smar - TT400WH

OPERATION, MAINTENANCE
INSTRUCTIONS / MANUAL

# TEMPERATURE TRANSMITTER
# *Wireless*HART

WirelessHART™


AUG / 13

**TT400W**

VERSION 7

TT400WME

smar

www.smar.com

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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 denote 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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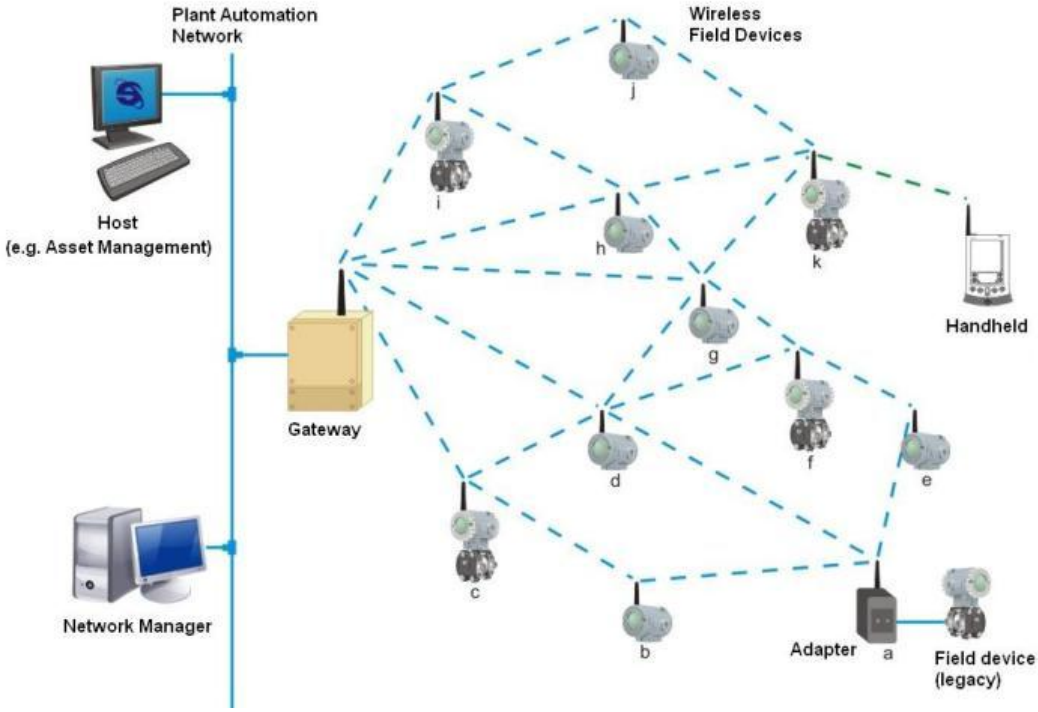
# INTRODUCTION

## *Wireless*HART technology overview

The *Wireless*HART 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.

***Wireless*HART network**
Basically, a *Wireless*HART network, defined in the HART specifications, consists of a host, a *Wireless*HART Gateway and one or more field devices and/or *Wireless*HART 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 an Human Machine Interface application, which allows an operator to interact with the process. Through the *Wireless*HART Gateway, the host can gather data from devices connected to the *Wireless*HART network. The host communicates with the *Wireless*HART Gateway using a communication protocol, for example, HSE, H1, Profibus or Modbus.

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

**Network Manager**
The Network Manager is an application that can be embedded in the *Wireless*HART Gateway. On a *Wireless*HART 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 *Wireless*HART device to the network, the Network Manager validates the Network ID and the Join Key attributes which are configured in the *Wireless*HART Gateway and *Wireless*HART devices.

The Network ID identifies a *Wireless*HART network in unique way. It is an unsigned integer attribute and must be configured on the *Wireless*HART Gateway and all *Wireless*HART devices. Considering a *Wireless*HART 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 *Wireless*HART devices that receive the advertisement with the Network Id identical to theirs. It may be single or each *Wireless*HART device may be configured with an individual Join Key. In the first case, the *Wireless*HART Gateway and all *Wireless*HART 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 *Wireless*HART Gateway a list with individual Join Keys, i.e., a key for each *Wireless*HART device, and (b) you must configure each *Wireless*HART 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-BYTES HEXADECIMAL STRING |
|---|---|
| 00000000000000000000000000000000 | 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00 |
| 00000000000000000000000000000302 | 0x00, 0x00, 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 |

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

***Wireless*HART 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 *Wireless*HART. The adapter uses HART FSK standard communication, wired, to access data from HART field devices. And the adapter also uses the *Wireless*HART communication to provide data of the field device to the host. The adapter thus enables a HART field device to work on *Wireless*HART network.

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

## Planning an *Wireless*HART network

The planning of a *Wireless*HART 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 *Wireless*HART network, is exempt, in general, detailed field surveys, which are usually needed when we plan networks based on other wireless technologies.

