

TP301

smar

JUL / 16
TP301
VERSION 1

OPERATION, MAINTENANCE AND
INSTRUCTIONS MANUAL

Smart Position Transmitter





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

INTRODUCTION

The **TP301** is from the well-know Hart® family of Smar's devices. It is a smart transmitter for position measurements. It can measure displacement or movement of rotary or linear type. The digital technology and communication provide an easy interface between the field and control room and several interesting features that considerably reduce the installation, operation and maintenance costs.

TP301 uses a magnetic coupler without physical contact to measure the position. Therefore, it is immune to vibrations resulting in a larger operational timelife. The magnetic coupler replacing the mechanical connection, results in a clear reduction of the deadband. TP301 can be set up in any linear or rotary valve, actuator or a variety of other equipment, such as floodgate skylight, dampers, rolls mill height, crusher, etc.

The **TP301**, besides the normal function of position measurement and 4-20 mA output generation, offers the following features:

- ✓ Linear or rotary travel type;
- ✓ 0.1% F.S.;
- ✓ Position calibration (4 - 20 mA) via local adjustment or remote calibration via configurator;
- ✓ Non contact position sensing;
- ✓ Optional LCD indicator;
- ✓ Diagnostics and configuration via Hart® communication.

NOTE

Get the best results of the **TP301** 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.

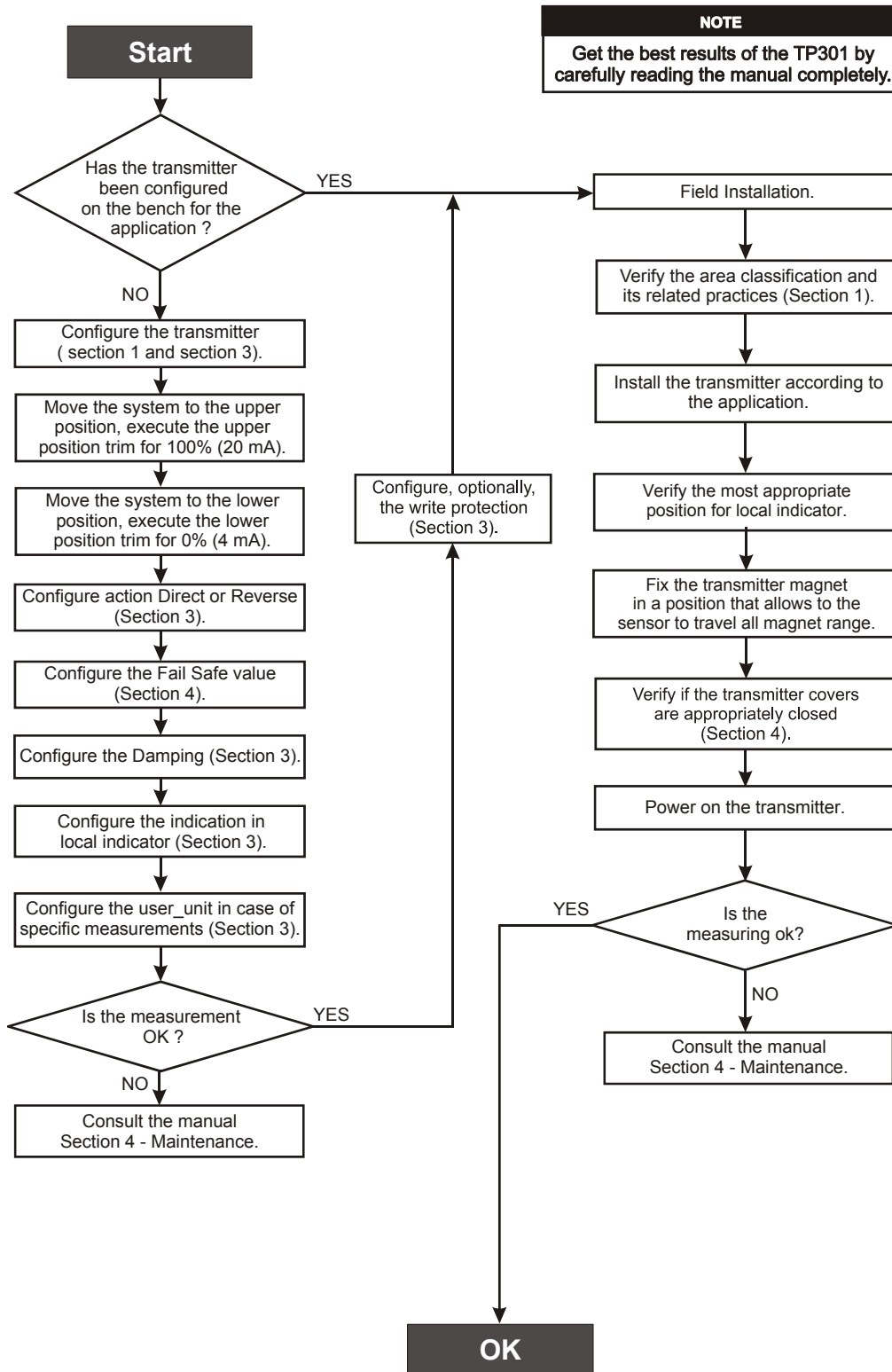
The field equipment referred to in this manual, when acquired for classified or hazardous areas, has its certification void when having its parts replaced or interchanged without functional and approval tests by Smar or any of Smar authorized dealers, which are the competent companies for certifying 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.

TABLE OF CONTENTS

SECTION 1 - INSTALLATION	1.1
GENERAL.....	1.1
MOUNTING.....	1.1
ELECTRONIC HOUSING ROTATING.....	1.7
ELECTRIC WIRING.....	1.7
RECOMMENDATIONS FOR MOUNTING APPROVED EQUIPMENTS WITH THE IP66/68 W CERTIFICATIONS ("W" INDICATES CERTIFICATION FOR USE IN SALINE ATMOSPHERES).....	1.9
ROTARY AND LINEAR MAGNET.....	1.9
REMOTE POSITION SENSOR.....	1.10
INSTALLATION IN HAZARDOUS AREAS.....	1.11
EXPLOSION/FLAME PROOF.....	1.11
INTRINSICALLY SAFE.....	1.11
SECTION 2 - OPERATION	2.1
FUNCTIONAL DESCRIPTION - POSITION SENSOR.....	2.1
FUNCTIONAL DESCRIPTION - ELECTRONICS.....	2.1
LOCAL INDICATOR.....	2.2
SECTION 3 - CONFIGURATION	3.1
JUMPER CONNECTION.....	3.1
LOCAL ADJUST.....	3.2
PROCEDURE TO CALIBRATE THE POSITION TRANSMITTER.....	3.4
CONFIGURATION VIA CONFIGURATORS.....	3.4
FAIL SAFE (ALARM SELECTION).....	3.9
SECTION 4 - MAINTENANCE PROCEDURES	4.1
GENERAL.....	4.1
RECOMMENDATIONS FOR MOUNTING APPROVED EQUIPMENT WITH THE IP66/68 W CERTIFICATIONS ("W" INDICATES CERTIFICATION FOR USE IN SALINE ATMOSPHERES).....	4.1
DIAGNOSTIC WITH CONFIGURATOR.....	4.1
DIAGNOSTICS WITHOUT CONFIGURATOR.....	4.2
DISASSEMBLY PROCEDURE.....	4.2
REASSEMBLY PROCEDURE.....	4.3
INTERCHANGEABILITY.....	4.4
ACCESSORIES.....	4.4
EXPLODED VIEW.....	4.5
SPARE PARTS LIST.....	4.6
SECTION 5 - TECHNICAL CHARACTERISTICS	5.1
FUNCTION SPECIFICATIONS.....	5.1
PERFORMANCE SPECIFICATIONS.....	5.1
PHYSICAL SPECIFICATIONS.....	5.1
ORDERING CODE.....	5.2
APPENDIX A - CERTIFICATIONS INFORMATION	A.1
EUROPEAN DIRECTIVE INFORMATION.....	A.1
HAZARDOUS LOCATIONS GENERAL INFORMATION.....	A.1
HAZARDOUS LOCATIONS APPROVALS.....	A.2
IDENTIFICATION PLATE.....	A.5
CONTROL DRAWING.....	A.7
APPENDIX B – SRF – SERVICE REQUEST FORM	B.1
RETURNING MATERIALS.....	B.2

Installation Flowchart



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 **TP301** mounting depends on the type movement, linear or rotary. Two brackets are required for mounting, one for the magnet and the other for the transmitter itself.

NOTE

Make sure that arrow engraved on the magnet coincides with the arrow engraved on the Position Transmitter when the system is in mid travel. When mounting the the Position Transmitter, consider that:

