

smar - TP400W

DEC / 13
TP400
VERSION 7

OPERATION, MAINTENANCE AND
INSTRUCTION MANUAL

WirelessHART™
Position Transmitter

WirelessHART®



smar
www.smar.com

**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

NOTE

This manual is compatible with version 7.XX, where 7 indicates software version and XX software release. The indication 7.XX means that this manual is compatible with any release of software version 7.

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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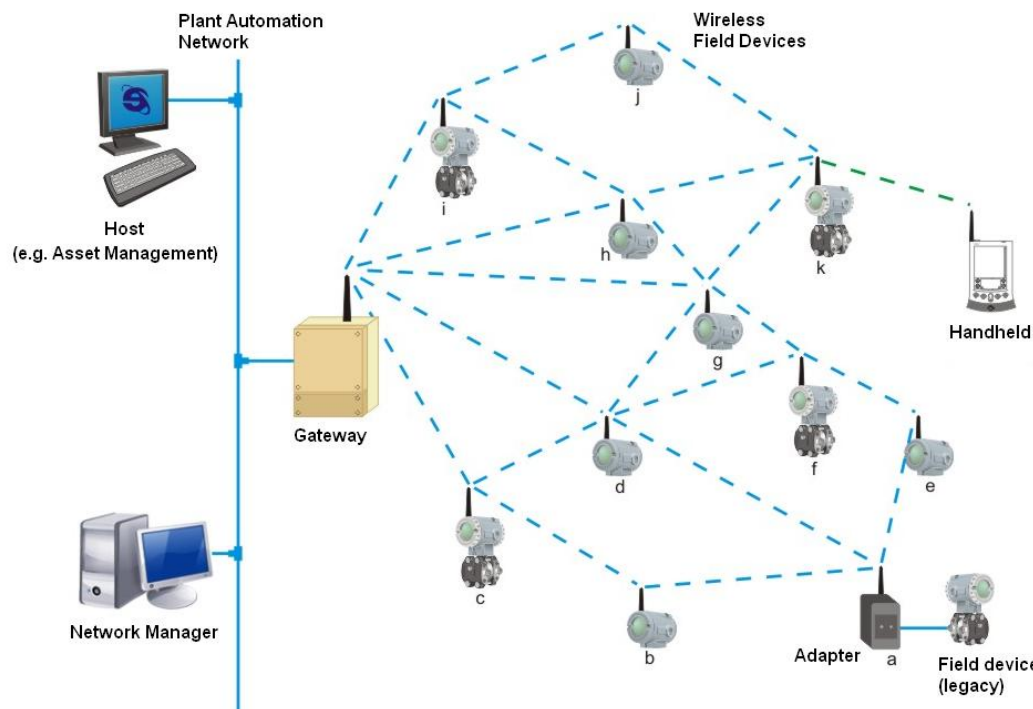
INTRODUCTION

WirelessHART Technology Overview

The *WirelessHART* technology is based on a wireless mesh network communication protocol used in process automation applications. It adds wireless capabilities to the HART protocol, while maintaining compatibility with existing HART devices, commands and already known and used tools.

WirelessHART network

Basically, a *WirelessHART* network, defined in the HART specifications, consists of a host, a *WirelessHART* Gateway and one or more field devices and/or *WirelessHART* adapters. Together they compose a mesh network where the host and devices can communicate.



Host

The host, usually connected to the control network, is a workstation in which, e.g., can be installed a Human Machine Interface application, which allows an operator to interact with the process. Through the *WirelessHART* Gateway (DF100), the host can gather data from devices connected to the *WirelessHART* network. The host communicates with the *WirelessHART* Gateway (DF100) using a communication protocol, for example, HSE, H1, Profibus or Modbus.

WirelessHART Gateway (DF100)

It is a "translator" equipment. Thus it converts data from the host to the *WirelessHART* protocol, used by the devices connected to the *WirelessHART* network, and converts data from the devices to the host. In general, the *WirelessHART* Gateway (DF100) incorporates the features of Network Manager and Access Point. Roughly, the access point can be understood as the *WirelessHART* radio installed at the gateway to communicate with devices connected to the wireless network.

Security Manager

The Security Manager is an application usually embedded in the *WirelessHART* Gateway (DF100). Allowed only one Network Manager in a *WirelessHART* network, but the same Security Manager can serve several *WirelessHART* networks.

Its main function is to create, store and manage security keys (encryption and authentication) for which the devices have network access and monitor the status of network security.

Network Manager

The Network Manager is an application that can be embedded in the *WirelessHART* Gateway. On a *WirelessHART* network is only allowed to have one Network Manager. Among its responsibilities, the Network Manager distributes network identity (advertisement) publishing its existence, manages and authenticates the addition (joining) of devices to the network. It also distributes individual security keys (static or rotating) to the devices to ensure secure communication between it and the devices. The Network Manager assigns communication band to the devices already connected to the network that requested services to it, as well as manages the routes between the devices on the mesh network.

Specifically about the joining process of a *WirelessHART* device to the network, the Network Manager validates the Network ID and the Join Key attributes which are configured in the *WirelessHART* Gateway and *WirelessHART* devices.

The Network ID identifies a *WirelessHART* network in unique way. It is an **unsigned integer** attribute and must be configured on the *WirelessHART* Gateway and all *WirelessHART* devices. Considering a *WirelessHART* network installed in a plant, the permitted values for the Network ID ranges from 0 (hex 0x0000) to 32767 (0x7FFF hexadecimal).

The Join Key is a security key used to encrypt joining requests from *WirelessHART* devices that receive the advertisement with the Network Id identical to theirs. It may be single or each *WirelessHART* device may be configured with an individual Join Key. In the first case, the *WirelessHART* Gateway and all *WirelessHART* devices must be configured with the same Join Key. In the second case, which provides higher communication security level, (a) must be configured in the *WirelessHART* Gateway a list with individual Join Keys, i.e., a key for each *WirelessHART* device, and (b) you must configure each *WirelessHART* device with its individual Join Key. The Join Key is a hexadecimal string of 16 bytes. There is no restriction to the hexadecimal value of each byte. The table below shows examples of some join keys.

JOIN KEYS	16-BYTE HEXADECIMAL STRING
00000000000000000000000000000000	0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00
000000000000000000000000000000302	0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x03, 0x02
00000000FFFFFFFF0000000000000000	0x00, 0x00, 0x00, 0x00, 0xFF, 0xFF, 0xFF, 0xFF, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00
550000000000000000000000000000AA	0x55, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0xAA

WirelessHART device

The *WirelessHART* field device is the device that connects to the process, being able to receive and/or transmit data on the *WirelessHART* network. It is a *WirelessHART* router (repeater) by nature, i.e., it is able to retransmit messages to/from other devices on the *WirelessHART* network.

WirelessHART Adapter

It is a bridge-type device, because it is able to provide data of HART + 4 to 20mA field device, legacy, to the host via *WirelessHART*. The adapter uses HART FSK standard communication, wired, to access data from HART field devices. And the adapter also uses the *WirelessHART* communication to provide data of the field device to the host. The adapter thus enables a HART field device to work on *WirelessHART* network.

Planning a WirelessHART network

The planning of a *WirelessHART* network is a task that is very similar to the activities that currently we perform with conventional wired devices. Furthermore, due to the simplicity of a mesh *WirelessHART* network, is exempt, in general, detailed field surveys, which are usually needed when we plan networks based on other wireless technologies.

Basically, a *WirelessHART* network involves planning, design, installation and commissioning phases.

Planning

This phase requires the execution of the following steps:

Scope definition

Clearly define the scope of the network. Answer the question: why do we need the wireless network? To monitor process variables or to implement a non-critical control? The answer to this question will facilitate the understanding between the team members responsible for the network and determine one or more process units in the plant. For each process unit, allocate a gateway with unique and specific Network ID. Outline the main field devices.

Identify potential sources of interference

Are there radio communications or other wireless networks in the plant? What protocols and frequencies do they use? Use high power? Although unlikely, given the robustness of the radios used by the *WirelessHART* technology, prior knowledge of the answers to these questions may identify potential sources of interference and to indicate the taking of preventive and/or limiting actions even before installation. For example, you can select a frequency channel as unavailable, adding it to the black list of frequencies that is under the *WirelessHART* Network Manager control.

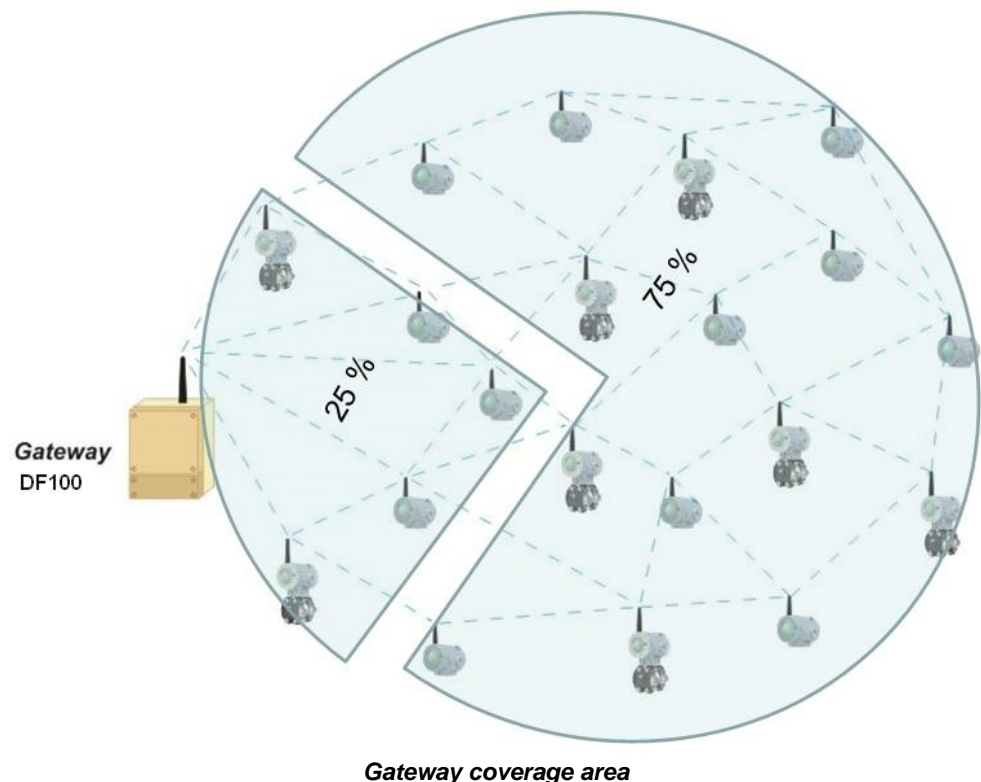
Integration with the host

The gateway connects the *WirelessHART* field devices to the host system. Plan what devices and what data are needed. Also, the stations or applications which will process the data have to be clearly defined. From this set, among the protocols in the system, define which one will be used for integration with the host and with the existing tools for configuring the devices. After defining the protocol for integration, the user has to choose the gateway on the market that best meets your requirements. Smar offers the Gateway DF100 that supports Modbus/TCP/HSE.

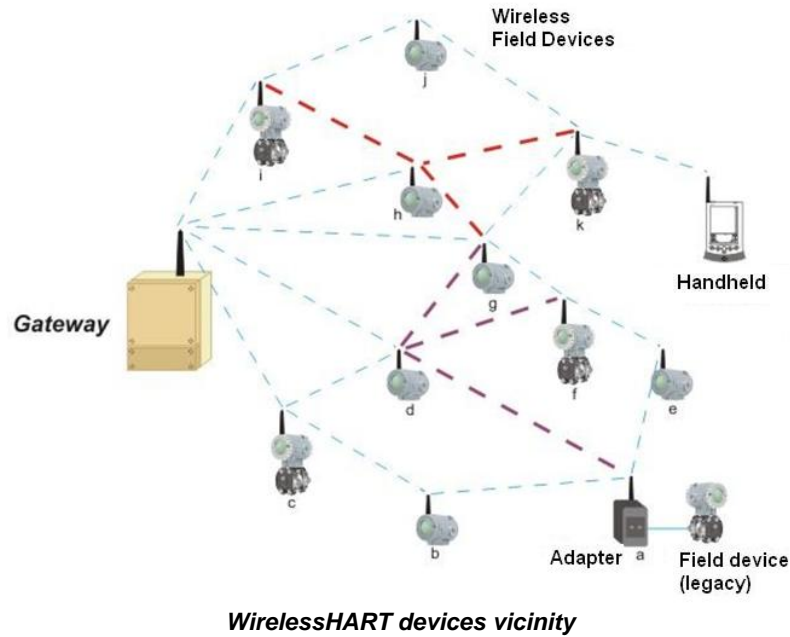
Project

In the project phase, it is recommended the adoption of the practices below. Although conservative, these practices ensure robustness and scalability to the network.

