

OPERATION AND MAINTENANCE INSTRUCTION MANUAL

POSITION TRANSMITTER 4 to 20 mA







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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 provides 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 Handheld Terminal;

- ✓ Noncontact 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

NOTE

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

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:

- 1. There is no friction 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 TP290, dimensional drawings.



LINEAR MAGNET





Figure 1.5 – TP290 Dimensional Drawing / Magnets Dimensional Drawing



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.





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 \Box 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 1.10 - Load Curve

Recommendations for mounting Approved Equipment 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 lenghts. 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

Consult the Appendix A for Hazardous Location Approvals.

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

Monitoring

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 \Box 19999 it will be displayed as a two digit and an exponent.



rigure

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

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).



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 SI

If the jumper W2 is connected in SI, 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 valve. Actions by increment are performed by repeatedly placing and removing the magnetic tool until reaching the desired valve.

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 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.
^oC (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.

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	OTE
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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.

Diagnostics

To carry out the diagnostics, refer to table 4.1.

DIAGNOSTICS									
SYMPTOM	PROBABLE ERROR SOURCE:								
POSITION IS NOT DISPLAY	 Position Transmitter Connections. Check wiring polarity and continuity. Power Supply Check load curve. Check power supply output. Voltage should be between 12 Vdc and 45 Vdc at the transmitter terminals. Electronic Circuit Failure Check the boards for malfunctions and faulty boards for spare ones. 								
NO RESPONSE FOR THE INPUT SIGNAL	 Calibration Check the Position Transmitter calibration points. 								

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.



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 \uparrow 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







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)						
	. Aluminum	1	204-0103							
	. 316 SS	1	204-0106							
COVER O-RING (NOTE 3)	. Buna-N	2	204-0122	В						
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							
		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							
		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							
	. Cover Aluminum	12	304-0119							
	. Cover 316 SS	12	204-0119							
	. Aluminum	13	204-0102							
	. 316 SS	13	204-0105							
EXTERNAL GROUND BOLT		14	204-0124							
	. 1/2" NPT Bichromatized Carbon SteeL BR-EX D	15	400-0808							
SIA-SIDED INTERNAL FLOG	. 1/2" NPT 304 SST BR-EX D	15	400-0809							
	. 1/2" NPT Bichromatized	15	400-0583-11							
SIX-SIDED INTERNAL PLUG		15	400 0592 12							
	. 1/2 INFT 304 331	15	400-0363-12							
SIX-SIDED EXTERNAL PLUG	. M20 X 1.5 310 551	15	400-0810							
	2/41 NPT 240 COT	15	400-0811							
	. 3/4 NPT 310 331	10	400-0812							
		16 17 19	400-0883							
	. Aluminum	10, 17, 10,	400-0884							
CONNECTION COVER SET	. 316 SS	16, 17, 18, 19	400-0885							
O-RING, Neck (NOTE 3)	. Buna-N	17	204-0113	В						
	. Aluminum	18	400-0074							
CONNECTION COVER	. 316 SS	18	400-0391							
ANALOG BOARD		19	400-0637							
UNION BLOCK O-RING		20	400-0085	В						
	. 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 + 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							

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

ΝΟΤΑ

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



* Select item.

Isolation Test on Equipment Housings

1. Power off the equipment in the field, remove its back cover and disconnect all field cables from the transmitter terminal block, isolating them safely.

2. It is not necessary to remove the main board and display.

3. Jumper (connect) the power terminals (positive and negative) with the cable coming from the Megohmmeter (megger).

4. Configure the megohmmeter for 500 Vdc scale and check the isolation between the housing and the cable that short-circuits all the terminals.



5. The value obtained must be greater than or equal to $2G\Omega$ and the voltage application time must be at least 1 second and at most 5 seconds.

6. If the value obtained by the megohimmeter is below $2G\Omega$, the possibility of moisture entering the electrical connection compartment must be analyzed.

7. It is possible to loosen the two screws that secure the terminal block to the housing and carry out a superficial cleaning and dry the surface well. Afterwards, the isolation can be tested again.

8. If the isolation test still shows that the isolation has been compromised, the housing must be replaced and sent to Nova Smar S.A. for analysis and retrieval.