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

### Planning
This phase requires the execution of the steps below:

**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.

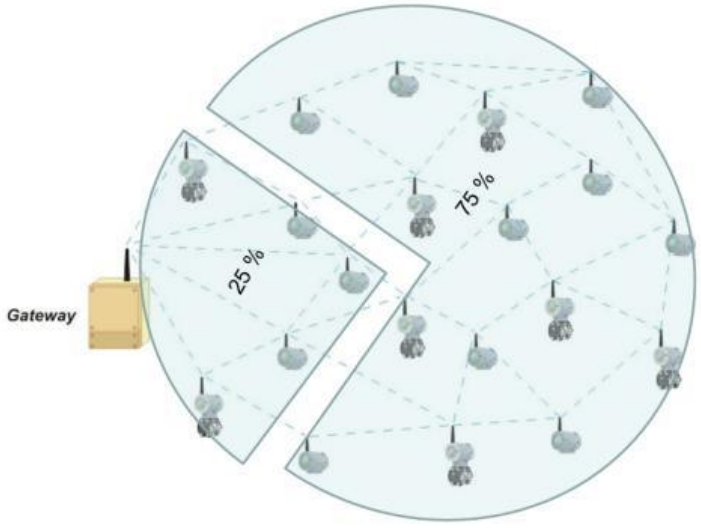
**Identify potential sources of interference**
Are there radio communications or other wireless networks in the plant? What protocols and frequencies do they use? Use high power? Although unlikely, given the robustness of the radios used by the *Wireless*HART technology, prior knowledge of the answers 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 *Wireless*HART Network Manager control.

**Integration with the host**
The gateway connects the *Wireless*HART 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.

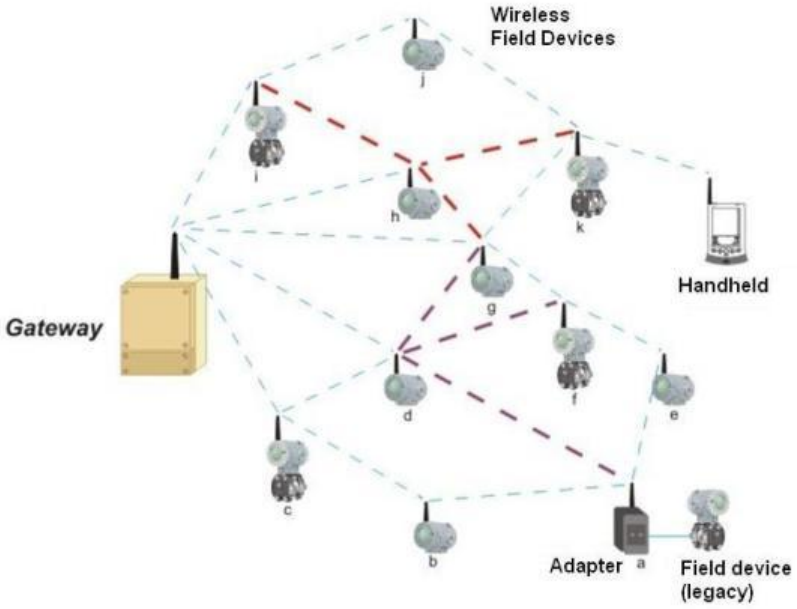
## Project

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;



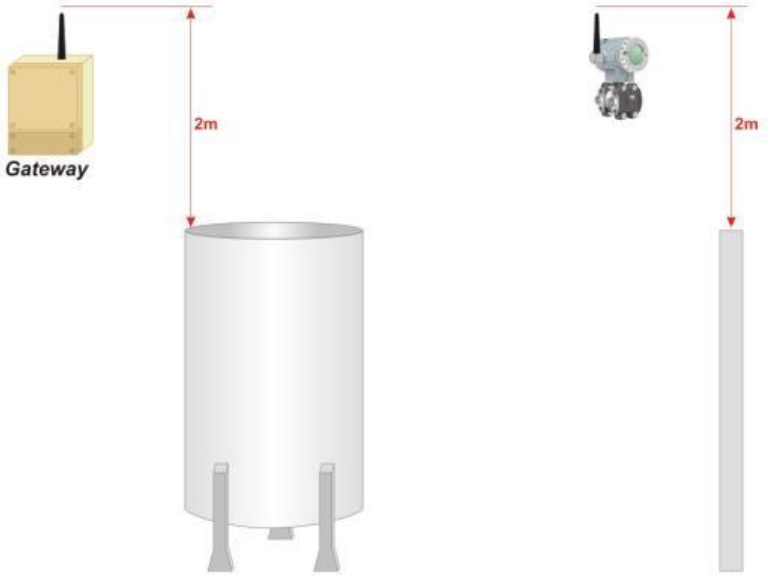

- Place the repeaters as needed.

### Installation

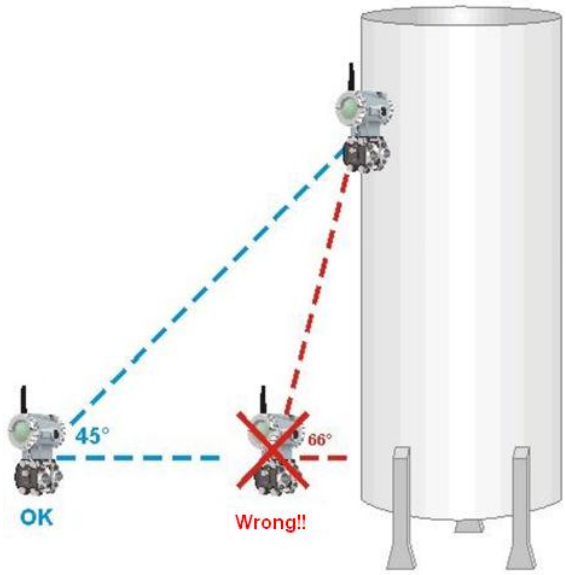
As mentioned before, *Wireless*HART devices should be connected to the process and configured the same way as conventional wired HART devices.