- Define the Network ID that will be used for all devices in the process unit;
- Define if the Join Key will be common to all devices or individual and dedicated ;
- Define the policy to be used for the definition of devices (Long) Tags;
- Use a scale drawing of the process unit;
- Place the gateway in a strategic position in the process unit ;
- Plan networks with at least five devices;
- Install at least five devices within the gateway coverage area;
- Ensure that 25 % of the devices are within the gateway coverage area;



- Reposition the gateway as needed ;
- Check the coverage area of each device;
- Ensure that each device has three neighbors within its coverage area;

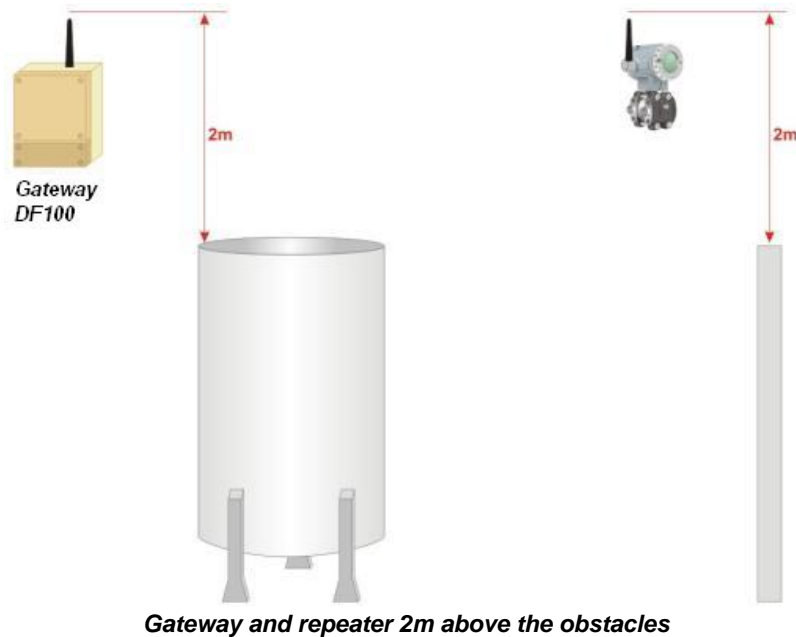


- Place the repeaters as needed.

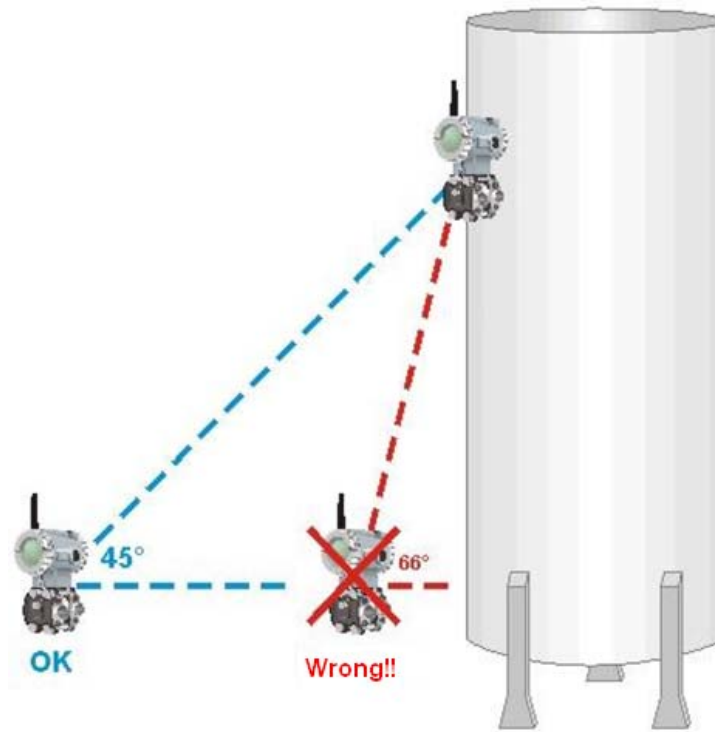
Installation

As mentioned before, *WirelessHART* devices should be connected to the process and configured the same way as conventional wired HART devices. Handheld terminals can be used normally. Just be sure of having it properly uploaded with the latest DD files of the devices. However, it is known that the *WirelessHART* devices have characteristics inherent to the technology. Because of this, it is recommended the adoption of practices mentioned below for positioning the gateway and devices.

- Install the gateway and the devices so that their antennas are vertical;
- Ensure that the antennas are at 0.5 m minimum distance of large obstacles or surfaces ;
- Ensure that the antennas of gateway and repeaters are 2 m above most obstacles within their coverage areas;



- o If there are high devices, does not exceed 45° viewing angles between them;



Device's viewing angle

- o Make sure that the gateway is integrated to the host system as planned.

Commissioning on Bench

Commissioning consists on testing the device and verifying its configuration data. The **TP400 WirelessHART** can be commissioned either before or after installation. The commissioning of the device in bench before its installation using CONF401, HPC401 or any DD-based configurator, e.g. Smar AssetView, ensures that all transmitters' components are working properly.

To turn on/off the repeater use the terminal SW1 (ON/OFF), as shown in Figure 1.7.

To connect the handheld to the device, use the communication terminals "CN1 and CN2" on the terminal block. See Figure 1.7.

Commission the devices and gateway.

WirelessHART devices commissioning

- Install and power the gateway (DF100)
- If not specified by the client at time of order, the Network ID and Join Key values of gateway and devices will be the factory default values. Note: It is strongly recommended that both be changed! To change these parameters install the gateway and all network devices following the steps below. Once the network is fully operational it will be more practical to change them.
- The devices configuration must be done individually, starting with those nearest to the gateway and further to the most distant so that communication is established correctly.
- Always install the device with the antenna in the vertical direction. None *WirelessHART* device must be located at the highest point of the plant, preventing it to work as possible lightning rod;
- Turn on the device by the switch at left of the display and wait for its connection to the network (this time can vary from 2 to 20 minutes depending on the network size). The device status on the network can be verified on display, maintenance port or gateway.

ATTENTION

If the device was not purchased with the gateway, i.e. the gateway already has values of Network ID and Join Key different from the default values, it is necessary to set these parameters in the device so that it properly connects to the network: first configure Network ID and then Join Key, restarting the device after settings.

- f. Once these steps are performed for all network devices and they are connected properly, it is time to change the values of Network ID and Join Key from factory following the instructions at the end of step "e" (if not changed yet). Network ID can be any number between 0 and 32767 which identifies the network among others. Join Key is a key of 32 hexadecimal characters (0-9 and AF) that works as a key so the devices can have access to the configured network.
- g. Configure the LongTAG parameter that identifies the device on the network.
- h. Check if the device engineering units are in accordance with those required by the process.
- i. Configure the parameters of the burst mode to publish measurements and status desired:
Burst Message: up to 3 messages with commands and different times can be configured;
 - Minimum Time : is the time for publication of the variables;
 - Maximum Time: must be greater than the minimum time and is only used in trigger mode (check the operation of the trigger mode in the device manual if you want to receive the monitoring variables only when there is any change on their values);
 - Command: HART command that sends the variables desired by user (e.g. , the command 3 sends values of PV, SV, TV and QV, when available);
 - Burst Mode: Once all parameters have been configured, activate Burst mode.
 - Acquisition based on Burst time parameter that reduces the consumption of the device to perform only one acquisition immediately before the burst transmission. If this parameter is disabled, the device will execute an acquisition every two seconds, regardless of the Burst Minimum Time.
- j. After some time negotiating with the gateway, the device will start publishing the configured command at a minimum time rate configured. The **ACK** icon is shown on the display (if available) when the device enters in Burst Mode and the icon **F(t)** blinks on the moment that the command burst is sent.

ATTENTION

The Burst mode configurations remain even after the shutdown of the device, i.e., when it is turned on, the device connects to the network automatically in Burst mode with the same time and command configured. The higher the refresh rate, the lower the lifetime of the battery and vice versa. Configure a refresh rate that allows the device to last few years.

- k. After the general network configuration, wait a period of about 1 hour for the network starts to operate 100% optimized.

ATTENTION

There is a battery estimated lifetime parameter that indicates the expected duration in days of the device. This parameter is recalculated every 60 minutes and its value should only become valid after two or three hours of operation of the device on the network (time required for consumption optimization). When this value is near the end, the user will receive a warning in the device status and in the display (when available). When you replace the Battery Module (Smar code 400-1209) you have to configure the replacement via configurator that will restart the counting of the estimated lifetime for the new module.

ATTENTION

Do not discard the Module of Batteries in regular trash. Use a proper disposal for batteries or chemical waste.

Verifying the Range of Device

Identify which distance to be considered according to the type of environment to install the device:

- Strong Obstruction - about 30 m (10 ft.). Very dense environments in relation to devices, pipes, cables, etc. Consider a place where you are not normally able to travel.
- Average Obstruction - about 75 m (25 ft.). Environment which have space among devices in relation to the rest of the plant.
- Light Obstruction - 150 m (50 ft.). Consider an open environment that has some kind of obstruction such as a silo or a tank. Although the obstruction is large, around the obstacle there is enough free space for propagation of the RF waves.
- Line of Sight - up to 225 m (75 ft.). Consider that the antenna's device "sees" directly the antenna of another network device, without any obstacle between them. Furthermore, the height difference between them should not have an angle greater than 5 degrees.

To mount the device near the ground, below ground level or under water, since the RF signal is absorbed into soil or water and does not propagate, can significantly reduce the range of the devices. Additionally, to mount the device outside the network area (gateway), for example, considering a network in an open environment and installing the device inside a closed room, also contributes to signal attenuation, because signal will not propagate very well within concrete, wood, etc.

Gateway commissioning

The gateways can have a remote connection to the antenna, allowing them to be installed indoors and only the antenna is in the network environment .

- a) Make sure that the gateway is available to the host system;
- b) Check the gateway and make sure it has at least five devices directly connected to it;
- c) Check if 25 % of the devices are connected directly to the gateway. If necessary, add repeaters;
- d) The gateway connects the devices to the host system. Thus, check if the data of the devices are coming to the applications that subscribe them.

We recommend a visit to the [HART Communication Foundation](#) website for additional information about the *WirelessHART* protocol such as *WirelessHART* project planning, positioning of devices, commissioning and verification tools, and practices.

TP400 WirelessHART

The **TP400** is a **WirelessHART™** transmitter for position measurement and it is part of the family of Smar devices.

It can measure displacement or movement of rotary or linear type based on Hall effect non-contact sensor. The digital technology and wireless communication provide an easy interface between the field and control room and several interesting features that considerably reduce the installation, operation and maintenance cost.

The **TP400 WirelessHART™** may be installed to monitor valves and actuators position or in any equipment with linear or rotary motion such as skylights, dampers, rollers spacing, crushers, etc. There is an option for remote sensor with cable length up to 20 m.

The **Remote Sensor Position** is a recommended accessory for high temperatures applications (up to 105 °C), for excessive vibration or even difficult local access. It avoids equipment excessive wear and, consequently, increases the equipment lifetime. The cable supplied by Smar is shielded and provides excellent protection against electromagnetic interferences.

INSTALLATION

General

NOTE

For hazardous area installations the IEC 60079-14 standard recommendations must be followed.

Although the TP400 has an outstanding performance, proper installation is essential to maximize its efficiency.

Humidity is fatal to electronic circuits. In areas subjected to high relative humidity level the O-rings for the electronic housing covers must be in good conditions and correctly placed. The covers must be completely closed by hand until the O-rings are compressed. Avoid using tools for this operation. Removal of the electronics cover in the field should be avoided in order to protect electronic circuit from humidity.