IMPORTANT

- a) For equipment certified Exd and Exi (Explosion Proof and Intrinsically Safe) the standards advise not to carry out repairs in the field of the housing electronic components, only at Nova Smar S.A.
- b) In normal use, the housing components must not cause failures that affect its isolation. For this reason, it is important to verify whether there are traces of water entering the housing and, if so, an assessment of the electrical installations and the sealing rings of the covers must be carried out. Nova Smar S.A. has a team ready to support the assessment of facilities, if necessary.

TECHNICAL CHARACTERISTICS

Function Specifications

Travel	Linear Motion: 3 to 100 mm.									
	Kotary Motion: 30° to 120° roation angle.									
Output Signal	Two-wire, 4 to 20 mA.									
Reverse Polarity Protection	12 to 45 Vdc.									
Load Limitation	Operating area 1650 1000 0 12 17 20 30 40 45 Power Supply									
Indicator	Optional 4 ¹ / ₂ - digit numerical and 5-character alphanumerical LCD indicator.									
Hazardous Area Certifications	See Appendix A.									
Zero and Span Adjustments	Non-interactive, via local adjustment or digital communication.									
Temperature Limits	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)									
Failure Alarm	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.									
Turn-on Time	Performs within specifications in less than 5.0 seconds after power is applied to the transmitter.									
Update Time	Approximately 150 ms.									
Humidity Limits	0 to 100% RH.									
Output Action	Direct or Reverse.									
Actual Position Sensing	Magnetic (Non-contact) via Hall Effect.									
Configuration	Can be done through local adjust.									

Performance Specifications

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

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

Physical Specifications

Electrical Connection	1/2 - 14 NPT, PG 13.5, or M20 x 1.5 metric.
Material of	Injected low copper aluminum with polyester painting or 316 Stainless Steel housing, with BUNA-N O-
Construction	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	POSI	TION TI	RANSM	ITTER											
TP290	4 to 2	0 mA													
!	COD.	Local	Local Display												
ł	1	With Lo	ocal Displ	lay											
ł		COD.	Mount	ing Bra	cket										
	ł	0	Without	Bracket											
ł	1	1	Carbon	Steel, "L	" + clamp	"U" pipe	2". (3)								
1		2	Stainles	s Steel, "	'L" + clarr	ıp "U" pip	e 2". (3)								
		3	Carbon	Steel, rot	tary - VDI	/ VDE N	AMUR								
		4	Stainless Steel, rotary - VDI / VDE NAMUR												
		7 Carbon Steel, "L" + clamp "U" pipe 2" - (316 SST) accessories. (3)													
Ì	i	ł	COD.	Electri	cal Conn	ection					_	•			
i	i		0	1/2" - 1	4 NPT			->				3	1/2" - 14	NPT X 1/2 BSP (-	(316 SST) - with adapter
i		ł	1	1/2" - 1	4 NPT X	3/4 NPT	(316 55)) - with a	dapter			A	M20 X 1.		
į				1/2" - 1	4 NPT X	3/4 BSP	316 551) - with a	dapter		-	в	PG 13.5	DIN	
i i		1	-	<u> </u>	Botory	DI ACTUA	itor								
i i		1	-	5	Linear	Stroke un	to 50 mr	n							
ł			Ì	7	Linear !	Stroke up	to 100 m	n nm							
ł			Ì	Å	Linear	Stroke up	to 30 mr	n							
ł				1	SPEC	AL OPT	IONS (1)							
ł				ł	COD.	Housi	ng	<i>'</i>							
					H0	Alumin	um (IP/T	YPE)				H2	Aluminum	for saline atmos	phere (IPW/TYPE X)
					H1	316 Sta	ainless S	teel (IP/T	YPE)			H4	Copper Fr	ee Aluminium (II	PW/TYPEX)
1					1	COD.	Identif	ication	Plate						
1	1		į		i	11	FM: XP	, IS, NI, E	DI				16	Without certific	ation
1	1	Ì		ł	i	14	EXAM	(DMT): Ex	k-ia, IP				IJ	NEMKO - Ex-o	i
1		i			į	15	CEPEL	: Ex-d, Ex	<−ia, IP						
1		i		1	į		COD.	Painti	ng						
1		i			i i		P0	Gray M	unsell N	6.5 Polye	ester				
1		į			ļ		P3	Black P	olyester						
1		į			ļ		Pð	Rivo Sc	foty Epo		troctatio	Dain	ting		
	Ì	į		i	ļ		P9				liostatic	Fairi	ung		
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1		į	ł	Ì			Ì		R0	Full Mo	ounting				
		į.		i	l l	1	į		R1	Remote	e sensor	- 5 m	n cable		
	i			i		-	į		R2	Remote	e sensor	- 10	m cable		
Ì	i	ł		i		1	į		R3	Remote	e sensor	- 15	m cable		
Ì	i	ł		i		1	į		R4	Remote	e sensor	- 20	m cable		
i	i			i	1		į		1	COD.	Speci	ial			
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	ł				I		ł			1					
TRACE		!	1			i i		I	1						
TP290 -	- 1	0	- 0	1	Î Î	• *	^	,	Î Î	Î			IYE	PICAL MODEL	. NUMBER