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 *Wireless*HART 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;




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




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

## Commissioning

The commissioning of devices and gateway must be considered[1].

### *Wireless*HART devices commissioning

a) Ensure that the gateway is installed and powered;
b) Install each device individually. Start with those closest to the gateway, i.e., those that will be within the coverage area of the gateway;
c) If the device is powered by batteries, check that they have the same characteristics documented in the device's operation manual;
d) Power the device up;
e) Use a handheld terminal and configure the device according to the application requirements;
f) Configure the Long Tag of the device;
g) Configure the Network ID;
h) Configure the Join Key;
i) Define and configure the update rate;
j) Command, if necessary, the device connection to the network;
k) Follow the device connection to the network, waiting until it reaches the operational state. The monitoring can be done from the device[2] or gateway;
l) Make sure the device is operating to ensure its commissioning. For example, check the value of PV measured and its update rate.

### Gateway commissioning

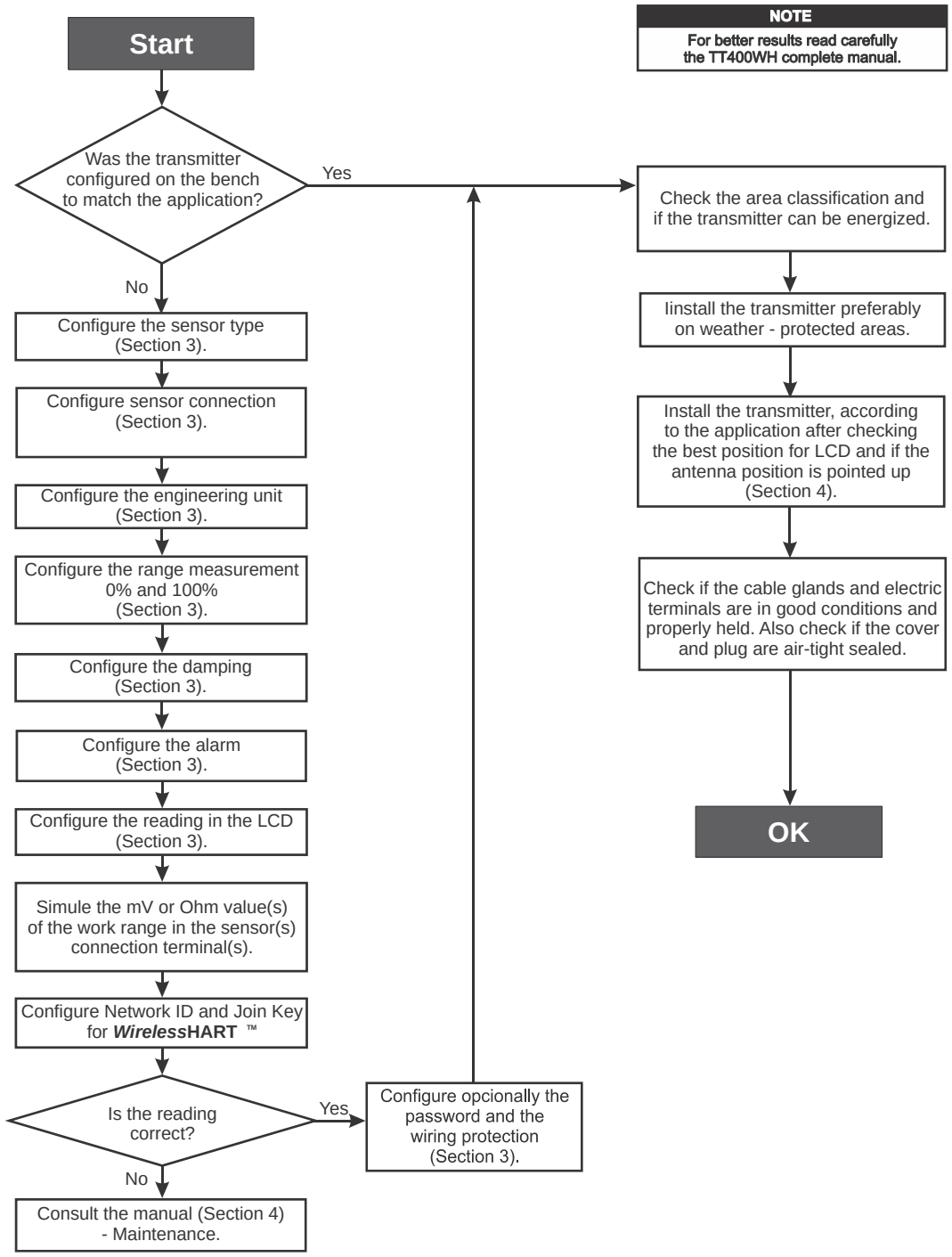
a) Make sure that the gateway is available to the host system;
b) Check the gateway and make sure it has at least five devices directly connected to it;
c) Check if 25 % of the devices are connected directly to the gateway. If necessary, add repeaters;

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.

[1] The steps bellow assumes that the Network ID and the Join Key(s) are already configured.

