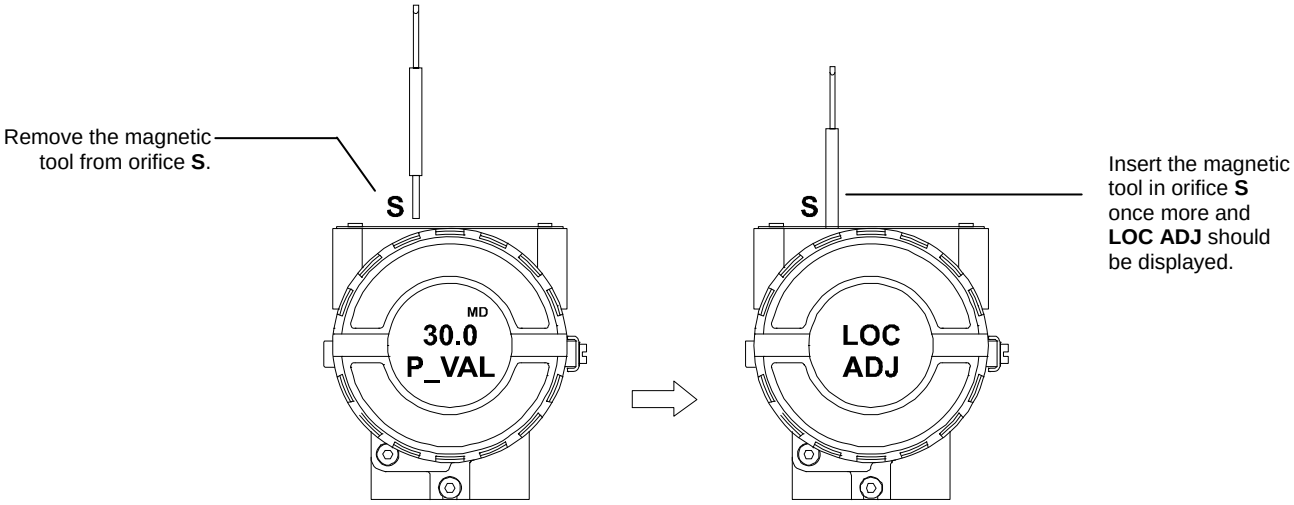


Figure 3.22 – Step 2 – TP303

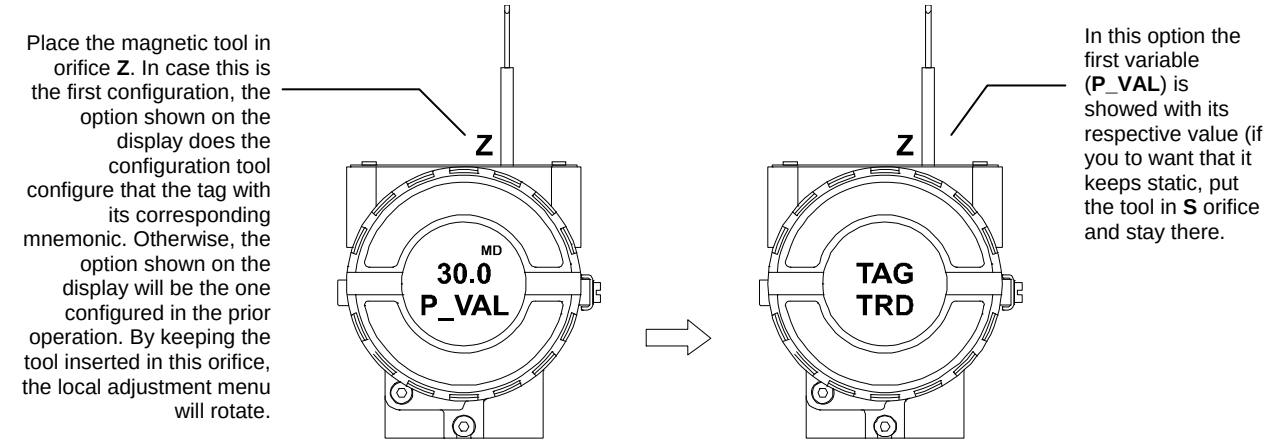
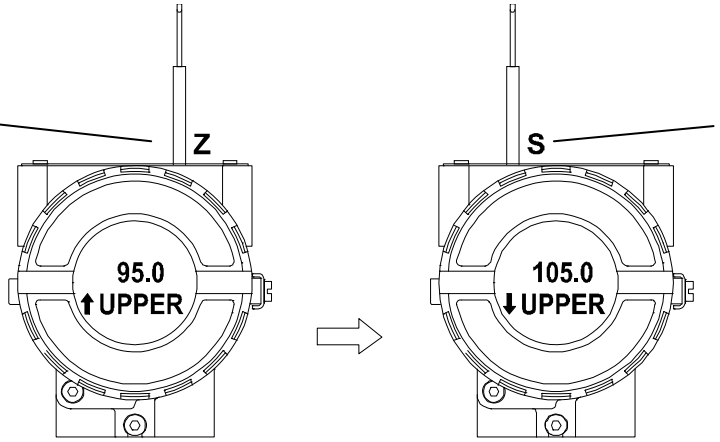


Figure 3.23 – Step 3 – TP303

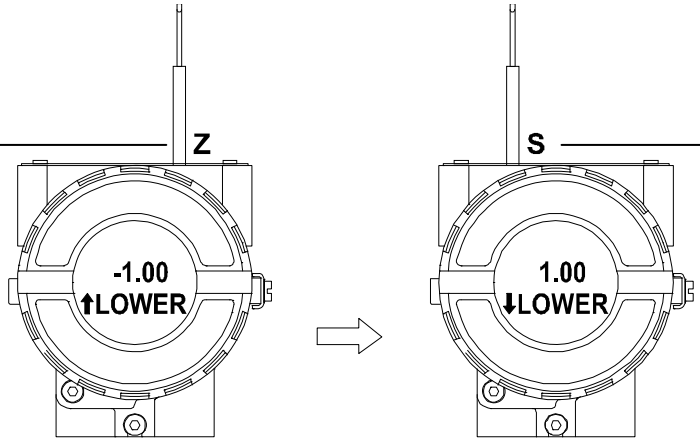
In order to range the upper value (lower); simply insert the magnetic tool in orifice **S** as soon as UPPER is shown on display. An arrow pointing upward (↑) increments the value and an arrow pointing downward (↓) decrements the value. In order to increment the value, keep the tool inserted in **S**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

Figure 3.24 – Step 4 – TP303

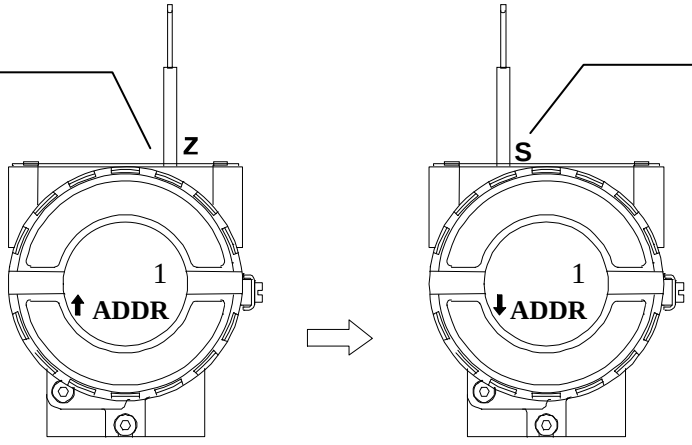
In order to range the lower value (lower); simply insert the magnetic tool in orifice **S** as soon as LOWER is shown on display. An arrow pointing upward (↑) increments the value and an arrow pointing downward (↓) decrements the value. In order to increment the value, keep the tool inserted in **S**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

Table of Points - Linearization

The output signal follows a curve determined by 16 points freely configurable.