NOTE

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

CERTIFICATIONS INFORMATION

European Directive Information

Consult www.Smar.com for the EC declarations of conformity and certificates.

Authorized representative/importer located within the Community:

Smar Europe BV De Oude Wereld 116 2408 TM Alphen aan den Rijn Netherlands

ATEX Directive 2014/34//EU - "Equipment for explosive atmospheres" (applicable from 20 April 2016)

The EC-Type Examination Certificate is released by DNV Product Assurance AS (NB 2460) and DEKRA Testing and Certification GmbH (NB 0158).

Designated certification body that monitors manufacturing and released QAN (Quality Assurance Notification) is UL International Demko AS (NB 0539).

LVD Directive 2014/35/EU - "Low Voltage" (applicable from 20 April 2016)

According the LVD directive Annex II, electrical equipment for use in an explosive atmosphere is outside the scope of this directive.

According to IEC standard: IEC 61010-1 - Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements.

ROHS Directive 2011/65/EU - "Restriction of the use of certain hazardous substances in electrical and electronic equipment"

For the evaluation of the products the following standards were consulted: EN IEC 63000.

EMC Directive 2014/30/EU - "Electromagnetic Compatibility" (applicable from 20 April 2016)

For products evaluation the standard IEC 61326-1 were consulted and to comply with the EMC directive the installation must follow these special conditions:

Use shielded, twisted-pair cable for powering the instrument and signal wiring. Keep the shield insulated at the instrument side, connecting the other one to the ground.

Hazardous locations general information

Ex Standards:

IEC 60079-0 General Requirements IEC 60079-1 Flameproof Enclosures "d" IEC 60079-7 Increased Safe "e" IEC 60079-11 Intrinsic Safety "i" IEC 60079-18 Encapsulation "m" IEC 60079-26 Equipment with Separation Elements or combined Levels of Protection IEC 60079-31 Equipment dust ignition protection by enclosure "t" IEC 60529 Classification of degrees of protection provided by enclosures (IP Code) IEC 60079-10 Classification of Hazardous Areas IEC 60079-14 Electrical installation design, selection and erection IEC 60079-17 Electrical Installations, Inspections and Maintenance IEC 60079-19 Equipment repair, overhaul and reclamation ISO/IEC 80079-34 Application of quality systems for equipment manufacture

Warning:

Explosions could result in death or serious injury, besides financial damage.

Installation of this instrument in hazardous areas must be in accordance with the local standards and type of protection. Before proceedings with installation make sure that the certificate parameters are in accordance with the classified hazardous area.

Maintenance and Repair

The instrument modification or replaced parts supplied by any other supplier than authorized representative of Smar is prohibited and will void the Certification.

Marking Label

The instrument is marked with type of protection options. The certification is valid only when the type of protection is indicated by the user. Once a particular type of protection is installed, do not reinstall it using any other type of protection.

Intrinsic Safety / Non Incendive application

Only connect the equipment with the "Intrinsic safety" protection type to a circuit intrinsically safe. If the equipment has already been used in circuits not intrinsically safe or if the electrical specifications have not been respected, the safety of the equipment is no longer guaranteed for "Intrinsic Safety" installations.

In hazardous areas with intrinsic safety or non-incendive requirements, the circuit entity parameters and applicable installation procedures must be observed.

The instrument must be connected to a proper intrinsic safety barrier. Check the intrinsically safe parameters involving the barrier and equipment including the cable and connections. Associated apparatus ground bus shall be insulated from panels and mounting enclosures. Shield is optional, when using shielded cable, 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 recommended do not remove the housing covers when powered on.

Explosionproof / Flameproof application

Only use Explosionproof/Flameproof certified Plugs, Adapters and Cable glands.