[2] **Refer to the device's manual to learn procedures for such verification.**

# Installation Flowchart



# Section 1

# INSTALLATION

## General

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

The overall accuracy of temperature and other measurements depends on several variables. Although the transmitter has an outstanding performance, proper installation is essential, in order to maximize its performance.

Among all factors, which may affect transmitter accuracy, environmental conditions are the most difficult to control. There are, however, ways of reducing the effects of temperature, humidity and vibration.

Temperature fluctuation effects can be minimized by locating the transmitter in areas protected from extreme environmental changes.

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. For temperature measurements, sensors with cooling-neck can be used or the sensor can be mounted separated from the transmitter housing.

Use of sunshades or heat shields to protect the transmitter from external heat sources should be considered, if necessary.

Humidity is fatal to electronic circuits. In areas subjected to high relative humidity, the O'Rings for the electronics cover must be correctly placed. Removal of the electronics cover in the field must be reduced to the minimum necessary, since each time it is removed 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 can not be protected by painting. Code-approved sealing methods on conduit entering the transmitter should be employed.

Measurement error can be decreased by connecting the sensor as close to the transmitter as possible and using proper wires (see Section 2, Operation).

| WARNING |
| --- |
| Do not remove the graphite grease from the covers, or they may jam. |

| WARNING |
| --- |
| Random, frequent or common cause failures must not damage the equipment´s work or result in death or serious injure, must not harm to the environment or equipment, and must not loss of equipment or production. |

| WARNING |
| --- |
| Electrical shock can result in serious injury. |

## Mounting

The transmitter may be mounted in two basic ways, as follows:

- Separated from the sensor, using optional mounting brackets;

- Mounted on the sensor assembly.

Using the brackets, the mounting may be done in several positions, as shown on Figure 1.1 e 1.2.

For better visibility, the digital indicator may be rotated in steps of 90° (see Section V, Maintenance).

Reach the display and main board by removing the cover with window. This cover can be locked closed by the cover locking screw. To release the cover, rotate the locking screw clockwise. See Figure 1.3.

## *Electric Wiring*

Access the wiring block by removing the Electrical Connection Cover. This cover can be locked closed by the cover locking screw (Figure 1.3).

