

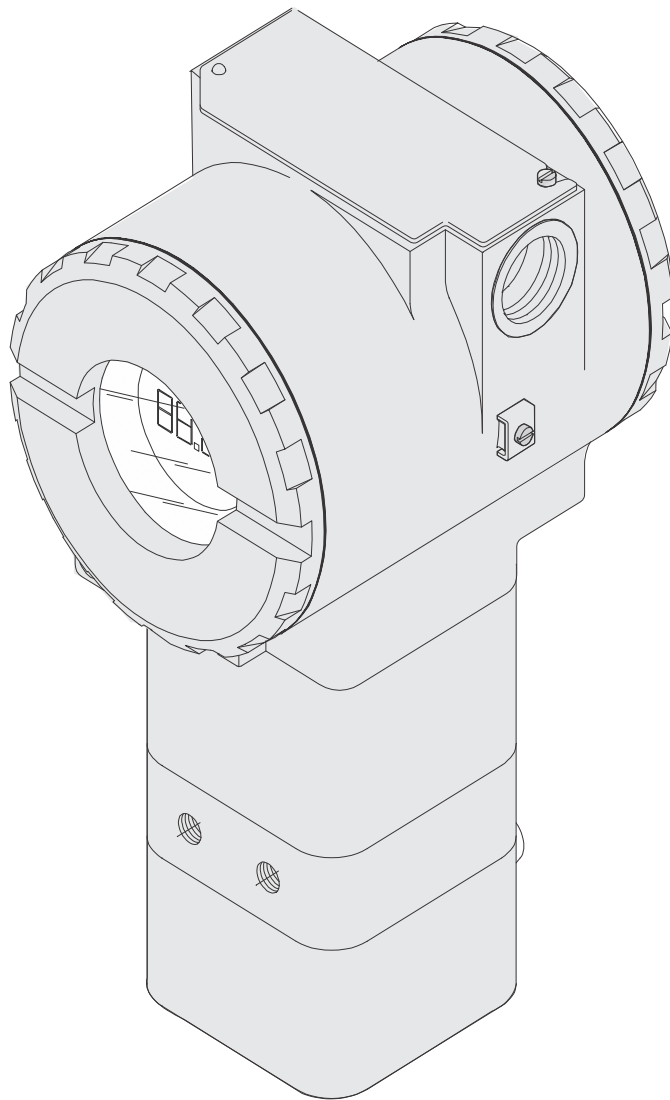
smar - TP290

JUL / 16  
**TP290**  
VERSION 1

OPERATION AND MAINTENANCE  
INSTRUCTION MANUAL

# POSITION TRANSMITTER

*4 to 20 mA*



T P 2 9 0 M E



Specifications and information are subject to change without notice.  
Up-to-date address information is available on our website.

web: [www.smar.com/contactus.asp](http://www.smar.com/contactus.asp)

# INTRODUCTION

The TP290 is from the well-know family of SMAR's devices. It is a transmitter for position measurements. It can measure displacement or movement of rotary or linear type. The digital technology provide an easy interface between the field and control room and several interesting features that considerably reduce the installation, operation and maintenance costs.

The TP290 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.

The TP290 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 TP290, besides the normal function of position measurement and 4-20mA output generation, offers the following functions:

- ✓ Linear or Rotary Travel type;
- ✓ 0.1% F.S.;
- ✓ Position Calibration (4 and 20 mA points) via Local Adjustment or Remote Calibration via Hand Held Terminal;
- ✓ Non contact position sensing;
- ✓ Optional LCD indicator;
- ✓ Diagnostics and Configuration via adjust local.

Get the best results of the TP290 by carefully reading these instructions.

**NOTE**

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

**Waiver of responsibility**

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

**Warning**

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

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

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

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

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

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

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

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

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## INSTALLATION

### General

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

NOTE
See appendix "A" Hazardous Area Certifications.

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 sun shades 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.

The electronic circuit is protected by a humidity proof coating, 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 removed, the threads are exposed to corrosion, since these parts cannot be protected by painting. 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 **TP290** 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: <ol style="list-style-type: none"><li>1. There is no attrict between the internal magnet face and the position sensor salience all over the travel (rotary or linear).</li><li>2. A minimum distance of 2 mm to of 4 mm distance is recommended between the magnet external face and the Position Transmitter face.</li></ol>

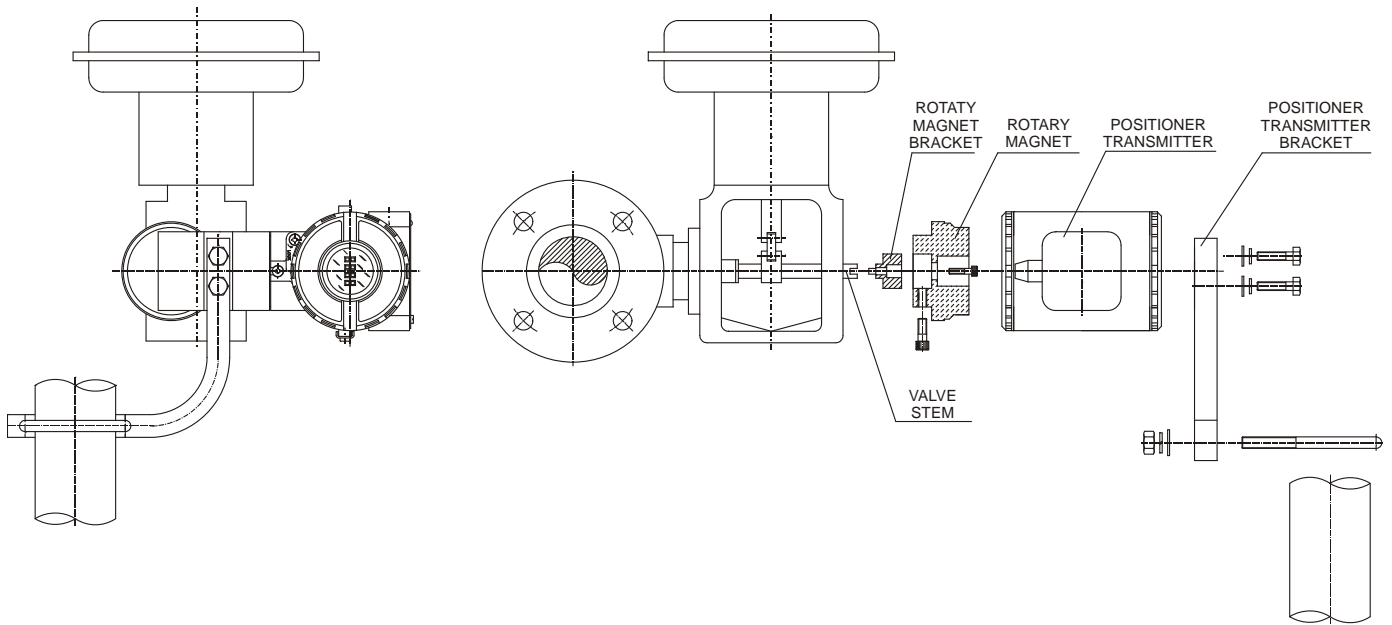
Should the transmitter installation change, or magnet change, or should any other modification, the transmitter will require a re-calibration.

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).

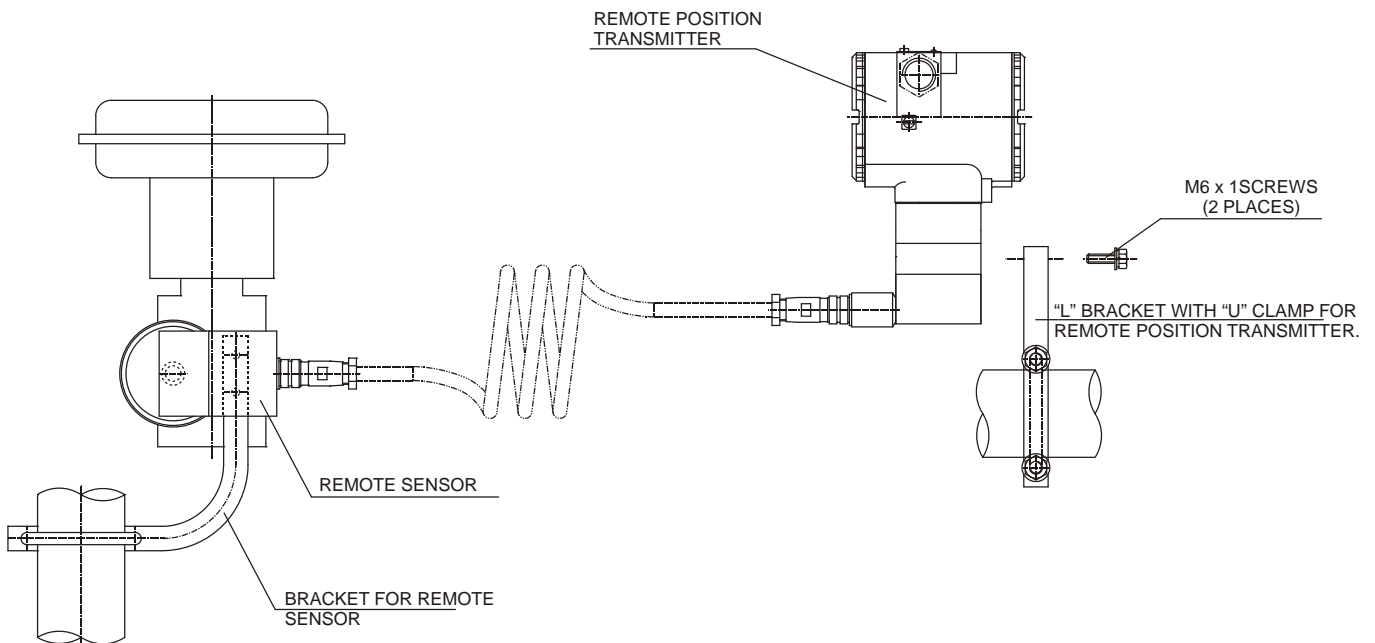
The following Figures 1.1 and 1.3 show both linear and rotary typical mounting:

**Rotary Movement**

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



**Figure 1.1 - Transmitter on a Rotary Actuator**



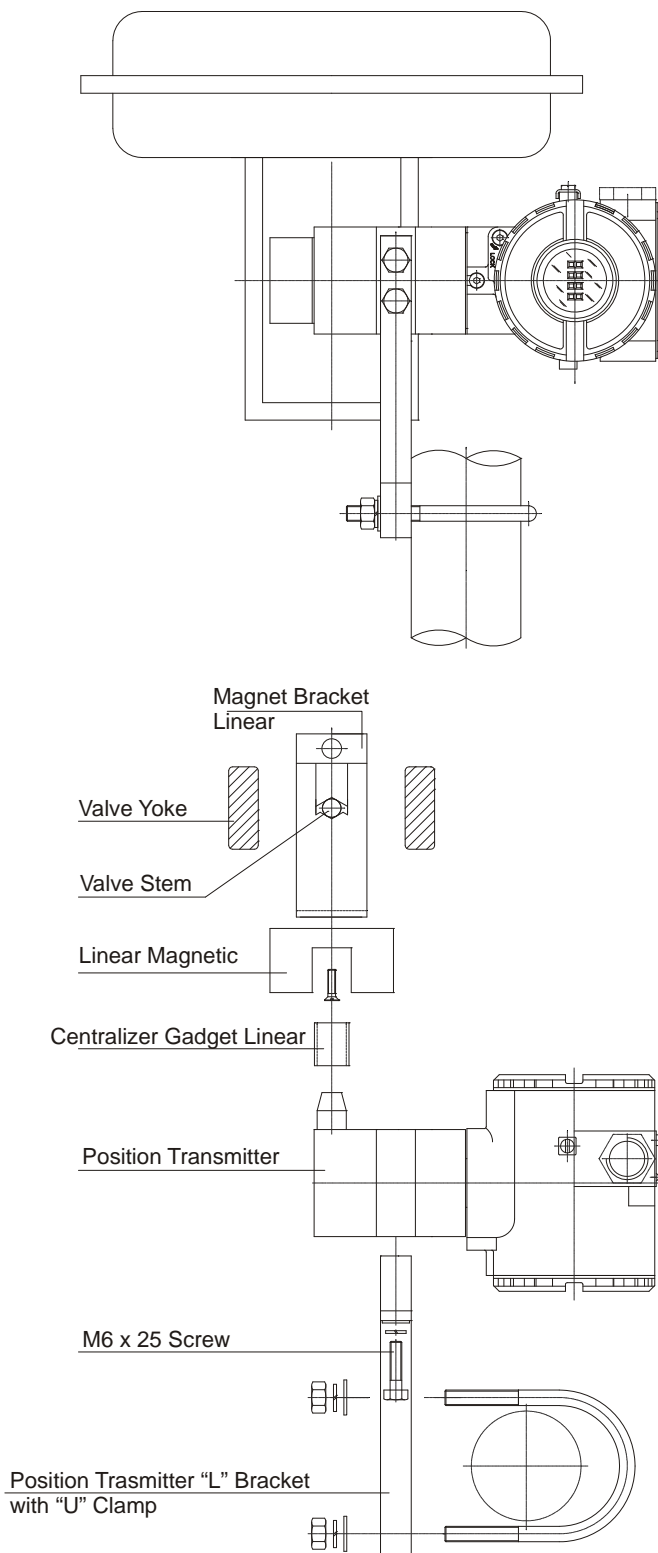
**Figure 1.2 – Position Transmitter on Rotary Actuator with Remote Position Sensor**