The electrical connections entries must be connected using a conduit with sealed unit or closed using metal cable gland or metal blanking plug with at least IP66.

Do not remove the housing covers when powered on.

Enclosure

The electronic housing and sensor threads installed in hazardous areas must have a minimum of 6 fully engaged threads. The covers must be tightening with at least 8 turns, to avoid the penetration of humidity or corrosive gases, and until it touches the housing. Then, tighten more 1/3 turn (120°) to guarantee the sealing. Lock the housing and covers using the locking screw.

The enclosure contains aluminum and is considered to present a potential risk of ignition by impact or friction. Care must be taken during installation and use to prevent impact or friction.

Degree of Protection of enclosure (IP)

IPx8: Second numeral meaning continuous immersion in water under special condition defined as 10m for a period of 24 hours (Ref: IEC60529).

IPW/ TypeX: Supplementary letter W or X meaning special condition defined as saline environment tested in saturated solution of NaCl 5% w/w at 35°C for a period of 200 hours (Ref: NEMA 250/ IEC60529).

For enclosure with IP/IPW/TypeX applications, all NPT threads must apply a proper water-proof sealant (a non-hardening silicone group sealant is recommended).

Hazardous Locations Approvals

FM Approvals

FM 3010145 / FM 3007267IS Class I, II, III Division 1, Groups A, B, C and D, E, F, G XP Class I, Division 1, Groups A, B, C, D DIP Class II, III Division 1, Groups E, F, G NI Class I, Division 2, Groups A, B, C, D T4; Ta = -25° C < Ta < 60° C; Type 4, 4X

Entity Parameters:

Vmax = 30 Vdc, Imax = 110 Ma, Ci = 5 nF, Li = 12 uH

Drawings 102A-0604, 102A-1235, 102A-1348, 102A-1954, 102A-1955

ATEX DNV

Explosion Proof (PRESAFE 21 ATEX 17657X) II 2G Ex db IIC T6 Gb Ta -20 °C to +60 °C Options: IP66/68W or IP66/68

Special Conditions for Safe Use ATEX and IECEx certified cable gland to be used. 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 3 of EN/IEC 60079-1.

The Essential Health and Safety Requirements are assured by compliance with: EN 60079-0:2018 General Requirements EN 60079-1:2014 Flameproof Enclosures "d"

Drawings 102A-1449, 102A-1505

IECEx DNV

Explosion Proof (IECEx PRE 21.0015X) Ex db IIC T6 Gb Ta -20 °C to +60 °C Options: IP66/68W or IP66/68

Special Conditions for Safe Use ATEX and IECEx certified cable gland to be used. 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 3 of EN/IEC 60079-1.

The Essential Health and Safety Requirements are assured by compliance with: IEC 60079-0:2017 General Requirements IEC 60079-1:2014-06 Equipment protection by flameproof enclosures "d"

Drawings 102A2163, 102A2164

ATEX DEKRA Intrinsic Safety (DMT 00 ATEX E 085) I M2 Ex ia I Mb II 2G Ex ia IIC T4/T5/T6 Gb

Supply and signal circuit intended for connection to an intrinsically safe 4-20 mA current loop: Ui = 28 Vdc, Ii = 93 mA, Ci \leq 5 nF Li = Neg

Maximum Permissible power:

Max. Ambient temperature Ta	Temperature Class	Power Pi		
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	Т5	575 mW
65°C	T5	500 mW
70°C	T5	425 mW
40°C	Т6	575 mW

Ambient Temperature: $-40^{\circ}C \le Ta \le +85^{\circ}C$

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"

Drawings 102A-1449, 102A-1505, 102A-1578, 102A-1579

INMETRO NCC

Segurança Intrínseca (NCC 24.0156X) Ex ia IIC T5 Ga Ex ia IIIC T $_{200}100^{\circ}$ C Da Ui = 30 V Ii = 100 mA Pi = 0,7 W Ci = 6,4 nF Li = desp Tamb: -20 °C a +50 °C IP66W/IP68W

Prova de Explosão (NCC 24.0146) Ex db IIC T6 Gb Ex tb IIIC T85 °C Db Tamb: -20 °C a +40 °C IP66W/IP68W

Observações:

O número do certificado é finalizado pela letra "X": Indicar que para a versão do Transmissor de Posição, Intrinsecamente Seguro, modelos TP290, TP301, TP302 e TP303 equipado com invólucro fabricado em liga de alumínio, somente pode ser instalado em "Zona 0", se durante a instalação for excluído o risco de ocorrer impacto ou fricção entre o invólucro e peças de ferro/aço.