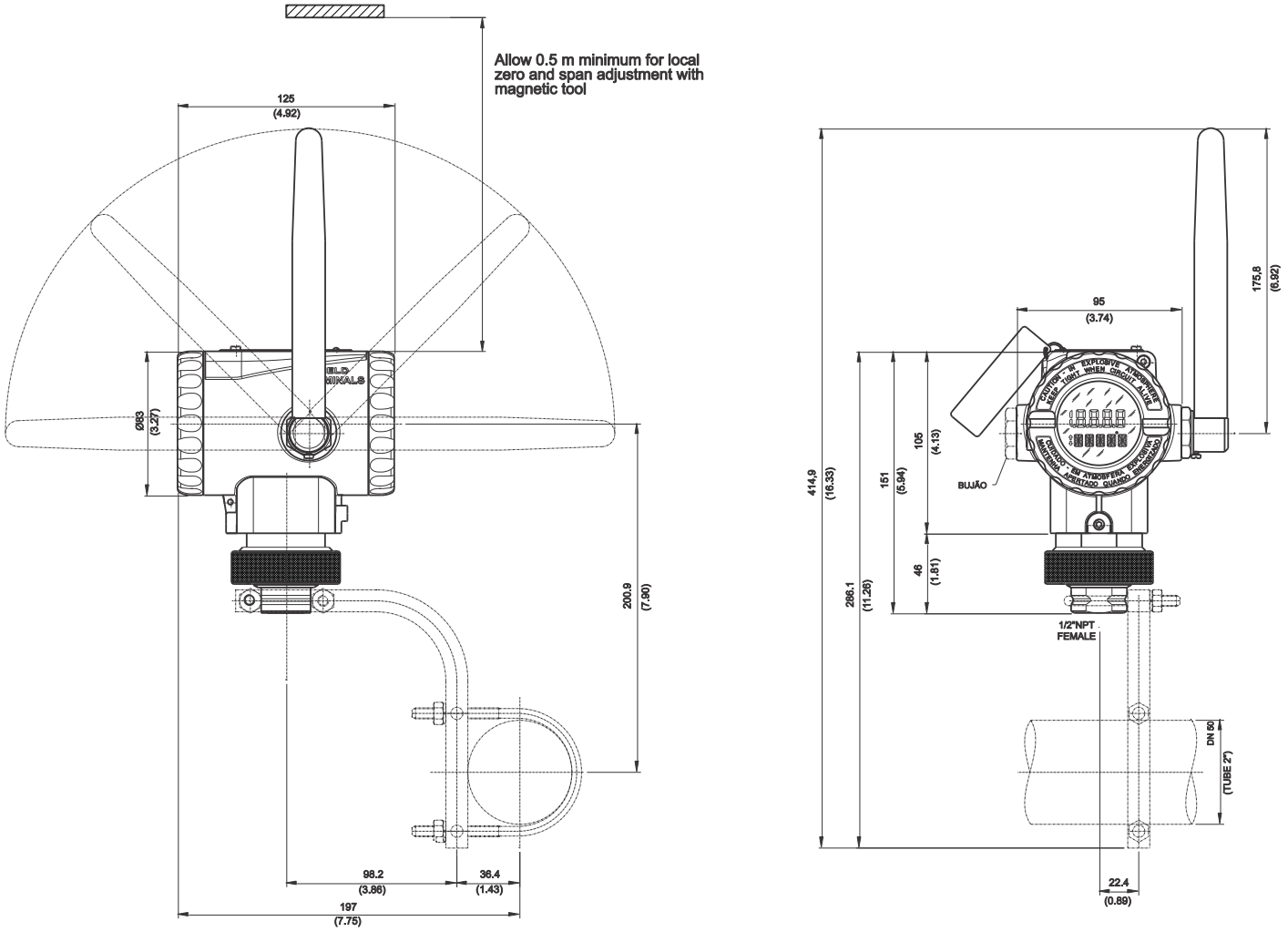
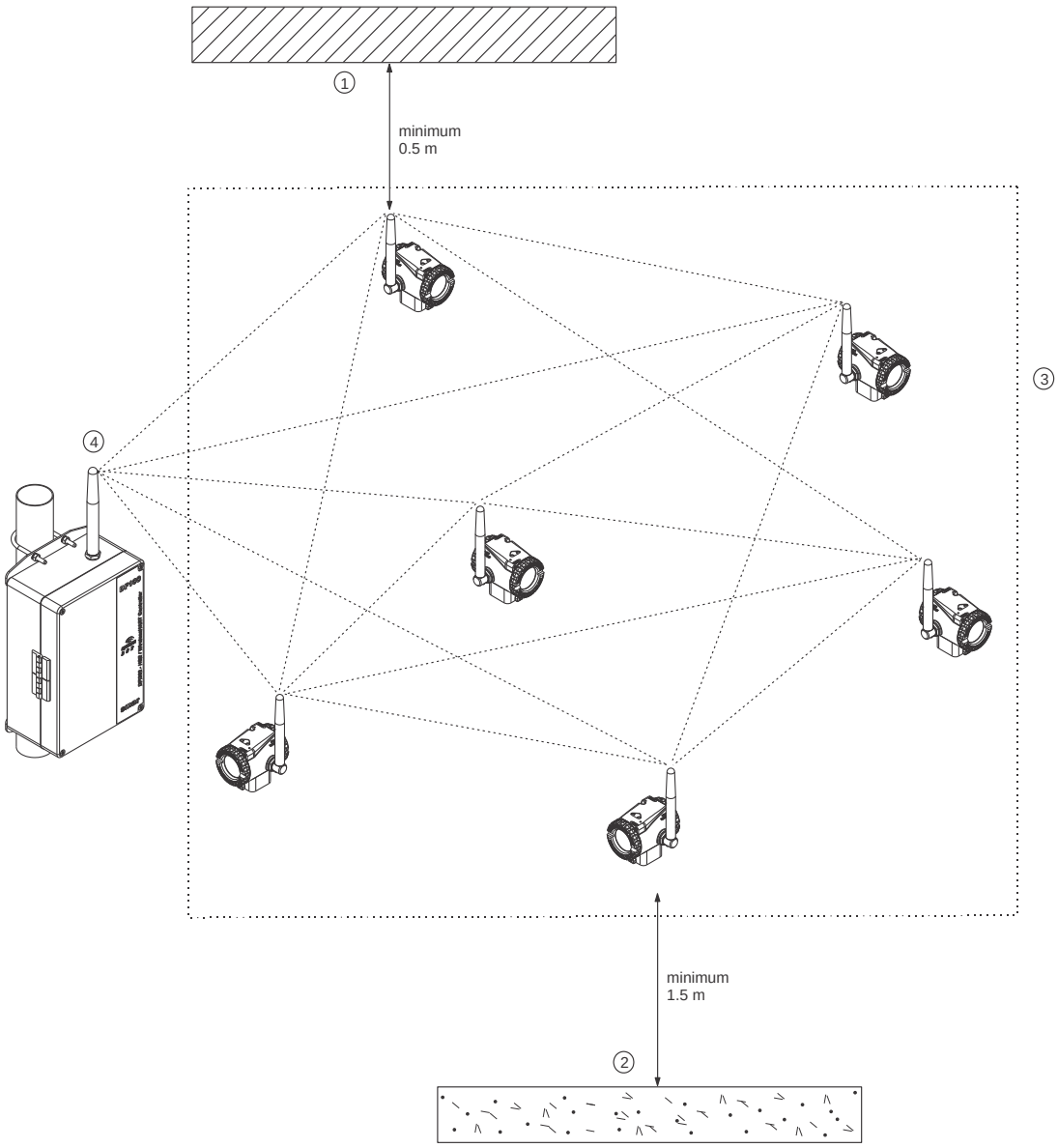



***Figure 1.1 - Dimensional Drawing and Mounting Positions***

| **WARNING** |
|---|
| The **TT400 *Wireless*HART™** should be installed with the antenna positioned upward. Do not rotate the antenna, because the cable may break. |




Notes:
1- Vertical obstacle
2- Floor
3- Minimum 3 neighbour equipment
4- Advised 5 neighboring transmitters