The electronic circuit is protected by a humidity proof varnish 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 are not protected by painting.

ATTENTION

Do not remove cover grease to avoid stuck housing.

ATTENTION

Common cause, random or often failures should not damage the device or result in death and serious injury, harm the environment or result in loss of production or devices.

ATTENTION

Electrical discharge can result in death and serious injury.

Installation Procedure

The position transmitter is designed to be lightweight and robust at the same time, allowing an easy installation. The following figures show the dimensions and usual mounting positions of the position transmitter.

ATTENTION

The **TP400 WirelessHART™** must always be installed with the antenna positioned upwards.
Do not rotate the antenna, because the cable may break.

To access the display and the main board remove the front cover. This cover can be locked by the cover locking screw. To release the cover, rotate the locking screw clockwise. See Figure 1.10.

The **TP400** 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. The magnet and the salience of position sensor must not be distant.

A minimum distance of 2 mm and a maximum distance of 4mm are recommended between the magnet external face and the transmitter face. For that, a centralizer device (linear) must be used. The centralizer device is in the transmitter packing.

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

Rotary Movement

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

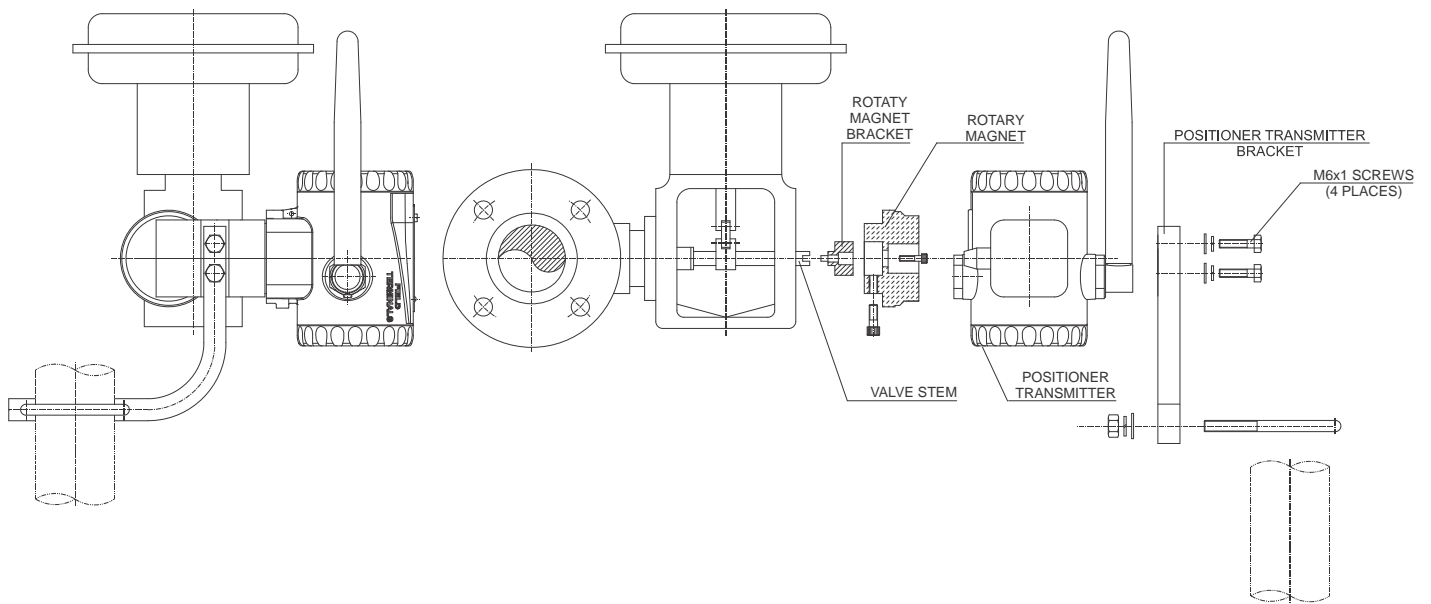


Figure 1.1 - Transmitter on a Rotary Actuator

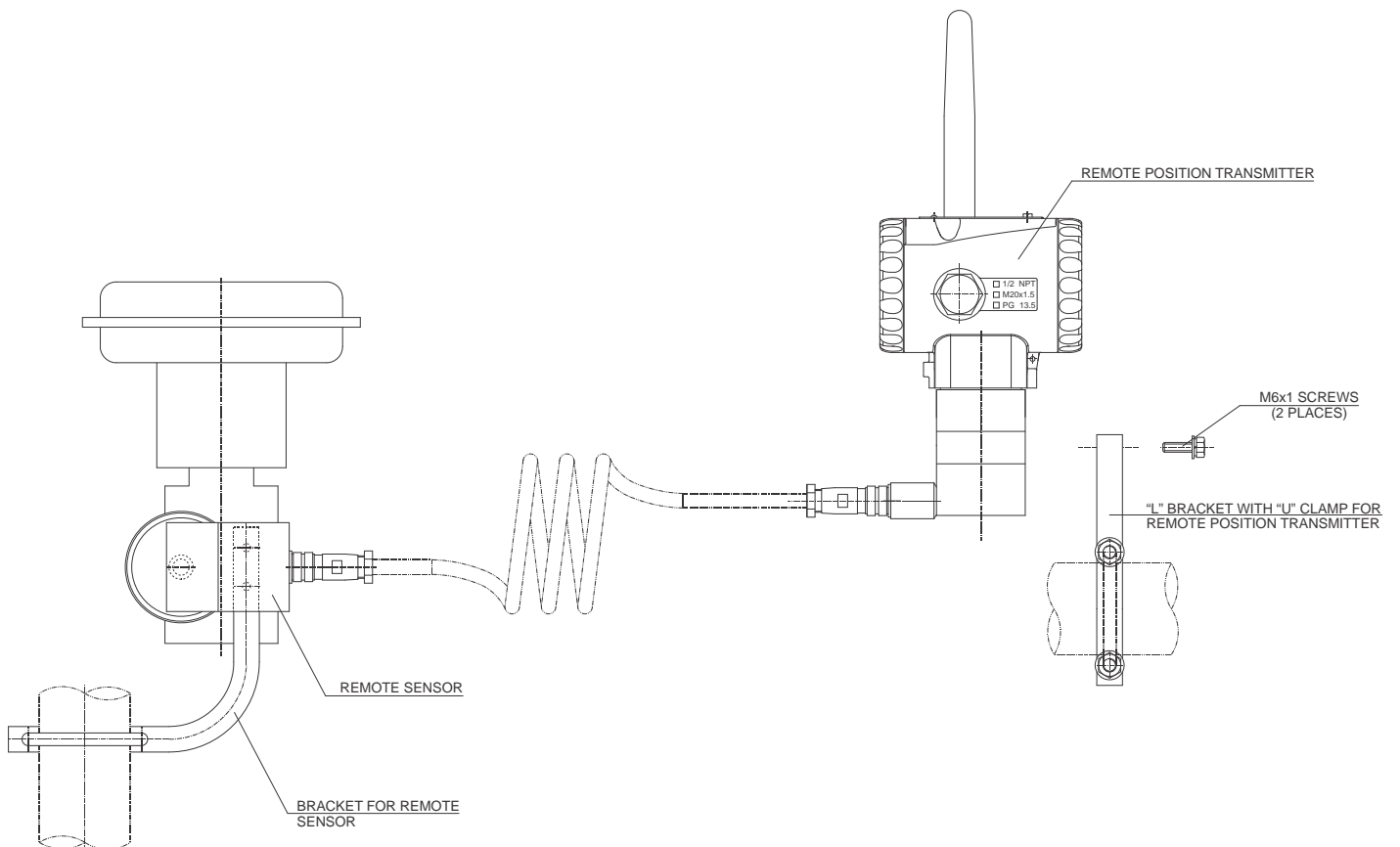


Figure 1.2 – Position Transmitter on Rotary Actuator with Remote Position Sensor

Linear Movement

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

The linear magnet movement must be orthogonal (90°) in relation to the main axis of the position transmitter. For example, if the linear magnet movement is vertical, the transmitter main axis must be horizontal, as show in Figure 1.3.

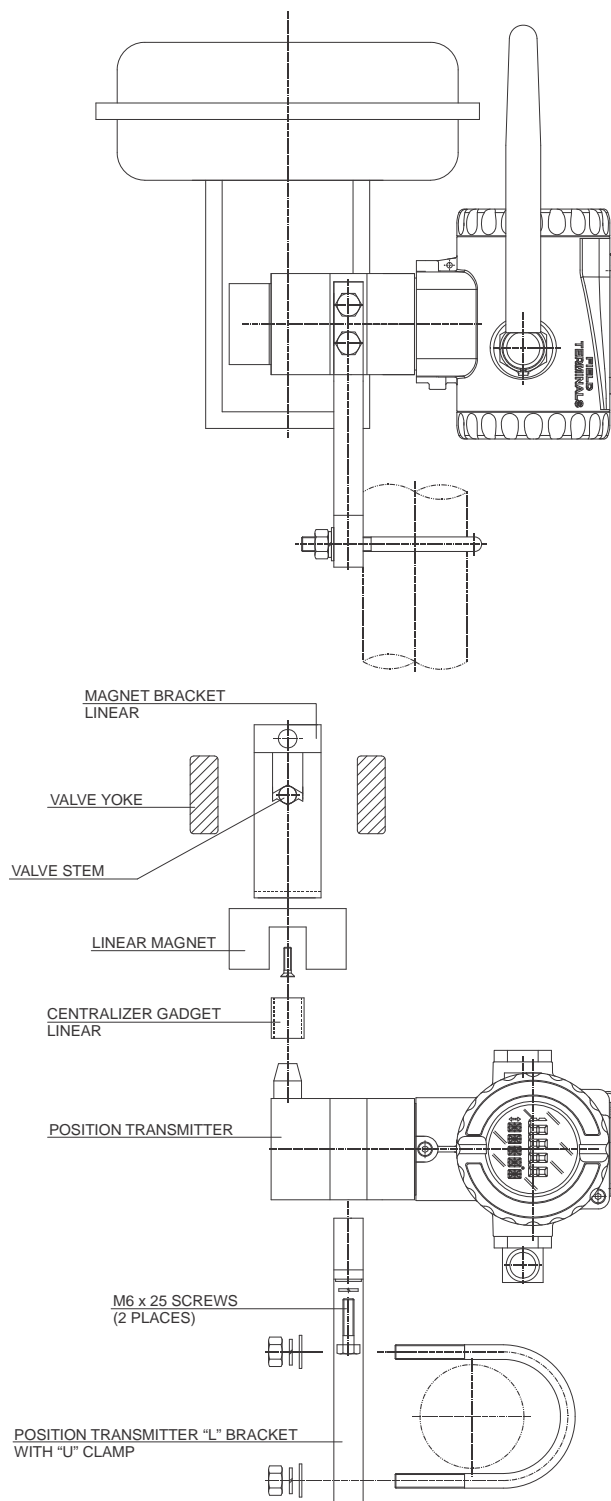


Figure 1.3 - Transmitter on a Linear Actuator

NOTE

Included in the package content the **centralizer device of linear magnet**. See figure 1.14