O produto adicionalmente marcado com a letra suplementar "W" indica que o equipamento foi ensaiado em uma solução saturada a 5% de NaCl p/p, à 35 °C, pelo tempo de 200 h e foi aprovado para uso em atmosferas salinas, condicionado à utilização de acessórios de instalação no mesmo material do equipamento e de bujões de aço inoxidável ASTM-A240, para fechamento das entradas roscadas não utilizadas.

Os planos de pintura P1 são permitidos apenas para equipamento fornecido com plaqueta de identificação com marcação para grupo de gás IIB.

O grau de proteção IP68 só é garantido se nas entradas roscadas de ½" NPT for utilizado vedante não endurecível à base de silicone.

O segundo numeral oito indica que o equipamento foi ensaiado para uma condição de submersão de dez metros por vinte e quatro horas. O acessório deve ser instalado em equipamentos com grau de proteção equivalente.

É responsabilidade do fabricante assegurar que todos os transformadores da placa analógica tenham sido submetidos com sucesso aos ensaios de rotina de 1500 V durante um minuto.

Este certificado é válido apenas para os produtos dos modelos avaliados. Qualquer modificação nos projetos, bem como a utilização de componentes ou materiais diferentes daqueles definidos pela documentação descritiva dos produtos, sem a prévia autorização, invalidará este certificado.

As atividades de instalação, inspeção, manutenção, reparo, revisão e recuperação dos equipamentos são de responsabilidade dos usuários e devem ser executadas de acordo com os requisitos das normas técnicas vigentes e com as recomendações do fabricante.

Normas Aplicáveis:

ABNT NBR IEC 60079-0:2020 Atmosferas explosivas - Parte 0: Equipamentos - Requisitos gerais

ABNT NBR IEC 60079-1:2016 Atmosferas explosivas - Parte 1: Proteção de equipamento por invólucro à prova de explosão "d"

ABNT NBR IEC 60079-11:2013 Atmosferas explosivas - Parte 11: Proteção de equipamento por segurança intrínseca "i"

ABNT NBR IEC 60079-26:2022 Atmosferas explosivas - Parte 26: Equipamentos com elementos de separação ou níveis de proteção combinados

ABNT NBR IEC 60079-31:2022 Atmosferas explosivas - Parte 31: Proteção de equipamentos contra ignição de poeira por invólucros "t"

ABNT NBR IEC 60529:2017 Graus de proteção providos por invólucros (Código IP)