***Figure 1.2 – Wiring Diagram for Wireless Transmitter***

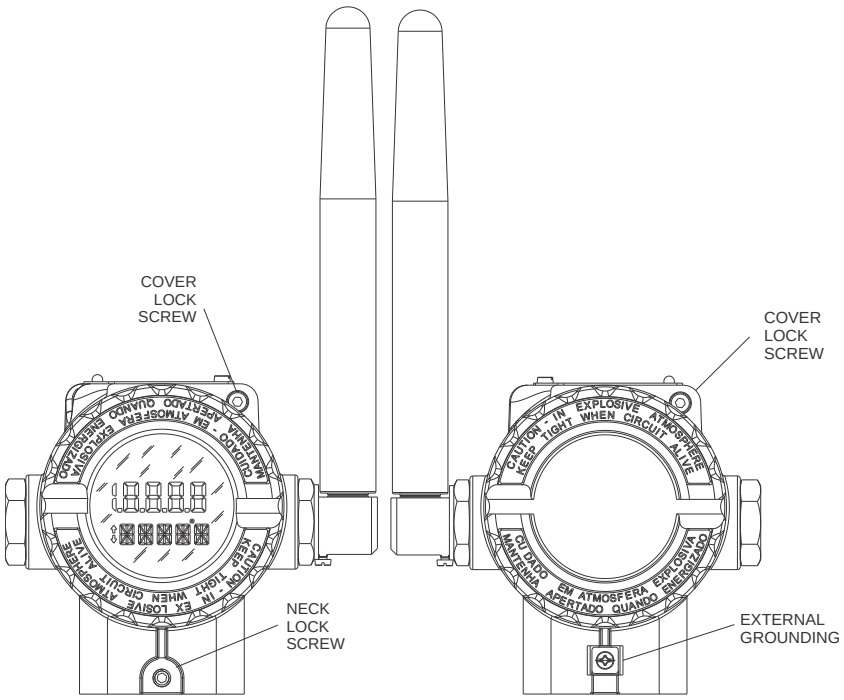



***Figure 1.3 – Terminal Locking Screws***

The communication ports allow communication with the transmitter. To this end, should be connected to a HART configurator in the "CN1" and "CN2" communication terminal, which is shown in Figure 1.4.

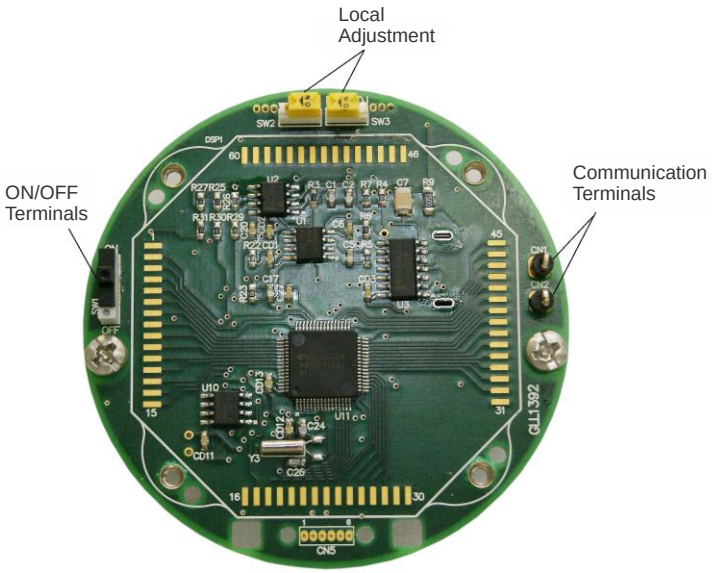



***Figure 1.4 – Transmitter Terminals***

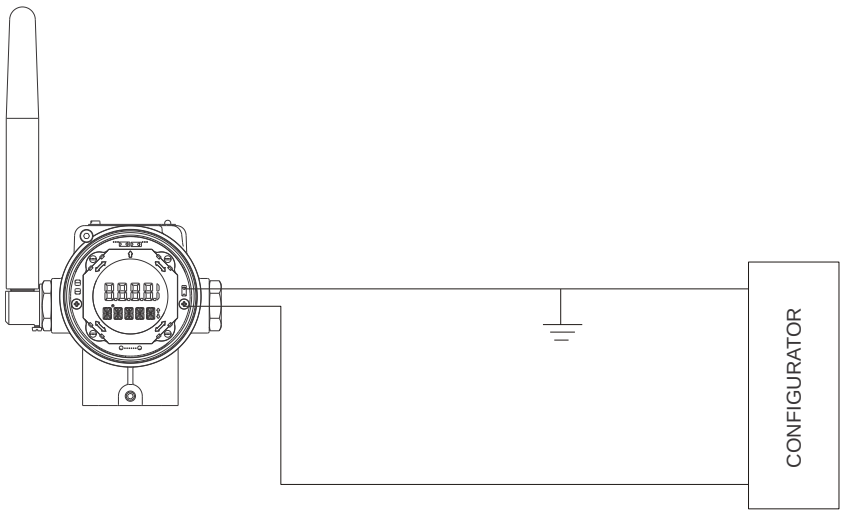



***Figure 1.5 - Wiring Diagram***

The sensor should be connected as per Figure 1.5.

| **WARNING** |
| --- |
| When operating with two sensors, the sensors can not be both grounded. At least one has to be not grounded for proper operation of **TT400 *WirelessHART*®**. |