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

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

IMPORTANT

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

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

Rotary Movement

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

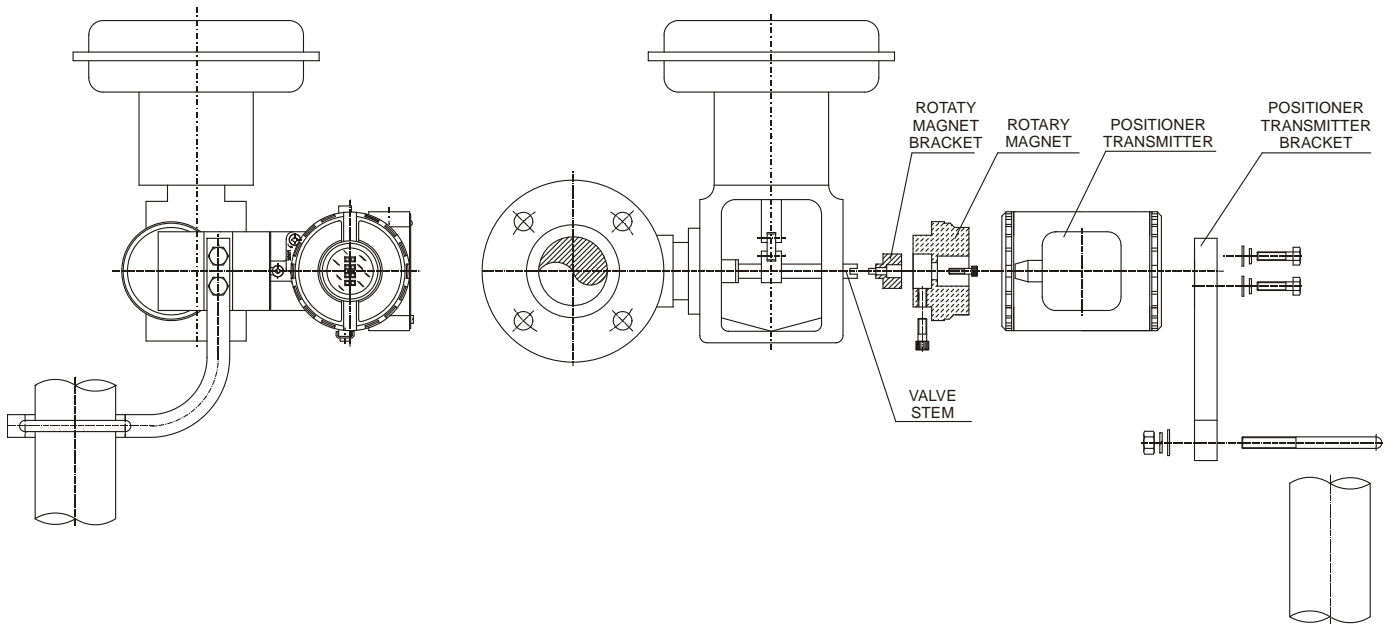


Figure 1.1 - Transmitter on a Rotary Actuator

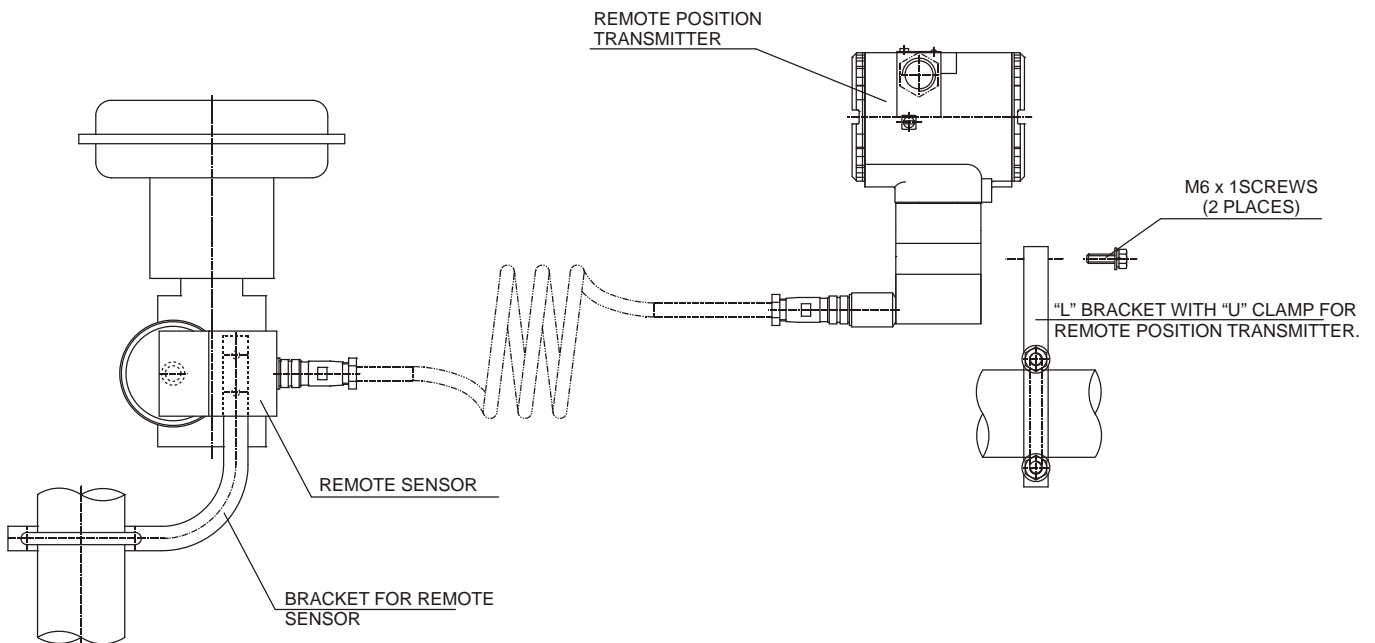


Figure 1.2 – Position Transmitter on Rotary Actuator with Remote Position Sensor

Linear Movement

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

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

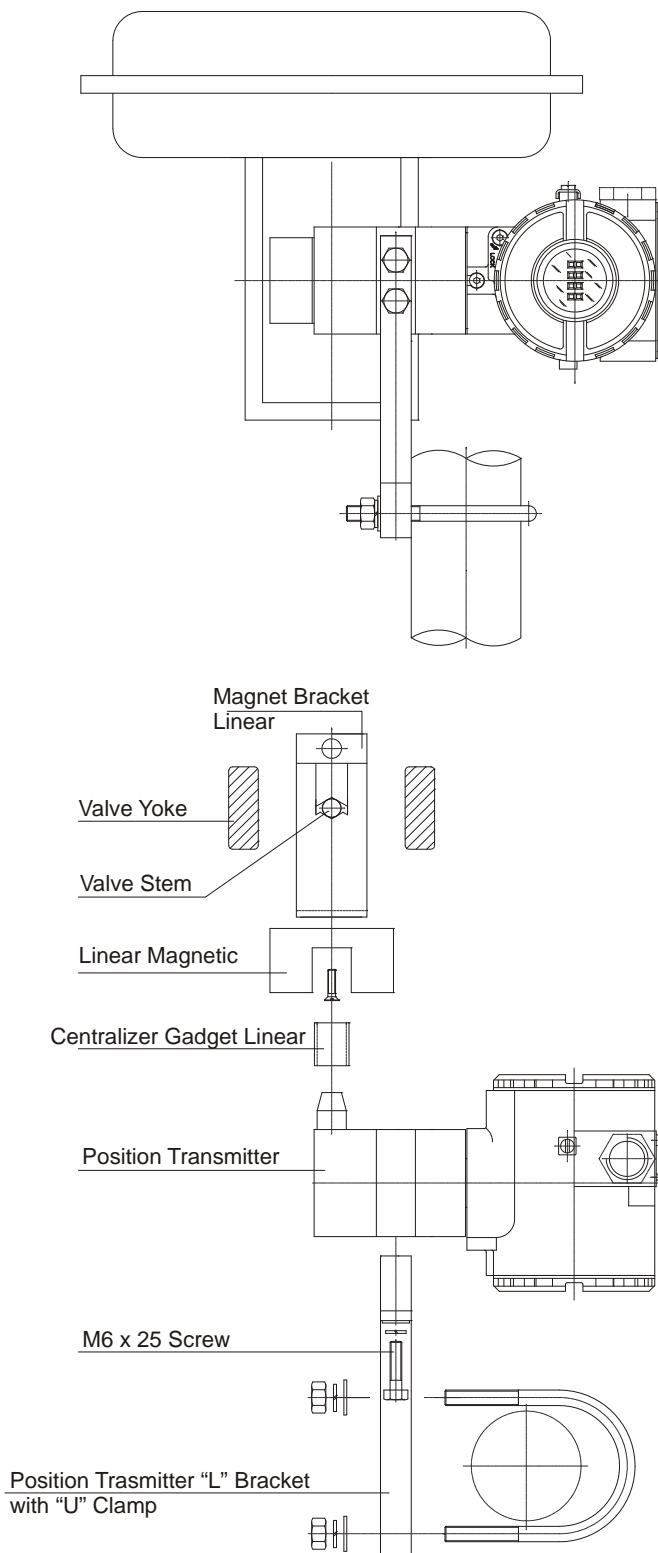


Figure 1.3 - Transmitter on a Linear Actuator

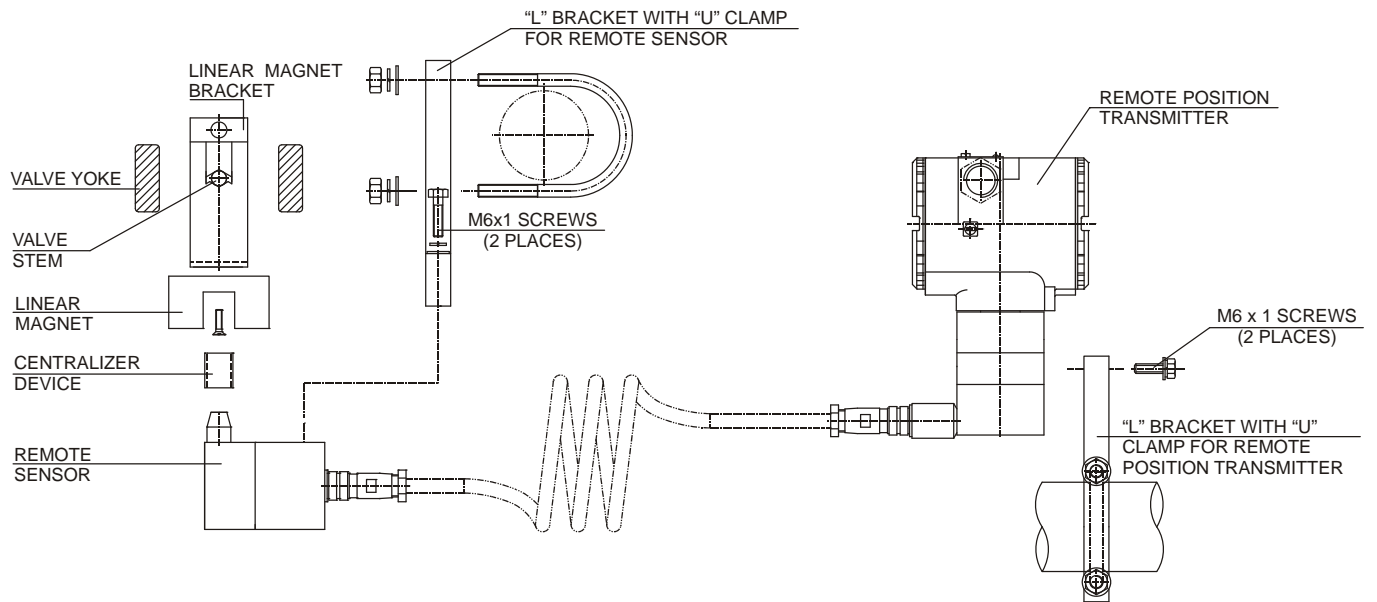
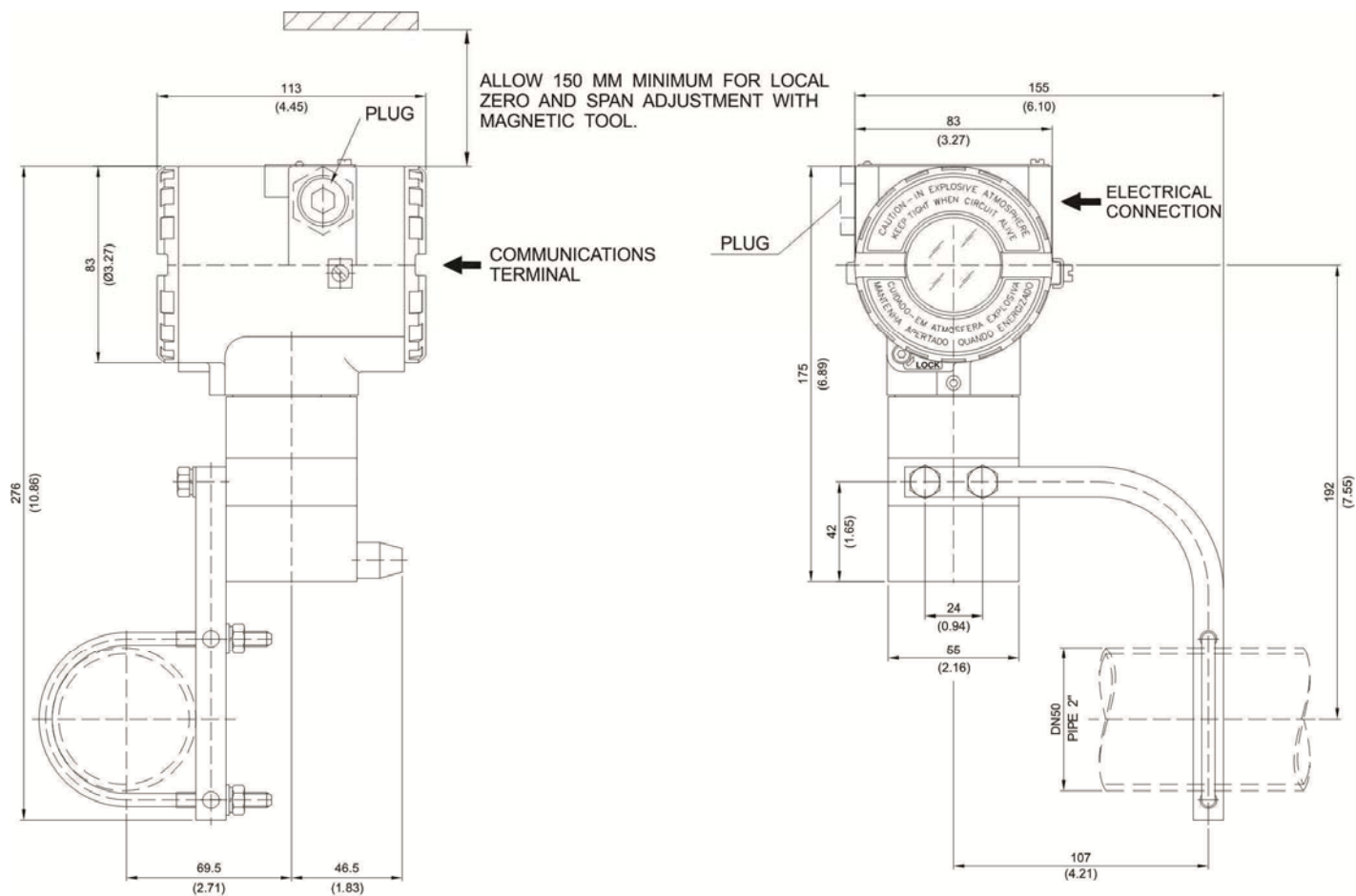
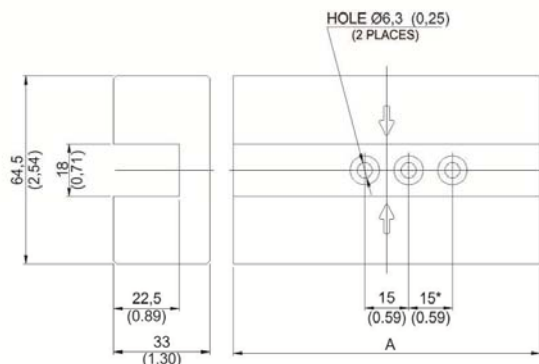