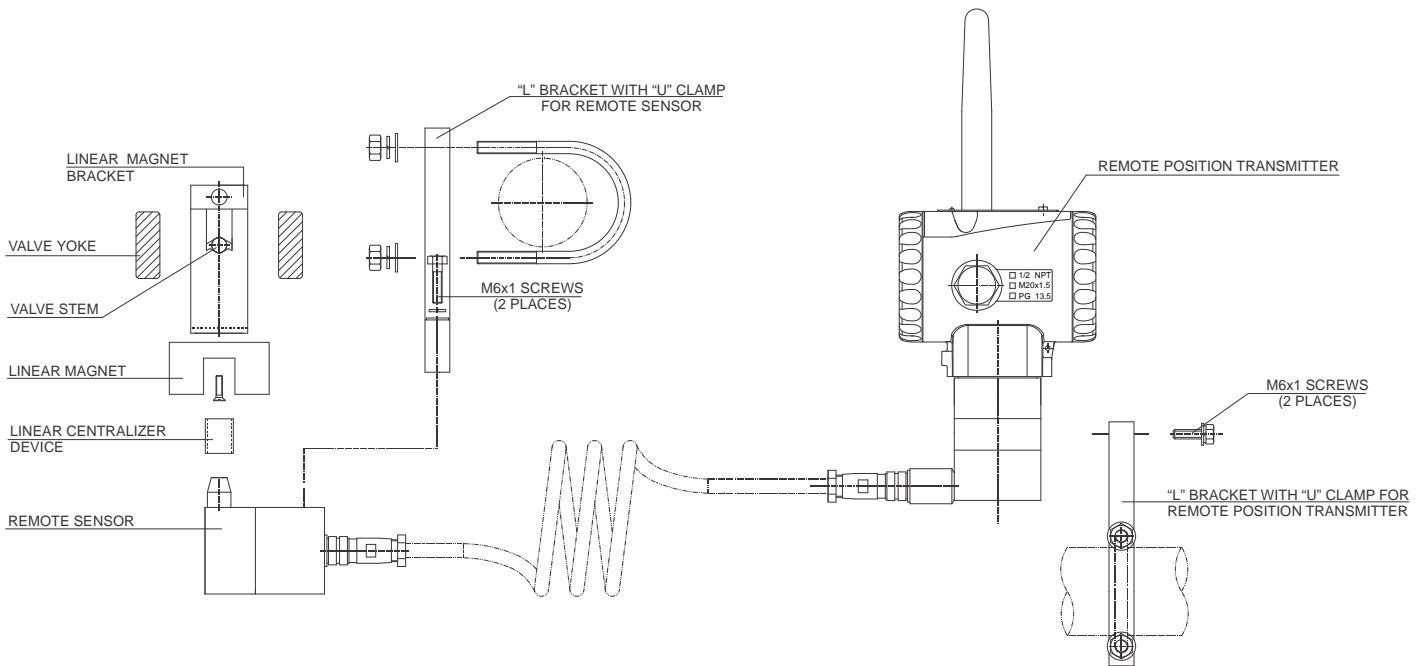
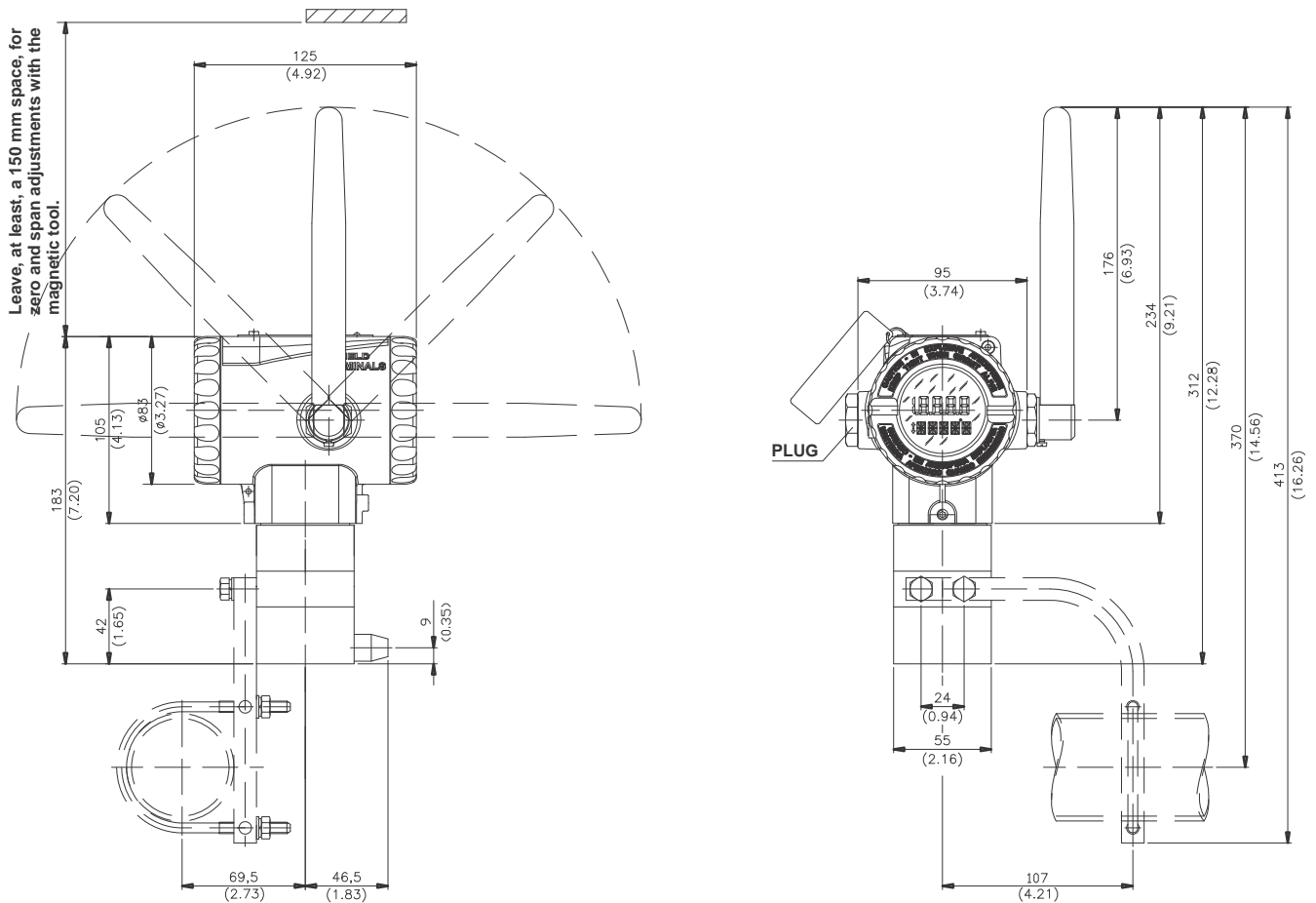


Figure 1.4 – Position Transmitter on Linear Actuator with Remote Position Sensor



NOTE: DIMMENSIONS IN MILIMETERS (INCH)

Figure 1.5 – Dimensional Drawing of TP400 WirelessHART™ in mounting in vertical

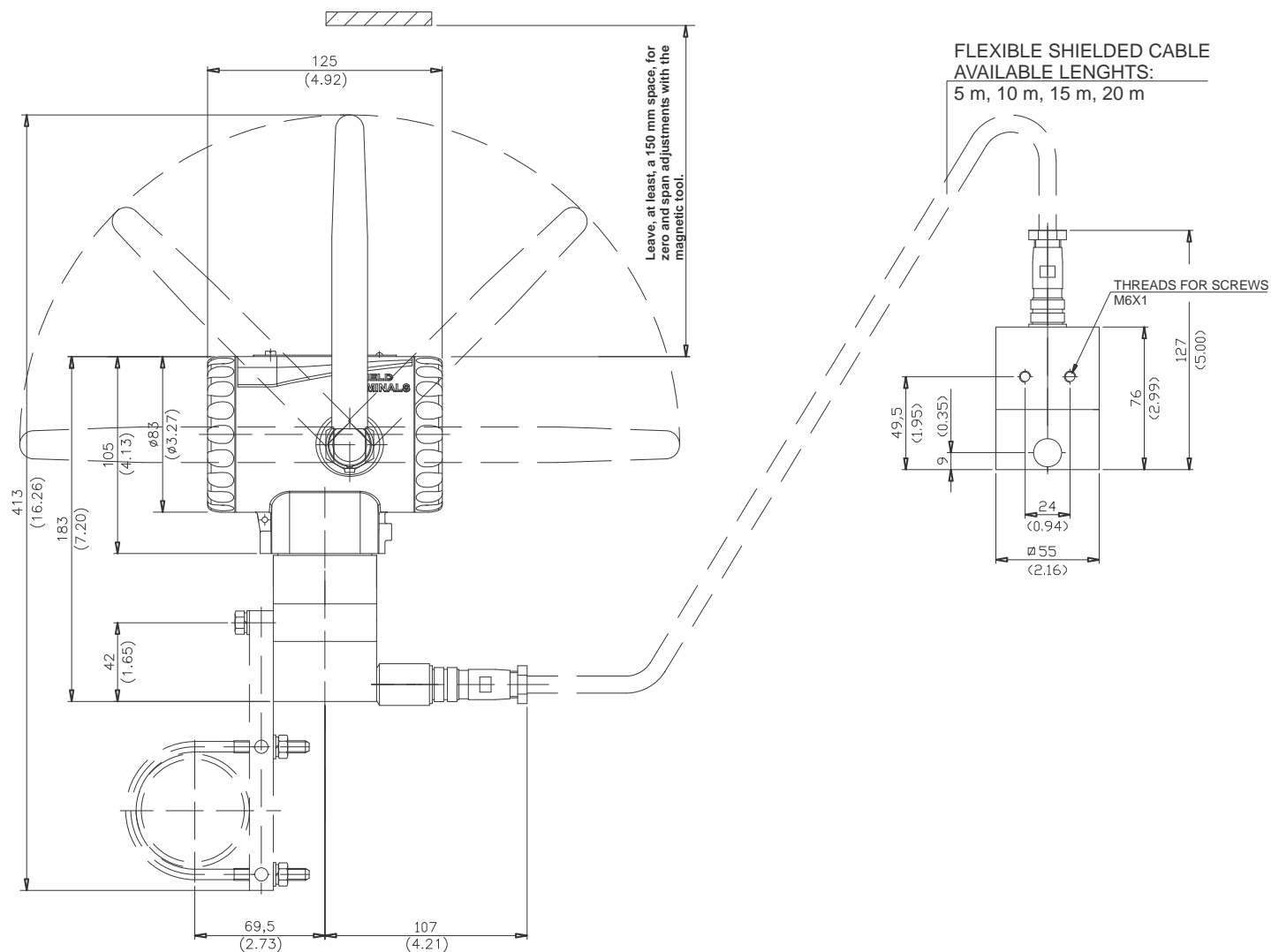


Figure 1.6 - Dimensional Drawing of TP400 WirelessHART™ with Remote Sensor

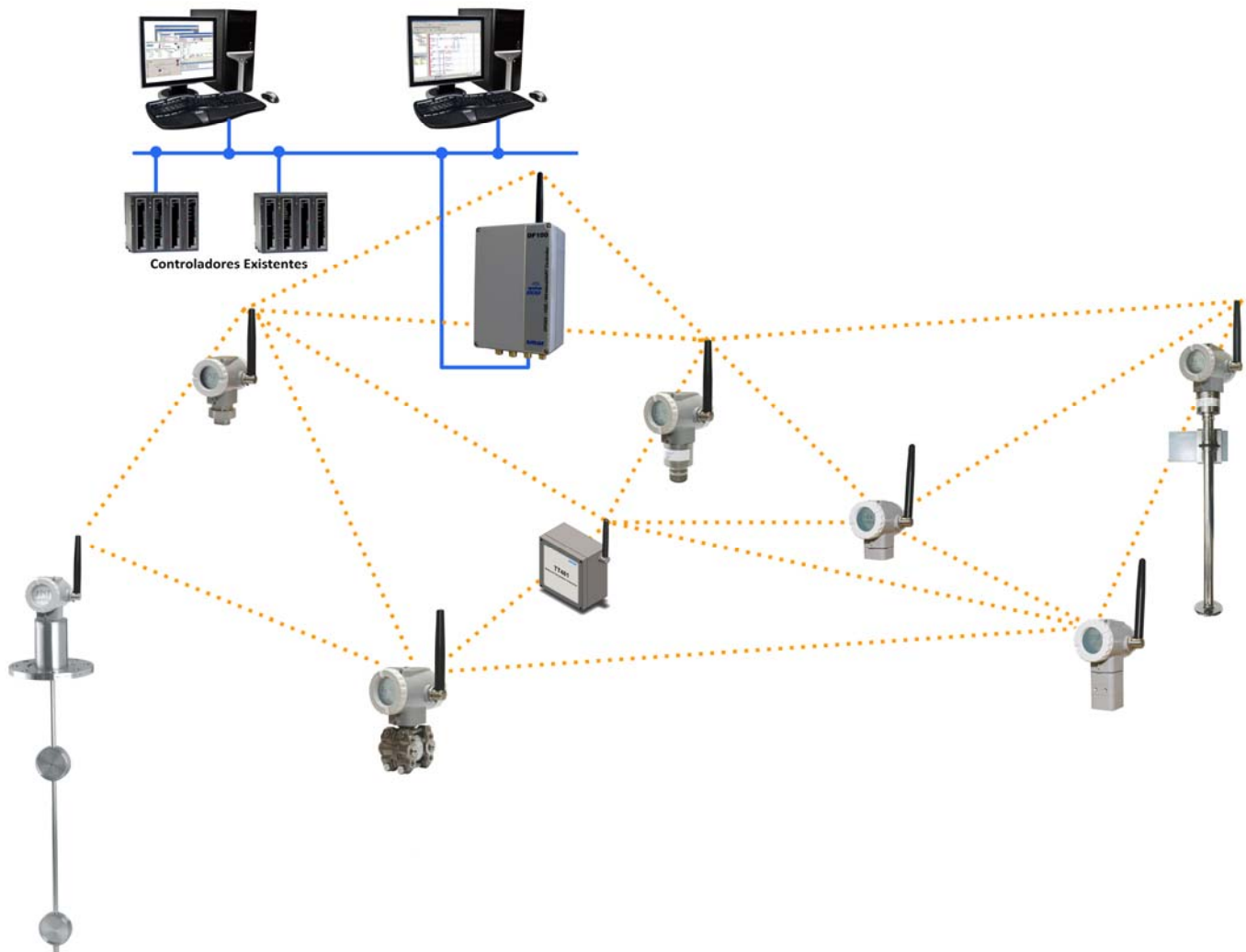


Figure 1.7 – Arrangement scheme of WirelessHART devices

Antenna Rotation

The antenna does not have rotation limits to allow easier device installation in several areas and positions. However, it is suggested that its movement is restricted to the upper 180° (90° left and 90° right with the device vertically) identified by the label on the device. See the next figure.