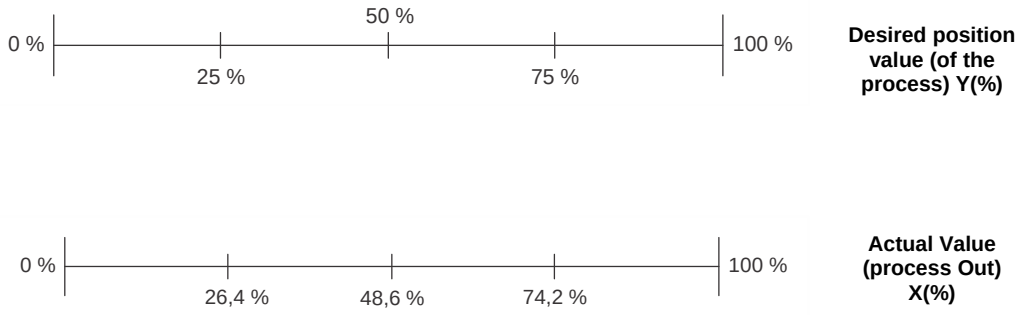
TABLE OF POINTS - LINEARIZATION			
Points %	**Actual Value (process Out) X(%)**	**Desired position value (of the process) Y(%)**	
1	0	0	**5 Points** (See figure: Position graphic of the magnet)
2	26.4	25	
3	48.6	50	
4	74.2	75	
5	100	100	
6	-	-	**Not used**
. . .	. . .	. . .	
16	-	-	

Table function (Linearization)
Depending on the application and according with the process, the transmitter output or PV is shown in one linear characteristic curve (position, level, opening etc.). TP also has the option for adjust this curve of linear output, to that the value in percentage can be linearized, you have to uses a table 16 points at maximum and minimum points 2. The output is calculated by interpolating these points. The user can set the total of points desired.

To configure the feature table:

- The user must choose the item "function" to "table" option.
- Select the number of points, according to you need, 2-16 points.
- Create the table and indicate the current position value in the "X" (%) column and the desired position value in the "Y" (%) column. Once created the table, send the points for the position transmitter.
- Done, this configured.

Position Graphic of the Magnet
Exemple:



NOTE: If the table is enabled there will be an indication on the Display LCD with the F(X) icon.

Figure 3.27 - Position Graphic of the Magnet

Cyclical Diagnosis

Via cyclic communication is possible to verify diagnostics from the **TP303** using the Profibus Master Class 1 or even via acyclic communication via Master Class 2. The Profibus-PA devices provide up to 4 standard diagnoses bytes via Physcial Block (see figure 3.28 and 3.29) and when the most significant bit of the fourth Byte is "1", the diagnose will extend the information in more 6 bytes. These Diagnosis bytes can also be monitored via cyclic tools.

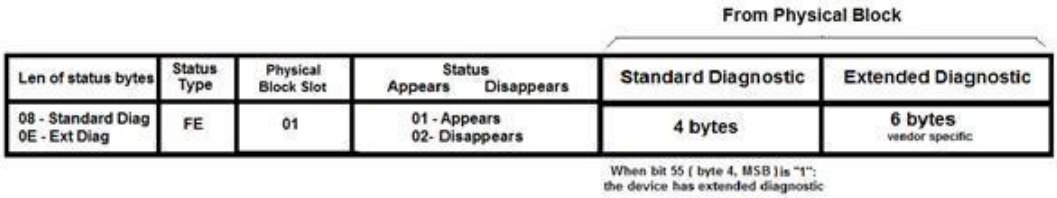


Figure 3.28 – Cyclical Diagnosis

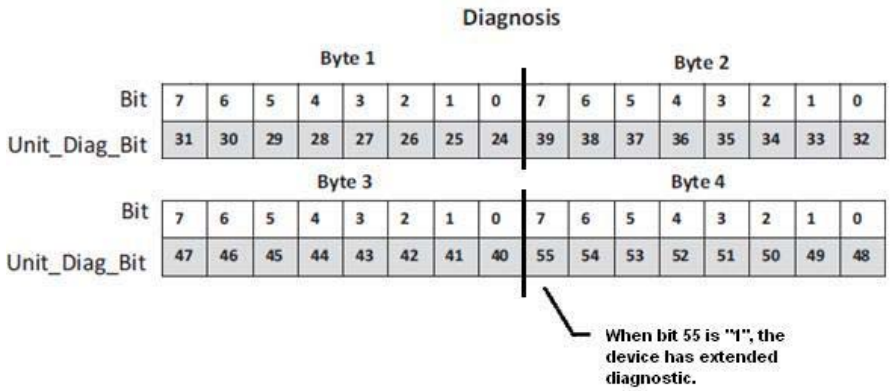


Figure 3.29 – Cyclic Diagnosis mapping for 4 bytes of Physical Block.

Unit_Diag_bit is described in the GSD file Profibus-PA device.

See below a description part of a GSD file for the 4 bytes and more detail:

```
;---------- Description of device related diagnosis: ---------------------
;

Unit_Diag_Bit(16)   = "Error appears"
Unit_Diag_Bit(17)   = "Error disappears"
;
;Byte 01
Unit_Diag_Bit(24)   = "Hardware failure electronics"
Unit_Diag_Bit(25)   = "Not used 25"
Unit_Diag_Bit(26)   = "Not used 26"
Unit_Diag_Bit(27)   = "Not used 27"
Unit_Diag_Bit(28)   = "Memory error"
Unit_Diag_Bit(29)   = "Measurement failure"
Unit_Diag_Bit(30)   = "Device not initialized"
Unit_Diag_Bit(31)   = "Device initialization failed"

;Byte 02
Unit_Diag_Bit(32)   = "Not used 32"
Unit_Diag_Bit(33)   = "Not used 33"
Unit_Diag_Bit(34)   = "Configuration invalid"
Unit_Diag_Bit(35)   = "Restart"
Unit_Diag_Bit(36)   = "Coldstart"
Unit_Diag_Bit(37)   = "Maintenance required"
Unit_Diag_Bit(38)   = "Not used 38"
Unit_Diag_Bit(39)   = "Ident_Number violation"
```

```
;Byte 03
Unit_Diag_Bit(40)   = "Not used 40"
Unit_Diag_Bit(41)   = "Not used 41"
Unit_Diag_Bit(42)   = "Not used 42"
Unit_Diag_Bit(43)   = "Not used 43"
Unit_Diag_Bit(44)   = "Not used 44"
Unit_Diag_Bit(45)   = "Not used 45"
Unit_Diag_Bit(46)   = "Not used 46"
Unit_Diag_Bit(47)   = "Not used 47"


;byte 04
Unit_Diag_Bit(48)   = "Not used 48"
Unit_Diag_Bit(49)   = "Not used 49"
Unit_Diag_Bit(50)   = "Not used 50"
Unit_Diag_Bit(51)   = "Not used 51"
Unit_Diag_Bit(52)   = "Not used 52"
Unit_Diag_Bit(53)   = "Not used 53"
Unit_Diag_Bit(54)   = "Not used 54"
Unit_Diag_Bit(55)   = "Extension Available"

;Byte 05 TRD Block & PHY Block
Unit_Diag_Bit(56)   = "Sensor Hall failure"
Unit_Diag_Bit(57)   = "Temperature Out of work range"
Unit_Diag_Bit(58)   = "Not used 58"
Unit_Diag_Bit(59)   = "Not Used 59"
Unit_Diag_Bit(60)   = "Calibration Error - Check XD_ERROR parameter"
Unit_Diag_Bit(61)   = "Not used 61"
Unit_Diag_Bit(62)   = "Not Used 62"
Unit_Diag_Bit(63)   = "Device is writing lock"

;byte 06 AI Block
Unit_Diag_Bit(64)   = "Simulation Active in AI Block"
Unit_Diag_Bit(65)   = "Fail Safe Active in AI Block"
Unit_Diag_Bit(66)   = "AI Block in Out of Service"
Unit_Diag_Bit(67)   = "AI Block Output out of High limit"
Unit_Diag_Bit(68)   = "AI Block Output out of Low limit"
Unit_Diag_Bit(69)   = "No assigned channel to AI Block"
Unit_Diag_Bit(70)   = "Not used 70"
Unit_Diag_Bit(71)   = "Not used 71"

;byte 07 TOT Block
Unit_Diag_Bit(72)   = "TOT Block in Out of Service"
Unit_Diag_Bit(73)   = "Totalization Out of High limit"
Unit_Diag_Bit(74)   = "Totalization Out of Low limit"
Unit_Diag_Bit(75)   = "No assigned channel to TOT Block"
Unit_Diag_Bit(76)   = "Not used 76"
Unit_Diag_Bit(77)   = "Not used 77"
Unit_Diag_Bit(78)   = "Not used 78"
Unit_Diag_Bit(79)   = "Not used 79"

;byte 08
Unit_Diag_Bit(80)   = "Not used 80"
Unit_Diag_Bit(81)   = "Not used 81"
Unit_Diag_Bit(82)   = "Not used 82"
Unit_Diag_Bit(83)   = "Not used 83"
Unit_Diag_Bit(84)   = "Not used 84"
Unit_Diag_Bit(85)   = "Not used 85"
Unit_Diag_Bit(86)   = "Not used 86"
Unit_Diag_Bit(87)   = "Not used 87"

;byte 09
Unit_Diag_Bit(88)   = "Not used 88"
Unit_Diag_Bit(89)   = "Not used 89"
Unit_Diag_Bit(90)   = "Not used 90"
```