Figure 1.4 – Position Transmitter on Linear Actuator with Remote Position Sensor

See below the **TP301**, 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

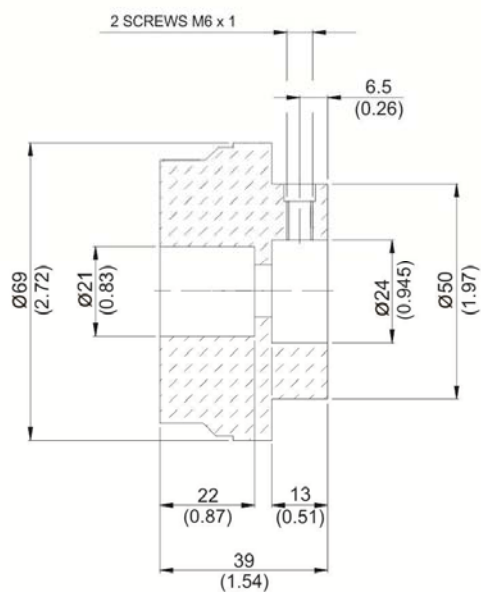


Figure 1.5 – TP301 Dimensional Drawing / Magnets Dimensional Drawing

REMOTE SENSOR

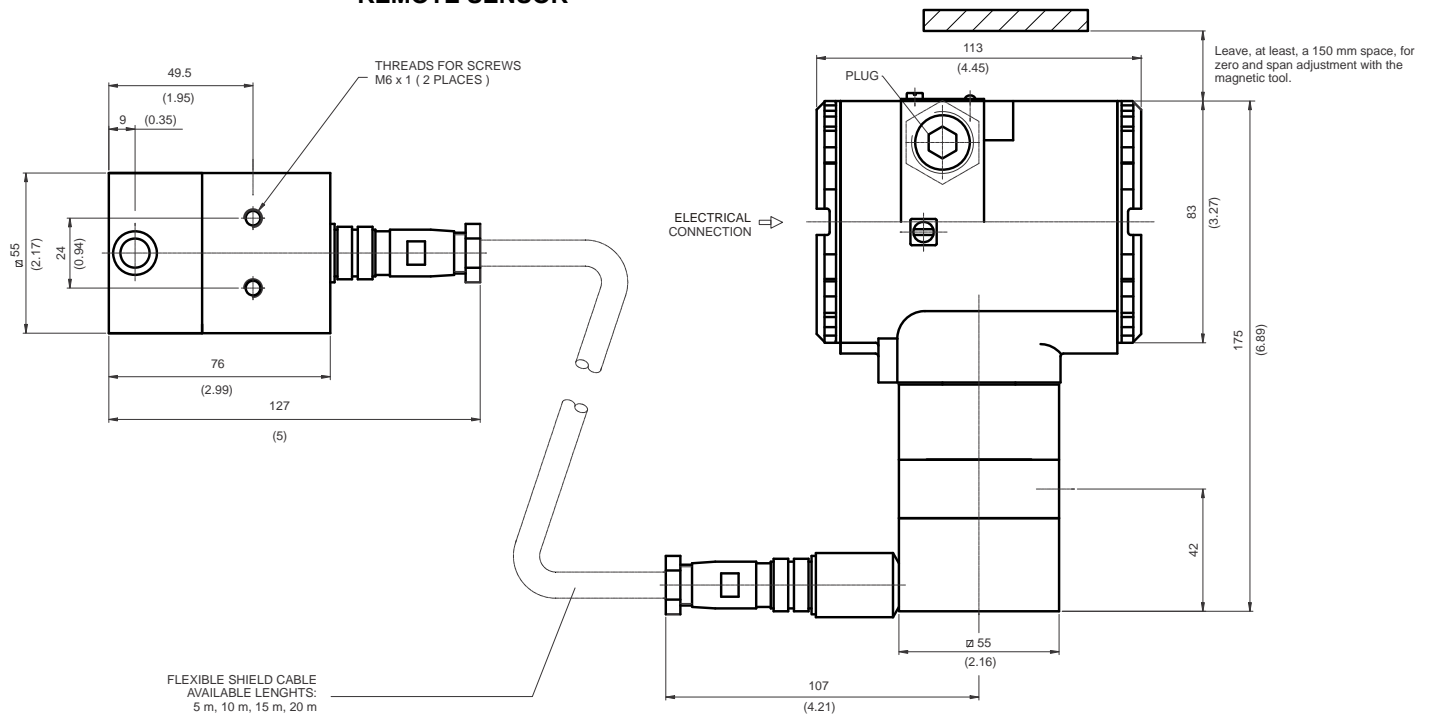
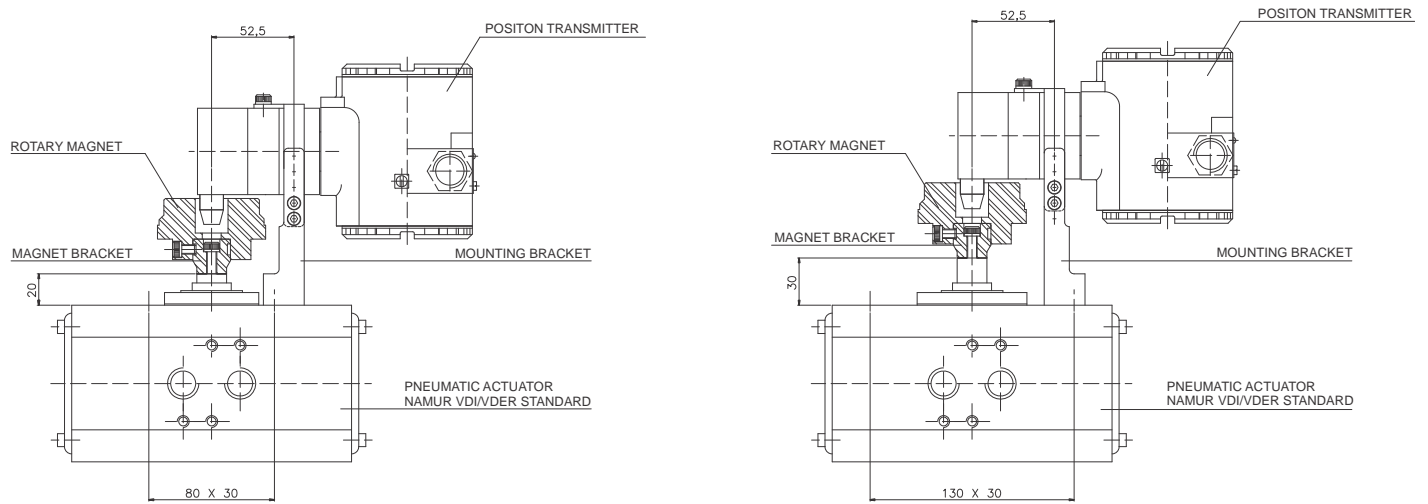


Figure 1.5.a – Remote Sensor Dimensional Drawing

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.

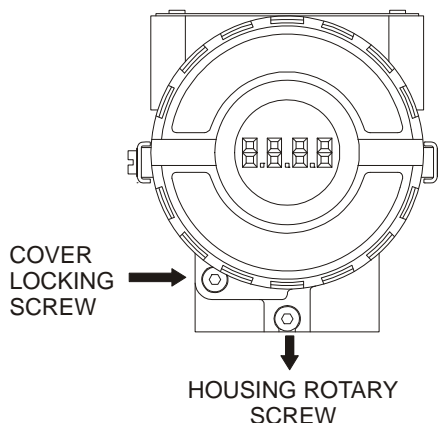


Figure 1.6 - Cover Locking and Housing Rotation Set Screw

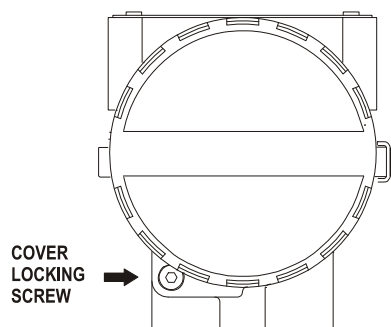


Figure 1.7 - Cover Locking Screw

Electric Wiring

The digital display also rotates for better reading. It is necessary to release the electronic house front cover (release the cover locking screw), release the electronic circuit board screws and choose one of the 90° different positions. Reassembly the whole set. To access the terminal block for electronic connections, remove the cover locking screw.

The terminal block accepts forks or eye-type connectors. For convenience there are two ground terminals: one inside the cover and one external, located close to the conduit entries.

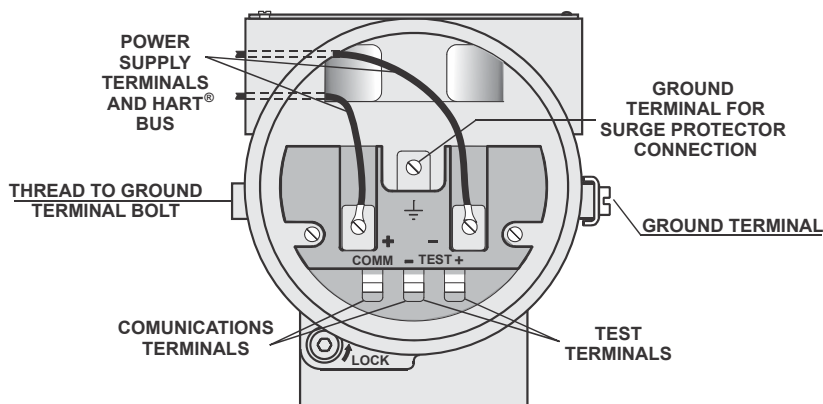


Figure 1.8 - Wiring Block

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 **TP301** is protected against reverse polarity, and supports \square 50 mA without damage.

The following figures show the possibilities for **TP301** connections.

ATTENTION

For proper operation, the configurator requires a minimum load of 250 Ohm between it and the power supply.

The configurator can be connected to the transmitter communication terminals or at any point of the signal line by using the interface IF3 with alligator clips.

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

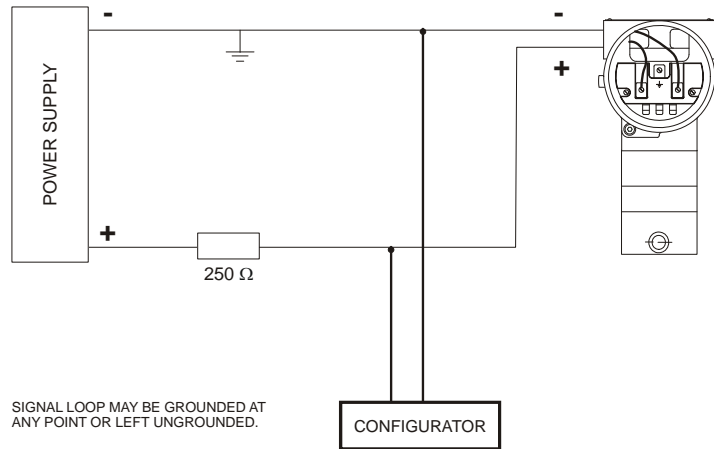
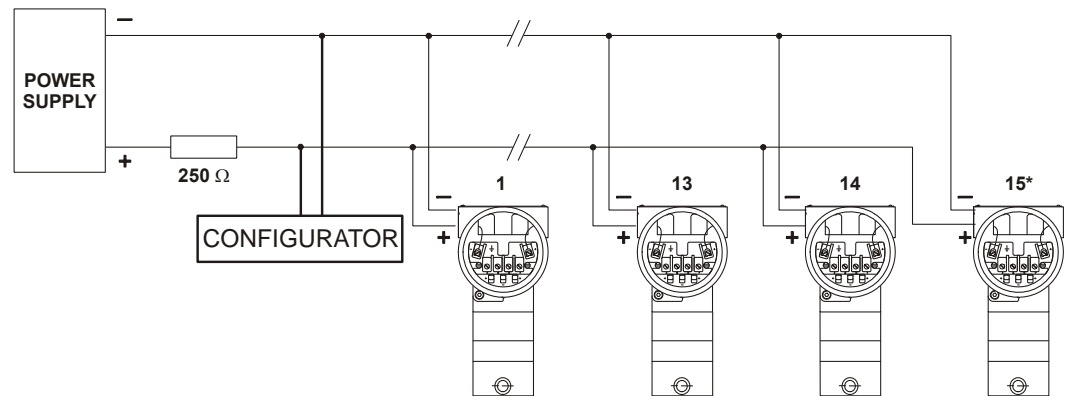


Figure 1.9 - TP301 Wiring Diagram

The Figure 1.10 shows a typical **TP301** connection in multidrop configuration. Such configurations allow a maximum of 15 transmitters on the same line connected in parallel. Take care to the power supply capacity as well, when many transmitters are connected on the same line.



* MAXIMUM NUMBER WITHOUT CONSIDERING INTRINSIC SAFETY

Figure 1.10 - TP301 Wiring Diagram for Multidrop Configuration

NOTE

Make sure that the transmitter is operating within the operating area as shown on the load curve. Communication requires a minimum load of 250 Ohm.

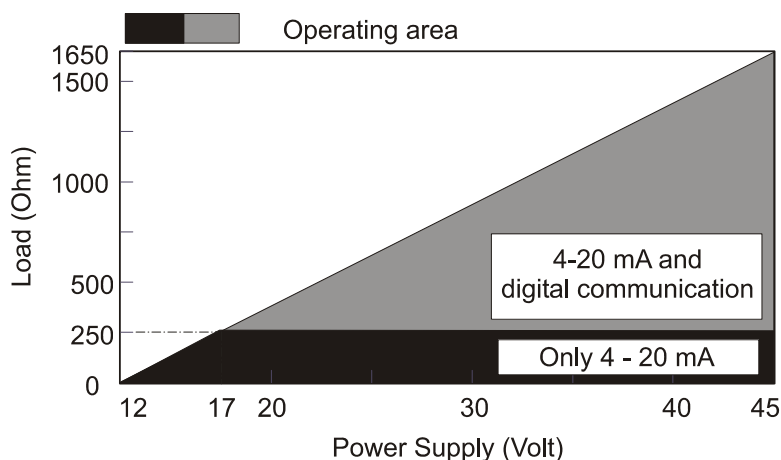


Figure 1.11 - Load Curve

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

NOTE
This TP301 certification is valid for stainless steel transmitter manufactured, approved with the certification IP66/68 W. All transmitter external material, such as plugs, connections etc., should be made in stainless steel. The electrical connection with 1/2” – 14NPT thread must use a sealant. A non-hardening silicone sealant is recommended. The instrument modification or replacement parts supplied by other than authorized representative of Smar is prohibited and will void the certification.