Figure 1.8 – Antenna rotation limits

In case of horizontal mounting adjust the antenna to the vertical position, as shown in following figure.



Figure 1.9 – Correct position of the antenna with device horizontally

If the mounting position does not allow rotation of the antenna to a vertical position, the housing must be rotated until the rotational movement of the antenna to the vertical position is reached.

It is of utmost importance for the quality of the *WirelessHART* network signal transmission that the antenna stays on the vertical position..

Housing Rotation

The housing can be rotated to adjust the digital display on a better position. To rotate it, loose the housing rotation set screw, see next figure.

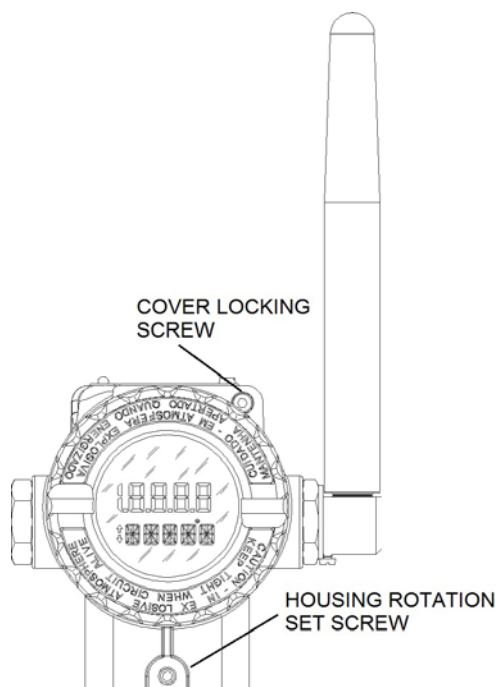


Figure 1.10 – Housing rotation set screw and cover locking screw

NOTE

The TP400 WirelessHART™ must always be installed with the antenna positioned upwards.

NOTES

To prevent humidity or corrosive gases entering, tighten the cover until it touches the housing. Then, tighten more 1/3 turn (120°) to guarantee the sealing. Lock the covers using the locking screw.

Maintenance Port

The communication port allows local communication with the position transmitter using a HART configurator connected to communication terminals "CN1" and "CN2" which are shown in the next figure.

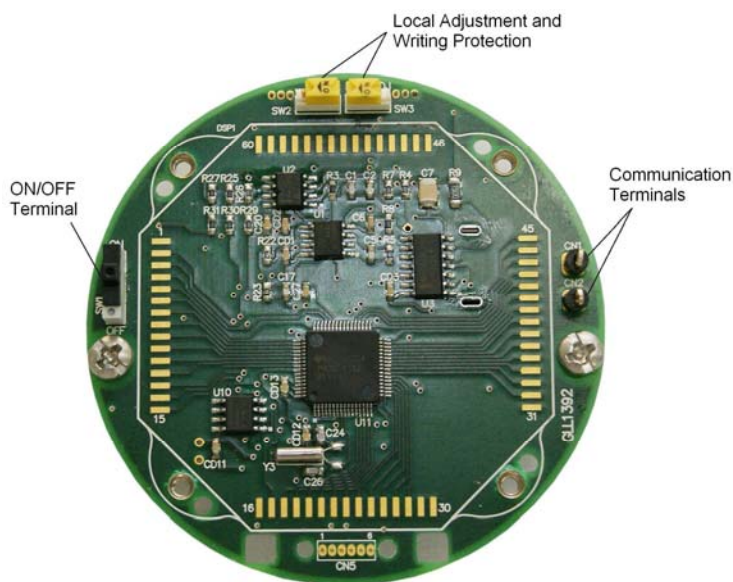


Figure 1.11 – Position transmitter maintenance port

A configurator can be connected to the communication terminals of the position transmitter through its connection terminals.

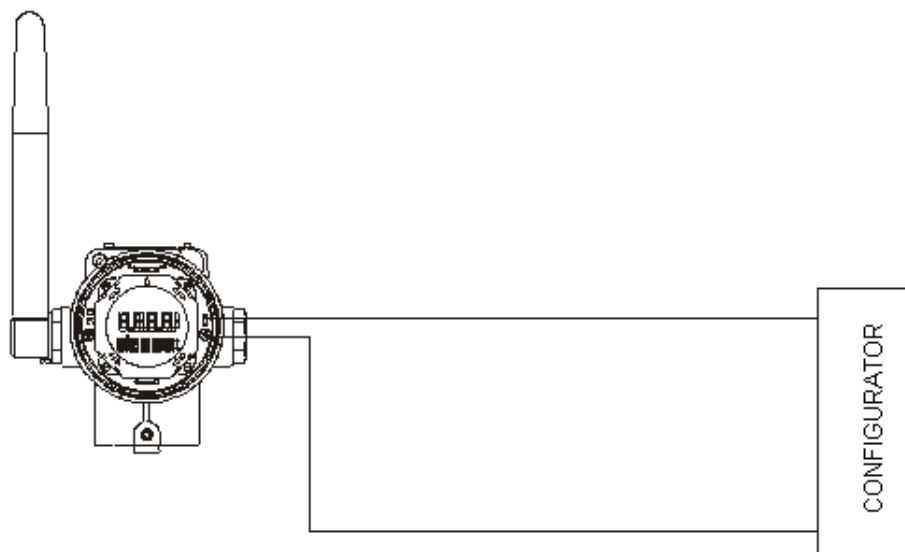


Figure 1.12 – Wiring Diagram of configurator to TP400 WirelessHART™

Linear Rotary and Linear Magnet

The models are linear and rotary magnet for use in linear and rotary actuators, respectively.

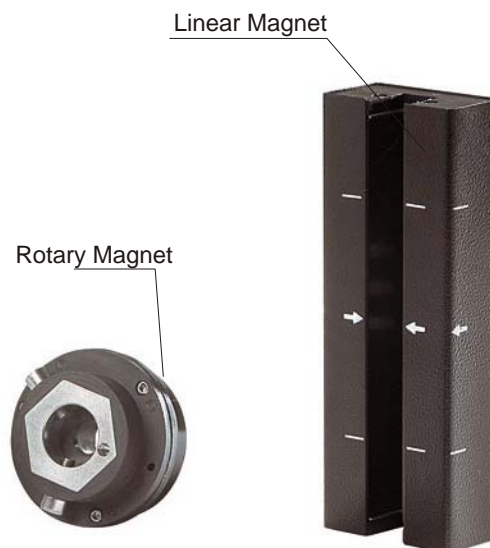


Figure 1.13 – Linear and Rotary Magnet Models

Centralizer device of linear magnet



NOTE

Centralizer device of linear magnet is used for all type of linear bracket.

Figure 1.14 - Centralizer device of linear magnet

Remote Sensor Position

The remote sensor position is an accessory recommended for high temperature and extreme vibration applications. It prevents excessive wear of the equipment and, consequently, the reduction of its lifetime.

For an appropriate installation of the sensor, check if the engraved arrow on the magnet matches the position transmitter arrow when the valve is at half way course.

The magnet mounting in relation to the position sensor should follow procedure below:

1. There is no friction between the magnet internal face, linear or rotary, and the remote position sensor bulge when excursions for opening or closing the valve.
2. The magnet and the remote sensor bulge are not too far.

It is recommended to keep a minimum 2 mm space and maximum 4 mm distance between the magnet external face and the remote sensor face. There is a centralizing device, for both linear installations, inside the position transmitter packing which will help you to correctly install the position transmitter and remote sensor.



Figure 1.15 - Remote Position Sensor

The electric signals in the remote sensor cable to device are of low intensity. Therefore, when installing the remote sensor cable inside the conduit (maximum limit 20 meters length), we recommend to avoid the proximity of possible induction sources and/or magnetic interference. The supplied cable is shielded for protection against electromagnetic interference, but despite this protection avoid the cable sharing the same conduit with other cables.

The connector for remote position sensor is easy handle and simple installation. See the installation procedure as per Figure 1.16:



Figure 1.16 – Connecting the Cable to the Remote Position Sensor



Figure 1.17 – Connecting Cable to the Transmitter Positioner

Installation in Hazardous Areas

ATTENTION

Explosions can result in death or serious injury besides financial damage. Installation of this instrument in an explosive environment must be compliant 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.

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.

Position Transmitter are marked with options of the protection type. The certification is valid only when the protection type is indicated by the user. When a specific type of protection is selected, any other type of protection cannot be used.

To install the housing in hazardous areas at least 6 full turns on cover threads must be done. The housing must be locked using locking screw (Figure. 1.6).

The cover must be tighten with at least 8 turns to avoid the penetration of humidity or corrosive gases 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).

Intrinsically Safe

ATTENTION

In hazardous areas with intrinsically safe and non-incendive requirements the circuit component parameters and applicable installation procedures must be observed.

For free access to the device in the explosive environment, ensure the instruments are installed in accordance with intrinsically safe and non-incendive field wiring practices.

Do not remove the position transmitter cover when in operation.

Section 2

OPERATION

TP400 *WirelessHART™* can measure displacement or movements from rotary or linear type, and constantly checks the status of the wireless network.