**Linear Movement**

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

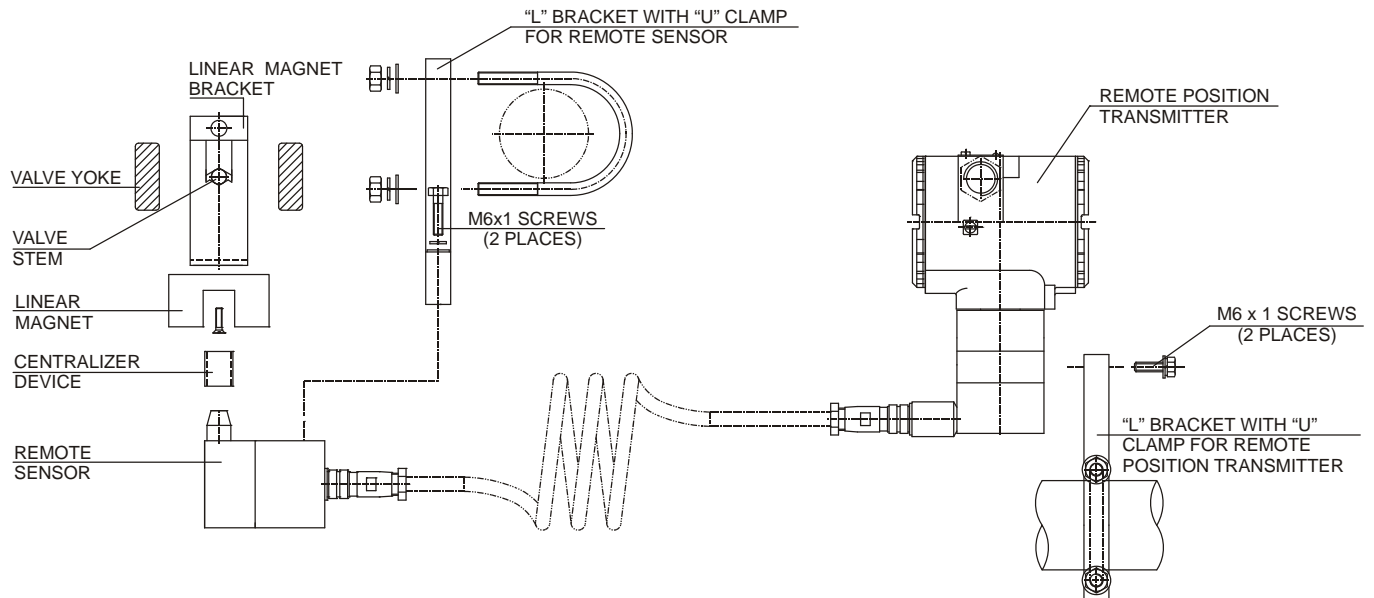
The linear magnet movement must be orthogonal in relation to the main axis of the position transmitter. For example, if the linear magnet movement is vertical, the transmitter main axis must be horizontal, as show in Figure 1.3.



**Figure 1.3 - Transmitter on a Linear Actuator**

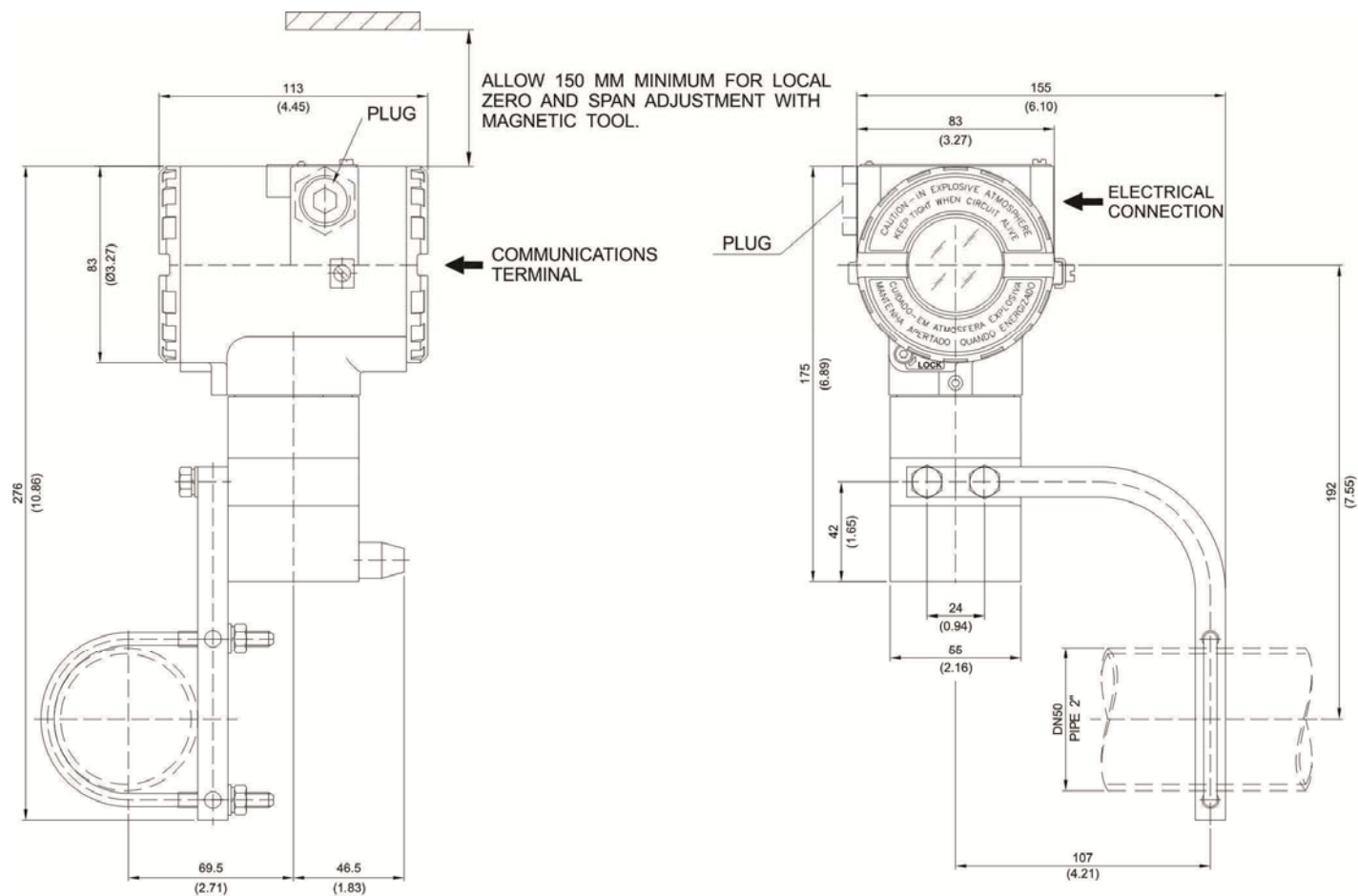
**NOTE**

Follows the centering device of the linear magnet on the packaging. See Figure 1.12.

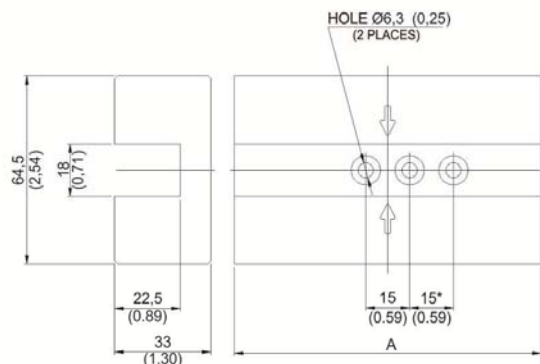


**Figure 1.4 – Position Transmitter on Linear Actuator with Remote Position Sensor**

See below the **TP290**, dimensional drawings.



**LINEAR MAGNET**



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.

**ROTARY MAGNET**

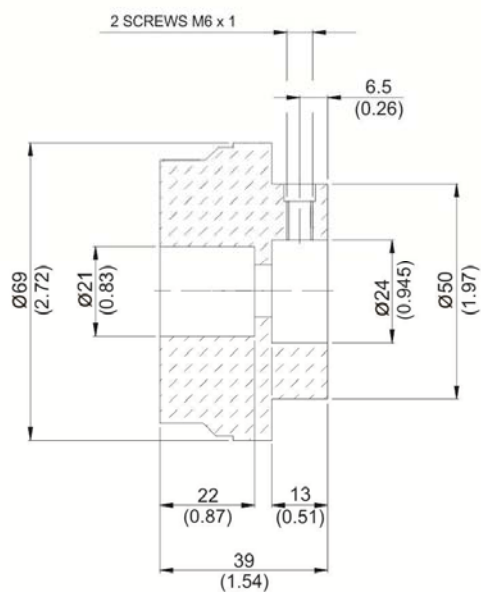
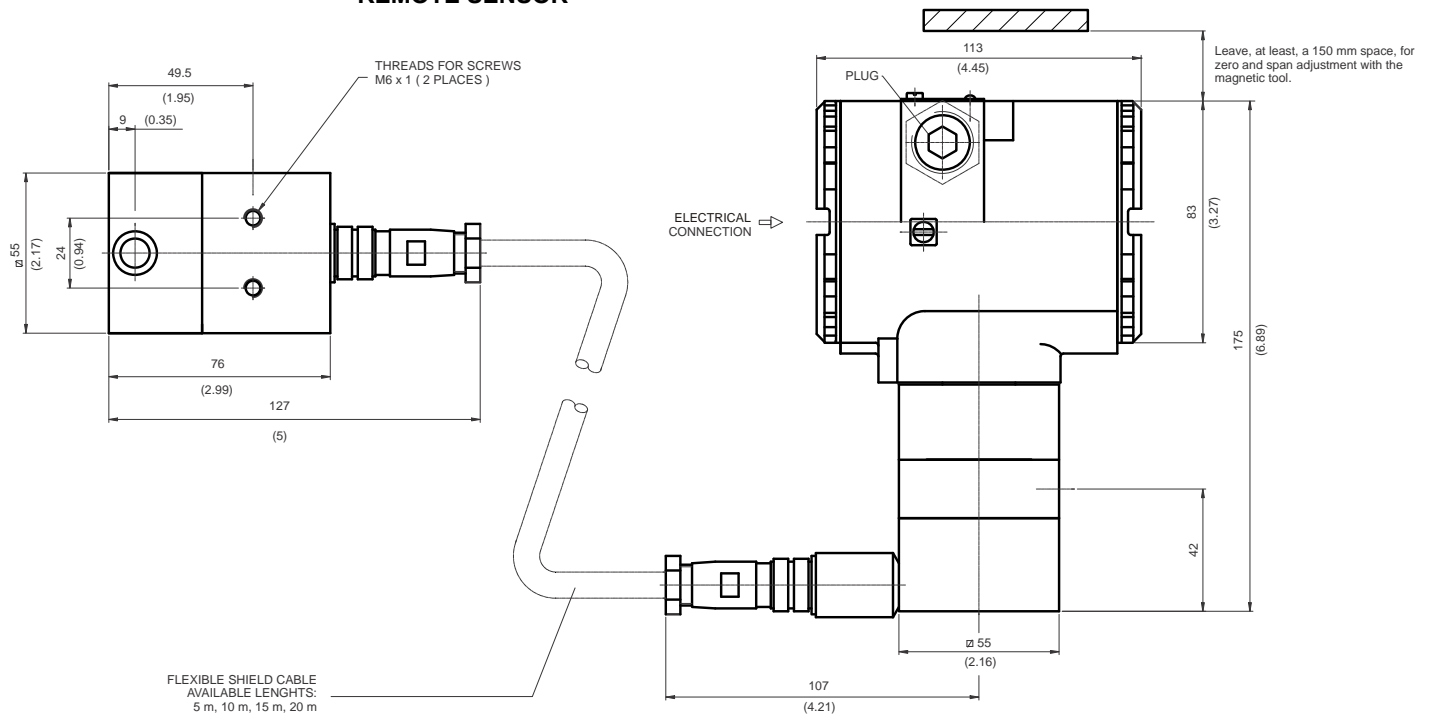