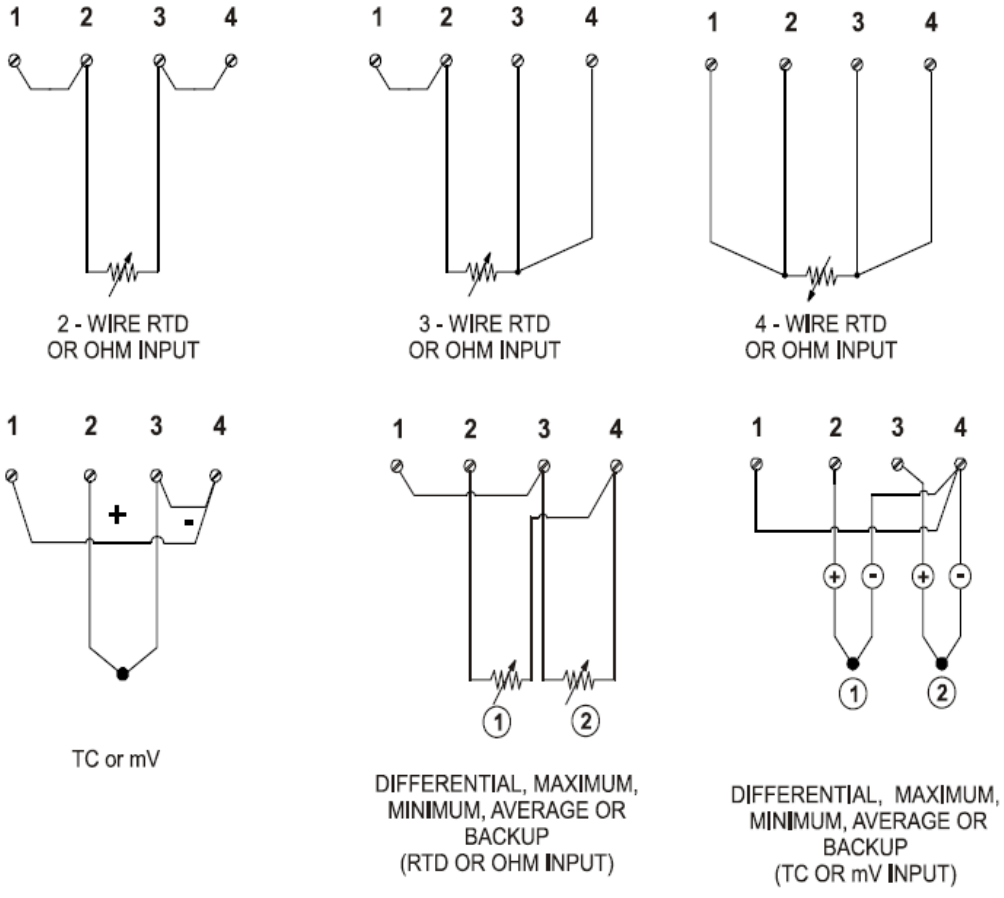



***Figure 1.6 – Sensor Wiring***

## *Installation in Hazardous Locations*

**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 1.7).

## *Intrinsically Safe*

**WARNING**

In hazardous zones with intrinsically safe or non-incendive requirements, the circuit entity parameters and applicable installation procedures must be observed.

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.

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

# OPERATION

The **TT400 *Wireless*HART™** accepts signals from mV generators such as thermocouples or resistive sensors such as RTDs. The criterium is that the signal is within the range of the input. For mV, the range is -50 to 500 mV and for resistance, 0 to 2000 Ohm.