Rotary and Linear Magnet

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

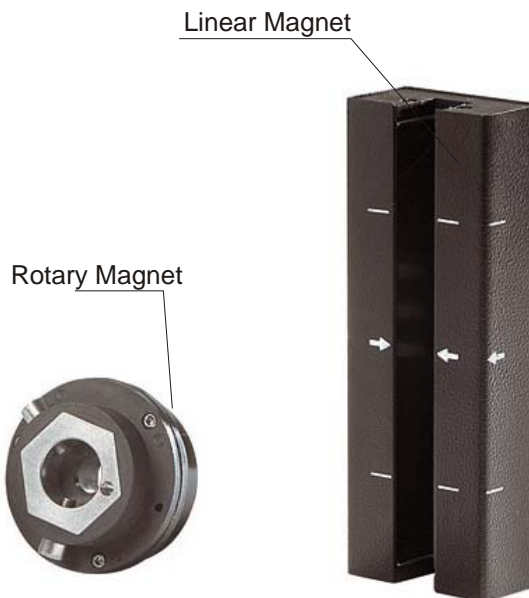


Figure 1.12 – Linear and Rotary Magnet Models

Remote Position Sensor

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

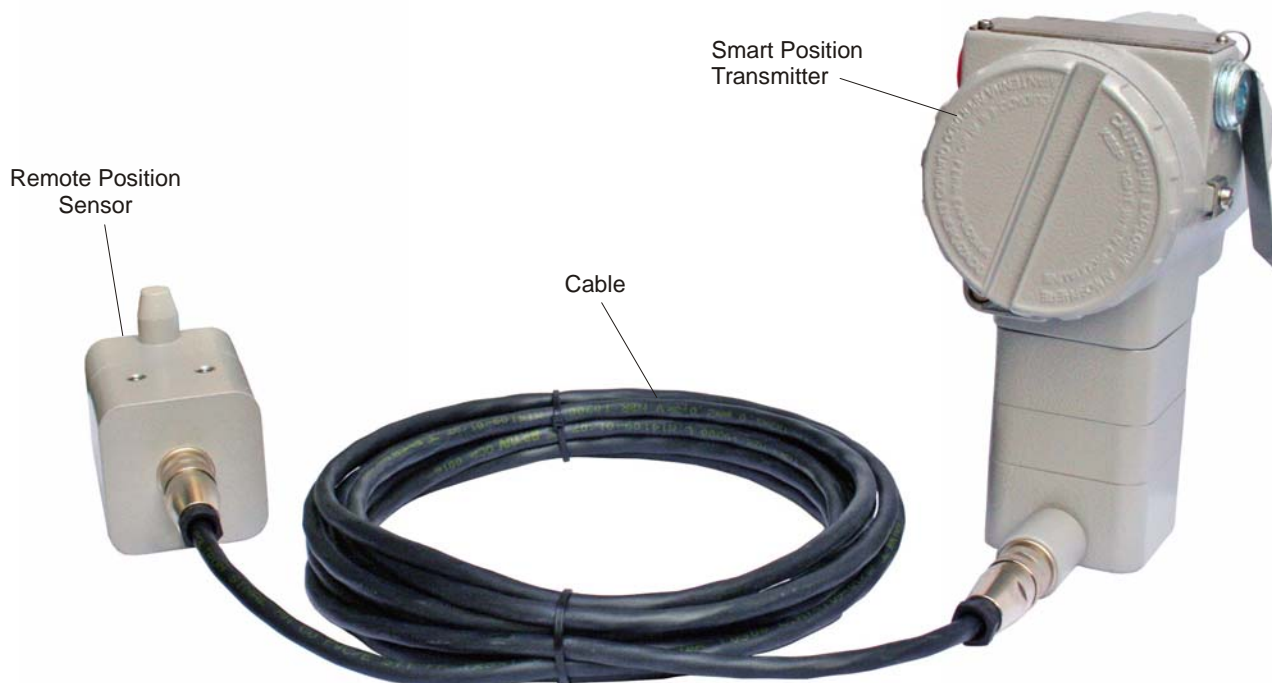


Figure 1.13 - Remote Position Sensor

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

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

See the installation procedure:



Figure 1.14 - Connecting the Cable to the Remote Position Sensor



Figure 1.15 - Connecting the Cable to the Position Transmitter

Installation in Hazardous Areas

WARNING

Explosions could result in death or serious injury, besides financial damage. Installation of this transmitter in explosive areas must be carried out in accordance with the local standards and the protection type adopted. Before continuing the installation make sure the certificate parameters are 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 - Position 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

The function of each block in the block diagram is described below.

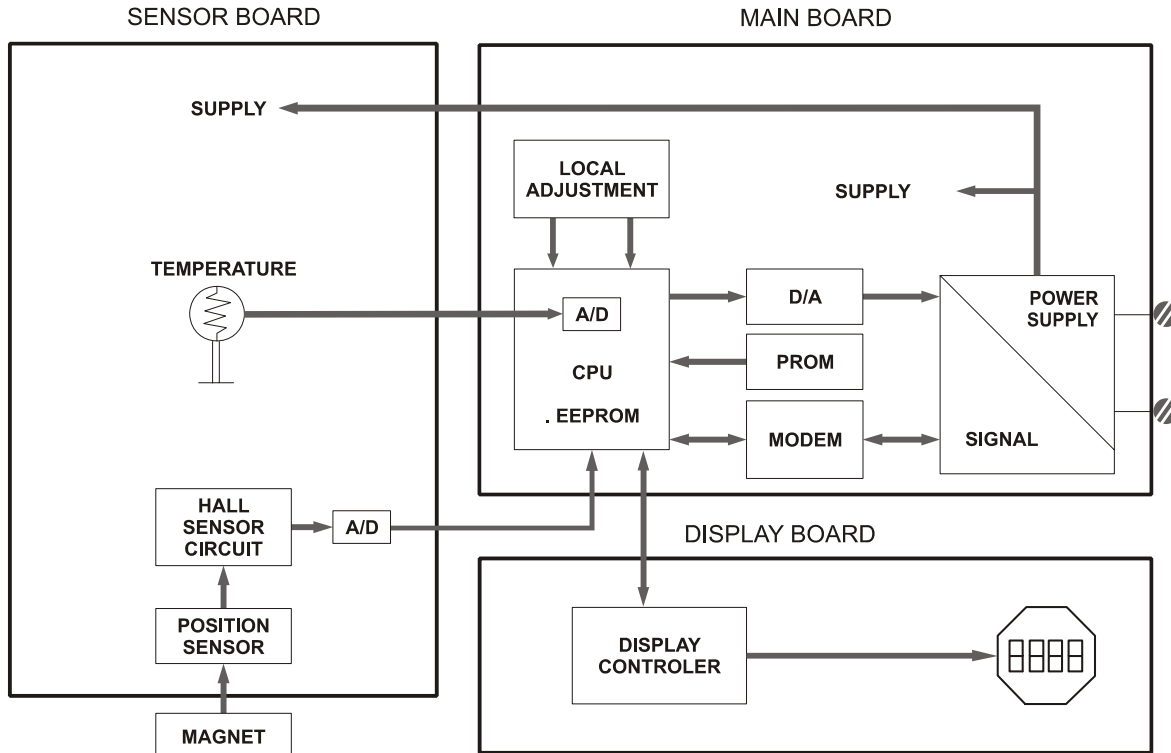


Figure 2.1 - TP301 Block Diagram

Hall Effect Position Sensor

The magnet, installed in the instrument to the position to be measured, moves the of the instrument movement accordingly. The hall effect position sensor detects the movement and produces a small voltage change variation proportional to the magnetic field variation due to the magnet movement.

Temperature Sensor

The sensor circuit of hall processes that tension variation, generating a signal for the converter A/D. The converter A/D produces a set of signals for the transmitter CPU (Central Processing Unit).

Modem HART

Modulates and demodulates communication signals superimposed onto current line. A "1" is represented by 1200 Hz and a "0" by 2200 Hz. The frequency signal is symmetrical and does not affect the DC level of the of the 4 - 20 mA signal.

CPU Central Processing Unit, RAM, PROM and EEPROM

The CPU is the transmitter intelligent part, being responsible for the data management and block execution, operation 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 non-volatile EEPROM where key data is stored. Examples of such data are the calibration and TP301 configuration.

Power Supply

The transmitter is powered with 12 to 45 Vdc using the signal line (2-wire system). The transmitter quiescent consumption is 3.6 mA; during operation, consumption may be as high as 21 mA, depending on the measurement and sensor status. If configured for low signal failure, the TP301 shows 3.6 mA indication if configured for high signal failure, it shows 21 mA indication; 3.8 mA in the case of low saturation; 20.5 mA in the case of high saturation and measurements proportional to the range position between 4 mA and 20 mA. 4 mA corresponds to 0% of the working range and 20 mA to 100 % of the range.

Display Controller

Receives data from the CPU and drives the liquid crystal display (LCD).

Local Adjustment

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

Local Indicator

The local indicator is used for signaling and operation in local adjustment. During normal operation, the TP301 remains in the monitoring mode and the display indicates the valve position, either as a percentage or as a current readout, according to the end-user configuration. The magnetic tool activates the local programming mode, by inserting it in orifice Z on the electronic housing.

The possible configuration and monitoring operation are shown on figure 2.2. When first powered, the TP301 initializes, by showing model TP301 and its software version (X.XX) on the display.

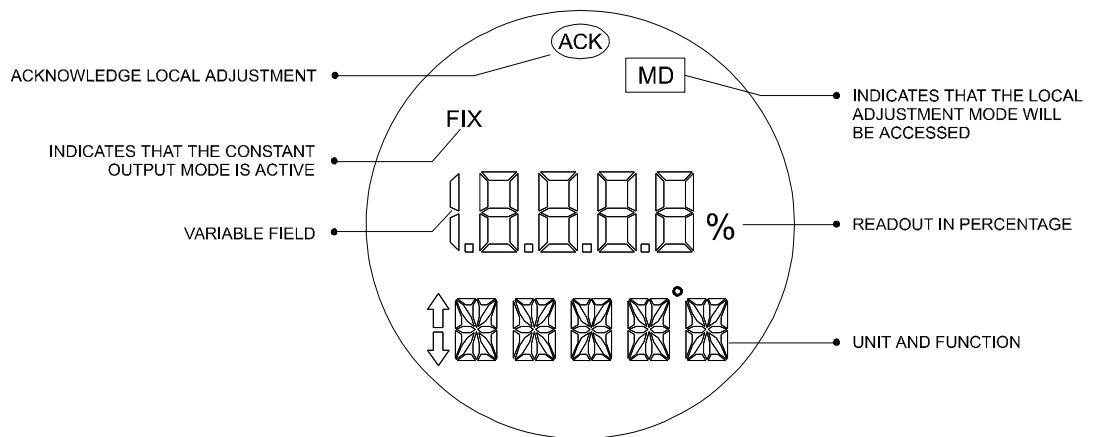


Figure 2.2 - Local Indicator

Monitoring

During normal operation, the TP301 remains in the monitoring mode. The figure 2.3 shows the positioning on the display. The display simultaneously shows the readout and other information chosen.

Normal displaying is interrupted when the magnetic tool is placed in orifice Z (Local Adjustment), starting the programming and local adjustment mode. The figure 3.1 shows the result of tool insertion in orifices Z and S, which inform, respectively, movement and actuation of the selected options.

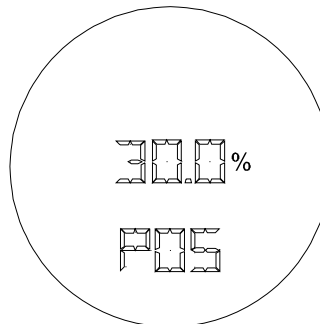


Figure 2.3 – Typical Indicator

CONFIGURATION

The **TP301** is configured via Local Adjust or configurators with digital communication (HART® Protocol). It is also possible to configure the **TP301** via the CONF401 configuration tool or any FDT/DTM software application, both for desk or laptop.

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. See Figure 3.2.

There are two orifices on the position transmitter, under its nameplate, identified by S and Z respectively, which provide access to two magnetic switches actuated by means of a magnetic tool.

NOTE

In this section the "magnetic tool" will be referred to as "TOOL", and the orifices identified by "S" and "Z" will be "S" orifice and "Z" orifice, respectively.

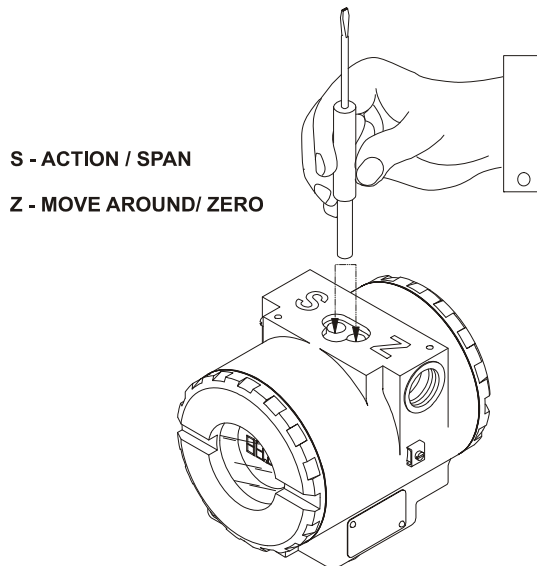


Figure 3.1 - Orifices of Local Adjustment

The table below shows the results of actions on "Z" and "S" on the **TP301**.

ORIFICE	ACTION
Z	Browsing the programming tree function.
S	Selects the displayed function.

The digital display is necessary for local adjustment programming.

Jumper Connection

Simple Local adjustment - W2 Jumper connected in SI

If the W2 jumper is connected in SI (see Figure 3.2), simple local adjustment enabled; the calibration can be done at the position of 0% inserting the cable of the tool in the Z orifice and 100% inserting it in the S orifice.