Figure 1.5 – TP290 Dimensional Drawing / Magnets Dimensional Drawing

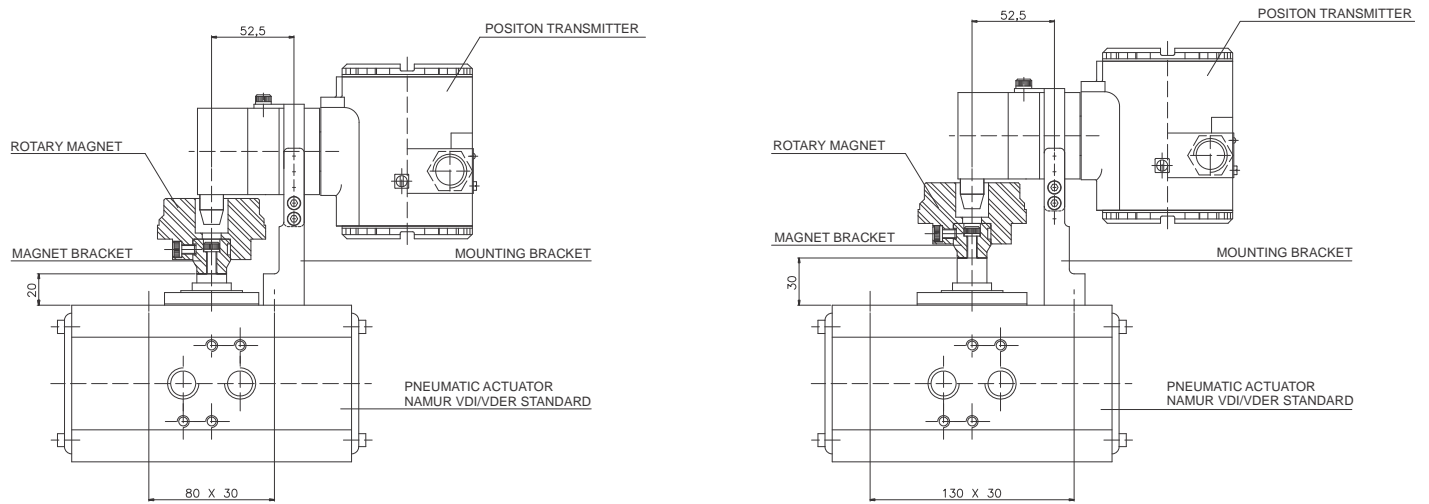
**REMOTE SENSOR**



**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.



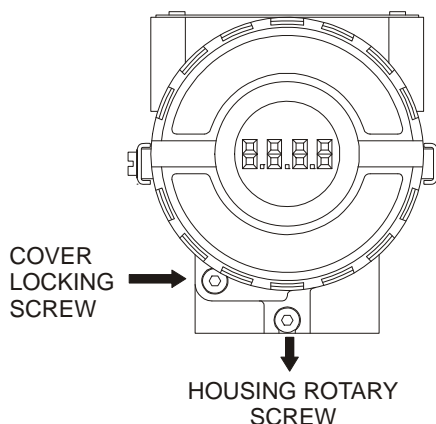
Mounting 80 mm between centers, 20 mm stem height.

Mounting 130 mm between centers, 30 mm stem height.

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

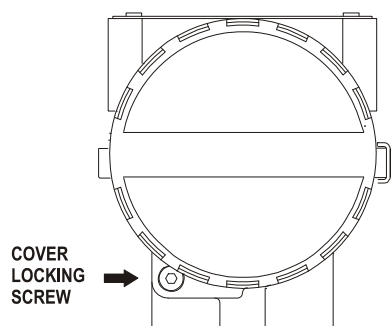
## Electronic Housing Rotating

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**

The digital display also rotates for better reading. See Section 4. To access the terminal block for electronic connections, remove the cover locking screw.

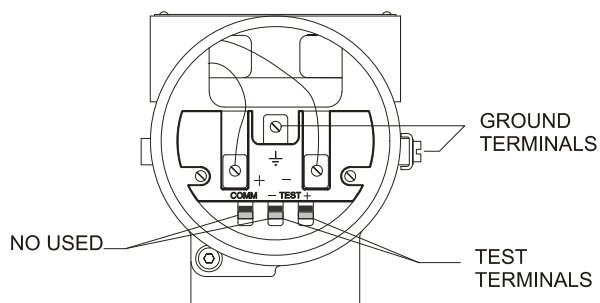


**Figure 1.7 - Cover Locking Screw**

## Electric Wiring

The terminal block accepts forks or eye-type connectors. **Test terminals** allow measuring the current in the 4 - 20 mA loop, without opening it. To measure it, connect a multimeter in the mA scale in the "-" and "+" terminals.

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**

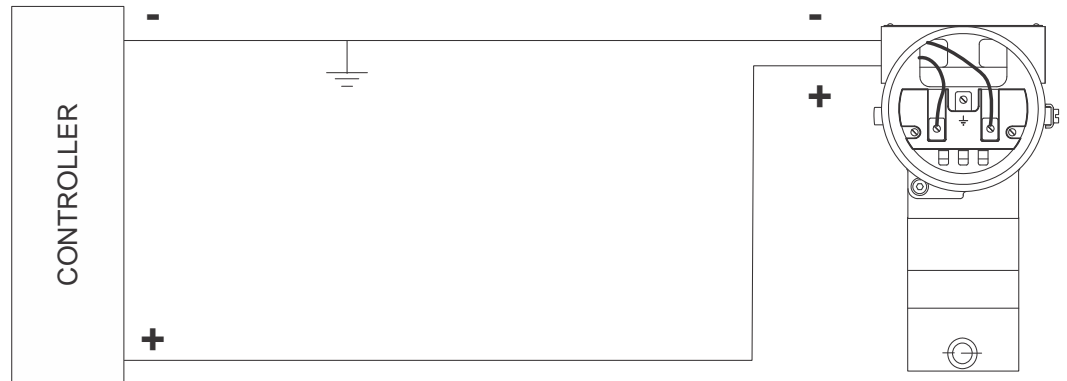
Use of twisted pair (22 AWG or greater than) cables is recommended. Avoid routing signal wiring cables close to power cables or switching equipment.

The TP290 is protected against reverse polarity, and supports  $\square$ 50 mA without damage.

The following figures show the possibilities for TP290 connections.

The TP290 connection could be done conform the figure 1.9 and 1.10.

It is also recommended to ground the shield of shielded cables at one end only. The non grounded end must be carefully isolated.



SIGNAL LOOP MAY BE GROUNDED AT ANY POINT OR LEFT UNGROUNDED.

Figure 1.9 - TP290 Wiring Diagram

**NOTE**

Make sure that the transmitter is operating within the operating area as shown on the load curve (Figure 1.10).

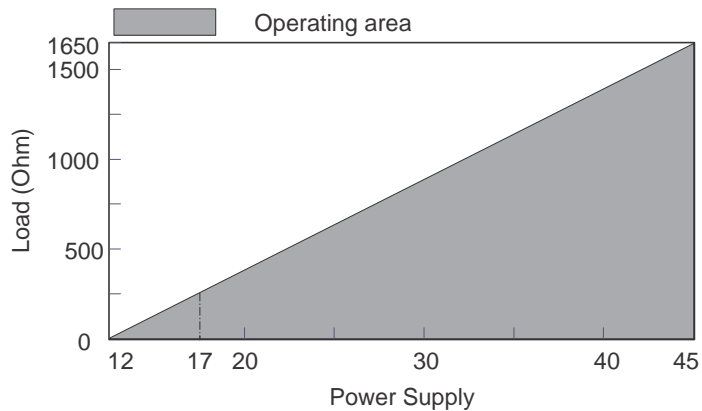


Figure 1.10 - Load Curve

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

**NOTE**

This TP290 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 1.11 shows typical shapes for both magnets. For better transmitter performance, the linear magnet is presented with different lengths. Consult the ordering code table for the best choice.