Desenhos 102A1377, 102A1304, 102A2062, 102A2061, 102A2096

Identification Plate

FM Approvals



TP290 – Certifications Information



FM Approvals

NON HAZARDOUS OR DIVISION 2 AREA NON HAZARDOUS OR DIVISION 2 AREA NON HAZARDOUS OR DIVISION 2 AREA SAFE AREA APPARATUS UNSPECIFIED EXCENTINALIT MUST NOT SAFE AREA APPARATUS UNSPECIFIED EXCONTROL NON CONTRUNDER NON HAZARDOUS OR DIVISION 2 AREA ASSOCIATED APPARATUS UNSPECIFIED EXCENTIALIN NELATION TO EXCINT A RANORMAL CONTINUES AND ACTIONS A SAFE AREA APPARATUS OT DOVING OF TABLED FROM ON OR CONTRUMUNDER ASSOCIATED APPARATUS OF DOVING OF TABLED FROM ON OR CONTRUMUNDER ABARTON OF TABLED FROM ON OR CONTRUMUNDE ADMART OF TABLED FROM ON OR CONTRUMUNDE ADMART OF TABLED FROM ON ON CONTRUMUNDE ADMART OF TABLED FROM ON ON CONTRUMUNDE ADMART OF TABLED FROM ON	HAZARDOUS AREA	REQUIREMENTS: 1- INSTALLATION TO BE IN ACCORDANCE WITH ANSI/ISA RP12-6 2- TRANSMITTER SPECIFICATION MUST BE IN ACCORDANCE TO FM>	APPROVAL LISTING. 3- ASSOCIATED APPARATUS GROUND BUS TO BE INSULATED FROM PANELS AND MOUNTING ENCLOSURES. 4- ASSOCIATED APPARATUS GROUND BUS RESISTANCE TO EARTH MUST BE	SMALLER THAN 1(ONE) OHM. 5 - OBSERVE TRANSMITTER POWER SUPPLY LOAD CURVE.	 WIRES: I WISTED PAIR, ZAWG UK LARGER. SHIELD IS OPTIONAL IF USED, BE SURE TO INSULATE THE END NOT GROUNDED. CROLUDED. COLLE CAPACITANCE AND INDUTANCE PLUS CI AND LI MUST BE 	SMALLEN HAN CA AND LA UP THE ASSOCIATED APPARATUS. INTRINSICALLY SAFE APPARATUS ENTITY VALUES: CI=5nF Li=12uH Vmax=30VDC	Imax=110mA + COMPONENTS CAN NOT		MODEL TP290 & TP301 - SERIES CLASS I,II,III DIV.1, GROUPS A,B,C,D,E,F & G ENTITY VALUES:	4-20mA Ci= 5nF Li= 12uH Vmax ≤ 30V Imax ≤ 110mA
APPROVAL CONTROLLED BY C.A.R. DRAWN CHECKED PROJECT APPROVAL APPROVAL CONTROLLED BY C.A.R. DRAWN CHECKED PROJECT APPROVAL MOACIR SINASTRE BASÍLIO MISSAWA 08 / 11 / 00 08 / 11 / 00 08 / 11 / 00 CONTROL DRAWING NUMBER REV 102A0604 01	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 POTENTIALIN RELATION TO EARTH IN EXCESS OF 250VAC OR 250VDC.	POWER SUPPLY A ASSOCIATED APPARATUS A ASSOCIATED APPARATUS	SIGNAL Rhin SHIELDING	BARRIER		ENTITY PARAMETERS FOR ASSOCIATED APPARATUS CLASS I,II,III DIV.1, GROUPS A,B,C,D,E,F & G Ca ≥ CABLE CAPACITANCE +5nF	La ≥ CABLE INDUCTANCE +12uH 4-20mA Voc ≤ 30V Isc ≤ 110mA
MOACIR SINASTRE BASÍLIO MISSAWA SINASTRE 08/11/00 08/11/00 08/11/00 08/11/00 08/11/00 08/11/00 1 MARCIAL MISSAWA ALT-DE EQUIPMENT: TP290/TP301 NUMBER REV 01 26/11/01 26/11/01 0108/01 CONTROL DRAWING 102A0604 01	APPR	OVAL CON	ITROLLED BY C	A.R.	DRAWN	CHECKED	PROJECT	APPROVAL		
01 MARCIAL MISSAWA ALT-DE CONTROL DRAWING 102A0604 01		/ /	/ /		MOACIR 08 / 11 /00	SINASTRE 08 / 11 / 00	BASÍLIO 08 / 11 /00	MISSAWA 08 / 11 /00		
	01 M		MISSAWA	ALT-DE 0108/01	CONTROL DRAWING				102A0604	01

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511	TP Position Transmitter									
				GENE	ERAL DA	ATA				
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Serial	11 302 ()				Sensor Nu		Tinnward	- version		
Number:										
TAG:										
Remote Position Sensor?	Yes ()		No ()							
Action:	Rotary ()		Linear ()							
Travel:	30 mm ()		50 mm ()	1	00 mm ()			Other:	mm
Configuration:	Magnetic To	ool ()	Palm ()	Psion ()	PC ()	Softwar	e:	Version: _	
				INSTALI	LATION	DATA				
Туре:	Valve + At	uador ()		Other:						
Size:										
Travel:										
Manufacturer:										
Model:										
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Hazardous Are Classification	a Non-Class	sified ()	Chemical	()	Explosi	ve()	Other: _			
Interference Types	Vibration	()	Tempera	ture()	Electro	magnetic()	Others:			
			S	SITUATIO	N DESC	RIPTION				
				SERVICE	SUGGE	STION				
Adjustment ()		Cleanin	g()	Pre	eventive N	Aaintenance (()	U	lpdate / Up-grad	e()
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	Further	For wa information	rranty or non-v about address	warranty rep and contac	oair, pleas cts can be	e contact you found on ww	ur represer w.smar.co	ntative. m.br/en/cor	ntact-us.	

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 warranty term should be accompanied by a purchase order or a quote request.