Unit_Diag_Bit(91) = "Not used 91"
Unit_Diag_Bit(92) = "Not used 92"
Unit_Diag_Bit(93) = "Not used 93"
Unit_Diag_Bit(94) = "Not used 94"
Unit_Diag_Bit(95) = "Not used 95"

;byte 10
Unit_Diag_Bit(96) = "Not used 96"
Unit_Diag_Bit(97) = "Not used 97"
Unit_Diag_Bit(98) = "Not used 98"
Unit_Diag_Bit(99) = "Not used 99"
Unit_Diag_Bit(100) = "Not used 100"
Unit_Diag_Bit(101) = "Not used 101"
Unit_Diag_Bit(102) = "Not used 102"
Unit_Diag_Bit(103) = "Not used 103"

NOTE

If the FIX flag is active on LCD, the **TP303** is configured to "Profile Specific" mode. When in "Manufacturer Specific" mode, the Identifier Number is 0x0904. Once the Identifier_Number_Selector is changed from "Profile Specific" to "Manufacturer Specific" or vice-versa, one must wait 5 seconds while the data is saved. Then, turn the **TP303** off and turn it on again. So, the Identifier Number is updated to the communication level. If the equipment is in "Profile Specific" and using the GSD file Identifier Number equals 0x0904, the acyclic communication will work with the tools based on EDDL, FDT/DTM, but no cyclic communication with the Profibus-DP master will get success.

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.

Recommendations for mounting Approved Equipments with the IP66/68 W certifications ("W" indicates certification for use in saline atmospheres)

NOTE
The certification is valid for stainless steel transmitter manufactured, approved with the certification IP66/68 W. All transmitter external material, such as plugs, connections etc., should be made in stainless steel. The electrical connection with 1/2" – 14NPT thread must use a sealant. A non-hardening silicone sealant is recommended. The instrument modification or replacement parts supplied by other than authorized representative of Smar is prohibited and will void the certification.

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

SYMPTOM	PROBABLE SOURCE OF PROBLEM
NO COMMUNICATION	***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.
	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.
	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.
	Network Configuration Make sure that device address is configured correctly.
	Electronic Circuit Failure Check the main board for defect by replacing it with a spare one.
INCORRECT READING	***Transmitter Connections*** Check for intermittent short circuits, open circuits and grounding problems. Check if the sensor is correctly connected to the **TP303** terminal block.
	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.
	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**.

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, disconnect before the electrical connections (in the field terminal side) and the main board.

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 **(7)** on the side not marked “Field Terminals”, then unscrew the cover **(1)**.

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.

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

Figure 4.1 - Sensor Rotation

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

Reassembly Procedure

WARNING
Do not assemble the main board with power on.

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.

Electronic Circuit
Plug transducer connector and power supply connector to main board **(5)**. Attach the display to the main board. Observe the four possible mounting positions. The ↑ mark indicates up position.

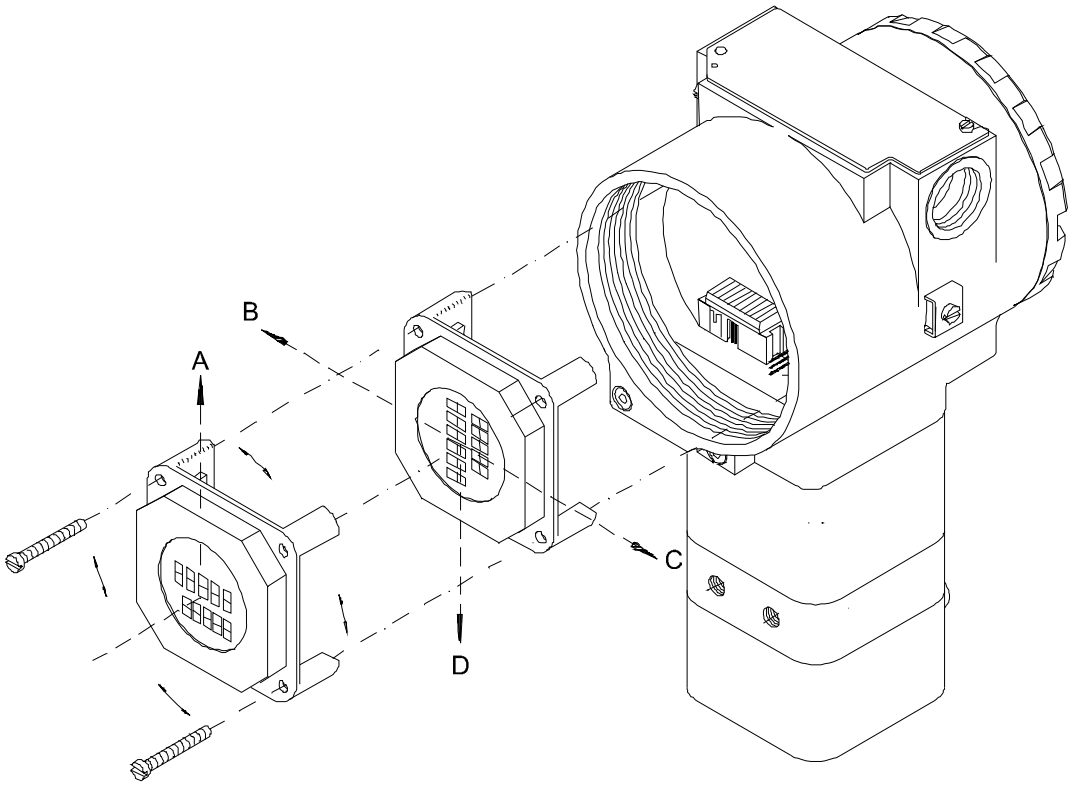


Figure 4.2 - Four Possible Positions of the Display

Anchor the main board **(5)** in the housing **(8)** with their screws **(3)**. After tightening the protective cover **(1)**, mounting procedure is complete. The transmitter is ready to be energized and tested.

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

ACCESSORIES AND RELATED PRODUCTS	
ORDERING CODE	**DESCRIPTION**
400-1176	Teflon guide for linear magnet.
400-1177	Teflon guide for rotary magnet.
AssetView FDT	Asset Management With FDT
BC1	Fieldbus/RS232 Interface
BT302	Terminator
DF47-17	Intrinsic Safety Barrier
DF73	HSE/PROFIBUS-DP Controller
DF95/DF97	PROFIBUS DP/PA Controller
FDI302	Field Device interface
PBI	USB Profibus Interface
ProfibusView	Profibus PA Device Parameterization Software
PS302/DF52	Power Supply
PSI302/DF53	Power Supply Impedance
SD1	Magnetic Tool for Local Adjustment