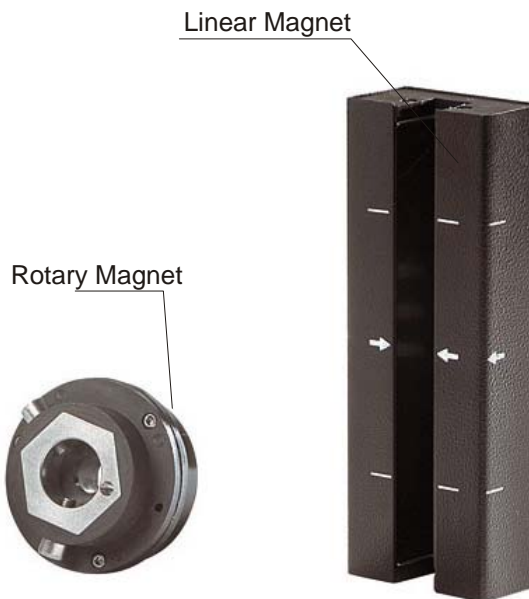


Figure 1.11 – Linear and Rotary Magnet Models

## Centering Device of the Linear Magnet



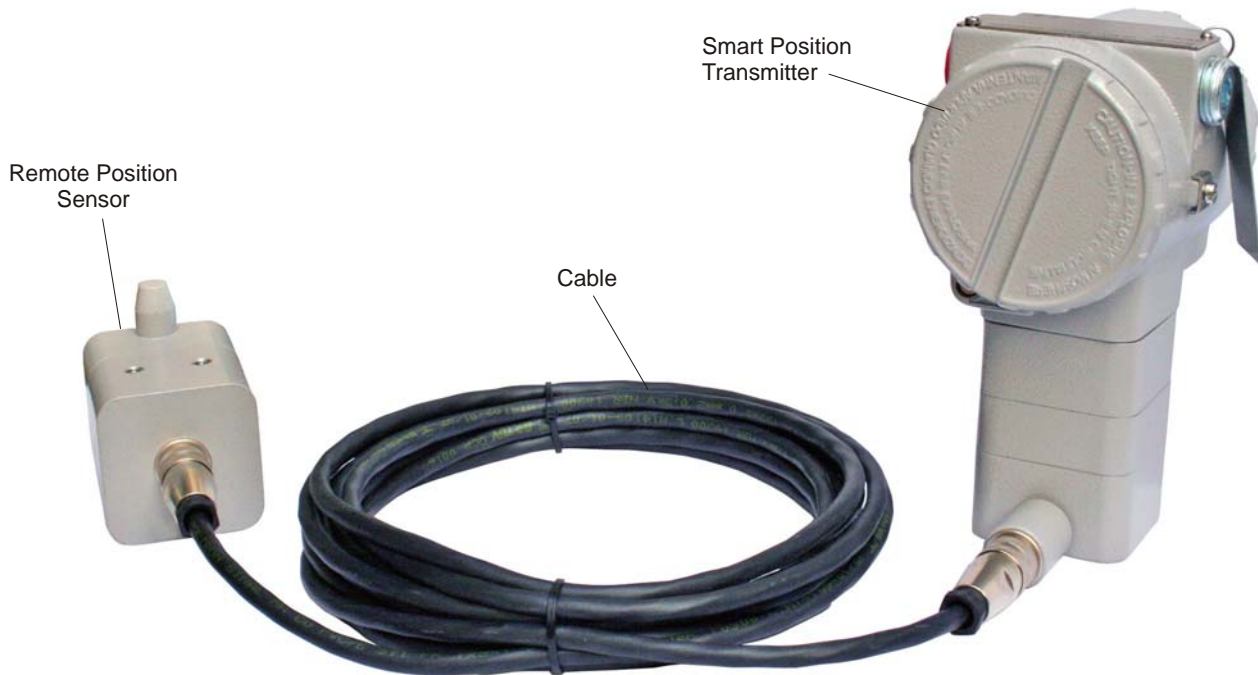
**NOTE**

Centralizing device of the linear magnet is used for any model of linear mounting bracket.

Figura 1.12 - Centralizing device of the linear magnet

## 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 in 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  $C_i$  and  $L_i$  must be smaller than  $C_o$  and  $L_o$  of the associated Apparatus.

For free access to the Hart bus in the explosive environment, ensure the instruments in the loop are installed in accordance with intrinsically safe or non-incendive field wiring practices. Use only Ex Hart communicator approved according to the type of protection Ex-i (IS) or Ex-n (NI).

It is not recommended to remove the transmitter cover when the power is ON.



# Section 2

## OPERATION

### Functional Description – Hall Sensor

The Position Sensor supplies an output voltage proportional to the applied magnetic field. This magnetic sensor, based on hall effect, is ideal for sensing linear or rotative position. The mechanical vibrations do not affect Position Sensor.

### Functional Description-Electronics

Refer to the block diagram (Figure 2.1). The function of each block is described below.

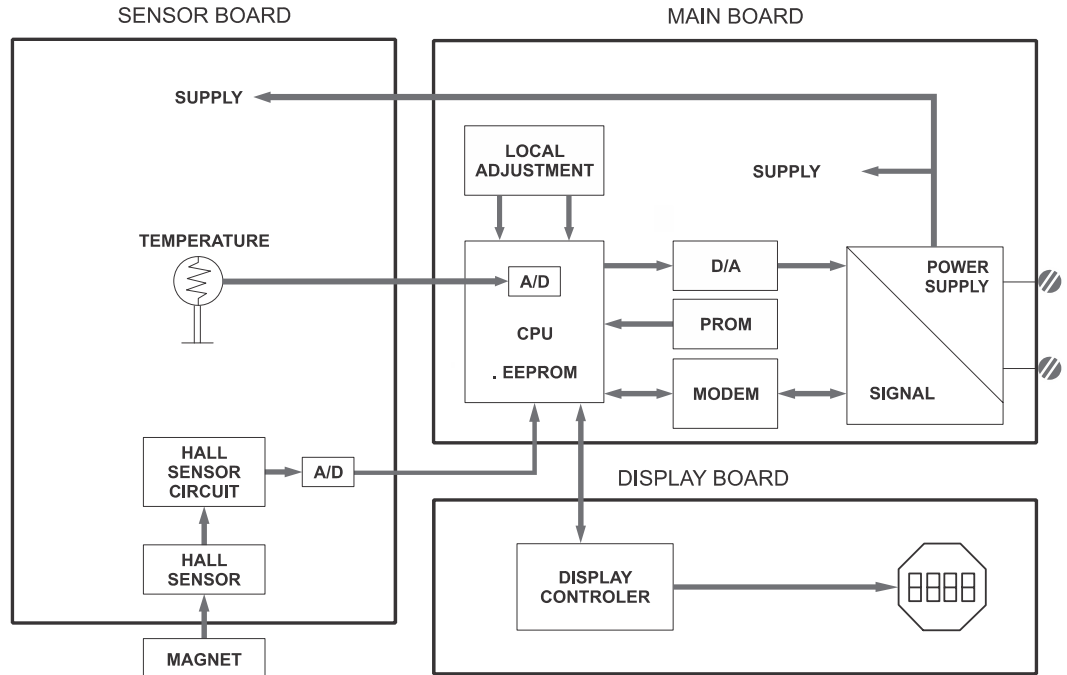


Figure 2.1 –TP290 Block Diagram

#### A/D

Receives the 4 - 20 mA signal and converts it in the digital format for the CPU.

#### D/A

Receives the signal from the CPU and converts it to an analog voltage proportional the measurement position.

#### Hall Effect Sensor

Measures the actual position.

#### Temperature Sensor

Measures the temperature of the control circuit and inform the CPU.

#### CPU Central Processing Unit, RAM, PROM and EEPROM

The CPU is the intelligent portion of the transmitter, being responsible for the management and operation of block execution, self-diagnostics and communication. The program is stored in PROM. For temporary storage of data there is a RAM. The data in the RAM is lost if the power is switched off, however the device also has a nonvolatile EEPROM where data that must be retained is stored. Examples of such data are: calibration and **TP290** configuration.

**Power Supply**

The transmitter circuit receives supply from a 4 - 20 mA power supply or take power of Loop\_Line to power the transmitter circuit this is, of course, limited to 3.8 mA.

**Display Controller**

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

**Local Adjustment**

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

**THE LOCAL INDICATOR**

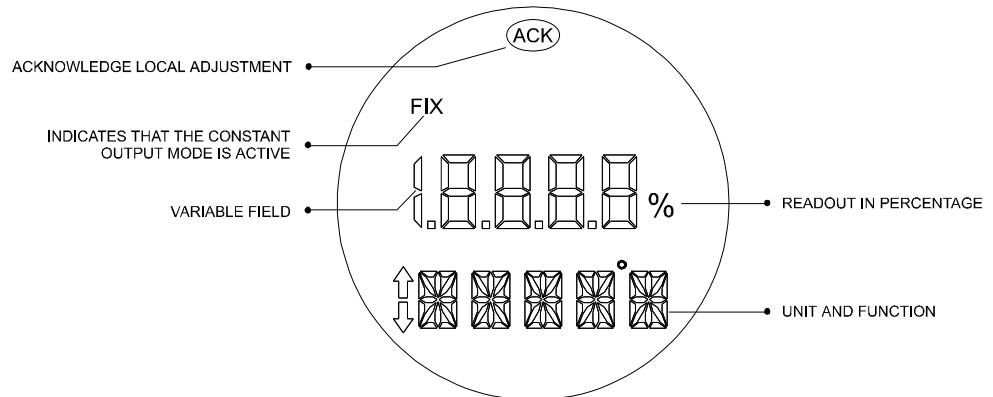
The local indicator is required for signaling and operation in local adjustment.

**Normal Indicator**

During normal operation, the **TP290** remains in the monitoring mode and the display indicates the valve position, either as a percentage or as a current readout. The magnetic tool activates the local programming mode, by inserting it in orifice Z on the housing.

The possible configuration and monitoring operation are shown on Figure 2.2.

Upon receiving power, the **TP290** initializes the position indication on the display, by showing model **TP290** and its software version (X.XX). Should the indication be higher than □19999 it will be displayed as a two digit and an exponent.



**Figure 2.2 – Normal Indicator**

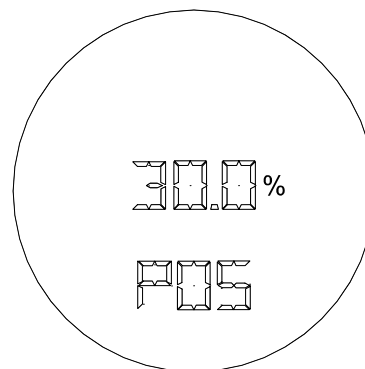
**Monitoring**

During normal operation, TP290 remains in the monitoring mode. Figure 2.3 shows the positioning.

The display simultaneously shows a readout and some other information.

Normal displaying is interrupted when the magnetic tool is placed in office Z (Local Adjustment), entering the programming mode local adjustment.

The above mentioned figure shows the result of tool insertion in orifices Z and S, which inform, respectively, movement and actuation of the selected options.



**Figure 2.3 – Typical Indicator**

# Section 3

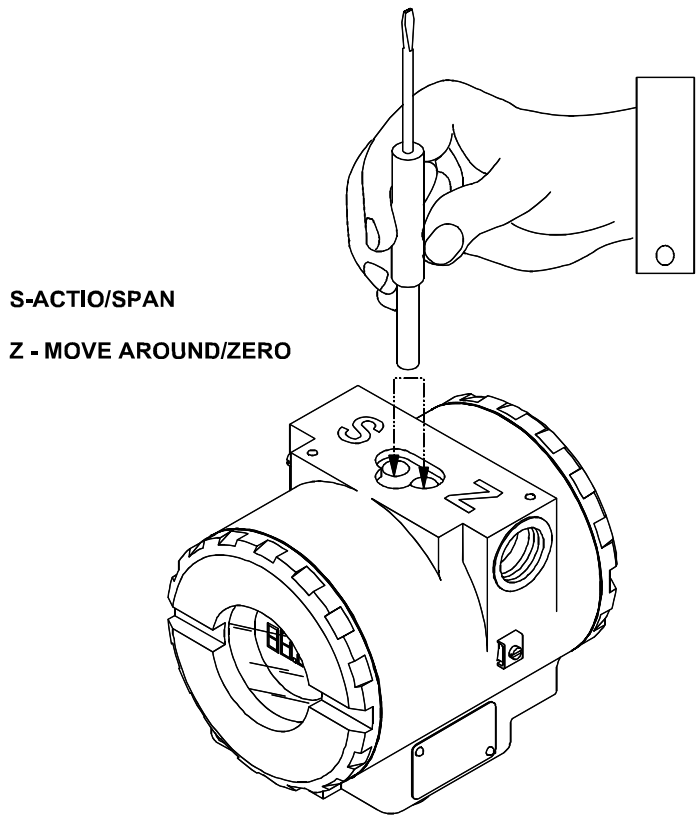
## PROGRAMMING USING LOCAL ADJUSTMENT

To enable local adjustment, the jumper "W1" located on top of the main board shall be connected to the pins where the word "ON" is engraved on the circuit board.

There are two orifices on the Transmitter, under the nameplate, identified by "S" and "Z" respectively, which provide access to two magnetic switches actuated by means of a magnetic tool (Refer to Figure 3.1).

**NOTE**

In this section the "Magnetic Tool" will be referred to as "TOOL", and the orifices identified by "S" and "Z" will be "ORIFICE S" and "ORIFICE Z", respectively.



**Figure 3.1 – Orifices of the Local Adjust**

Table 3.1- shows the results of what actions on "Z" and "S" cause on the TP290.

ORIFICE	ACTION
Z	Function browsing.
S	Selects the displayed function.

**Table 3.1 - Orifices on the Case**

### Jumper Connection

#### Jumper W2 connected in S1

If the jumper W2 is connected in S1, simple local adjustment enabled, the calibration can be done at the position of 0% inserting the cable of the key in the hole Z and 100% inserting it in the hole S.