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

See block diagram

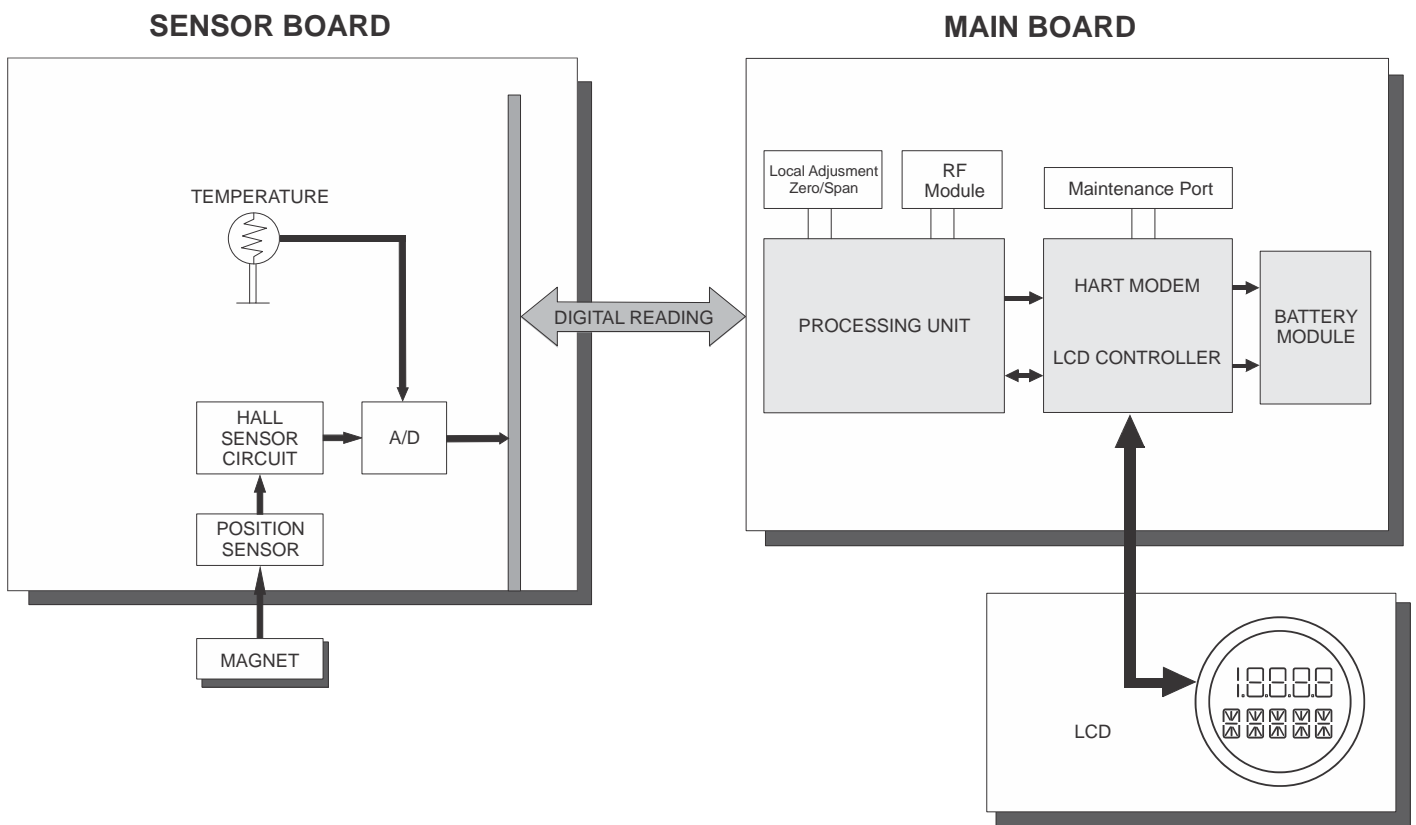


Figure 2.1 - TP400 *WirelessHART™* Block Diagram

SENSOR BOARD: 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.

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).

MAIN BOARD:

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

The CPU is the intelligent portion of the position transmitter, being responsible for the management and operation of all other blocks. The firmware is stored in a FLASH memory while the calibration data, identification and configuration are stored in nonvolatile FRAM. For temporary data storage the CPU uses an internal RAM. The data in the RAM is lost if power is switched off.

HART Modem

It modulates a communication signal in the communication port. A "1" is represented by 1200 Hz and "0" by 2200 Hz.

The function of this system is to make possible the exchange of information between the configurator and the repeater, through Master-Slave type digital communication.

Therefore, the transmitter demodulates the signal received serially from the configurator through the maintenance port, after treating it appropriately; it modulates the response to be sent. The HART[®] uses FSK technology to modulate the signal.

Battery

The Battery Module has 7.2V, consisting of 2 primary lithium batteries (Li-SOCl₂) of 3.6 V. Each battery has 2.5 grams of lithium, or 5.0 grams for the Battery Module.

WARNING

By no means should be used other than the power supplied by batteries Module Smar (code 400-1209). When you replace the Battery Module (code Smar 400-1209) to set up the replacement via a configurator that will cause the device to reboot count the estimated lifespan for the new module.

Under normal use, the batteries offer no risk of spontaneous reaction if they are handled properly. You should exercise caution in relation to falls, high temperature and short-circuit the Battery Module, so that it does not offer any risk or malfunction.

Even with low batteries should keep the same care, they still offer dangers. Never attempt to disassemble, modify or recharge the batteries as this may result in leakage or explosion.

STORAGE

The battery module should preferably be stored in an environment below 30 ° C, dry, ventilated subject to less variation in temperature.

Do not dispose of batteries in Module trash. Use a battery for proper disposal or chemical waste.

When you replace the Battery Module (code Smar 400-1209) to set up the replacement via a configurator that will cause the device to reboot count the estimated lifespan for the new module.

For Additional Information and First Aid, see Appendix B - "Safety Datasheet Battery" or consult the manufacturer's website: <http://www.tadiranbat.com/index.php/shipping-and-information>.

Display Controller

It receives the data from the CPU and activates the LCD segments.

Local Adjustment

The position transmitter, under the identification plate, two holes that allow the placement of the magnetic tool to perform the Local Adjustment.

The holes are marked with **Z** (Zero) and **S** (Span) and from now on will be designated simply by **(Z)** and **(S)**, respectively. See the following figure:

NOTE
For configuration via local adjustment the following actions are necessary: <ul style="list-style-type: none"> • The write protection jumper must be disabled; • The local adjustment jumper must be enabled. See on Figure 1.11 the location of Local Adjustment and Write Protection jumpers on the main board.

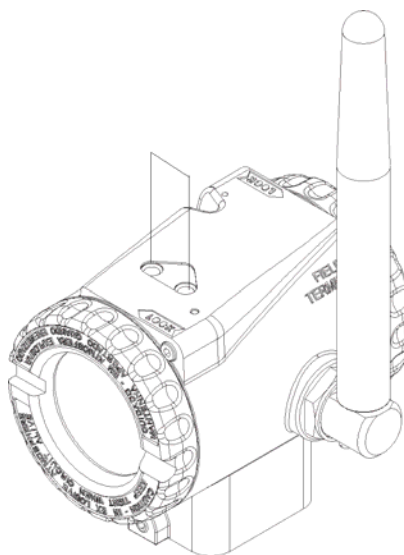
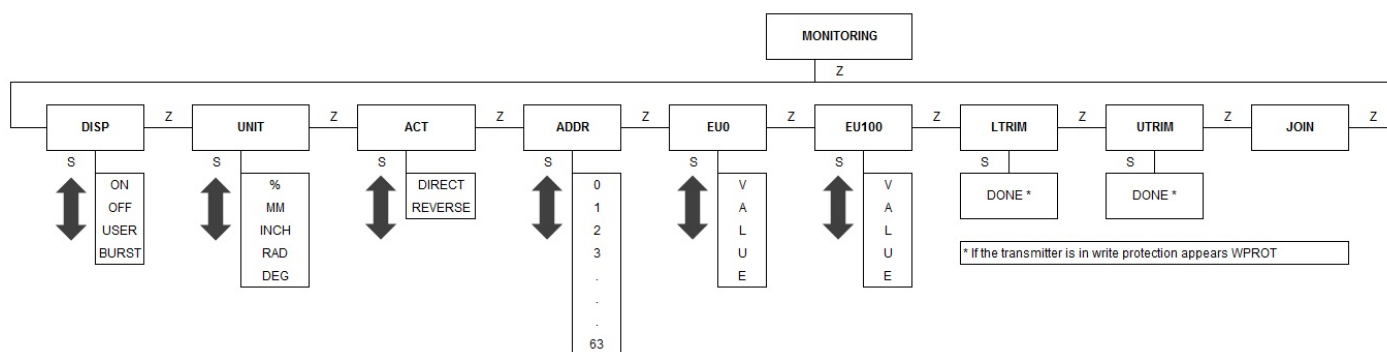


Figure 2.2 – Local Adjustment

Browsing the functions and their branches works as follows:

- Inserting the handle of the magnetic tool in **(Z)**, the device passes from the normal measurement state to the configuration state. The position transmitter software automatically starts to display the available functions in a cyclic routine.
- Apply the magnetic tool in **(Z)** to navigate through all available configuration options;
- Once the display shows the desired option, change the magnetic tool to **(S)** to select and navigate within the branch of the selected option. Removing the magnetic tool will allow the device to save the configurations (in case of changing).

The options available for **TP400W** local adjustment are:



** When starting the Span, the transmitter will save the information in the first 5 (SAVED) or show WPROT for write protection enabled.

Figure 2.3 – Local adjustment - Options

The **DISP** option changes the configuration of display mode. There are four modes supported:

- **OFF**: display always turned off
- **ON**: display always turned on
- **USER**: display normally off but activated when user inserts the magnetic key (**S**)
- **BRST**: display normally off but activated when device sends a burst command.

UNIT: Engineering unit or percentage;

ACT: Direct or reverse action;

ADDR: Address 0 up to 63;

EU0: 0% corresponding to lower value;

EU100: 100% corresponding to upper value;

LTRIM: Lower position Trim (set with the actuator or mechanism in the lower position);

UTRIM: Upper position Trim (adjust with the actuator or mechanism in the upper position);

The **ADDR** and **JOIN** options are read-only and are used to identify the configuration address by maintenance port and the device status on the **WirelessHART™** network, respectively.

Write Protection

The write protection function can be activated by two ways: hardware (switch on main board) and software. The writing of any parameter only will be able if both protections are disabled.

Another way to protect the writing, but partially, is using the Lock Device option (WirelessHART).

This option is used in WirelessHART devices to block the writing for only one configuration master, **Communication Port** or **Gateway**. With this function user avoids configuration conflicts when acting by one of the configurators in dangerous situations.

The types of locking are:

- **Unlocked**: both configurators have write permission.
- **Temporarily Locked**: only the configurator that locked the device has write permission. However, after restarting the device its state returns to Unlocked.
- **Permanently Locked**: only the configurator that locked the device has write permission, and its state remains even after restarting the device.
- **All locked**: no configurator has write permission until the device is unlocked by the same configurator that locked it.

ATTENTION

The use of this function is intended only for special occasions, which the security parameter writing is critical and fast. After writing, the configurator must return the device to the Unlocked mode.

Functional Description - Display (LCD)

The local indicator is able to display three variables, which are user-selected. When multiples variables are chosen, the display will alternate between both with an interval of 3 seconds.

The liquid crystal display includes a field with 4 ½ numeric digits, a field with 5 alphanumeric digits and an information field, as shown on Figure 2.4.

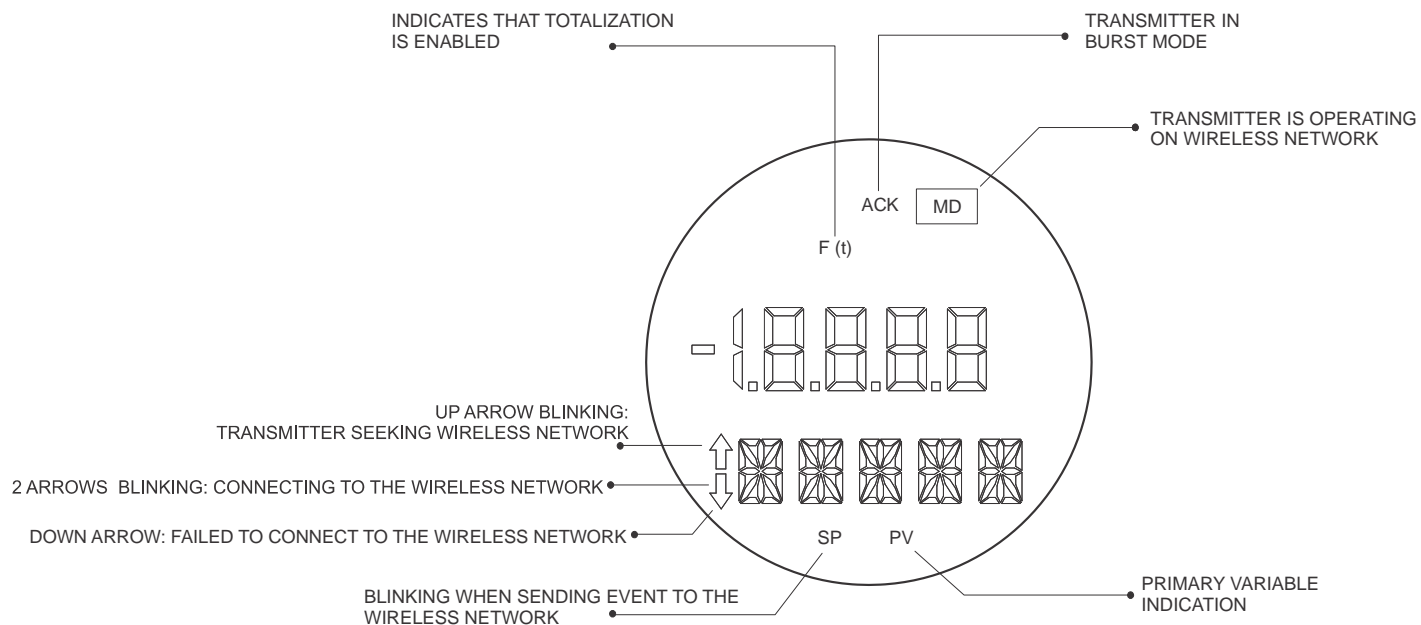


Figure 2.4 – Display

Monitoring

During normal operation, the **TP400 WirelessHART™** is in the monitoring mode. In this mode, indication alternates between the three variables (LCD_1, LCD_2, LCD_3) as configured by the user.