Complete Local adjustment - W2 Jumper Connected in COM

With the jumper connected in COM (see Figure 3.2), complete local adjustment enabled, allowing to change the displayed unit direct or reverse indication and to calibrate the lower position (LOPOS) or the upper position (UPPOS).

NOTE

After configuring these parameters, we recommend to leave the W1 jumper in OFF (disabled) to avoid accidental mis-configuration.

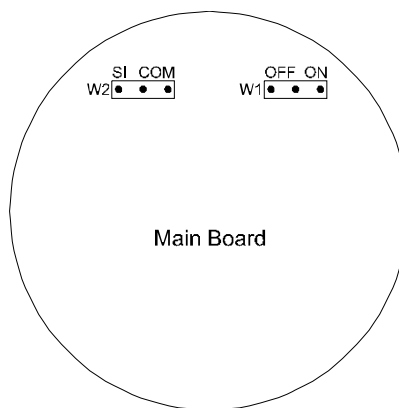


Figure 3.2 - W2 and W1 Jumpers

Local Adjust

Local Configuration Tree

The Local Adjustment Configuration Tree, as per Figure 3.3, shows possesses the available functions in the equipment.

Step 1

To configure the functions it is enough to maintain the magnetic tool in Z; in that way it will browse all the available functions. See the available functions in the figure 3.3.

Step 2

When the indicator shows the function the user wants to change, remove the tool and insert it in the orifice S. If there are more options on this particular function, just keep the magnetic tool in that orifice, to browse the functions submenus.

Step 3

To select an option of this submenu, remove the magnetic tool and to insert it again in the orifice Z.

To act in other functions wait until the display shows the main tree branch and remove the tool to exit the Local Adjustment.

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..

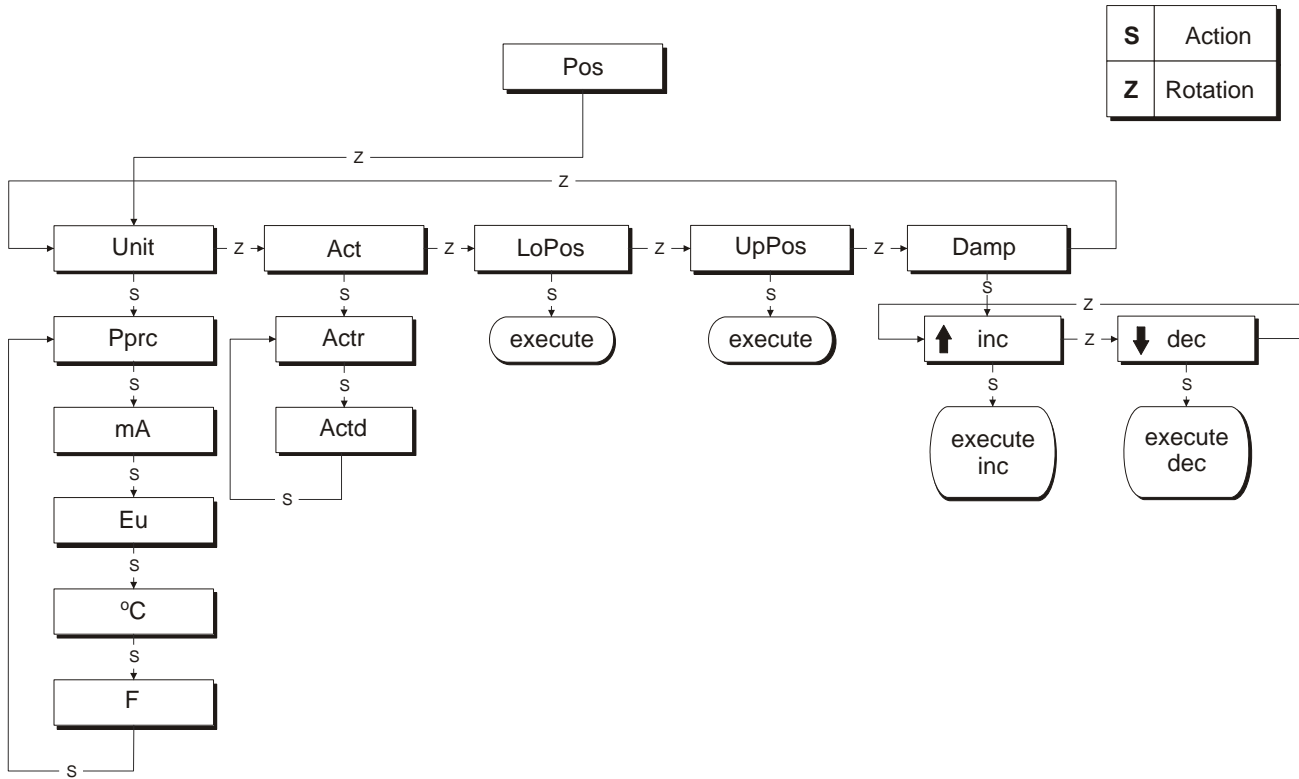


Figure 3.3 – Local Adjustment Configuration Tree

Description of the Parameters of the Local Adjustment Configuration Tree

POS – Position in Percentage

UNIT

Engineering Unit or Percentage.

Pprc

Position in Percentage.

mA (Mileampere)

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.

NOTE

Every parameter configuration shall be performed judiciously, since it writes the configuration parameters on permanent basis and does not ask for confirmation by the user. Once it is performed it is assumed to be the desired configuration.

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.

See the steps:

Step 1

Place the magnet at the lower point and insert the magnet tool in the Z orifice.

Step 2

To adjust the upper value, place the magnet in the upper point and insert the tool in the S orifice.

After this, move the device to the upper and lower position and check the measurement on the display.

Calibration for the complete local adjustment

When the complete local adjustment is enabled the can be configured,

- the Display Indication in:
 - Position in % (Perc);
 - Current in mA (mA);
 - Temperature in °C (C);
 - Temperature in F (F).
- the indication Direct or Reverse;
- the Lower and Upper Position.

NOTE

To change from percentage indication (factory default) to any available engineering units, refer to the configuration through configurators (see the programming tree at the configurator manual).

Configuration via Configurators

TP301 can be configured through the manual portable configurator portable manual based on PalmOS platform. Besides, the **TP301** has connectivity with FDT/DTM, CONF401 and DDCON configuration application for desk and laptop.

NOTE

For detailed information on how to install and operate the configurations softwares, please consult www.smar.com for downloading the current instructions manuals.

- **Configuration via manual configurator**

See below the programming tree for the portable configurator based on PalmOS platform.

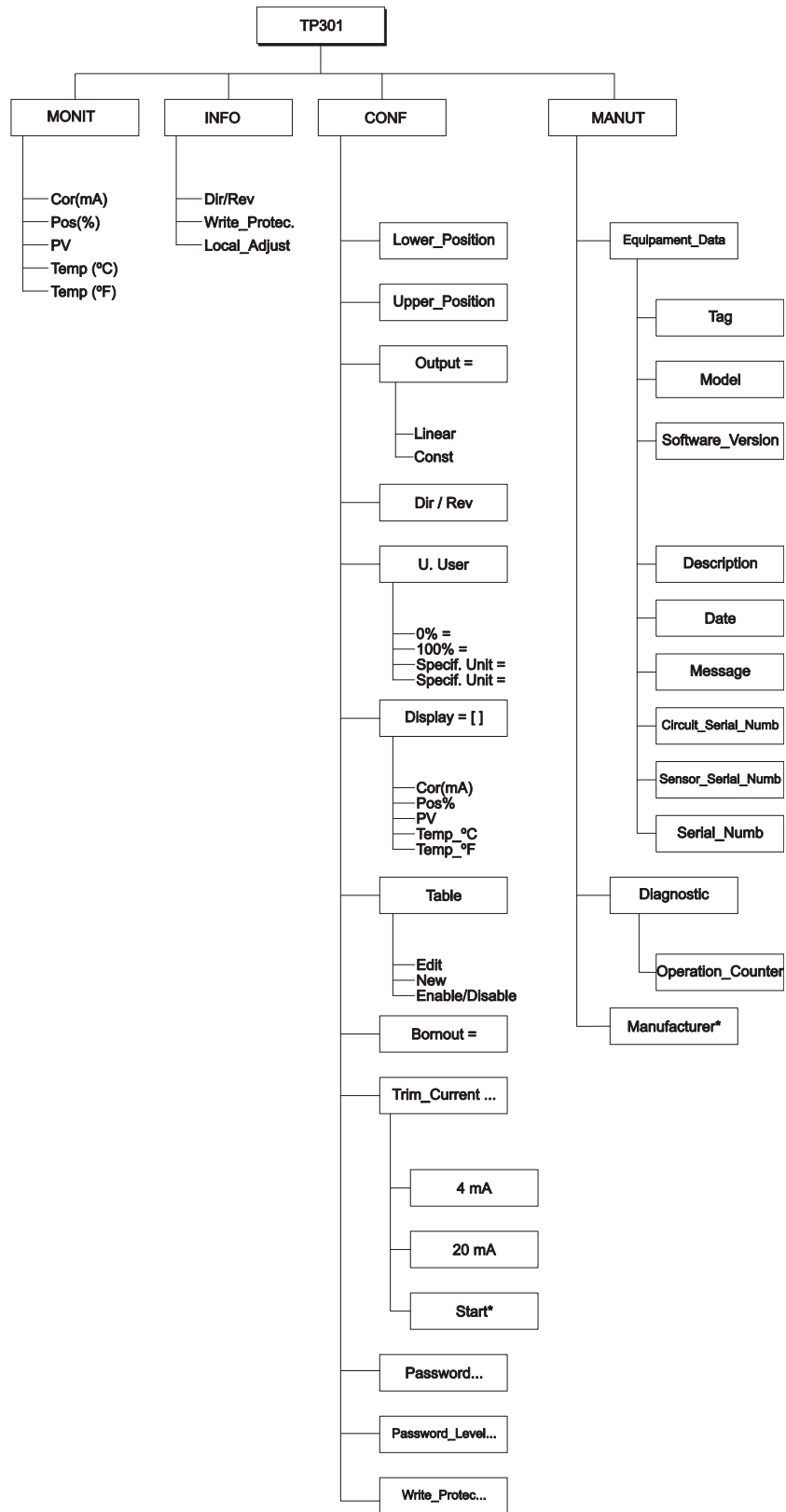


Figure 3.4 – TP301 programming tree for the portable configurator based on PalmOS platform

TABLE OF POINTS - LINEARIZATION

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

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

Table function (Linearization)

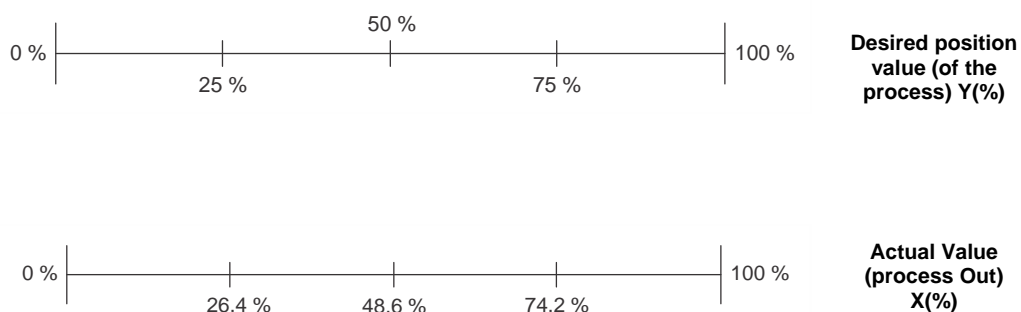
Depending on the application and according with the process, the transmitter output or PV is shown in one linear characteristic curve (position, level, opening etc.). TP also has the option for adjust this curve of linear output, to that the value in percentage can be linearized, you have to uses a table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

To configure the feature table:

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

Position Graphic of the Magnet

Exemple:



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

Figure 3.5 - Position Graphic of the Magnet

- **Applications with base in FDT/DTM (Field Device Tool/Device Type Manager)**

The TP301 comes with the factory default connectivity with FDT/DTM systems.

The FDT (Field Device Tool) it is a digital communication technology between field devices and systems. It is a non proprietary communication protocol (open) and its use has been growing quickly, as a result of the user's search for an independence in relation to the suppliers.

The DTM (Device Type Manager) it is an application based on the DD - device description, and it is responsible to link all the device information for instance the TP301, with the FDT. This

system is interactive, in other words, not only it reads the **TP301** parameters, but also it "writes" information into the **TP301**.

To configure the **TP301** with the FDT/DTM tool, please refer to the TP301DTM manual - Device Type Manager downloadable from www.smar.com. The Figure 3.5 is an example of one of the available screens for the **TP301**.