### Jumper W2 Connected in COM

With the jumper connected in COM, complete local adjustment enabled, it is allowed to alter the unit to be shown, the Direct or Reverse indication and to calibrate the lower position (LOPOS) or the upper position (UPPOS).

**NOTE**

After gauging these values, we advised to leave the jumper W2 in OFF (disabled) to avoid that somebody for negligence adjusts the transmitter erroneously.

### Local Programming Tree

The programming tree is a tree shaped structure with a menu of all available software functions, as shown on Figure 3.2.

While in local Adjustment, it is possible to browse through all configuration options by keeping the magnetic tool in orifice “Z”. Upon choosing the option as described, place the tool in orifice “S” in order to actuate.

By keeping the tool in orifice “S” it is possible to continuously actuate the selected parameter, since this is a numeric value. Actions by increment are performed by repeatedly placing and removing the magnetic tool until reaching the desired value.

**NOTE**

Every parameter actuation shall be performed judiciously, since actuation writes configuration parameters on a permanent basis and does not require confirmation by the use. Once an actuation is performed it is assumed to be the desired configuration.

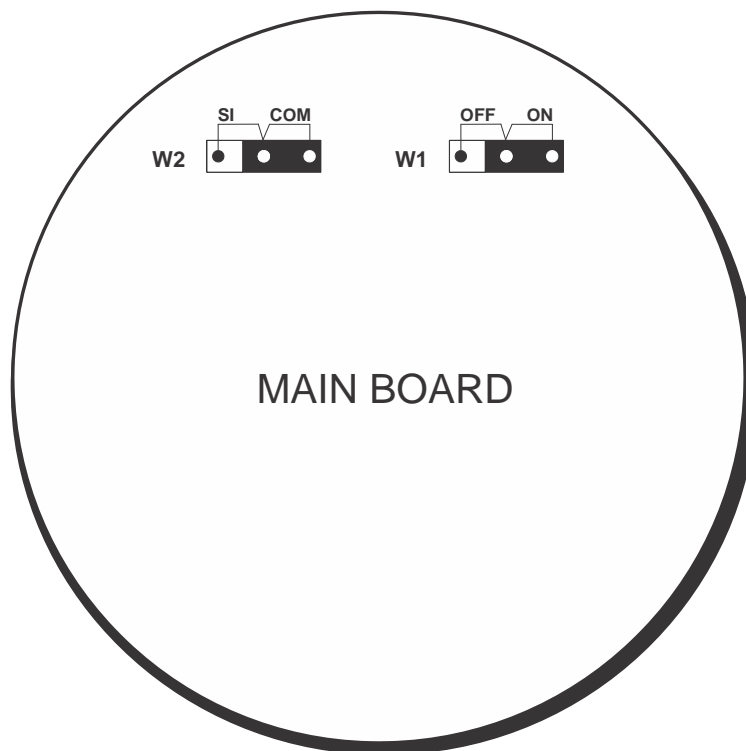


Figure 3.2 – Jumpers W2 and W1

## Procedure to Calibrate the Position Transmitter

### Calibration Using the Jumper in Simple Local Adjustment

If the Simple Local adjustment is enabled, only the Lower and Upper Position can be adjusted. To adjust them position the magnet in the lower point of the stroke and insert the magnet part of the tool in the hole **Z**. To adjust the upper value, position the magnet in the upper point and insert the tool in the hole **S**. After this, move the magnet and check the indications of other positions. Repeat the procedures if necessary.

### Calibration using the jumper in Complete Local Adjustment

If the Complete Local adjustment is enabled, the unit and the direct or reverse indication can be configured and the lower and upper positions of the stroke can be adjusted. To adjust the lower and upper position, refer to the procedures of the calibration of the Simple Local Adjustment. The Figure 3.3 shows how to travel the options.

**NOTE**  
TP290 has a new function: **Damp (Damping)**.

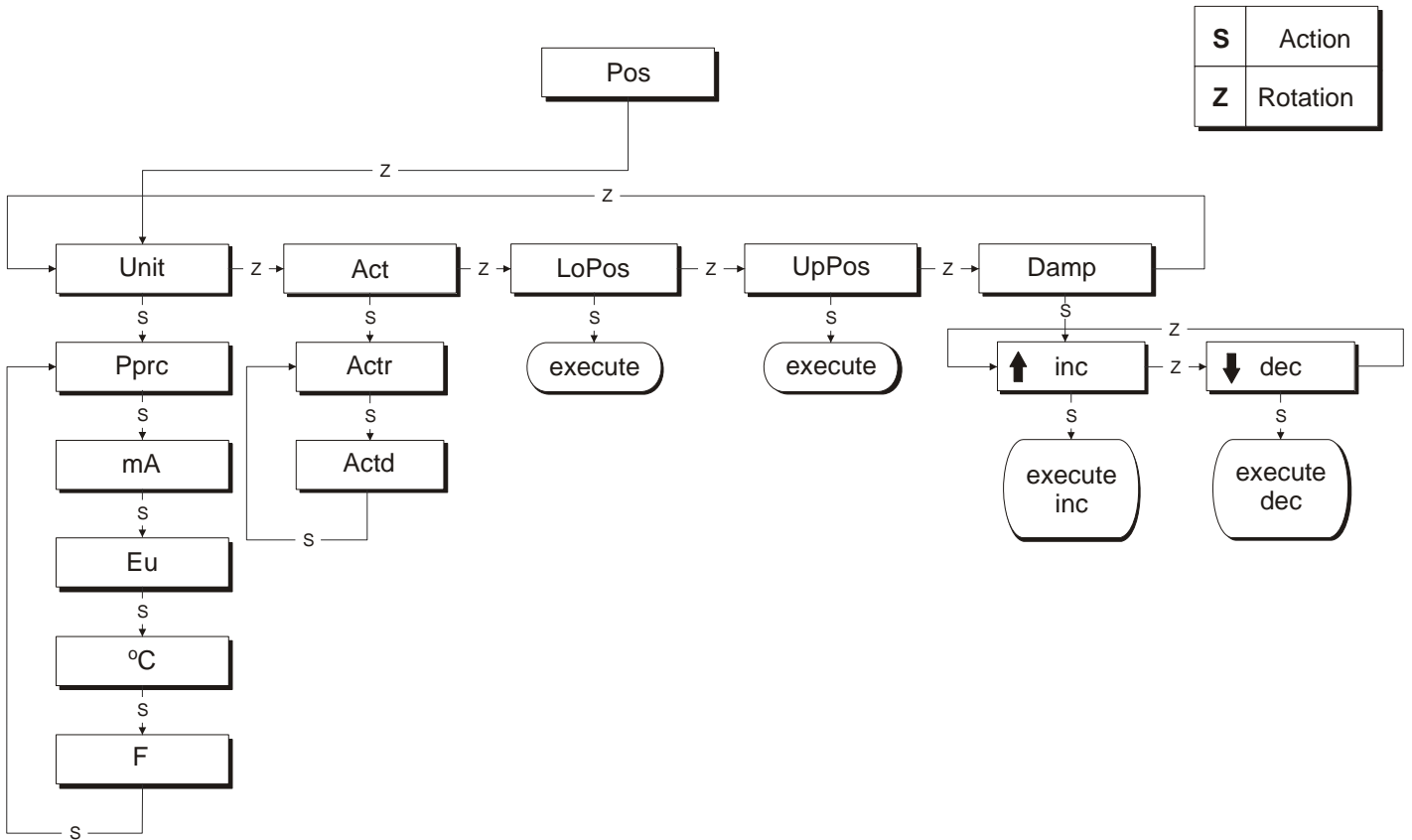


Figure 3.3 – Local Adjustment Configuration Tree

**NOTE**  
Remove the Magnetic Tool of the orifice to Save (to execute) the selected option.  
When the display shows the symbol **ACK**: option was accepted

**DESCRIPTION OF THE PARAMETERS OF THE LOCAL ADJUSTMENT CONFIGURATION TREE**

**POS – Position in Percentage**

**Unit** - Engineering Unit or Percentage

**Pprc** - Position in Percentage.

**mA** (Mile Ampere) - Current.

**Eu** (End User's choice) - Position.

**°C** (Degrees Celsius) - Temperature.

**F** (Degrees Fahrenheit) - Temperature.

**Act** - Action

**Actr** - Reverse action.

**Actd** - Direct action.

**LoPos (0% Position)** - TRIM of inferior position.

**UpPos (100% Position)** - TRIM of Superior Position.

**Damp (Damping)** - reduction function.

**Inc** - Increment.

**Dec** - Decrement.



# Section 4

## MAINTENANCE PROCEDURES

### General

SMAR **TP290** to read Position are extensively tested and inspected before delivery to the end user. Nevertheless, during their design and development, consideration was given to the possibility of repairs by the end user, if necessary.

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

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

NOTE
<p>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.</p> <p>The electrical connection with 1/2” – 14NPT thread must use a sealant. A non-hardening silicone sealant is recommended.</p> <p>The instrument modification or replacement parts supplied by other than authorized representative of Smar is prohibited and will void the certification.</p>

### Diagnostics

In order to carry out the diagnostics, refer to table 4.1.

DIAGNOSTICS	
SYMPTOM	PROBABLE ERROR SOURCE:
POSITION IS NOT DISPLAY	<ul style="list-style-type: none"> <li>▪ Position Transmitter Connections.</li> <li>• Check wiring polarity and continuity.</li>   <li>▪ Power Supply</li> <li>• Check load curve.</li> <li>• Check power supply output.</li> <li>• Voltage should be between 12 Vdc and 45 Vdc at the transmitter terminals.</li>   <li>▪ Electronic Circuit Failure</li> <li>• Check the boards for malfunctions and faulty boards for spare ones.</li> </ul>
NO RESPONSE FOR THE INPUT SIGNAL	<ul style="list-style-type: none"> <li>▪ Calibration</li> <li>• Check the Position Transmitter calibration points.</li> </ul>

*Table 4.1 - TP290 Diagnostics Without the Programmer*

### Disassembly Procedure

Refer to **TP290** Exploded View 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 boards have CMOS components which may be damaged by electrostatic discharges. Observe correct procedures for handling CMOS components. It is also recommended to store the circuit boards in electrostatic-proof cases.