Exploded View

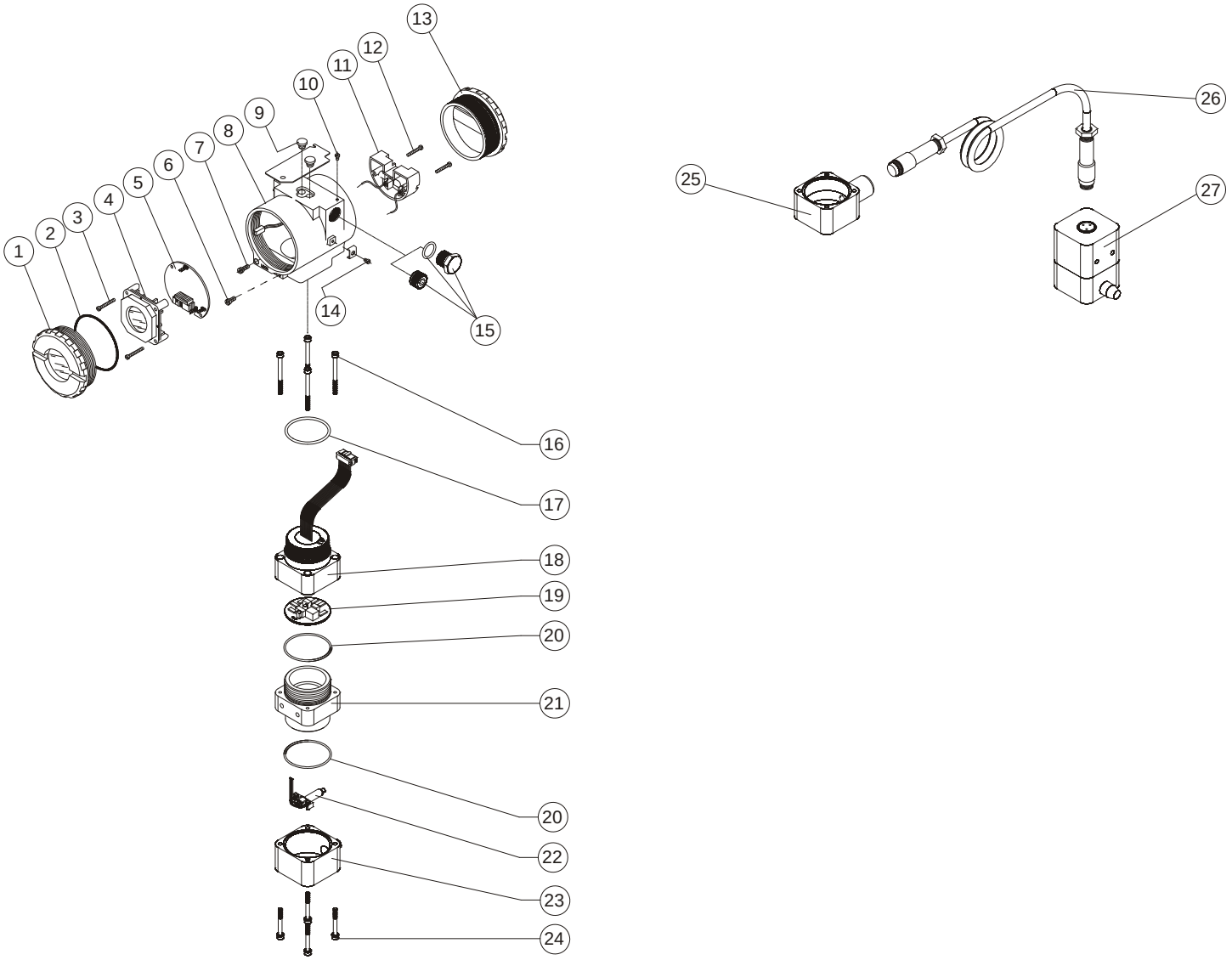


Figure 4.3 – TP303 Exploded View

Spare Parts List

SPARE PARTS LIST				
DESCRIPTION OF PARTS		**POSITION**	**CODE**	**CATEGORY (NOTE 1)**
COVER WITH WINDOW	. Aluminum	**1**	204-0103	
	. 316 SS	**1**	204-0106	
COVER O-RING (**NOTE 3**)	. Buna-N	**2**	204-0122	B
ALUMINUM HOUSING MAIN BOARD SCREW	. Units with indicator	**3**	304-0118	
	. Units without indicator	**3**	304-0117	
STAINLESS STEEL HOUSING MAIN BOARD SCREW	. Units with indicator	**3**	204-0118	
	. Units without indicator	**3**	204-0117	
DIGITAL INDICATOR		**4**	214-0108	
MAIN ELECTRONIC CIRCUIT BOARD		**5**	400-0269	A
HOUSING LOCKING SCREW	. M4 Screw	**6**	204-0121	
	. M6 Without Head Screw	**6**	400-1121	
COVER LOCKING SCREW		**7**	204-0120	
HOUSING (**NOTE 2**)		**8**	(**NOTE 5**)	
LOCAL ADJUSTMENT PROTECTION CAP		**9**	204-0114	
IDENTIFICATION PLATE SCREW		**10**	204-0116	
TERMINAL BLOCK ISOLATOR		**11**	400-0058	
TERMINAL BLOCK HOLDING BOLT	. Cover Aluminum	**12**	304-0119	
	. Cover 316 SS	**12**	204-0119	
COVER WITHOUT WINDOW	. Aluminum	**13**	204-0102	
	. 316 SS	**13**	204-0105	
EXTERNAL GROUND BOLT		**14**	204-0124	
SIX-SIDED INTERNAL PLUG	. 1/2" NPT Bichromatized Carbon SteeL BR-EX D	**15**	400-0808	
	. 1/2" NPT 304 SST BR-EX D	**15**	400-0809	
SIX-SIDED INTERNAL PLUG	. 1/2" NPT Bichromatized Carbon SteeL	**15**	400-0583-11	
	. 1/2" NPT 304 SST	**15**	400-0583-12	
SIX-SIDED EXTERNAL PLUG	. M20 X 1.5 316 SST	**15**	400-0810	
	. PG13.5 316 SST	**15**	400-0811	
RETAINING BUSHING	. 3/4" NPT 316 SST	**15**	400-0812	
CONNECTION COVER SCREW		**16**	400-0883	
CONNECTION COVER SET	. Aluminum	**16, 17, 18, 19**	400-0884	
	. 316 SS	**16, 17, 18, 19**	400-0885	
O-RING, Neck (**NOTE 3**)	. Buna-N	**17**	204-0113	B
CONNECTION COVER	. Aluminum	**18**	400-0074	
	. 316 SS	**18**	400-0391	
ANALOG BOARD		**19**	400-0637	
UNION BLOCK O-RING		**20**	400-0085	B
UNION BLOCK	. Aluminum	**21**	400-0386	
	. 316 SS	**21**	400-0387	
POSITION SENSOR COVER SET	. Aluminum	**22, 23, 24**	400-0656	
	. 316 SS	**22, 23, 24**	400-0657	
POSITION SENSOR BRACKET + POSITION SENSOR SENSOR + FLAT CABLE		**22**	400-0090	
POSITION SENSOR COVER	. Aluminum	**23**	400-0089	
	. 316 SS	**23**	400-0396	
POSITION SENSOR COVER BOLT		**24**	400-0092	
REMOTE POSITION SENSOR COVER SET(**NOTE 4**)	. Aluminum	**25**	400-0853	
	. 316 SS	**25**	400-0854	

SPARE PARTS LIST				
DESCRIPTION OF PARTS		**POSITION**	**CODE**	**CATEGORY (NOTE 1)**
CABLE SET + CONNECTOR	. 5 M	**26**	400-0857	
	. 10 M	**26**	400-0858	
	. 15 M	**26**	400-0859	
	. 20 M	**26**	400-0860	
REMOTE EXTENSION SET	. Aluminum	**27**	400-0855	
	. 316 SS	**27**	400-0856	
TRANSDUCER SET	. Aluminum	**16 a 24**	400-0038	
	. 316 SS	**16 a 24**	400-0400	
MOUNTING BRACKET, "L" + CLAMP "U" TO PIPE 2"	. Carbon Steel	**-**	400-0339	
	. 316 SS	**-**	400-0340	
MAGNETS	. Linear up to 50 mm	**-**	400-0035	
	. Linear up to 100 mm	**-**	400-0036	
	. Linear up to 30 mm		400-0748	
	. Rotary	**-**	400-0037	

NOTA

Note 1: For category **A** it is recommended to keep in stock 25 parts installed for each set and 50 for category **B**.
Nota 2: Includes terminal block isolator, bolts (cover locking, ground and terminal block isolator) and identification plate without certification.
Note 3: O-rings are packaged with 12 units.
Nota 4: Includes cover, position sensor flat cable, and extension cable connector.
Nota 5: To specify the housing, use HOUSING ORDER CODE table.

HOUSING ORDER CODE

400-1314	HOUSING						
	COD.	Product					
	5	TP303					
		COD.	Communications Protocol				
		P	PROFIBUS PA				
			COD.	Electrical Connection			
			0	½ NPT			
			A	M20 X 1.5			
			B	PG13.5			
				COD.	Housing Material		
				H0	Aluminum Housing (IP/Type)		
				H1	316 SST Housing (IP/Type)		
				H2	Aluminum for saline atmosphere (IPW/TYPE X)		
				H4	Copper Free Aluminium (IPW/TYPEX)		
					COD.	Painting	
					P0	Gray Munsell N 6.5 Polyester	
					P3	Black Polyester	
					P8	Without Painting	
					P9	Safety Blue Epoxy – Electrostatic Painting	
						COD.	Manufacturing Standard
						S0	Smar

400-1314	5	P	*	*	*	*

TYPICAL MODEL NUMBER

* Select item.

Section 5

TECHNICAL CHARACTERISTICS

Functional Specifications

Travel	Linear Motion: 3 -100 mm; Rotary Motion: 30 -120º rotation angle.
Output Signal	Digital only. PROFIBUS-PA, 31.25 kbit/s voltage mode with bus power.
Power Supply	Bus power 9 - 32 Vdc. Current consumption quiescent 12 mA. Output impedance: - Non intrinsic 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 alphanumerical LCD indicator.
Hazardous Area Certifications	Explosion-proof and intrinsically safe (ATEX (NEMKO and DEKRA EXAM), FM, CEPEL and CSA). Designed to comply with European regulations ATEX 94/9/EC and LVD 2006/95/EC standards.
Temperature Limits	Ambient: - 40 to 85 ºC (- 40 to 185 ºF) Storage: - 40 to 90 ºC (- 40 to 194 ºF) Digital Display: - 10 to 75 ºC (14 to 167 ºF) operation; - 40 to 85 ºC (- 40 to 185 ºF) without damage. Remote Sensor: - 40 to 105°C (- 40 to 221°F)
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 25ºC (77ºF), power supply of 24 Vdc.