The display indicates engineering units, values and parameters simultaneously with most status indicators.

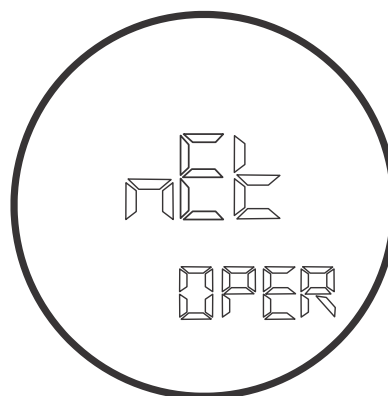


Figure 2.5 – Typical Display in Monitoring Mode

The monitoring mode is interrupted when the user applies the complete local adjustment.

The **TP400 WirelessHART™** display may also exhibit messages and errors. For a complete list, see Section 3 – Maintenance.

Section 3

MAINTENANCE

General

The network position transmitter **TP400 WirelessHART™** are extensively tested and inspected before being sent to the user.

All maintenance service should be done by a qualified person and the exchange of components (supplied by Smar) should only be performed by people certified to do so.

Diagnostic with Display

The display can show failure messages in alphanumeric segment. When these messages are shown, the position transmitter automatically goes to a safe state. These messages are shown in Table 3.1.

DIAGNOSTIC MESSAGES	PROBABLE SOURCE OF TROUBLE
FAIL RADIO	Indicates problem in the radio.
LOW BATT	Indicates low battery level.
FAIL BATT	Indicates critical battery level.

Table 3.1 – Diagnostic with Display

Disassembly Procedure

ATTENTION
This type of operation should be done in a safe area and the position transmitter turned off.
WARNING
The board has CMOS components which may be damaged by electrostatic discharges. Observe correct procedures for handling CMOS components. It is also recommended to store the circuit boards in electrostatic-proof cases.
IMPORTANT
To avoid damage do not rotate the electronic housing more than 270° starting from the fully threaded. See the following figure.



Figure 3.1 – housing safety rotation

IMPORTANT
To avoid device damage, do not rotate the antenna below the 180° imaginary line relative to the device base. If there is the need to rotate the antenna, loosen the locking screw and the move it just above this line. See the following figure. For more details see the topic "Antenna Rotation" in section 1.



Figure 3.2 – Antena safety rotation

Here is the disassembly procedure of TP400. Figure 3.3 indicates the position of the components mentioned in this description



a) Open the frontal (1) and rear covers (15);



b) Open the bottom cover (20), loosening the housing fixation screw (6);



c) Remove the main board (5) on the front housing (8), disconnecting the radio board (10);



d) Disconnect Battery Module (13) from radio board at the point indicated and unscrew it from the housing;



e) Disconnect the antenna cable from the radio board, as shown in the picture. Unscrew the radio board from housing;



f) Loosen the antenna (17) with the aid of a wrench. Use the wrench in the way is being shown in the picture, always beneath the antenna;

Assembly Procedure

ATTENTION

This type of operation should be done in a safe area and with the position transmitter turned off.

Here is the assembly procedure of **TP400**. Figure 3.3 indicates the position of the components mentioned in this description.



- a) First, make the antenna assembly (17) on the housing side (8) indicated by "FIELD TERMINALS";



- b) Tighten the antenna with a wrench. Use the wrench as shown in the picture, always beneath the antenna. At the end, keep the antenna in a vertical position;



- c) Screw the radio board (10) on the back of the housing. Pass the antenna cable through the hole indicated in the picture and connect it to the radio board as shown in the picture;



- d) Screw Battery Module (13) and connect it to the radio board at the point indicated;



- e) Place the main board (5) on the front of the housing and connect the radio cable to it. After connection, screw the board to the housing;



- f) Fit the cover (20) at the bottom of the housing, locking it with the fixing screw (6);



- g) End threading the front (1) and rear (15) covers;



- h) Mounting with Remote Sensor (optional).

Troubleshooting

1) Device does not connect to the WirelessHART network.

POSSIBLE CAUSES:

- The device is turned off;
- The Network Manager/Gateway is turned off;
- The device is far from the Network Manager/Gateway or other device connected to it;
- Network ID and Join Key are not configured correctly;
- The antenna is not connected to the Network Manager/Gateway or to the device;
- There is an Access Control List in the Network Manager/Gateway and the device is not on this list ;
- Maximum number of devices configured in Network Manager/Gateway has been reached.

2) Device connects and disconnects to the *WirelessHART* network.

POSSIBLE CAUSES:

- Low battery or bad contact in the powering causing a device restarting;
- The connectivity related to the neighbors is unstable (moving obstacles or distance in the limit);

3) Devices in the operation range but with low communication stability.

POSSIBLE CAUSE:

- Interference. Approximate the devices to get a better stability.

Exploded view

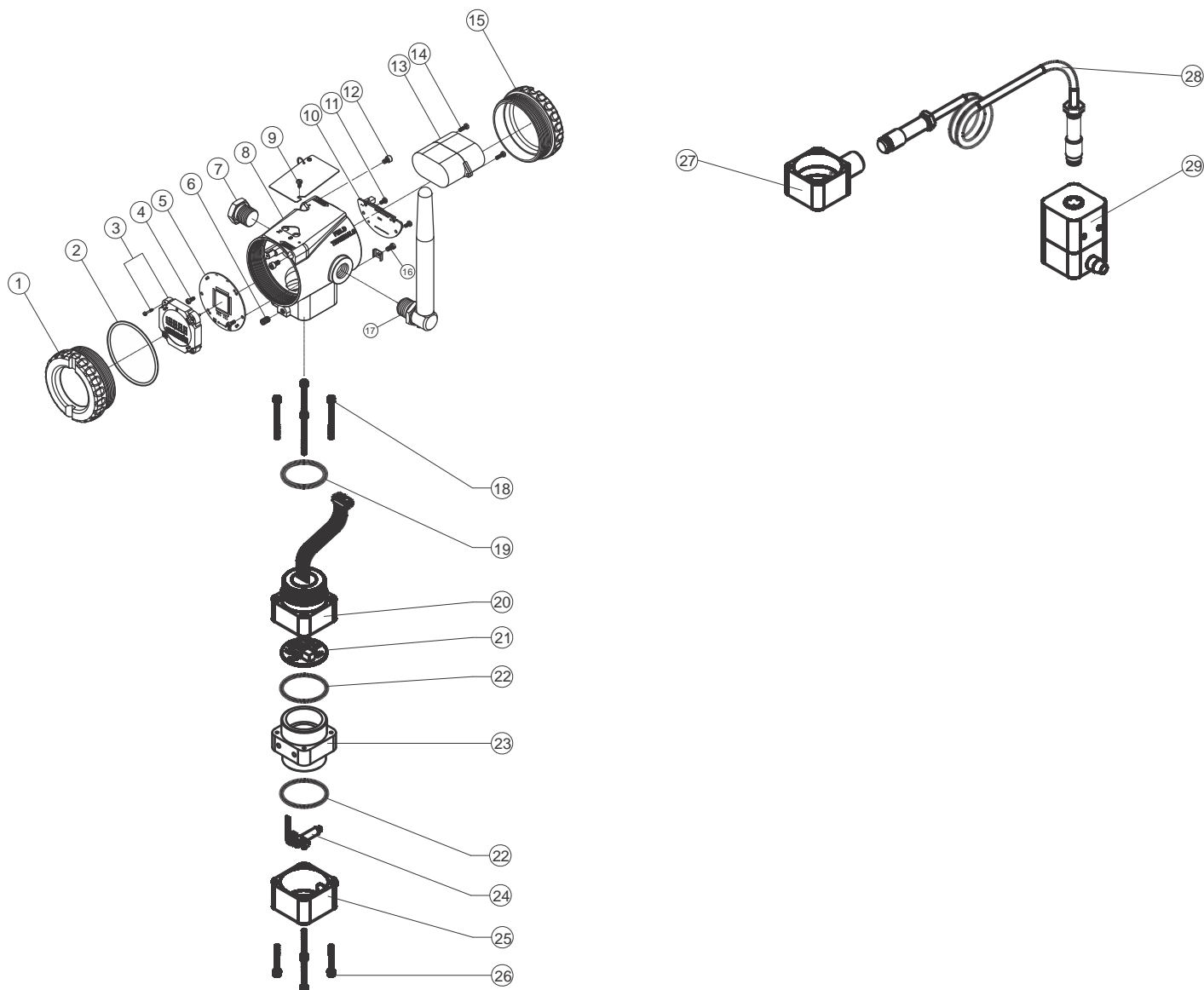


Figure 3.3 – Exploded view

Accessories and Spare Parts

ACCESSORIES	
ORDERING CODE	DESCRIPTION
SD-1	Magnetic tool for local adjustment.
Palm*	Palm Handheld, 16 Mbytes, including installation software and startup of HPC401.
HPC401*	HART Interface - (HPC401 Plus) for Palm, including configuration package for Smar transmitters and generic transmitters.
HPC401 Plus *	HART [®] Interface.
CONF401*	PC-based Smar configurator.
HI321*	HART Interface for CONF401.
400-1176	Teflon guide for linear magnet.
400-1177	Teflon guide for rotary magnet.

* For upgrades of devices and software HPC401 or CONF401 visit: <http://www.smarresearch.com> .

LISTA DE SOBRESSALENTES				
DESCRIÇÃO DAS PARTES		POSIÇÃO	CÓDIGO	CATEGORIA (NOTA1)
FRONT COVER (WITH WINDOW FOR INDICATION)		01	400-0822	
COVER O-RING (NOTE 3)		02	204-0122	B
DISPLAY (WITH SCREWS)		03	400-0828	
MAIN BOARD FIXATION SCREW	CARBON STEEL 316 STAINLESS STEEL	04	400-0905 400-0832	
MAIN BOARD		05	400-1274	A
COVER LOCKING SCREW		06	400-1121	
M20 x 1,5 HEXAGONAL PLUG		07	400-0810	
HOUSING 400W SERIES (NOTE 2)	ALUMINUM 316 STAINLESS STEEL	08	400-1205 400-1206	
PLATE FIXATION SCREW		09	204-0116	
RADIO BOARD		10	400-1211	
RADIO BOARD FIXATION SCREW		11	400-1212	
COVER LOCKING SCREW		12	204-0120	
BATTERY MODULE		13	400-1209	
BATTERY MODULE FIXATION SCREW		14	400-1210	
REAR COVER (WITHOUT WINDOW FOR INDICATION)		15	400-1208	
EXTERNAL GROUND SCREW	HOUSING IN ALUMINUM HOUSING IN 316 STAINLESS STEEL	16	400-0904 400-0826	
WIRELESS ANTENNA		17	400-1214	
CONNECTION COVER SCREW		18	400-0883	
O-RING, Neck (NOTE 3)		19	204-0113	
CONNECTION COVER	ALUMINUM 316 STAINLESS STEEL	20	400-0910 400-0911	
ANALOG BOARD		21	400-1275	
UNION BLOCK O-RING (NOTE 3)		22	400-0915	
UNION BLOCK	ALUMINUM 316 STAINLESS STEEL (H1)	23	400-1276 400-1276	
POSITION SENSOR BRACKET + POSITION SENSOR SENSOR + FLAT CABLE		24	400-0927	
POSITION SENSOR COVER	ALUMINUM 316 STAINLESS STEEL	25	400-0928 400-0929	
POSITION SENSOR COVER BOLT		26	400-0092	
REMOTE POSITION SENSOR COVER SET (NOTE 4)	ALUMINUM 316 STAINLESS STEEL	27	400-0932 400-0933	
CABLE SET + CONNECTOR	5 m 10 m 15 m 20 m	28	400-0857	
			400-0858	
			400-0859	
			400-0860	
REMOTE EXTENSION SET	ALUMINUM 316 STAINLESS STEEL	29	400-0934 400-0935	
TRANSDUCER SET		-	400-1277	
MOUNTING BRACKET	CARBON STEEL FOR 2"PIPE 316 STAINLESS STEEL	-	400-0339	
			400-0340	
MAGNETS	LINEAR MAGNET UP TO 30 MM LINEAR MAGNET UP TO 50 MM LINEAR MAGNET UP TO 100 MM ROTARY MAGNET	-	400-0748	
			400-0035	
			400-0036	
			400-0037	

NOTES

- 1) For category **A** it is recommended to keep in stock one set for **25** installed parts, and for category **B** one set for **50** installed parts.
- 2) It includes screws (cover locking and grounding) and identification plate without certification.
- 3) O-Rings are packaged in packs of 12 units.
- 4) Includes cover, Position Sensor with flat cable and connector for cable extension.