#### CAUTION

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

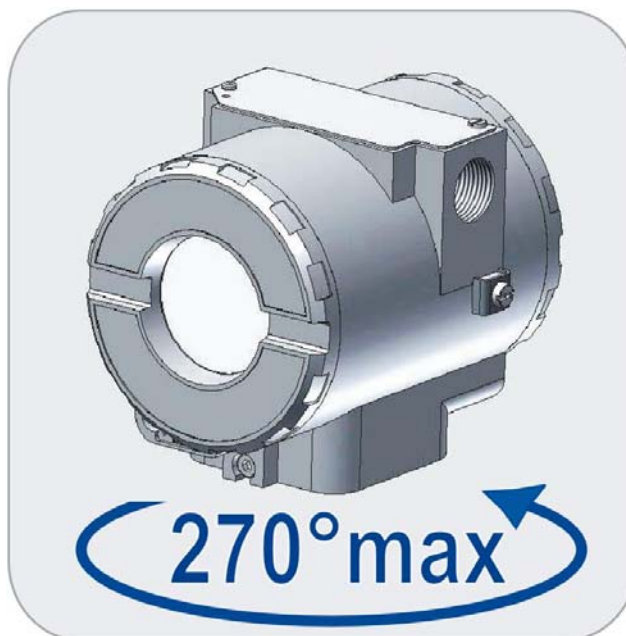


Figure 4.1 – Transducer Rotation Stopper

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

## Reassembly Procedure

#### WARNING

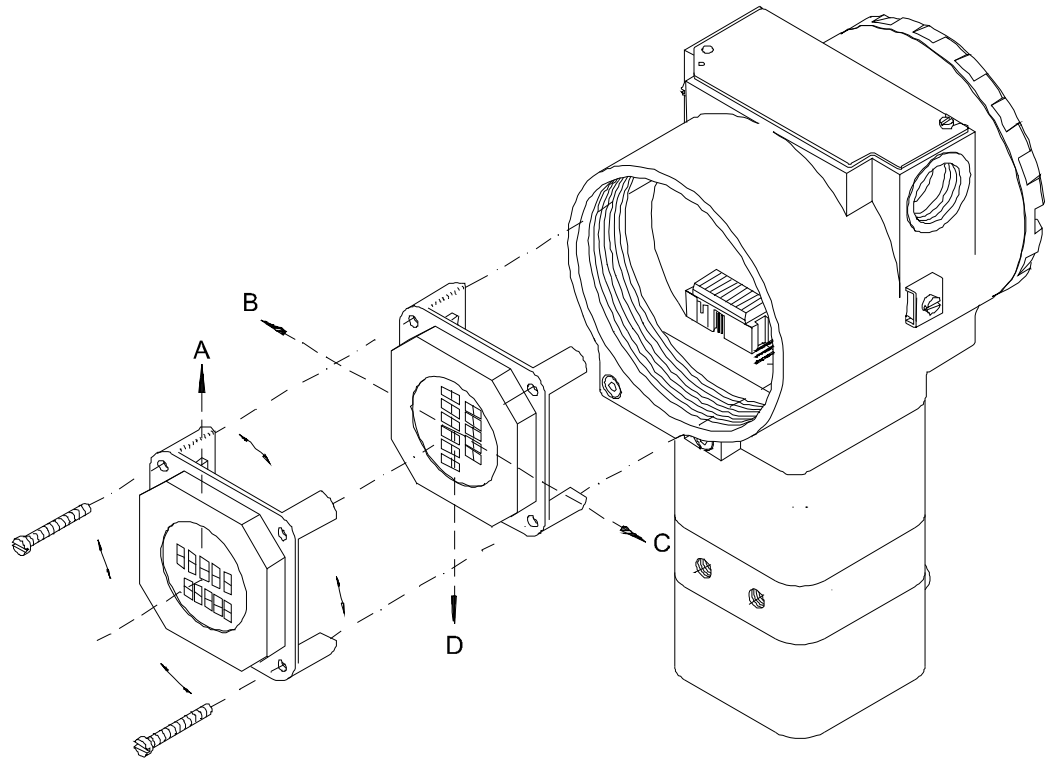
Do not assemble the main board with power on.

### 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 Indicator**

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.

## **Interchangeability**

Main board can be replaced by a similar new one keeping the operational features unchanged. The transducer EEPROM has all the information related to the TRIM and factory default configuration.

## Exploded View

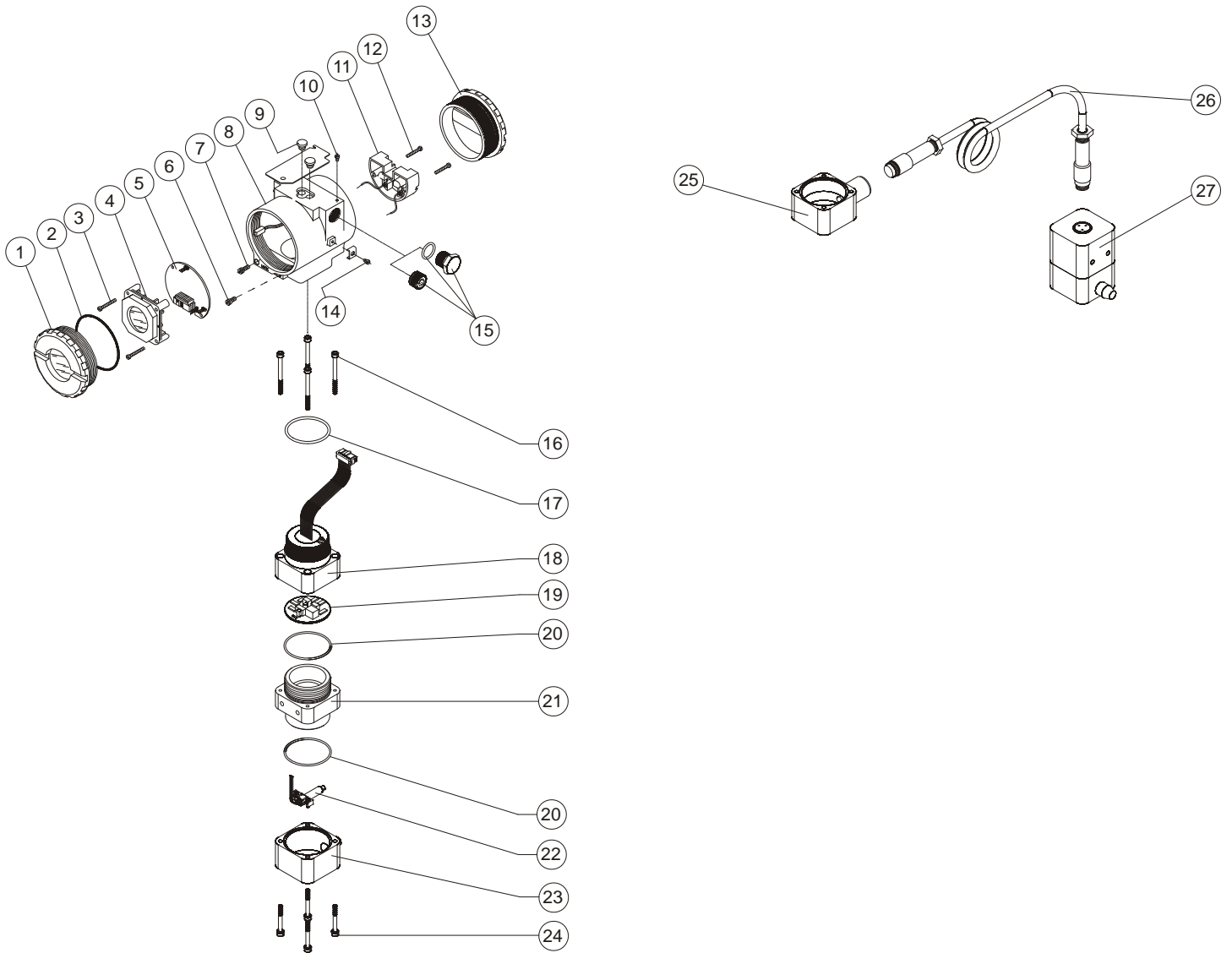


Figure 4.3 – TP290 Exploded View

## Accessories

ACCESSORIES	
ORDERING CODE	DESCRIPTION
SD-1	Magnetic Tool for Local Adjustment.
400-1176	Teflon guide for linear magnet.
400-1177	Teflon guide for rotary magnet.

## 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	400-0100	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**.  
**Note 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.  
**Note 4:** Includes cover, position sensor flat cable, and extension cable connector.  
**Note 5:** To specify the housing, use HOUSING ORDER CODE table.

HOUSING ORDER CODE	
400-1314	HOUSING
	COD. Product
	5 TP290
	COD. Communications Protocol
	0 4-20 mA
	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	0	*	*	*	*
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← TYPICAL MODEL NUMBER

\* Select item.

## Section 5

# TECHNICAL CHARACTERISTICS

### Function Specifications

<b>Travel</b>	Linear Motion: 3 to 100 mm. Rotary Motion: 30° to 120° rotation angle.																																								
<b>Output Signal</b>	Two-wire, 4 to 20 mA.																																								
<b>Reverse Polarity Protection</b>	12 to 45 Vdc.																																								
<b>Load Limitation</b>																																									
<b>Indicator</b>	Optional 4½ - digit numerical and 5-character alphanumeric LCD indicator.																																								
<b>Hazardous Certifications Area</b>	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.																																								
<b>Zero and Adjustments Span</b>	Non-interactive, via local adjustment or digital communication.																																								
<b>Temperature Limits</b>	<table> <tr> <td>Ambient:</td> <td>- 40</td> <td>to</td> <td>85 °C</td> <td>(- 40</td> <td>to</td> <td>185 °F)</td> <td></td> </tr> <tr> <td>Storage:</td> <td>- 40</td> <td>to</td> <td>90 °C</td> <td>(- 40</td> <td>to</td> <td>194 °F)</td> <td></td> </tr> <tr> <td>Digital Display:</td> <td>- 10</td> <td>to</td> <td>75 °C</td> <td>( 14</td> <td>to</td> <td>167 °F)</td> <td>operation;</td> </tr> <tr> <td></td> <td>- 40</td> <td>to</td> <td>85 °C</td> <td>(- 40</td> <td>to</td> <td>185 °F)</td> <td>without damage.</td> </tr> <tr> <td>Remote Sensor:</td> <td>- 40</td> <td>to</td> <td>105°C</td> <td>(- 40</td> <td>to</td> <td>221°F)</td> <td></td> </tr> </table>	Ambient:	- 40	to	85 °C	(- 40	to	185 °F)		Storage:	- 40	to	90 °C	(- 40	to	194 °F)		Digital Display:	- 10	to	75 °C	( 14	to	167 °F)	operation;		- 40	to	85 °C	(- 40	to	185 °F)	without damage.	Remote Sensor:	- 40	to	105°C	(- 40	to	221°F)	
Ambient:	- 40	to	85 °C	(- 40	to	185 °F)																																			
Storage:	- 40	to	90 °C	(- 40	to	194 °F)																																			
Digital Display:	- 10	to	75 °C	( 14	to	167 °F)	operation;																																		
	- 40	to	85 °C	(- 40	to	185 °F)	without damage.																																		
Remote Sensor:	- 40	to	105°C	(- 40	to	221°F)																																			
<b>Failure Alarm</b>	In case of sensor or circuit failure, the self-diagnostics drivers the output to 3.9 or 21.0 mA, according to the user's choice.																																								
<b>Turn-on Time</b>	Performs within specifications in less than 5.0 seconds after power is applied to the transmitter.																																								
<b>Update Time</b>	Approximately 150 ms.																																								
<b>Humidity Limits</b>	0 to 100% RH.																																								
<b>Output Action</b>	Direct or Reverse.																																								
<b>Actual Position Sensing</b>	Magnetic (Non-contact) via Hall Effect.																																								
<b>Configuration</b>	Can be done through local adjust.																																								

### Performance Specifications

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

<b>Accuracy</b>	Linearity, hysteresis and repeatability effects are included.
<b>Resolution</b>	≤ 0.1% F.S.
<b>Repeatability</b>	≤ 0.5% F.S.
<b>Hysteresis</b>	≤ 0.2% F.S.
<b>Stability</b>	± 0.1% of F.S. for 12 months.
<b>Temperature Effect</b>	± 0.8%/20°C of F.S.
<b>Power Supply Effect</b>	± 0.005% of calibrated F.S. per volt.
<b>Electromagnetic Interface Effect</b>	Designed to comply with European Directive EMC 2004/108/EC.