Accuracy	≤ 0.2% F. S. the effects of linearity, hysteresis and repeatability are included. (NOTE: Valid value only when used with the table of points. See configuration section in this manual).
Resolution	≤ 0.1% F.S.
Repeatability	≤ 0.5% F.S.
Hysteresis of Full Scale	≤ 0.2% F.S.
Stability	± 0.1% F.S.
Temperature Effect	± 0.8%/20ºC F.S.
Power Supply Effect	± 0.005% F.S. Calibration.
Electromagnetic Interface Effect	Designed to comply with European Directive EMC 2004/108/EC.

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.
Mounting Bracket	Plated carbon steel with polyester painting or 316 SST.
Identification Plate	316 SST.
Approximate Weights	• **TP** 1.5 kg in Aluminum (without mounting bracket); 3.3 kg in Stainless Steel (without mounting bracket). • **Remote sensor:** 0.58 kg in Aluminum; 1.5 kg in Stainless Steel. • **Cable and remote sensor connectors:** Cable 0.045 kg/m; 0.05 kg for each connector.

Ordering Code

MODEL	POSITION TRANSMITTER
TP303	PROFIBUS-PA

COD. — Local Display

COD.	
0	Without Local Display
1	With Local Display

COD. — Mounting Bracket

COD.	
0	Without Bracket
1	Carbon Steel, "L" + clamp "U" pipe 2". **(3)**
2	Stainless Steel, "L" + clamp "U" pipe 2". **(3)**
3	Carbon Steel, rotary - VDI / VDE NAMUR
4	Stainless Steel, rotary - VDI / VDE NAMUR
7	Carbon Steel, "L" + clamp "U" pipe 2" - (316 SST) accessories. **(3)**

COD. — Electrical Connection

COD.		COD.	
0	1/2" - 14 NPT	3	1/2" - 14 NPT X 1/2 BSP (316 SST) - with adapter
1	1/2" - 14 NPT X 3/4 NPT (316 SST) - with adapter	A	M20 X 1.5
2	1/2" - 14 NPT X 3/4 BSP (316 SST) - with adapter	B	PG 13.5 DIN

COD. — Type of Actuator

COD.	
1	Rotary
5	Linear Stroke up to 50 mm
7	Linear Stroke up to 100 mm
A	Linear Stroke up to 30 mm

SPECIAL OPTIONS (1)

COD. — Housing

COD.		COD.	
H0	Aluminum (IP/TYPE)	H2	Aluminum for saline atmosphere (IPW/TYPE X)
H1	316 Stainless Steel (IP/TYPE)	H4	Copper Free Aluminium (IPW/TYPE X)

COD. — Identification Plate

COD.		COD.	
I1	FM: XP, IS, NI, DI	I5	CEPEL: Ex-d, Ex-ia, IP
I3	CSA: XP, IS, NI, DI	I6	Without certification
I4	EXAM (DMT): Ex-ia, IP	IJ	NEMKO - Ex-d

COD. — Painting

COD.	
P0	Gray Munsell N 6.5 Polyester
P3	Black Polyester
P8	Without Painting
P9	Safety Blue Epoxy – Electrostatic Painting

COD. — TAG Plate

COD.	
J0	With TAG
J1	Blank
J2	According to user's notes

COD. — Sensor Mounting (2)

COD.	
R0	Full Mounting
R1	Remote sensor - 5 m cable
R2	Remote sensor - 10 m cable
R3	Remote sensor - 15 m cable
R4	Remote sensor - 20 m cable

COD. — Special

COD.	
ZZ	See notes

TP303	-	1	0	-	0	1	*	.	*	*	*	*	*

TYPICAL MODEL NUMBER

NOTE

1) Leave it blank when there are not optional items.
2) Consult us for classified areas applications.
3) Magnet mounting bracket not supplied with the TP.

Appendix A

CERTIFICATIONS INFORMATION

European Directive Information

Consult www.smar.com for the EC declarations of conformity for all applicable European directives and certificates.

ATEX Directive (94/9/EC) – "Electrical equipment and protective system intended for use in potential explosive atmospheres"
The EC-Type Examination Certificate had been released by Nemko AS (CE0470) and/or DEKRA EXAM GmbH (CE0158), according to European Standards.
The certification body for Production Quality Assurance Notification (QAN) and IECEx Quality Assessment Report (QAR) is Nemko AS (CE0470).

Hazardous Locations General Information

Ex Standards:
IEC 60079-0 General Requirements
IEC 60079-1 Flameproof Enclosures "d"
IEC 60079-11 Intrinsic Safety "i"
IEC 60079-26 Equipment with equipment protection level (EPL) Ga
IEC 60529 Classification of degrees of protection provided by enclosures (IP Code)

Customer responsibility:
IEC 60079-10 Classification of Hazardous Areas
IEC 60079-14 Electrical installation design, selection and erection
IEC 60079-17 Electrical Installations, Inspections and Maintenance

Warning:
Explosions could result in death or serious injury, besides financial damage.
Installation of this instrument in an explosive environment must be in accordance with the national standards and according to the local environmental protection method. Before proceeding with the installation match the certificate parameters according to the environmental classification.

General Notes:
Maintenance and Repair
The instrument modification or replaced parts supplied by any other supplier than authorized representative of Smar Equipamentos Industriais Ltda is prohibited and will void the Certification.

Marking Label
Once a device labeled with multiple approval types is installed, do not reinstall it using any other approval types. Scratch off or mark unused approval types on the approval label.

For Ex-i protection application
- Connect the instrument to a proper intrinsically safe barrier.
- Check the intrinsically safe parameters involving the barrier, equipment including the cable and connections.
- Associated apparatus ground bus shall be insulated from panels and mounting enclosures.
- When using shielded cable, isolate the not grounded cable end.
- Cable capacitance and inductance plus C_i and L_i must be smaller than C_o and L_o of the Associated Apparatus.

For Ex-d protection application
- Only use Explosion Proof/Flameproof certified Plugs, Adapters and Cable glands.
- In an Explosion-Proof/Flame-Proof installation, do not remove the instrument housing covers when powered on.

- Electrical Connection
In Explosion-Proof installations the cable entries must be connected through conduit with sealed unit or closed using metal cable gland or closed using metal blanking plug, all with at least IP66 and Ex-d certification. For enclosure with saline environment protection (W) and ingress protection (IP) applications, all NPT thread parts must apply a proper water-proof sealant (a non-hardening silicone group sealant is recommended).

For Ex-d and Ex-i protection application
- The transmitter has a double protection. In this case the transmitter shall be fitted with appropriate certified cable entries Ex-d and the electric circuit supplied by a certified diode safety barrier as specified for the protection Ex-ia.

Environmental Protection
- Enclosure Types (Type X): Supplementary letter X meaning special condition defined as default by Smar the following: Saline Environment approved - salt spray exposed for 200 hours at 35ºC. (Ref: NEMA 250).
- Ingress protection (IP W): Supplementary letter W meaning special condition defined as default by Smar the following: Saline Environment approved - salt spray exposed for 200 hours at 35ºC. (Ref: IEC60529).
- Ingress protection (IP x8): Second numeral meaning continuous immersion in water under special condition defined as default by Smar the following: 1 Bar pressure during 24hours. (Ref: IEC60529).

Hazardous Locations Approvals

CSA (Canadian Standards Association)

Class 2258 02 – Process Control Equipment – For Hazardous Locations (CSA1078546)
Class I, Division 1, Groups B, C and D
Class II, Division 1, Groups E, F and G
Class III, Division 1
Class I, Division 2, Groups A, B, C and D
Class II, Division 2, Groups E, F and G
Class III

C**LASS 2258 03 - PROCESS CONTROL EQUIPMENT – Intrinsically Safe and Non-Incendive Systems - For Hazardous Locations** (CSA 1078546)
Class I, Division 2, Groups A, B, C and D

Model TP303 Position Transmitters; input supply 12-42V dc; 4-20mA; Enclosure Type 4/4X; non-incendive with Fieldbus/FNICO Entity parameters at terminals "+" and "-" of :
Vmax = 24V, Imax = 570mA, Pmax = 9.98 W, Ci = 5nF, Li = 12µH;
when connected as per Smar installation drawing 102A0834; T Code T3C @ Max Ambient 40 Deg C.