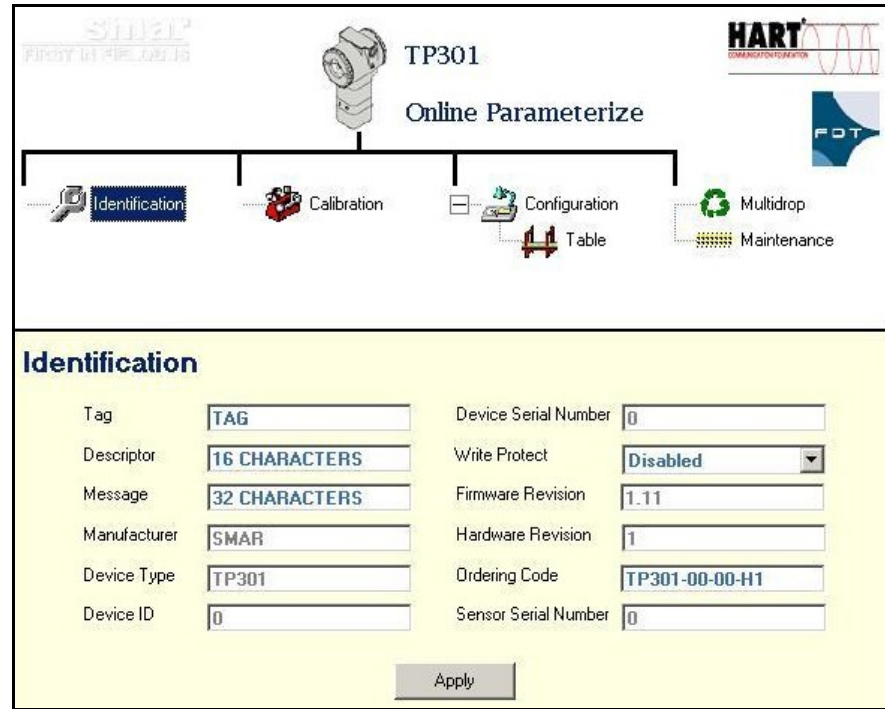


Figure 3.5 – TP301DTM Screen “Online Parameterize”

- CONF401

The CONF401 is a configurator HART for PC allowing easy configuration and field devices monitoring. It also analyzes device data and modify its performance. The graphic interface is intuitive and easy to learn and to use, doing with that is not necessary the use.

CONF401 is compatible with Windows 95/98/ME/NT/2000 and XP.

CONF401 is compatible with the interfaces: HI311, HI321, HF1400, DDCON100 and any interface HART[®] based on the protocol RS232 <->HART.

Minimum configuration:

1. Pentium 350 MHz processor;
2. Windows 95/98/ME/NT/2000/XP operating system;
3. 128 MB RAM;
4. At least a door serial (HI311) or it carries USB (HI321, HF1400 or DDCON100) available.

To configure see the Manual of the User of CONF401 - CONFIGURADOR HART[®], in the site <http://www.smar.com> or <http://www.smarresearch.com>.

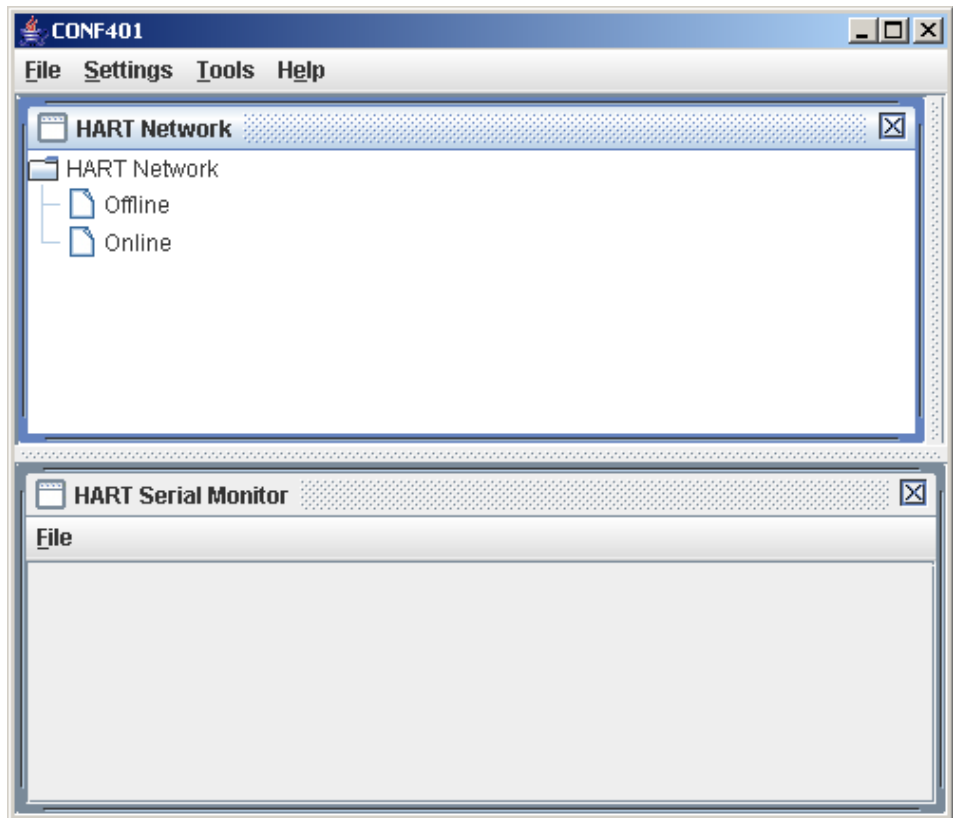


Figure 3.6 – CONF401 Screen

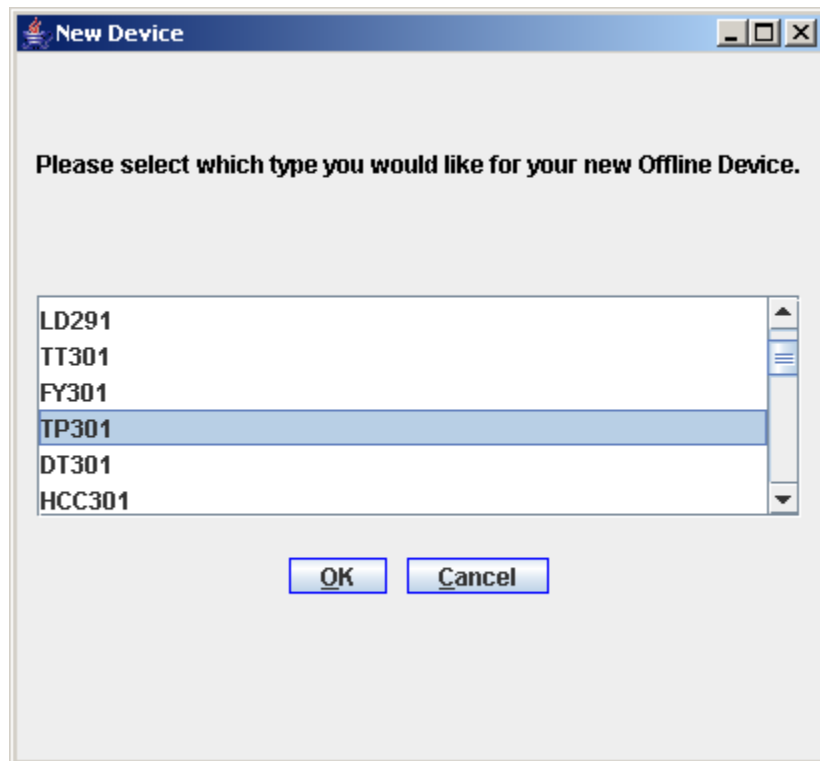


Figure 3.7 – New Device

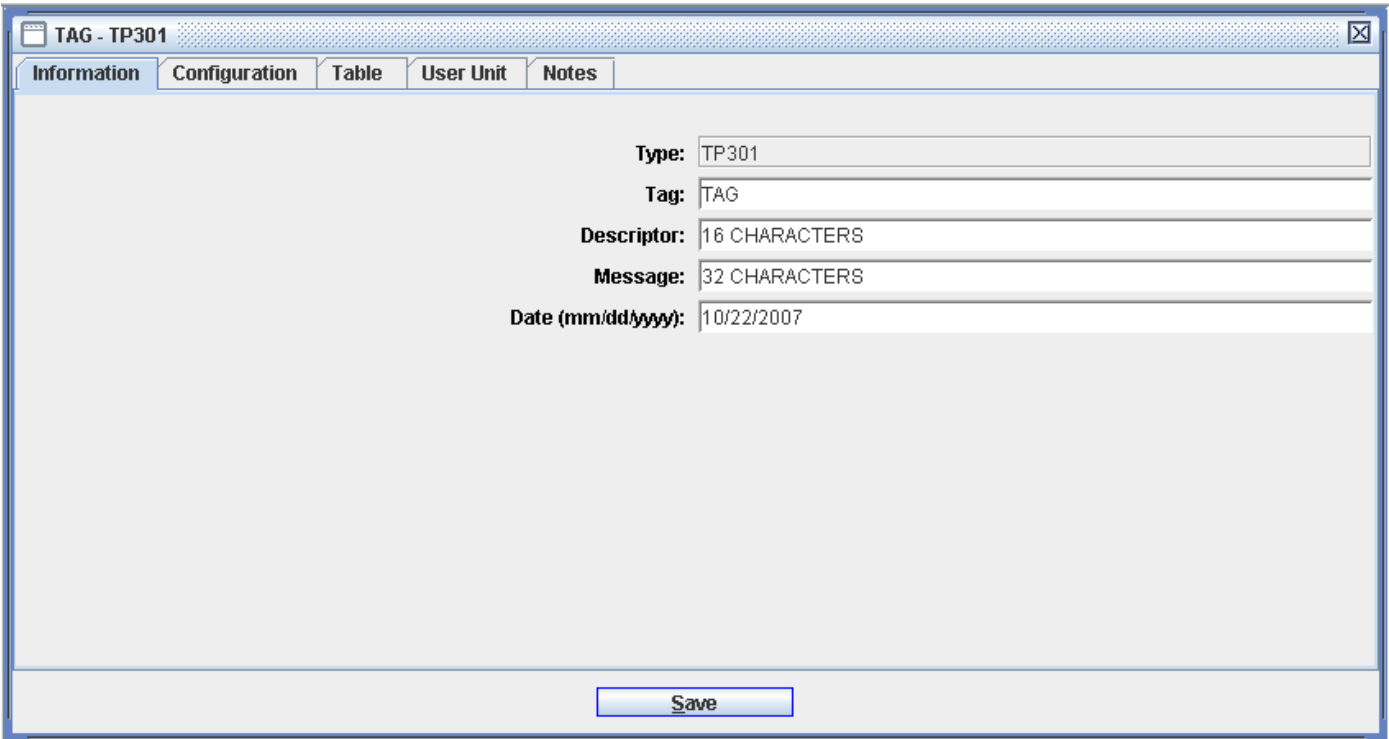


Figure 3.8 – TP301 Configuration Screen

- **DDCON 100 - DDL Based HART Configurator**
To configure see the manual in the site: <http://www.smarresearch.com>.



Figure 3.9 – DDCON 100 - DDL Based HART Configurator

FAIL SAFE (Alarm Selection)

The Fail Safe parameter is set by using the configurators only. It allows to the user to configure the TP301 to alarm when the current is as lows as 3.6 mA or as high as 21 mA.

Section 4

MAINTENANCE PROCEDURES

General

Smar **TP301** Position Transmitters are extensively tested and inspected before delivered to the end user. Nevertheless, during their design and development, Smar considered 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, 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

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.

Diagnostic with Configurator

In case any malfunction related to the transmitter output, investigation may be carried out with the configurator, as long as the transmitter is powered, the communication and the processing unit are operating normally.

Connect the configurator to the transmitter according to the wiring diagram shown on Section 1.

ERROR MESSAGES

When communicating using the configurator the user will be informed about any problem found by the transmitter self diagnostics.

The messages always alternate with the information on the top line. The table below lists the error messages, potential source of malfunction and more details on corrective action.

ERROR MESSAGES	POTENTIAL SOURCE OF PROBLEM
PARITY ERROR	<ul style="list-style-type: none">• The line resistance is not according to technical characteristics.• Excessive noise or ripple.• Low level signal.• Interface damaged.• Power supply or battery voltage of the configurator lower than 9 V.
OVERRUN ERROR	
CHECK SUM ERROR	
FRAMING ERROR	
NO RESPONSE	<ul style="list-style-type: none">• Transmitter line resistance is not according to technical characteristics.• Transmitter not powered.• Transmitter not connected or damaged.• Transmitter configured in multidrop mode being accessed by “ON LINE SINGLE UNIT”.• Transmitter reversely powered (Polarity is reversed).• Interface damaged.• Power supply or battery voltage of the configurator lower than 9 V.
LINE BUSY	<ul style="list-style-type: none">• Other device using the line.
CMD NOT IMPLEMENTED	<ul style="list-style-type: none">• Software version not compatible between configurator and position transmitter.
DEVICE BUSY	<ul style="list-style-type: none">• Transmitter carrying out an important task, e.g., local adjustment.