## Physical Specifications

<b>Electrical Connection</b>	1/2 - 14 NPT, PG 13.5, or M20 x 1.5 metric.
<b>Material of Construction</b>	Injected low copper aluminum with polyester painting or 316 Stainless Steel housing, with BUNA-N O-rings on cover.
<b>Mounting Bracket</b>	Plated carbon steel with polyester painting or 316 SST.
<b>Identification Plate</b>	316 SST.
<b>Approximate Weights</b>	<ul style="list-style-type: none"> <li>• <b>TP</b> 1.5 kg in Aluminum (without mounting bracket); 3.3 kg in Stainless Steel (without mounting bracket).</li> <li>• <b>Remote sensor:</b> 0.58 kg in Aluminum; 1.5 kg in Stainless Steel.</li> <li>• <b>Cable and remote sensor connectors:</b> Cable 0.045 kg/m; 0.05 kg for each connector.</li> </ul>



# Ordering Code

MODEL	POSITION TRANSMITTER										
TP290	4 to 20 mA										
	<b>COD.</b>	<b>Local Display</b>									
	1	With Local Display									
	<b>COD.</b>	<b>Mounting Bracket</b>									
	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)									
	<b>COD.</b>	<b>Electrical Connection</b>									
	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									
	2	1/2" - 14 NPT X 3/4 BSP (316 SST) - with adapter									
	A	M20 X 1.5									
	B	PG 13.5 DIN									
	<b>COD.</b>	<b>Type of Actuator</b>									
	1	Rotary									
	5	Linear Stroke up to 50 mm									
	7	Linear Stroke up to 100 mm									
	A	Linear Stroke up to 30 mm									
	<b>SPECIAL OPTIONS (1)</b>										
	<b>COD.</b>	<b>Housing</b>									
	H0	Aluminum (IP/TYPE)				H2					Aluminum for saline atmosphere (IPW/TYPE X)
	H1	316 Stainless Steel (IP/TYPE)									
	H4	Copper Free Aluminium (IPW/TYPEX)									
	<b>COD.</b>	<b>Identification Plate</b>									
	I1	FM: XP, IS, NI, DI				I6					Without certification
	I4	EXAM (DMT): Ex-ia, IP									
	I5	CEPEL: Ex-d, Ex-ia, IP									
	IJ	NEMKO - Ex-d									
	<b>COD.</b>	<b>Painting</b>									
	P0	Gray Munsell N 6.5 Polyester									
	P3	Black Polyester									
	P8	Without Painting									
	P9	Blue Safety Epoxy – Electrostatic Painting									
	<b>COD.</b>	<b>TAG Plate</b>									
	J0	With TAG									
	J1	Blank									
	J2	According to user's notes									
	<b>COD.</b>	<b>Sensor Mounting (2)</b>									
	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									
	<b>COD.</b>	<b>Special</b>									
	ZZ	See notes									

TP290 - 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](http://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 35°C. (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 35°C. (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

**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 TP290 Position Transmitters; input supply 12-42V dc; 4-20mA; Enclosure Type 4/4X; intrinsically safe with Entity parameters:

$V_{max} = 28\text{ V}$ ,  $I_{max} = 110\text{ mA}$ ,  $C_i = 5\text{ nF}$ ,  $L_i = 12\mu\text{H}$ ,

when connected through CSA Certified Safety Barriers as per Smar Installation Drawing 102A0832; 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: 40°C (-20 to 40 °C)

### 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:

Vmax = 30 Vdc, I<sub>max</sub> = 110 Ma, C<sub>i</sub> = 5 nF, L<sub>i</sub> = 12 uH  
 Temperature Class: T4  
 Maximum Ambient Temperature: 60°C (-20 to 60 °C)

**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 °C

**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 085)**  
 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 and signal circuit intended for connection to an intrinsically safe 4-20 mA current loop:  
 U<sub>i</sub> = 28 Vdc, I<sub>i</sub> = 93 mA, C<sub>i</sub> ≤ 5 nF L<sub>i</sub> = Neg

Maximum Permissible power:

Max. Ambient temperature Ta	Temperature Class	Power P <sub>i</sub>
85°C	T4	700 mW
75°C	T4	760 mW
44°C	T5	760 mW
50°C	T5	700 mW
55°C	T5	650 mW
60°C	T5	575 mW
65°C	T5	500 mW
70°C	T5	425 mW
40°C	T6	575 mW

Ambient Temperature: -40°C ≤ Ta ≤ + 85°C

**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 T5, EPL Ga

Entity Parameters:  
 P<sub>i</sub> = 0.7 W, U<sub>i</sub> = 30 V, I<sub>i</sub> = 100 mA, C<sub>i</sub> = 6.4 nF, L<sub>i</sub> = Neg

Ambient Temperature: -20 to 50°C

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

**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 TP290 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

ABNT NBR IEC 60529:2009 Classification of degrees of protection provided by enclosures (IP Code)

# Identification Plate

## CSA (Canadian Standards Association)

**smar TP290** Position Transmitter  
BR - 14160

XP - CL I DIV 1 GR BCD, CL II DIV 1 GR EFG, CL III DIV 1  
NI - CL I DIV 2 GR ABCD  
IS - Exia - CL I DIV 1 GR ABCD, CL II DIV 1 GR EFG, CL III DIV 1  
Vmax=28V Imax=110mA Ci=5nF Li=12uH  
T3C Ta=40°Cmax Inst. Dwg. 102A0832

Temp. Class: T4  
Tamb. 60°C max.  
Vmax. 30 VDC  
I max. 110 mA  
Ci 5 nF  
Li 12 uH

XP CL I, DIV 1, GP A,B,C,D.  
DIP CL II,III, DIV 1, GP E,F,G.  
IS CL I,II,III, DIV 1, GP A,B,C,D,E,F,G.  
NI CL I, DIV 2, GP A,B,C,D.  
Per inst. dwg 102A0604.

Seal not required (conduit)

0044333 - 2007

CE 143601

**smar TP290** Position Transmitter  
BR - 14160

XP - CL I DIV 1 GR BCD, CL II DIV 1 GR EFG, CL III DIV 1  
NI - CL I DIV 2 GR ABCD  
IS - Exia - CL I DIV 1 GR ABCD, CL II DIV 1 GR EFG, CL III DIV 1  
Vmax=28V Imax=110mA Ci=5nF Li=12uH  
T3C Ta=40°Cmax Inst. Dwg. 102A0832

Temp. Class: T4  
Tamb. 60°C max.  
Vmax. 30 VDC  
I max. 110 mA  
Ci 5 nF  
Li 12 uH

XP CL I, DIV 1, GP A,B,C,D.  
DIP CL II,III, DIV 1, GP E,F,G.  
IS CL I,II,III, DIV 1, GP A,B,C,D,E,F,G.  
NI CL I, DIV 2, GP A,B,C,D.  
Per inst. dwg 102A0604.

Seal not required (conduit)

0044333 - 2007

CE 140501

## FM Approvals (Factory Mutual)

**smar TP290** Position Transmitter  
BR - 14160  
Made in Brazil

Temp. Class: T4  
Tamb. 60°C max.  
Vmax. 30 VDC  
I max. 110 mA  
Ci 5 nF  
Li 12 uH

XP CL I, DIV 1, GP A,B,C,D.  
DIP CL II,III, DIV 1, GP E,F,G.  
IS CL I,II,III, DIV 1, GP A,B,C,D,E,F,G.  
NI CL I, DIV 2, GP A,B,C,D.  
Per inst. dwg 102A0604.

APPROVED

0044333 - 2007

CE 123500

**smar TP290** Position Transmitter  
BR - 14160  
Made in Brazil

Temp. Class: T4  
Tamb. 60°C max.  
Vmax. 30 VDC  
I max. 110 mA  
Ci 5 nF  
Li 12 uH

XP CL I, DIV 1, GP A,B,C,D.  
DIP CL II,III, DIV 1, GP E,F,G.  
IS CL I,II,III, DIV 1, GP A,B,C,D,E,F,G.  
NI CL I, DIV 2, GP A,B,C,D.  
Per inst. dwg 102A0604.

APPROVED

0044333 - 2007

CE 134800

**smar TP290** Position Transmitter  
TX - 77040  
Made in USA

Temp. Class: T4  
Tamb. 60°C max.  
Vmax. 30 VDC  
I max. 110 mA  
Ci 5 nF  
Li 12 uH

XP CL I, DIV 1, GP A,B,C,D.  
DIP CL II,III, DIV 1, GP E,F,G.  
IS CL I,II,III, DIV 1, GP A,B,C,D,E,F,G.  
NI CL I, DIV 2, GP A,B,C,D.  
Per inst. dwg 102A0604.

APPROVED

0000000 - 0000

CE 195400

**smar TP290** Position Transmitter  
TX - 77040  
Made in USA

Temp. Class: T4  
Tamb. 60°C max.  
Vmax. 30 VDC  
I max. 110 mA  
Ci 5 nF  
Li 12 uH

XP CL I, DIV 1, GP A,B,C,D.  
DIP CL II,III, DIV 1, GP E,F,G.  
IS CL I,II,III, DIV 1, GP A,B,C,D,E,F,G.  
NI CL I, DIV 2, GP A,B,C,D.  
Per inst. dwg 102A0604.

APPROVED

0000000 - 0000

CE 195500

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

**smar TP290** Position Transmitter  
BR - 14160  
Sertãozinho  
Brazil

Temp. Class: T4  
Tamb. 60°C max.  
Vmax. 30 VDC  
I max. 110 mA  
Ci 5 nF  
Li 12 uH

XP CL I, DIV 1, GP A,B,C,D.  
DIP CL II,III, DIV 1, GP E,F,G.  
IS CL I,II,III, DIV 1, GP A,B,C,D,E,F,G.  
NI CL I, DIV 2, GP A,B,C,D.  
Per inst. dwg 102A0604.

DMT 00 ATEX E 085 ( )  
-40°C ≤ Ta ≤ +85°C  
700 mW (T4, Ta = 85°C)  
575 mW (T5, Ta = 60°C)  
575 mW (T6, Ta = 40°C)  
U<sub>i</sub> = 28 VDC I<sub>i</sub> = 93 mA  
Li = neg Ci ≤ 5 nF

Nemko 01 ATEX 445X ( )  
U = 28 VDC  
Tamb = -20° to 60°C

IP66  
IP68  
10m/24h

0000000 - 0000

CE 0470 144904

**smar TP290** Position Transmitter  
BR - 14160  
Sertãozinho  
Brazil

Temp. Class: T4  
Tamb. 60°C max.  
Vmax. 30 VDC  
I max. 110 mA  
Ci 5 nF  
Li 12 uH

XP CL I, DIV 1, GP A,B,C,D.  
DIP CL II,III, DIV 1, GP E,F,G.  
IS CL I,II,III, DIV 1, GP A,B,C,D,E,F,G.  
NI CL I, DIV 2, GP A,B,C,D.  
Per inst. dwg 102A0604.

DMT 00 ATEX E 085 ( )  
-40°C ≤ Ta ≤ +85°C  
700 mW (T4, Ta = 85°C)  
575 mW (T5, Ta = 60°C)  
575 mW (T6, Ta = 40°C)  
U<sub>i</sub> = 28 VDC I<sub>i</sub> = 93 mA  
Li = neg Ci ≤ 5 nF

Nemko 01 ATEX 445X ( )  
U = 28 VDC  
Tamb = -20° to 60°C

IP66W  
IP68W  
10m/24h

0000000 - 0000

CE 0470 150504

**smar TP290** Position Transmitter  
BR - 14160  
Sertãozinho  
Brazil

Temp. Class: T4  
Tamb. 60°C max.  
Vmax. 30 VDC  
I max. 110 mA  
Ci 5 nF  
Li 12 uH

XP CL I, DIV 1, GP A,B,C,D.  
DIP CL II,III, DIV 1, GP E,F,G.  
IS CL I,II,III, DIV 1, GP A,B,C,D,E,F,G.  
NI CL I, DIV 2, GP A,B,C,D.  
Per inst. dwg 102A0604.

DMT 00 ATEX E 085  
-40°C ≤ Ta ≤ +85°C  
700 mW (Ta = 85°C)  
U<sub>i</sub> = 28 VDC I<sub>i</sub> = 93 mA Li = neg Ci ≤ 5 nF

IP66  
IP68

0000000 - 0000

CE 0470 157801

**smar TP290** Position Transmitter  
BR - 14160  
Sertãozinho  
Brazil

Temp. Class: T4  
Tamb. 60°C max.  
Vmax. 30 VDC  
I max. 110 mA  
Ci 5 nF  
Li 12 uH

XP CL I, DIV 1, GP A,B,C,D.  
DIP CL II,III, DIV 1, GP E,F,G.  
IS CL I,II,III, DIV 1, GP A,B,C,D,E,F,G.  
NI CL I, DIV 2, GP A,B,C,D.  
Per inst. dwg 102A0604.