Class 2258 04 – Process Control Equipment – Intrinsically Safe Entity – For Hazardous Locations (CSA 1078546)
Class I, Division 1, Groups A, B, C and D
Class II, Division 1, Groups E, F and G
Class III, Division 1

Model TP303 Position Transmitters; input supply 12-42V dc; 4-20mA; Enclosure Type 4/4X; intrinsically safe with Fieldbus/FISCO Entity parameters at terminals "+" and "-" of :
Vmax = 24 V, Imax = 380 mA, Pmax = 5.32 W, Ci = 5 nF, Li = 12uH;
when connected as per Smar Installation Drawing 102A0834; T Code T3C @ Max Ambient 40 Deg C.
Note: Only models with stainless steel external fittings are Certified as Type 4X.

Special conditions for safe use:
Temperature Class T3C
Maximum Ambient Temperature: 40ºC (-20 to 40 ºC)

FM Approvals (Factory Mutual)

Intrinsic Safety (FM 3010145)
IS Class I, Division 1, Groups A, B, C and D
IS Class II, Division 1, Groups E, F and G
IS Class III, Division 1

Explosion Proof (FM 3007267)
XP Class I, Division 1, Groups A, B, C and D

Dust Ignition Proof (FM 3010145)
DIP Class II, Division 1, Groups E, F and G
DIP Class III, Division 1

Non Incendive (FM 3010145)
NI Class I, Division 2, Groups A, B, C and D

Environmental Protection (FM 3010145)
Option: Type 4X or Type 4

Special conditions for safe use:
Entity Parameters Fieldbus Power Supply Input (report 3015629):

Vmax = 24 Vdc, Imax = 250 mA, Pi = 1.2 W, Ci = 5 nF, Li = 12 uH

Vmax = 16 Vdc, Imax = 250 mA, Pi = 2 W, Ci = 5 nF, Li = 12 uH

Temperature Class: T4

Maximum Ambient Temperature: 60ºC (-20 to 60 ºC)

NEMKO (Norges Elektriske MaterielKontroll)

Explosion Proof (NEMKO 01ATEX445X)
Group II, Category 2 G, Ex d, Group IIC, Temperature Class T6, EPL Gb

Ambient Temperature: -20 to +60 ºC

Environmental Protection (NEMKO 01ATEX445X)
Options: IP66/68W or IP66/68

Special Conditions for Safe Use
Repairs of the flameproof joints must be made in compliance with the structural specifications provided by the manufacturer. Repairs must not be made on the basis of values specified in tables 1 and 2 of EN/IEC 60079-1.

The Essential Health and Safety Requirements are assured by compliance with:
EN 60079-0:2012 General Requirements
EN 60079-1:2007 Flameproof Enclosures “d”

EXAM (BBG Prüf - und Zertifizier GmbH

Intrinsic Safety (DMT 00 ATEX E 086)
Group I, Category M2, Ex ia, Group I, EPL Mb
Group II, Category 2 G, Ex ia, Group IIC, Temperature Class T4/T5/T6, EPL Gb

Supply circuit for the connection to an intrinsically safe fieldbus circuit:
Ui = 24 Vdc, Ii = 380 mA, Pi = 5.32 W, Ci ≤ 5 nF, Li = Neg
Parameters of the supply circuit comply with FISCO model according to Annex G EN 60079-11:2012, replacing EN 60079:2008.

Ambient Temperature: -40ºC ≤ Ta ≤ +60ºC

The Essential Health and Safety Requirements are assured by compliance with:
EN 60079-0:2012 + A11:2013 General Requirements
EN 60079-11:2012 Intrinsic Safety “i”

CEPEL (Centro de Pesquisa de Energia Elétrica)

Intrinsic Safety (CEPEL 07.1501X)
Ex ia, Group IIC, Temperature Class T4/T5, EPL Ga

Entity Parameters:
Pi = 5.32 W, Ui = 30 V, Ii = 380 mA, Ci = 5.0 nF, Li = Neg

Ambient Temperature:
-20 to 65 ºC for T4
-20 to 50 ºC for T5

Explosion Proof (CEPEL 01.0016)
Ex d, Group IIC, Temperature Class T6, EPL Gb
Maximum Ambient Temperature: 40ºC (-20 to 40 ºC)

Environmental Protection (CEPEL 07.1501X AND CEPEL 01.0016)
Options: IP66/68W or IP66/68

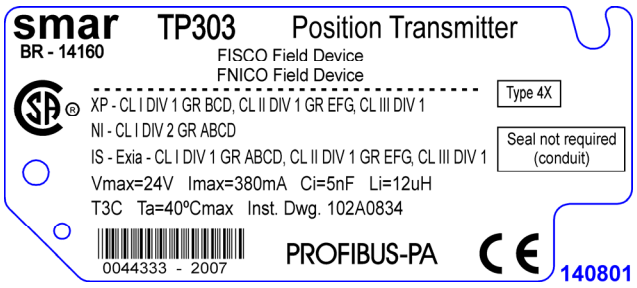
Special conditions for safe use:
The certificate number ends with the letter "X" to indicate that for the version of Position Transmitter model TP303 equipped with housing made of aluminum alloy, only can be installed in "Zone 0" if is excluded the risk of occurs impact or friction between the housing and iron/steel itens.

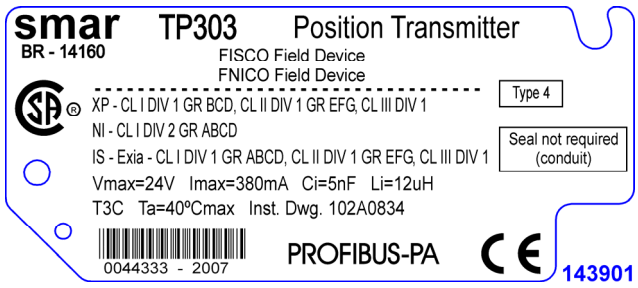
The Essential Health and Safety Requirements are assured by compliance with:

ABNT NBR IEC 60079-0:2008 General Requirements
ABNT NBR IEC 60079-1:2009 Flameproof Enclosures “d”
ABNT NBR IEC 60079-11:2009 Intrinsic Safety “i”
ABNT NBR IEC 60079-26:2008 Equipment with equipment protection level (EPL) Ga
IEC 60079-27:2008 Fieldbus intrinsically safe concept (FISCO)
ABNT NBR IEC 60529:2009 Classification of degrees of protection provided by enclosures (IP Code)

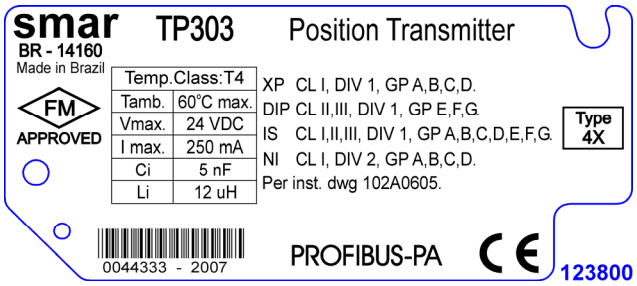
Identification Plate

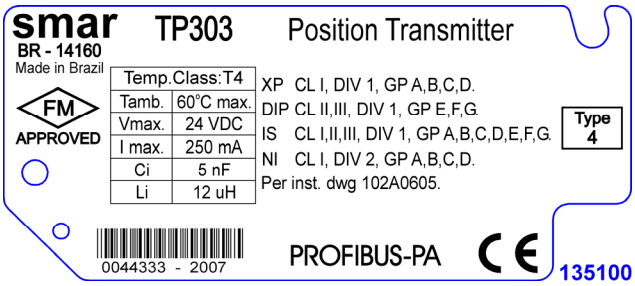
CSA (Canadian Standards Association)

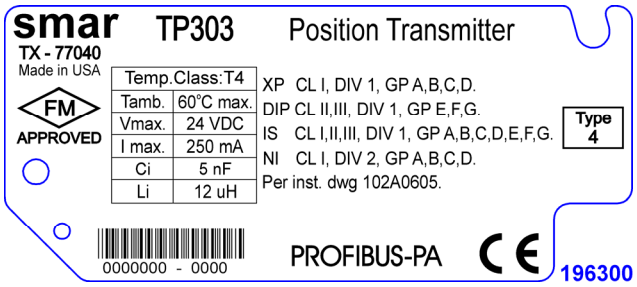


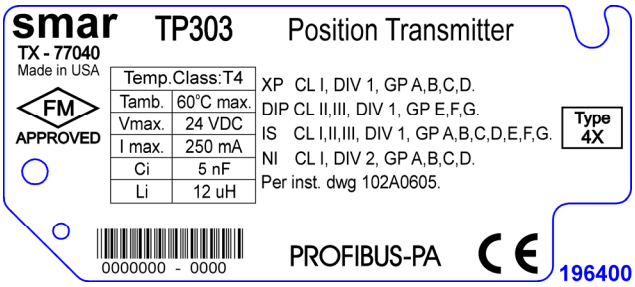


FM Approvals (Factory Mutual)