ERROR MESSAGES	POTENTIAL SOURCE OF PROBLEM
POSITION TRANSMITTER MALFUNCTION	<ul style="list-style-type: none"> • Transducer disconnected. • Transducer failure.
COLD START	<ul style="list-style-type: none"> • Start-up or reset due to power supply failure.
OUTPUT FIXED	<ul style="list-style-type: none"> • Operating in local mode with fix position. • Connected in burnout.
OUTPUT SATURATED	<ul style="list-style-type: none"> • Position out of calibrated span or in fail-safe (Output current in 3.9 or 21.0 mA).
SV OUT OF LIMITS	<ul style="list-style-type: none"> • Temperature out of operating limits. • Temperature sensor damaged.
PV OUT OF LIMITS	<ul style="list-style-type: none"> • Position out of operation transmitter range. • Transducer damaged or transducer not connected. • Position transmitter with error configuration.
LOWER RANGE VALUE TOO HIGH	<ul style="list-style-type: none"> • The lower range value > (Upper limit of range - minimum span).
LOWER RANGE VALUE TOO LOW	<ul style="list-style-type: none"> • The lower range value < (Upper limit of range).
UPPER RANGE VALUE TOO HIGH	<ul style="list-style-type: none"> • The upper range value > 110%. (Upper limit of range).
UPPER RANGE VALUE TOO LOW	<ul style="list-style-type: none"> • The upper range value < -10%. (Lower limit of range).
UPPER AND LOWER RANGE VALUES OUT OF LIMITS	<ul style="list-style-type: none"> • Both the upper and lower points were outside the transmitter range limit.
SPAN TOO SMALL	<ul style="list-style-type: none"> • The difference, between the upper and lower points, is less than the allowed by the transmitter.
ACTUAL POSITION	<ul style="list-style-type: none"> • The actual position is above of the upper range limit.
ACTUAL POSITION	<ul style="list-style-type: none"> • The actual position is below of the lower range limit.
PASSED PARAMETER TOO LARGE	<ul style="list-style-type: none"> • Parameter above operating limits.
PASSED PARAMETER TOO SMALL	<ul style="list-style-type: none"> • Parameter below operating limits.
CONTROL LOOP SHOULD BE IN MANUAL	<ul style="list-style-type: none"> • Indicates the operation could affect the output.
CONTROL LOOP MAY BE RETURNED TO AUTO	<ul style="list-style-type: none"> • After the operation is completed, you are reminded to return the loop to automatic control.

Table 4.1 - TP301 Diagnostics with Configurator

Diagnostics without Configurator

ERROR MESSAGES

The Table 4.2 presents a list of possible diagnosis for the TP301.

SYMPTOM	CAUSES / SOLUTION
SAT	<p>When the Indicator presents FAIL, the output current 3.6 mA, the default value for FAIL SAFE configuration.</p> <p>If the position may be either below or above the limits. Check if the magnet this installed correctly.</p>
FAIL	<p>The configurator allows the user to configure FAIL, the value of the current, 3.6 mA or 21 mA, it is defined in agreement with FAIL SAFE chosen: Up or Down.</p> <p>Verify electrical connection between the circuit boards.</p>
NO OUTPUT SIGNAL VARIATION	<p>Verify if the Magnet it is not stuck or loosen.</p>

Table 4.2 - TP301 Diagnostics without Configurator

Disassembly Procedure

Refer to TP301 Exploded View figure (Figure 4.3). Make sure to disconnect power supply before disassembling the position transmitter.

NOTE

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

Transducer

To remove the transducer from the electronic housing, disconnect before the electrical connections (in the field terminal side) and the main board.

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

Electronic Circuit

To remove the circuit board **(5)** and indicator **(4)**, first loose the cover locking **(7)** on the side not marked "Field Terminals", then unscrew the cover **(1)**.

WARNING

The 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

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

Reassembly Procedure**WARNING**

Do not assemble the main board with power on.

Transducer

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

Electronic Circuit

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

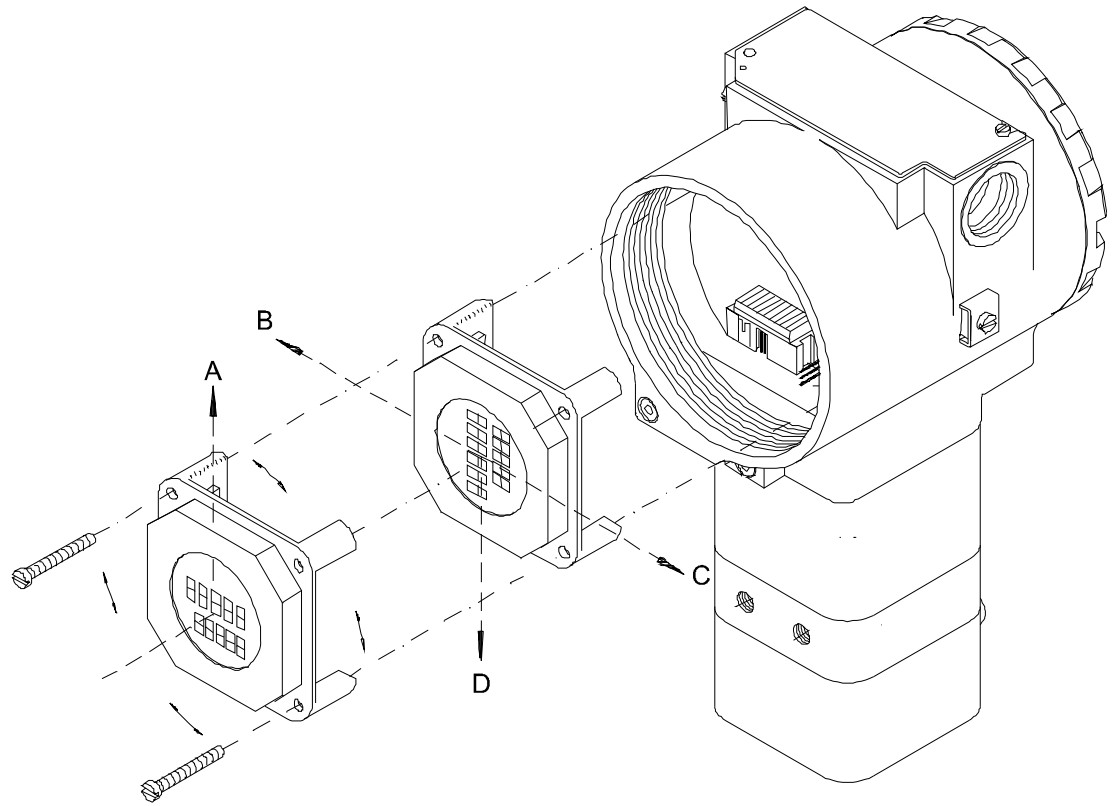


Figure 4.2 – Four Possible Positions for Indicator

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.

Accessories

ACCESSORIES	
ORDERING CODE	DESCRIPTION
SD-1	Magnetic Tool for Local Adjustment.
HPC401*	Configurator in platform PalmOS, included interface, USB cable, initialization and installation software.
400-1176	Teflon guide for linear magnet.
400-1177	Teflon guide for rotary magnet.

(*) For equipment updates and software, just check: <http://www.smarresearch.com>

Exploded View

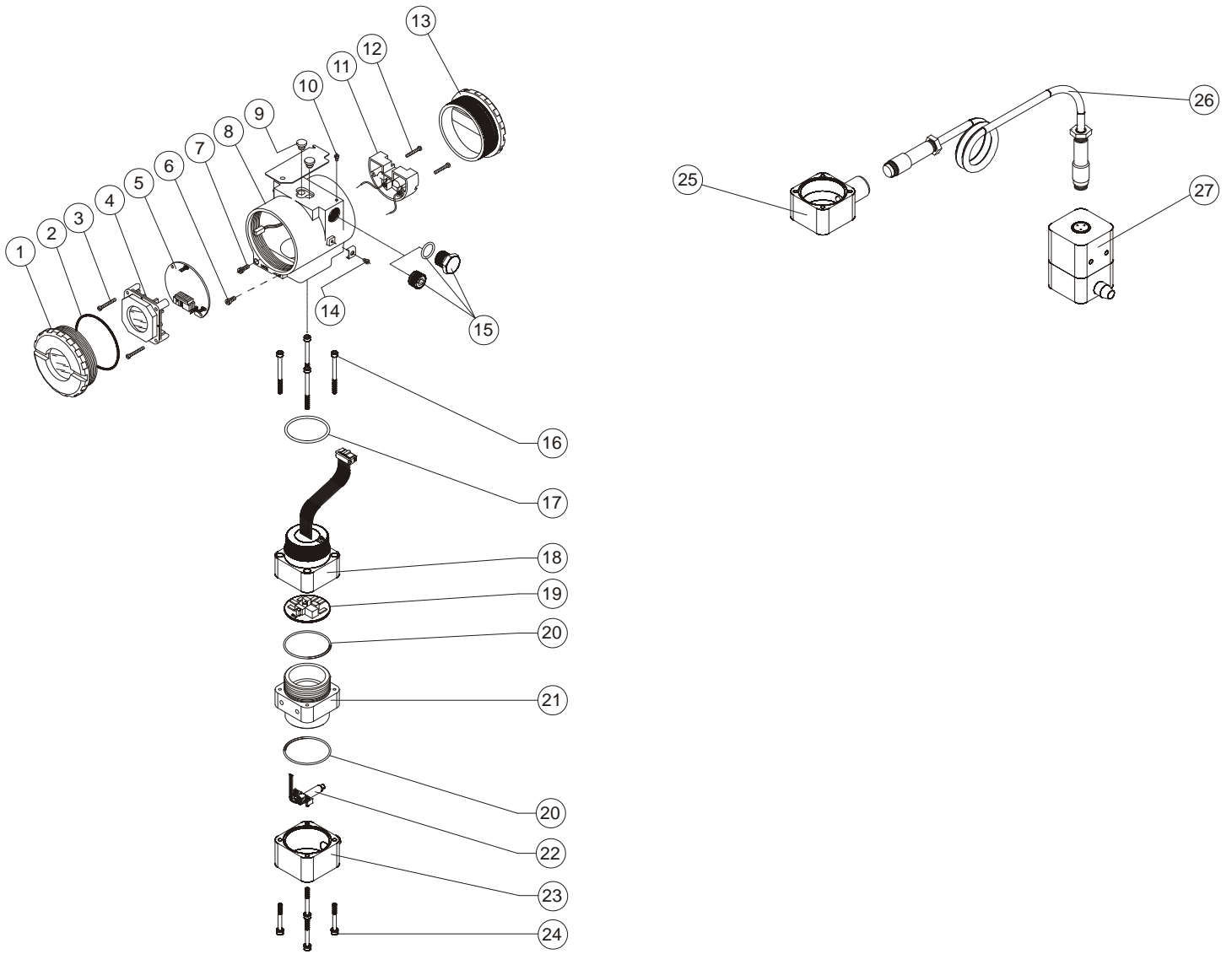


Figure 4.3 - TP301 Exploded View

Spare Parts List

SPARE PARTS LIST				
DESCRIPTION OF PARTS		POSITION	CODE	CATEGORY (NOTE 1)
COVER WITH WINDOW	. Aluminum	1	204-0103	
	. 316 SS	1	204-0106	
COVER O-RING (NOTE 3)	. Buna-N	2	204-0122	B
ALUMINUM HOUSING MAIN BOARD SCREW	. Units with indicator	3	304-0118	
	. Units without indicator	3	304-0117	
STAINLESS STEEL HOUSING MAIN BOARD SCREW	. Units with indicator	3	204-0118	
	. Units without indicator	3	204-0117	
DIGITAL INDICATOR		4	214-0108	
MAIN ELECTRONIC CIRCUIT BOARD		5	400-0098	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 TP301
	COD. Communications Protocol
	H HART & 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	H	*	*	*	*
----------	---	---	---	---	---	---



TYPICAL MODEL NUMBER

* Select item.

Section 5

TECHNICAL CHARACTERISTICS

Function Specifications

Travel	Linear Motion: 3 – 100 mm. Rotary Motion: 30 – 120° rotation angle.
Input Signal	4-20 mA, Two-wire.
Protection against Reverse Polarity	12 to 45 Vdc.
Communication Protocol	Hart® Communication Protocol (Is superimposed on the current signal).
Indicator	LCD indicator (4½-numerical digit and 5- alphanumeric characters).
Hazardous Area Certifications	Explosion-proof and intrinsically safe (ATEX (NEMKO and DEKRA EXAM), FM, CEPEL and CSA). Designed to comply with European regulations ATEX 94/9/EC and LVD 2006/95/EC standards.
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 mA, according to the user's choice.
Turn-on Time	Performs within specifications in less than 5 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	Configuration can be done through digital communication using the Hart® protocol or partially through local adjustment.

Performance Specifications

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

Physical Specifications

Electrical Connection	½ - 14 NPT, PG 13.5, or M20 x 1.5.
Material of Construction	Injected low copper aluminum with polyester painting or 316 stainless steel housing, with Buna-N o-rings on cover (Nema 4X FM, IP65/67 EXAM, IP66/68 CEPEL).
Mounting Bracket	Plated carbon steel with polyester painting or 316 SST.
Identification Plate	316 SST.
Approximate Weights	<ul style="list-style-type: none"> • TP 1.5 kg in Aluminum (without mounting bracket); 3.3 kg in Stainless Steel (without mounting bracket). • Remote sensor: 0.58 kg in Aluminum; 1.5 kg in Stainless Steel. • Cable and remote sensor connectors: Cable 0.045 kg/m; 0.05 kg for each connector.