DMT 00 ATEX E 085  
-40°C ≤ Ta ≤ +85°C  
700 mW (Ta = 85°C)  
U<sub>i</sub> = 28 VDC I<sub>i</sub> = 93 mA Li = neg Ci ≤ 5 nF

IP66W  
IP68W

0000000 - 0000

CE 0470 157901

CEPEL (Centro de Pesquisa de Energia Elétrica)

**smar** TP290 Transmissor de Posição  
BR - 14160

**Segurança**  
INMETRO OCP 0007

Ex d IIC T6 Gb CEPEL 01.0016 ( )  
Ex ia IIC T5 Ga CEPEL 07.1501 X ( )  
Tamb = -20° a 50°C  
Ui = 30 V li = 100 mA Pi = 0,7 W  
Ci = 6,4 nF Li = desp

IP  
66 W  
68 W

0044333 - 2007

CE 130401

**smar** TP290 Transmissor de Posição  
BR - 14160

**Segurança**  
INMETRO OCP 0007

Ex d IIC T6 Gb CEPEL 01.0016 ( )  
Ex ia IIC T5 Ga CEPEL 07.1501 X ( )  
Tamb = -20° a 50°C  
Ui = 30 V li = 100 mA Pi = 0,7 W  
Ci = 6,4 nF Li = desp

IP  
66  
68

0044333 - 2007

CE 137701



# Control Drawing

Canadian Standards Association (CSA)

### NON HAZARDOUS OR DIVISION 2 AREA

SAFE AREA APPARATUS

UNSPECIFIED, EXCEPT THAT IT MUST NOT BE SUPPLIED FROM, NOR CONTAIN UNDER NORMAL OR ABNORMAL CONDITIONS, A SOURCE OF POTENTIAL IN RELATION TO EARTH IN EXCESS OF 250VAC OR 250VDC.

ASSOCIATED APPARATUS

BARRIER

GROUND BUS

OPTIONAL SHIELDING

POWER SUPPLY

SIGNAL

$R_{min}$  250 W

### HAZARDOUS AREA

REQUIREMENTS:

- 1- INSTALLATION TO BE IN ACCORDANCE WITH THE CEC PART I.
- 2- ASSOCIATED APPARATUS GROUND BUS TO BE INSULATED FROM PANELS AND MOUNTING ENCLOSURES.
- 3- ASSOCIATED APPARATUS GROUND BUS RESISTANCE TO EARTH MUST BE SMALLER THAN 1(ONE) OHM.
- 4- OBSERVE TRANSMITTER POWER SUPPLY LOAD CURVE.
- 5- WIRES: TWISTED PAIR, 22AWG OR LARGER.
- 6- SHIELD IS OPTIONAL IF USED, BE SURE TO INSULATE THE END NOT GROUNDED.
- 7- BARRIERS MUST BE "CSA" CERTIFIED AND MUST BE INSTALLED IN ACCORDANCE WITH MANUFACTURE INSTRUCTIONS.
- 8- IF BARRIERS WITH VOLT/OHM PARAMETERS ARE USED, THE FOLLOWING PARAMETERS SHALL APPLY:- ONE 28 V(MAX), 300 OHM(MIN).
- 9- INTRINSICALLY SAFE, Exia FOR USE IN CLASS I, DIV. 1, GROUPS A, B, C, D; CLASS II, DIV. 1, GROUPS E, F, G; CLASS III, DIV. 1, WITH ENTITY INPUT PARAMETERS AS LISTED BELOW.
- 10- NON-INCENDIVE FOR CLASS I, DIV. 2, GROUPS A, B, C, D, WITH NON-INCENDIVE FIELD WIRING INPUT PARAMETERS AS LISTED BELOW.

INTRINSICALLY SAFE APPARATUS AND NON-INCENDIVE APPARATUS ENTITY VALUES:  $C=5nF$   $L=10\mu H$   $V_{max}=28VDC$   $I_{max}=110mA$

CAUTION: EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR USE IN HAZARDOUS LOCATIONS.

CAUTION: EXPLOSION HAZARD - DO NOT DISCONNECT FOR CLASS I, DIV. 2 EQUIPMENT THAT IS NOT CONNECTED TO BARRIERS.

MODELS TP290 & TP301 - SERIES POSITION TRANSMITTERS

ENTITY PARAMETERS FOR ASSOCIATED APPARATUS

$C_a \geq$  CABLE CAPACITANCE +C1

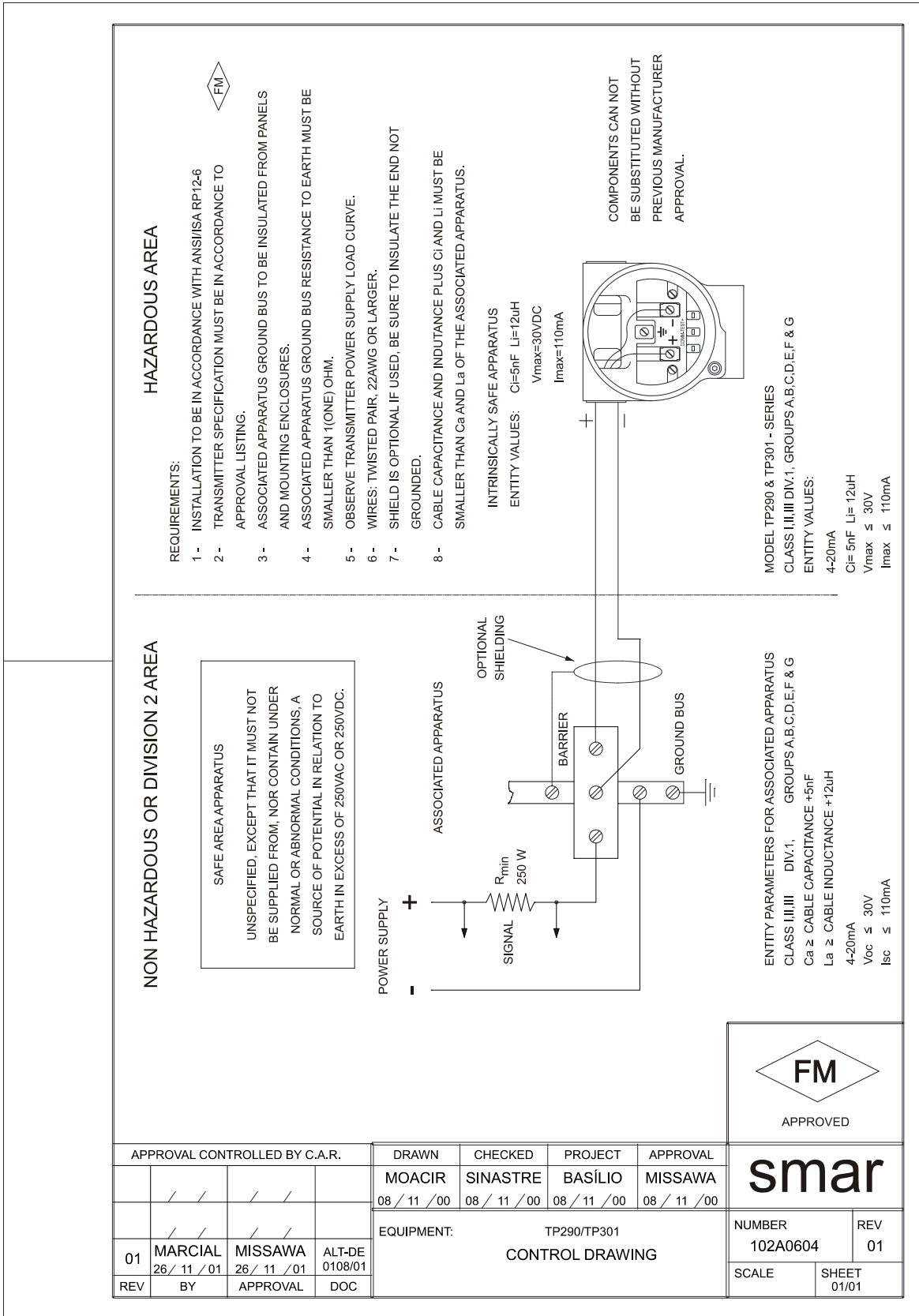
$L_a \geq$  CABLE INDUCTANCE +L1

$V_{oc} \leq$  28V


$I_{sc} \leq$  110mA

APPROVAL CONTROLLED BY C.A.R.				DRAWN	CHECKED	PROJECT	APPROVAL	
	//	//	//	MOACIR	SINASTRE	SINASTRE	EMBOABA	
	//	//	//	28 / 05 / 01	28 / 05 / 01	28 / 05 / 01	28 / 05 / 01	
01	MARCIAL 25 / 09 / 08	CIRO 25 / 09 / 08	ALT-DE 0043/08	EQUIPMENT: TP290/TP301 - CONTROL DRAWING				NUMBER 102A0832
REV	BY	APPROVAL	DOC	FOR NON-INCENDIVE: CALSS I, DIV. 2 FOR INTRINSICALLY SAFE: CLASS I, DIV. 1				REV 01
				SCALE		SHEET 01/01		

Factory Mutual (FM)



# Appendix B

	<h2 style="margin: 0;">SRF – Service Request Form</h2>
TP Position Transmitter	
GENERAL DATA	
<b>Model:</b> TP290 ( <input type="checkbox"/> ) Firmware Version: _____ TP301 ( <input type="checkbox"/> ) Firmware Version: _____ TP302 ( <input type="checkbox"/> ) Firmware Version: _____ TP303 ( <input type="checkbox"/> ) Firmware Version: _____	
<b>Serial Number:</b> _____ <b>Sensor Number:</b> _____	
<b>TAG:</b> _____	
<b>Remote Position Sensor?</b> Yes ( <input type="checkbox"/> ) No ( <input type="checkbox"/> )	
<b>Action:</b> Rotary ( <input type="checkbox"/> ) Linear ( <input type="checkbox"/> )	
<b>Travel:</b> 30 mm ( <input type="checkbox"/> ) 50 mm ( <input type="checkbox"/> ) 100 mm ( <input type="checkbox"/> ) Other: _____ mm	
<b>Configuration:</b> Magnetic Tool ( <input type="checkbox"/> ) Palm ( <input type="checkbox"/> ) Psion ( <input type="checkbox"/> ) PC ( <input type="checkbox"/> ) Software: _____ Version: _____	
INSTALLATION DATA	
<b>Type:</b> Valve + Atuador ( <input type="checkbox"/> ) Other: _____	
<b>Size:</b> _____	
<b>Travel:</b> _____	
<b>Manufacturer:</b> _____	
<b>Model:</b> _____	
PROCESS DATA	
<b>Hazardous Area Classification</b> Non-Classified ( <input type="checkbox"/> ) Chemical ( <input type="checkbox"/> ) Explosive ( <input type="checkbox"/> ) Other: _____	
<b>Interference Types</b> Vibration ( <input type="checkbox"/> ) Temperature ( <input type="checkbox"/> ) Electromagnetic ( <input type="checkbox"/> ) Others: _____	
SITUATION DESCRIPTION	
_____ _____ _____ _____	
SERVICE SUGGESTION	
Adjustment ( <input type="checkbox"/> ) Cleaning ( <input type="checkbox"/> ) Preventive Maintenance ( <input type="checkbox"/> ) Update / Up-grade ( <input type="checkbox"/> )	
Other: _____	
USER INFORMATION	
<b>Company:</b> _____	
<b>Contact:</b> _____	
<b>Title:</b> _____	
<b>Section:</b> _____	
<b>Phone:</b> _____	<b>Extension:</b> _____
<b>E-mail:</b> _____	<b>Date:</b> ____/____/____
For warranty or non-warranty repair, please contact your representative. Further information about address and contacts can be found on <a href="http://www.smar.com/contactus.asp">www.smar.com/contactus.asp</a> .	

## ***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.