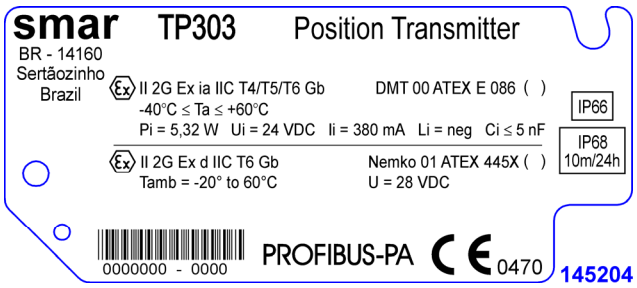


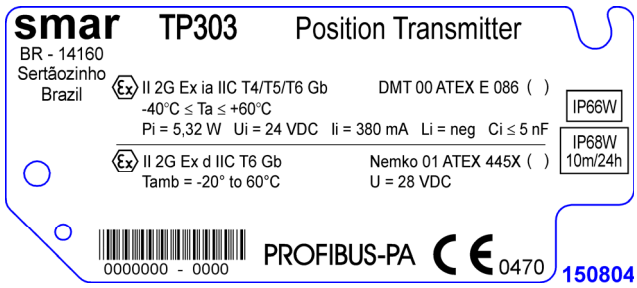


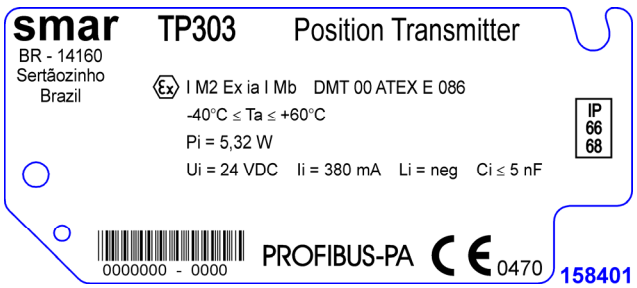


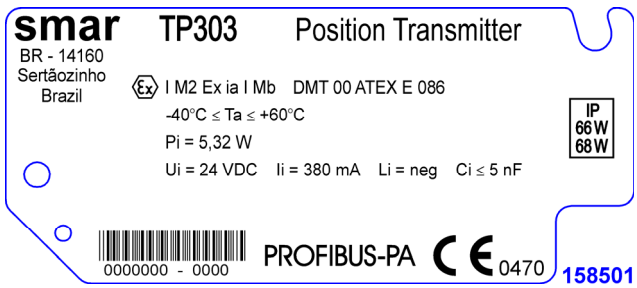


NEMKO (Norges Elektriske MaterielKontroll) / EXAM (BBG Prüf - und Zertifizier GmbH)

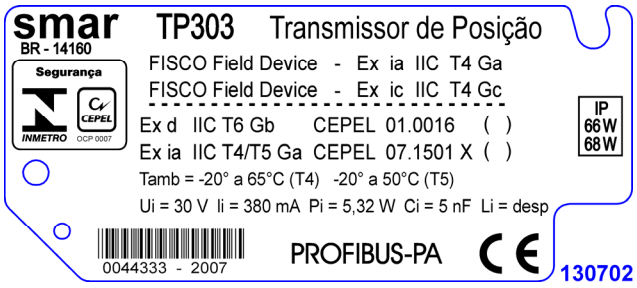


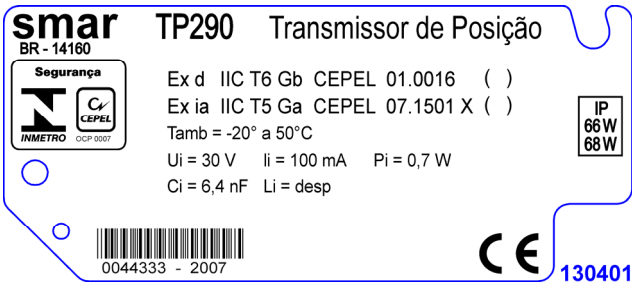






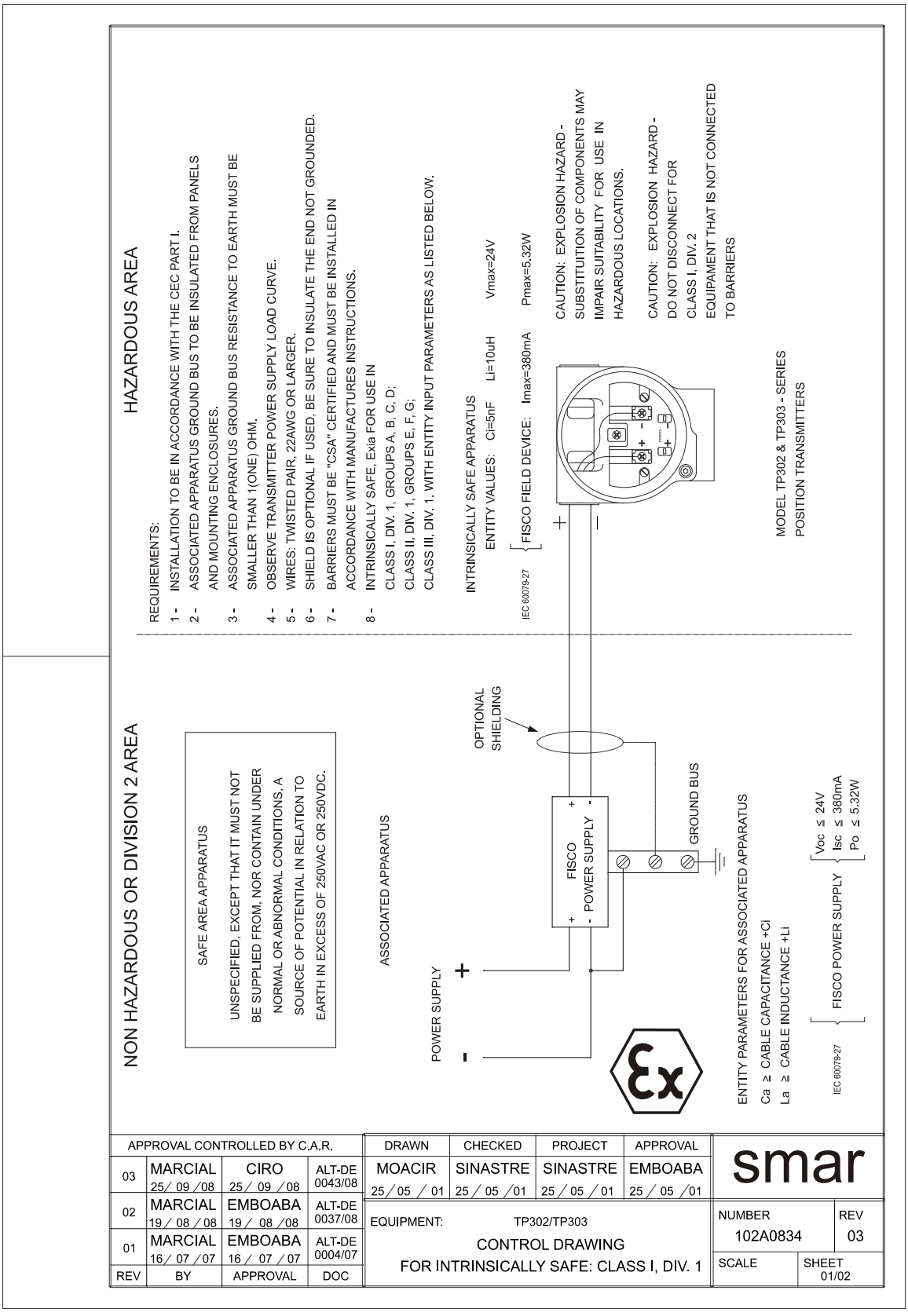
CEPEL (Centro de Pesquisa de Energia Elétrica)