Ordering Code

MODEL	POSITION TRANSMITTER	
TP301	HART® & 4 to 20 mA	
	COD.	Local Display
	0	Without Local Display
	1	With Local Display
	COD.	Mounting Bracket
	0	Without Bracket
	1	Carbon Steel, "L" + clamp "U" pipe 2". (3)
	2	Stainless Steel, "L" + clamp "U" pipe 2". (3)
	3	Carbon Steel, rotary - VDI / VDE NAMUR
	4	Stainless Steel, rotary - VDI / VDE NAMUR
	7	Carbon Steel, "L" + clamp "U" pipe 2" - (316 SST) accessories. (3)
	COD.	Electrical Connection
	0	1/2" - 14 NPT
	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
	3	1/2" - 14 NPT X 1/2 BSP (316 SST) - with adapter
	A	M20 X 1.5
	B	PG 13.5 DIN
	COD.	Type of Actuator
	1	Rotary
	5	Linear Stroke up to 50 mm
	7	Linear Stroke up to 100 mm
	A	Linear Stroke up to 30 mm
SPECIAL OPTIONS (1)		
COD.	Housing	
H0	Aluminum (IP/TYPE)	H2 Aluminum for saline atmosphere (IPW/TYPE X)
H1	316 Stainless Steel (IP/TYPE)	H4 Copper Free Aluminium (IPW/TYPE X)
COD.	Identification Plate	
I1	FM: XP, IS, NI, DI	I6 Without certification
I4	EXAM (DMT): Ex-ia, IP	IJ NEMKO - Ex-d
I5	CEPEL: Ex-d, Ex-ia, IP	
COD.	Painting	
P0	Gray Munsell N 6.5 Polyester	
P3	Black Polyester	
P8	Without Painting	
P9	Safety Blue Epoxy – Electrostatic Painting	
COD.	TAG Plate	
J0	With TAG	
J1	Blank	
J2	According to user's notes	
COD.	Sensor Mounting (2)	
R0	Full Mounting	
R1	Remote sensor - 5 m cable	
R2	Remote sensor - 10 m cable	
R3	Remote sensor - 15 m cable	
R4	Remote sensor - 20 m cable	
COD.	Special	
ZZ	See notes	

TP301 - 1 0 - 0 1 * . * * * * *

← TYPICAL MODEL NUMBER

NOTE

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

Appendix A

CERTIFICATIONS INFORMATION

European Directive Information

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

ATEX Directive (94/9/EC) – “Electrical equipment and protective system intended for use in potential explosive atmospheres”

The EC-Type Examination Certificate had been released by Nemko AS (CE0470) and/or DEKRA EXAM GmbH (CE0158), according to European Standards.

The certification body for Production Quality Assurance Notification (QAN) and IECEx Quality Assessment Report (QAR) is Nemko AS (CE0470).

Hazardous Locations General Information

Ex Standards:

IEC 60079-0 General Requirements

IEC 60079-1 Flameproof Enclosures “d”

IEC 60079-11 Intrinsic Safety “i”

IEC 60079-26 Equipment with equipment protection level (EPL) Ga

IEC 60529 Classification of degrees of protection provided by enclosures (IP Code)

Customer responsibility:

IEC 60079-10 Classification of Hazardous Areas

IEC 60079-14 Electrical installation design, selection and erection

IEC 60079-17 Electrical Installations, Inspections and Maintenance

Warning:

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

Installation of this instrument in an explosive environment must be in accordance with the national standards and according to the local environmental protection method. Before proceeding with the installation match the certificate parameters according to the environmental classification.

General Notes:

Maintenance and Repair

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

Marking Label

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

For Ex-i protection application

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

For Ex-d protection application

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

- Electrical Connection

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

For Ex-d and Ex-i protection application

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

Environmental Protection

- Enclosure Types (Type X): Supplementary letter X meaning special condition defined as default by Smar the following: Saline Environment approved - salt spray exposed for 200 hours at 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 TP301 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:

V_{max} = 30 Vdc, I_{max} = 110 Ma, C_i = 5 nF, L_i = 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_i = 28 Vdc, I_i = 93 mA, C_i ≤ 5 nF L_i = 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	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_i = 0.7 W, U_i = 30 V, I_i = 100 mA, C_i = 6.4 nF, L_i = 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 TP301 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 Type 4X

IS - Exia - CL I DIV 1 GR ABCD, CL II DIV 1 GR EFG, CL III DIV 1 Seal not required (conduit)

Vmax=28V Imax=110mA Ci=5nF Li=12uH
T3C Ta=40°Cmax Inst. Dwg. 102A0832



0044333 - 2007   **140601**

smar TP301 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 Type 4

IS - Exia - CL I DIV 1 GR ABCD, CL II DIV 1 GR EFG, CL III DIV 1 Seal not required (conduit)

Vmax=28V Imax=110mA Ci=5nF Li=12uH
T3C Ta=40°Cmax Inst. Dwg. 102A0832



0044333 - 2007   **143701**

FM Approvals (Factory Mutual)

smar TP301 Position Transmitter
BR - 14160
Made in Brazil

Temp. Class: T4	XP CL I, DIV 1, GP A,B,C,D.
Tamb. 60°C max.	DIP CL II,III, DIV 1, GP E,F,G
Vmax. 30 VDC	IS CL I,II,III, DIV 1, GP A,B,C,D,E,F,G.
I max. 110 mA	NI CL I, DIV 2, GP A,B,C,D.
Ci 5 nF	Per inst. dwg 102A0604.
Li 12 uH	



FM APPROVED Type 4X

0044333 - 2007   **123600**

smar TP301 Position Transmitter
BR - 14160
Made in Brazil

Temp. Class: T4	XP CL I, DIV 1, GP A,B,C,D.
Tamb. 60°C max.	DIP CL II,III, DIV 1, GP E,F,G
Vmax. 30 VDC	IS CL I,II,III, DIV 1, GP A,B,C,D,E,F,G.
I max. 110 mA	NI CL I, DIV 2, GP A,B,C,D.
Ci 5 nF	Per inst. dwg 102A0604.
Li 12 uH	



FM APPROVED Type 4

0044333 - 2007   **134900**

smar TP301 Position Transmitter
TX - 77040
Made in USA

Temp. Class: T4	XP CL I, DIV 1, GP A,B,C,D.
Tamb. 60°C max.	DIP CL II,III, DIV 1, GP E,F,G
Vmax. 30 VDC	IS CL I,II,III, DIV 1, GP A,B,C,D,E,F,G.
I max. 110 mA	NI CL I, DIV 2, GP A,B,C,D.
Ci 5 nF	Per inst. dwg 102A0604.
Li 12 uH	



FM APPROVED Type 4

0000000 - 0000   **195700**

smar TP301 Position Transmitter
TX - 77040
Made in USA

Temp. Class: T4	XP CL I, DIV 1, GP A,B,C,D.
Tamb. 60°C max.	DIP CL II,III, DIV 1, GP E,F,G
Vmax. 30 VDC	IS CL I,II,III, DIV 1, GP A,B,C,D,E,F,G.
I max. 110 mA	NI CL I, DIV 2, GP A,B,C,D.
Ci 5 nF	Per inst. dwg 102A0604.
Li 12 uH	

FM APPROVED Type 4X

0000000 - 0000   **195800**



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

smar TP301 Position Transmitter
BR - 14160
Sertãozinho
Brazil

II 2G Ex ia IIC T4/T5/T6 Gb	DMT 00 ATEX E 085 ()
Pi = 760 mW (T4, Ta = 75°C)	-40°C ≤ Ta ≤ +85°C
700 mW (T4, Ta = 85°C)	Ui = 28 VDC li = 93 mA
575 mW (T5, Ta = 60°C)	Li = neg Ci ≤ 5 nF
575 mW (T6, Ta = 40°C)	

IP66
IP68 10m/24h

II 2G Ex d IIC T6 Gb Nemko 01 ATEX 445X ()
Tamb = -20° to 60°C U = 28 VDC



0000000 - 0000   0470 **145004**

smar TP301 Position Transmitter
BR - 14160
Sertãozinho
Brazil

II 2G Ex ia IIC T4/T5/T6 Gb	DMT 00 ATEX E 085 ()
Pi = 760 mW (T4, Ta = 75°C)	-40°C ≤ Ta ≤ +85°C
700 mW (T4, Ta = 85°C)	Ui = 28 VDC li = 93 mA
575 mW (T5, Ta = 60°C)	Li = neg Ci ≤ 5 nF
575 mW (T6, Ta = 40°C)	

IP66W
IP68W 10m/24h



II 2G Ex d IIC T6 Gb Nemko 01 ATEX 445X ()
Tamb = -20° to 60°C U = 28 VDC

0000000 - 0000   0470 **150604**

smar TP301 Position Transmitter
BR - 14160
Sertãozinho
Brazil

I M2 Ex ia I Mb	DMT 00 ATEX E 085
-40°C ≤ Ta ≤ +85°C	
Pi = 700 mW (Ta = 85°C)	
Ui = 28 VDC li = 93 mA	Li = neg Ci ≤ 5 nF



IP 66 68

0000000 - 0000   0470 **158001**

smar TP301 Position Transmitter
BR - 14160
Sertãozinho
Brazil

I M2 Ex ia I Mb	DMT 00 ATEX E 085
-40°C ≤ Ta ≤ +85°C	
Pi = 700 mW (Ta = 85°C)	
Ui = 28 VDC li = 93 mA	Li = neg Ci ≤ 5 nF

IP 66W 68W

0000000 - 0000   0470 **158101**

CEPEL (Centro de Pesquisa de Energia Elétrica)

smar TP301 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 **HART** **CE** 130501

smar TP301 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 **HART** **CE** 137801

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.

ENTITY PARAMETERS FOR ASSOCIATED APPARATUS
 $C_a \geq$ CABLE CAPACITANCE +Ci
 $L_a \geq$ CABLE INDUCTANCE +Li
 $V_{oc} \leq 28V$
 $I_{sc} \leq 110mA$

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 MANUFACTURES 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: Ci=5nF Li=10uH Vmax=28VDC Imax=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

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			
REV	BY	APPROVAL	DOC	FOR NON-INCENDIVE: CALSS I, DIV. 2 FOR INTRINSICALLY SAFE: CLASS I, DIV. 1			

NUMBER	REV
102A0832	01
SCALE	SHEET
	01/01

Factory Mutual (FM)

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.

ENTITY PARAMETERS FOR ASSOCIATED APPARATUS
 CLASS I,II,III DIV.1, GROUPS A,B,C,D,E,F & G
 $C_a \geq$ CABLE CAPACITANCE +5nF
 $L_a \geq$ CABLE INDUCTANCE +12uH
 $V_{oc} \leq$ 30V
 $I_{sc} \leq$ 110mA

HAZARDOUS AREA

REQUIREMENTS:

- 1- INSTALLATION TO BE IN ACCORDANCE WITH ANSI/ISA RP12-6
- 2- TRANSMITTER SPECIFICATION MUST BE IN ACCORDANCE TO 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.
- 6- WIRES: TWISTED PAIR, 22AWG OR LARGER.
- 7- SHIELD IS OPTIONAL IF USED, BE SURE TO INSULATE THE END NOT GROUNDED.
- 8- CABLE CAPACITANCE AND INDUCTANCE PLUS C_i AND L_i MUST BE SMALLER THAN C_a AND L_a OF THE ASSOCIATED APPARATUS.

INTRINSICALLY SAFE APPARATUS
 ENTITY VALUES: $C_i=5nF$ $L_i=12uH$
 $V_{max}=30VDC$
 $I_{max}=110mA$


MODEL TP290 & TP301 - SERIES
 CLASS I,II,III DIV.1, GROUPS A,B,C,D,E,F & G
 ENTITY VALUES:
 4-20mA
 $C_i=5nF$ $L_i=12uH$
 $V_{max} \leq$ 30V
 $I_{max} \leq$ 110mA

COMPONENTS CAN NOT BE SUBSTITUTED WITHOUT PREVIOUS MANUFACTURER APPROVAL.

smar

APPROVAL CONTROLLED BY C.A.R.				DRAWN	CHECKED	PROJECT	APPROVAL
01	MARCIAL 26 / 11 / 01	MISSAWA 26 / 11 / 01	ALT-DE 0108/01	MOACIR 08 / 11 / 00	SINASTRE 08 / 11 / 00	BASÍLIO 08 / 11 / 00	MISSAWA 08 / 11 / 00
REV	BY	APPROVAL	DOC	EQUIPMENT: TP290/TP301 CONTROL DRAWING			
				NUMBER 102A0604		REV 01	
				SCALE		SHEET 01/01	

Appendix B

	SRF – Service Request Form			
	TP Position Transmitter			
GENERAL DATA				
Model:	TP290 () Firmware Version: _____	TP301 () Firmware Version: _____	TP302 () Firmware Version: _____	TP303 () Firmware Version: _____
Serial Number:	_____ Sensor Number: _____			
TAG:	_____			
Remote Position Sensor?	Yes ()	No ()		
Action:	Rotary ()	Linear ()		
Travel:	30 mm ()	50 mm ()	100 mm ()	Other: _____ mm
Configuration:	Magnetic Tool ()	Palm ()	Psion ()	PC () Software: _____ Version: _____
INSTALLATION DATA				
Type:	Valve + Atuador ()	Other: _____		
Size:	_____			
Travel:	_____			
Manufacturer:	_____			
Model:	_____			
PROCESS DATA				
Hazardous Area Classification	Non-Classified ()	Chemical ()	Explosive ()	Other: _____
Interference Types	Vibration ()	Temperature ()	Electromagnetic ()	Others: _____
SITUATION DESCRIPTION				

SERVICE SUGGESTION				
Adjustment ()	Cleaning ()	Preventive Maintenance ()	Update / Up-grade ()	
Other: _____				
USER INFORMATION				
Company: _____				
Contact: _____				
Title: _____				
Section: _____				
Phone: _____			Extension: _____	
E-mail: _____			Date: ____/____/____	
<p>For warranty or non-warranty repair, please contact your representative. Further information about address and contacts can be found on www.smar.com/contactus.asp.</p>				

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.