Returning Materials

Should it become necessary to return the position transmitter and/or configurator to SMAR, simply contact your local agent or SMAR office, informing the defective device's serial number, and return it to our factory.

In order to expedite 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 to the instrument operation, such as service and process conditions, is also helpful. For this, fill out the SRF (Service Request Form). The SRF is available on Appendix A.

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

ATTENTION

The device must have its Battery Module disconnected before being sent for safety and shipping standards. To do this, first turn it off by front switch (Figure 1.11). Disconnect the Battery Module and radio board, located at the rear of the device.

Section 4

TECHNICAL CHARACTERISTICS

FUNCTIONAL SPECIFICATIONS	
Travel	Linear Motion: 3 - 100 mm. (For measurement beyond 100 mm consult the BFY-CL catalog at www.smar.com). Rotary Motion: 30° - 120° Rotation Angle.
Battery Module	The module consists of 2 primary lithium batteries (Li - SOCl ₂) of 3.6 V, totaling 7.2 V. Duration Burst Mode at 8 seconds, @25°C, network with at least 3 neighbors devices: 3 years. Note: The Battery Module used in the repeaters must be provided exclusively by Smar (Battery Module - Code 400-1209).
Communication Protocol	HART [®] Version 7 protocol, with TP400 WirelessHART™ command set. A HART [®] transmitter specific review must be managed according to the TP400 WirelessHART™ transmitter. HART [®] is a trademark of HART Communication Foundation.
Output Signal	Digital output via 2.4 GHz radio frequency, according to HCF_SPEC-65 Rev. 1.0.
Measurement Type	Position for linear and rotary displacement.
Zero and Span Adjustment	Jumper of local adjustment with two positions: Able and Disable.
Indicator	Rotary CLD with 4½ - numerical digits and 5 alphanumeric characters. Function and Status Indication.
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) in operation; -40 to 85°C (-40 to 185°F) without damage. Remote Sensor: -40 to 105°C (-40 to 221°F).
Configuration	Remotely with external programmer via WirelessHART™ network. Locally via programmer with wired maintenance port.
Humidity Limits	0 to 100% RH (Non-condensable Relative Humidity).
Failure Alarms (Diagnostics)	Detailed diagnostics via HART [®] communicator and display LCD.
Wireless Certification (pending)	ANATEL (National Telecommunications Agency).
Update Time	2 seconds.
Turn-on Time	Performs within specifications in less than 7 seconds after power is applied to the transmitter.
Reading of the Position	Direct or reverse.
Position Sensor	Non-contact Hall effect sensor. Available in the remote mounting version (optional; consult the Smar on applicable hazardous certifications).

PERFORMANCE SPECIFICATIONS	
Accuracy	≤ 0.2% F. S. the effects of linearity, hysteresis and repeatability are included. (NOTE: For more precise linear measurements use the linearization process. Refer to the Linearization chapter on the Instructions Manual.)
Resolution	≤ 0.1 % F.S.
Repeatability	≤ 0.5 % F.S.
Hysteresis	≤ 0.2 % F.S.
Temperature Effect	± 0.8% / 20°C F.S.
Electromagnetic Interference Effect	Designed to comply with European Directive EMC 2004/108/EC.

PHYSICAL SPECIFICATIONS	
Electrical Connection	M20 X 1.5 (default to antenna wireless equipment).
Material of Construction	Injected low copper Aluminum with polyester painting or Stainless Steel housing, with Buna N O-Rings on cover (NEMA 4X, IP66).

PHYSICAL SPECIFICATIONS	
Mounting Brackets	In SAE 1020 Carbon Steel with electrostatic polyester paint or Stainless Steel. Including accessories (bolts, nuts, washers and U-clamp) in Carbon Steel or Stainless Steel.
Identification Plate	Stainless Steel plate with label in special plastic.
Approximate Weight	<p>TP400 1.8 kg in Aluminum; 3.6 kg in Stainless Steel.</p> <p>Remote Position Sensor 0.58 kg in Aluminum; 1.5 kg in Stainless Steel.</p> <p>Cable and Connector Add 0.05 kg for the Remote Sensor connector and 0.045 kg/m for each meter of the Remote Sensor extension cable.</p>
Electronic Circuit	Antenna omnidirectional 2.4 GHz. Coaxial cable to connect the antenna with the radio board. Battery pack with 2 units Type 'C'.

OPERATION PROTECTION SPECIFICATIONS	
Counter Operation	Historical of configuration change.
Protection Configuration	Write protection via hardware and software.
Certification	Intrinsic safety (pending) and weather proof.

HUMAN MACHINE INTERFACE (HMI) SPECIFICATIONS			
Display LCD Status	ITEM	ICON	DEFINITION
	1	PV	Indication of the primary variable
	2	↑	Blinking when the transmitter is seeking wireless network
	3	↑↓	Flashing when connecting to the wireless network
	4	MD	Transmitter operating on a wireless network
	5	↓	Failed to connect to the wireless network
	6	ACK	Transmitter in burst mode
	7	F(t)	Lights when sending command in burst mode
	8	SP	Lights when an event is sent by the device
	9	F(x)	When the points table for linearization is enabled


Ordering Code

MODEL																							
TP400	POSITION TRANSMITTER																						
	COD	Communication Protocol																					
	W	WirelessHART™																					
	COD	Security Option																					
	0	Standard (for use in measurement and control)																					
	COD	Local Indicator																					
	1	With digital indicator																					
	COD	Electrical Connection																					
	A	M20 X 1.5 (also standard antenna for wireless device)																					
	COD	Mounting Bracket																					
	0	Without Bracket																					
	1	Carbon Steel Brackets																					
	2	Stainless Steel Brackets																					
	COD	Housing																					
	A	Aluminum (IP/TYPE)																					
	I	316 Stainless Steel - CF8M (ASTM - A351) (IP/TYPE)																					
	COD	Painting																					
	0	Gray Munsell N 6.5 Polyester																					
	8	Without Painting																					
	Z	User specification																					
	COD	Certification Type																					
	N	Without Certification																					
	COD	Certifying Body																					
	0	Without																					
	COD	TAG Plate																					
	0	With TAG, when specified																					
	1	Blank																					
	2	User specification																					
	COD	Type of Actuator																					
	0	Without magnet																					
	1	Rotary																					
	5	Linear up to 50 mm																					
	7	Linear up to 100 mm																					
	A	Linear up to 30 mm																					
	SPECIAL OPTIONS (1)																						
	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 me cable																					
	COD	Special Features																					
	ZZ	User specification																					
	COD	Certification for Telecommunications																					
	W1	ANATEL																					
	COD	Manufacture Standard																					
	S0	SMAR																					
TP400	-	W	0	1	-	A	1	A	0	-	N	0	0	-	1	.	*	*	*	*	TYPICAL MODEL NUMBER		

NOTE

- 1) Leave it blank for no optional item.
- 2) Consult Smar for applications in hazardous areas.

Appendix A

	SRF – Service Request Form			
	TP Position Transmitter			
GENERAL DATA				
Model:	TP400 () Firmware Version: _____			
Serial Number:	_____			
TAG:	_____			
Remote Position Sensor?	Yes ()	No ()		
Action:	Rotary ()	Linear ()		
Travel:	30 mm ()	50 mm ()	100 mm ()	Other: _____ mm
Configuration:	Magnetic Tool ()	Palm ()	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.

BATTERY SAFETY DATASHEET

Section 1 – Identification

Manufacturer: Tadiran

Model: TL-5920

US office address: 2001 Marcus Avenue, Suite 125E, Lake Success, NY 11040

Emergency Telephone: 1-800-424-9300

Information Telephone: 1-516-621-4980

Section 2 – Composition

Ingredients	%
Lithium Metal (Li)	<5%
Thionyl Chloride (SOCl ₂)	<47%
Carbon (C)	<6%
Aluminum Chloride (AlCl ₃)	<5%
Lithium Chloride (LiCl)	<2%
Glass	<1%
PVC	<1%
PTFE	<1%
Steel, nickel and inherent components	balance

Section 3 – Hazard Identification

The batteries described herein are hermetically sealed and are not hazardous when used according to the manufacturer's recommendations.

Batteries should not be exposed to short-circuit, recharged, punched, burned, crushed, immersed in water, forced to discharge or placed in temperatures above the range specified for the product. In these cases there is a risk of fire and explosion.

Section 4 – First aid

In case of rupture, explosion or leakage, remove personnel from the contaminated area and ventilate it to release smoke, corrosive gases and odor. Seek medical help immediately.

Eyes - flush with plenty of water for at least 15 minutes (remove contact lenses if possible) and then seek medical attention.

Skin - Remove contaminated clothing and flush affected skin with plenty of water for 15 minutes and then seek medical attention.

Inhalation - look for an area with fresh air, rest, use artificial respiration, if necessary, and seek medical attention.

Ingestion - rinse your mouth, do NOT induce vomiting, drink lots of water, and then seek medical attention.

Section 5 – Fire fighting

If the batteries are directly involved in fire DO NOT USE: WATER, SAND, CO₂ and DRY CHEMICAL POWDER EXTINGUISHERS.

If the batteries are in a location adjacent to the fire, it can be combated according to the combustible material (paper or plastic, for example). In this case, the use of large quantities of cold water would be an effective way to combat.

To firefighting use equipment and protective clothing that prevent contact with battery solution. The fire must be fought at a safe distance and after evacuation of the area.

Batteries may explode when exposed to: excessive heat (above 150 °C), recharged, discharged below 0V, punched and crushed. Hydrogen Chloride (HCl) and sulfur dioxide (SO₂) can be formed during thermal decomposition of Cl₂.

Section 6 – Leakage

The material contained in the batteries will leak only if exposed to abusive conditions.

On the occasion of leakage: contain the leakage if using protective clothing and ventilate the area well. Cover with Sodium Carbonate (Na₂CO₃) and keep away from water, rain or snow. Put in a secure container and pour into proper trash, according to local regulatory standards.

Section 7 – Handling and storage

Never attempt to disassemble or modify the batteries as this may result in accident.

HANDLING – do not short-circuit the terminals or expose to temperatures above the range specified for the battery, overload, force discharge or thrown in fire. Do not punch, crush or immerse in water.

STORAGE – preferably store in an environment below 30 °C, dry and ventilated subject to less variation in temperature.

Do not store the batteries near heating equipment, nor expose to direct sunlight for long periods. Elevated temperatures may result in shortened batteries life and degrade their performance.

Do not store batteries in high humidity environment for long periods.

The batteries should not be recharged. High pressures can cause deformities and release of chemicals from the battery.

Ecological Information: When properly used or discarded, the batteries pose no danger to the environment. The batteries do not contain mercury, cadmium or lead. Do not let internal components exposed to the marine environment.

Disposal: Absolutely not incinerate batteries. Dispose of batteries according to local regulations.

Transportation: Batteries are considered "Dangerous Goods" when transported in or out of equipment.

For additional information, see the manufacturer's website
<http://www.tadiranbat.com/index.php/shipping-and-information>