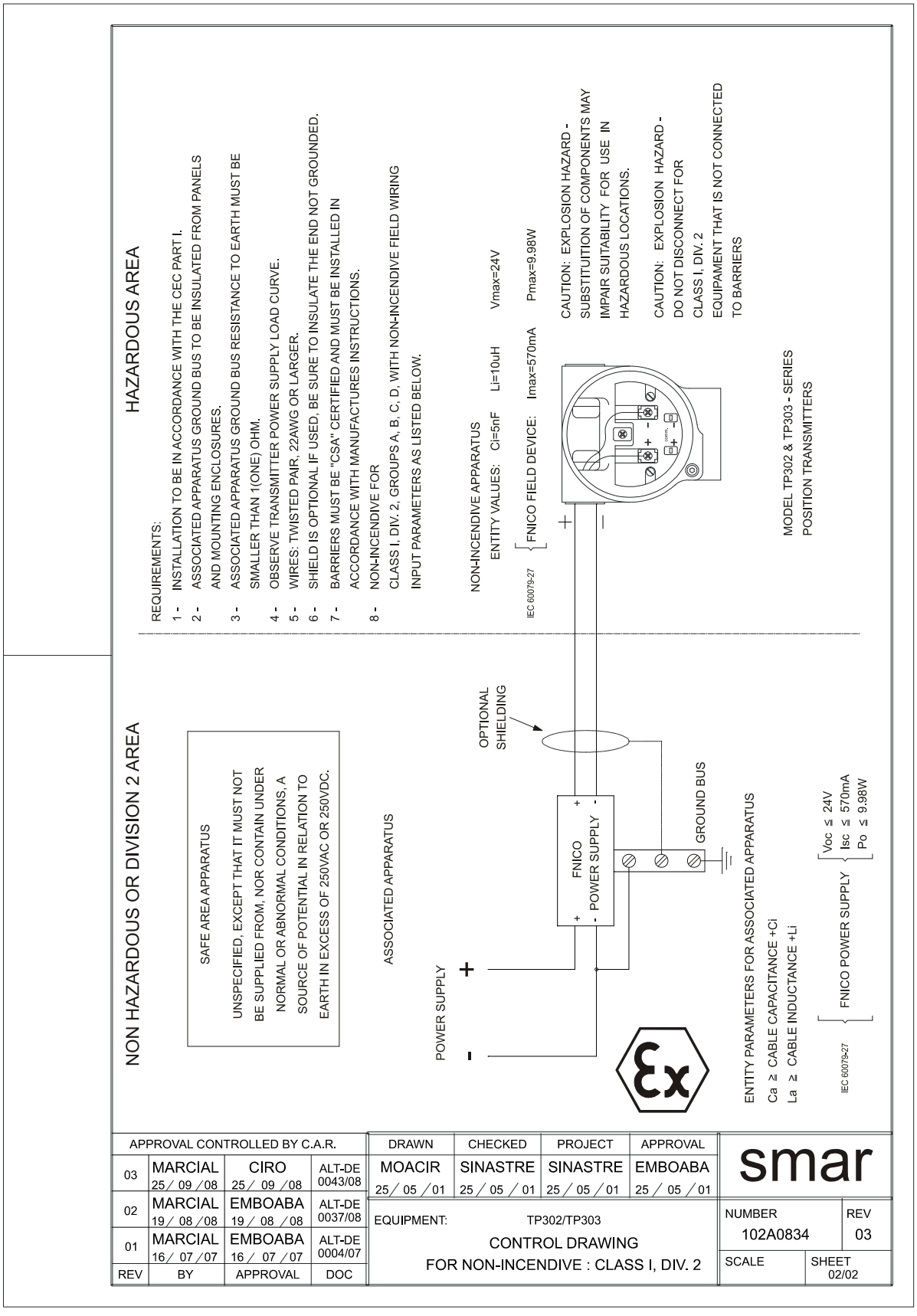




Control Drawing

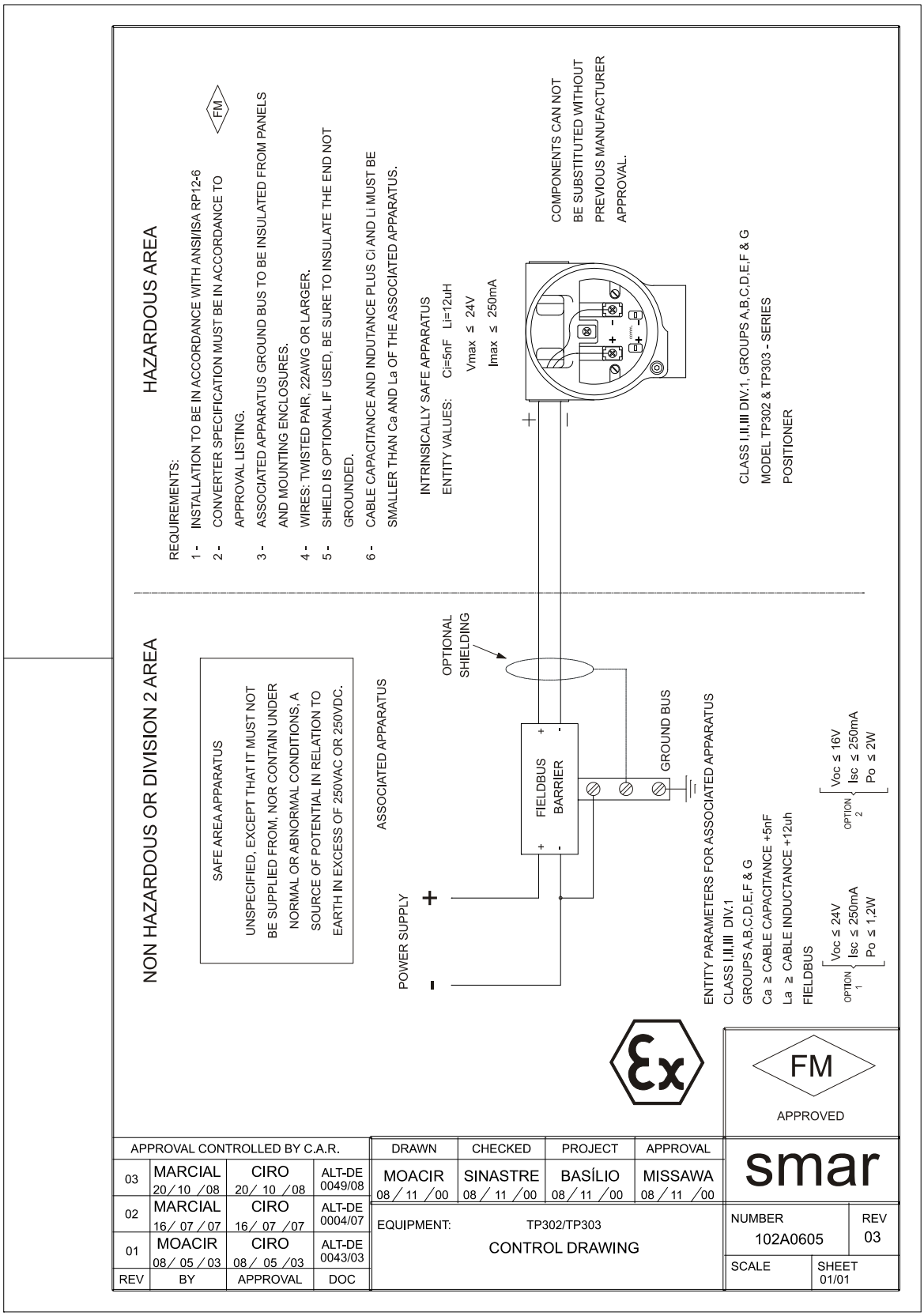
Canadian Standards Association (CSA)





APPROVAL CONTROLLED BY C.A.R.				DRAWN	CHECKED	PROJECT	APPROVAL	smar
03	MARCIAL 25/ 09 /08	CIRO 25/ 09 /08	ALT-DE 0043/08	MOACIR 25/ 05 /01	SINASTRE 25 / 05 / 01	SINASTRE 25 / 05 / 01	EMBOABA 25 / 05 / 01	
02	MARCIAL 19/ 08 /08	EMBOABA 19 / 08 /08	ALT-DE 0037/08	EQUIPMENT: TP302/TP303				NUMBER 102A0834 / REV 03
01	MARCIAL 16/ 07 /07	EMBOABA 16 / 07 /07	ALT-DE 0004/07	CONTROL DRAWING FOR NON-INCENDIVE : CLASS I, DIV. 2				SCALE / SHEET 02/02
REV	BY	APPROVAL	DOC					

Factory Mutual (FM)



Appendix B

smar

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: 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 Área 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.