## *Functional Description-Hardware*

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

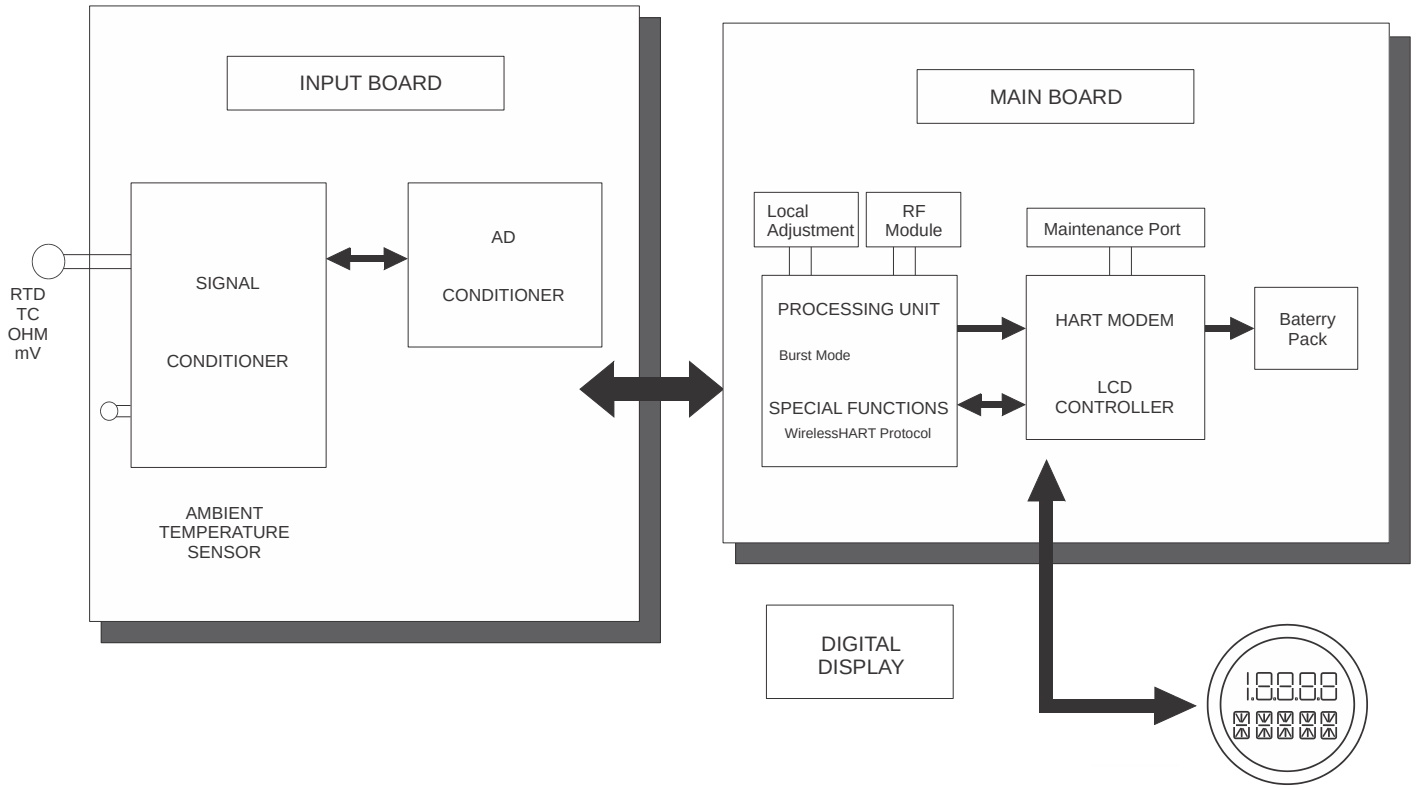



***Figure 2.1 – TT400 WirelessHART™ Block Diagram***

**Input Signal Conditioner**
A function to apply the correct gain to the input signals to make them suit the A/D converter.

**A/D Converter**
The A/D converts the input signal to a digital format for the CPU.

**Processing Central Unit (CPU), RAM, FLASH and FRAM**
The central processing unit (CPU) is the intelligent part of the transmitter responsible for the management and operation of measurement, execution block, self-test and communication.
The program is stored in FLASH memory. For temporary storage of data, the CPU has an internal RAM. If you lose power, data stored in RAM is lost.
For data storage that requires persistence, such as configuration data, startup and aggregation, we use a non-volatile memory type FRAM for **TT400 *Wireless*HART™**. It has an access time consistent with the RAMs normal and there is no limitation in terms of write cycles.

**Modem**
The function of this system is to make possible the exchange of information between the configurator and the transmitter, through digital communications Master-Slave type.

Therefore, the transmitter makes the demodulation of the received signal serially configurator, for the current line, and after treating it appropriately modulates the response to be sent. The HART® technology uses FSK for modulation of the signal.

**Battery**
The Battery Module consists of 2 primary lithium batteries (Li-SOCl2) of 3.6 Volts, totaling 7.2 Volts. Each battery has 2.5 grams of lithium, totaling 5.0 grams 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.<br><br>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.<br><br>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.<br><br>**STORAGE** - the battery module should preferably be stored in an environment below 30 ° C, dry, ventilated subject to less variation in temperature.<br><br>Do not dispose of batteries in Module trash. Use a battery for proper disposal or chemical waste.<br><br>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.<br><br>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 actives the LCD segments. It also activates the back plane and the control signals for each segment.

# *Temperature Sensors*

The **TT400 *Wireless*HART™**, as previously explained, accepts several types of sensors. The **TT400 *Wireless*HART™** is specially designed for temperature measurement using thermocouples or thermoresistances (RTDs).

Some basic concepts about these sensors are presented below.

## THERMOCOUPLES

Thermocouples are the most widely used sensors in industrial temperature measurements.

Thermocouples consist of two wires made from different metals or alloys joined at one end, called measuring junction. The measuring junction should be placed at the point of measurement. The other end of the thermocouple is open and connected to the temperature transmitter. This point is called reference junction or cold junction.

For most applications, the Seebeck effect is sufficient to explain thermocouple behavior:

**How the Thermocouple Works**
When there is a temperature difference along a metal wire, a small electric potential, unique to every alloy, will occur. This phenomenon is called Seebeck effect.

When two wires of different metals are joined in one end, and left open in the other, a temperature difference between the two ends will result in a voltage since the potentials generated by the different materials are not the same and does not cancel each other out. Two important things must be noted. First: the voltage generated by the thermocouple is proportional to the difference between the measuring-junction and the cold junction temperatures. Therefore the temperature at the reference junction must be added to the temperature derived from the thermocouple output, in order to find the temperature measured. This is called cold junction compensation, and is done automatically by the **TT400 *Wireless*HART™**, which has a temperature sensor at the sensor terminals for this purpose. Secondly, if the thermocouple wires are not used all the way to the terminals of the transmitter (e.g. copper wire is used from sensor-head or marshalling box), new junctions with additional Seebeck effects will be created and ruin the measurement in most cases, since the cold-junction compensation will be done in the wrong point.

The relation between the measuring junction temperature and the generated millivoltage is tabulated in thermocouple calibration tables for standardized thermocouple types, the reference temperature being 0 °C.

Standardized thermocouples which are commercially used, whose tables are stored in the memory of the **TT400 *Wireless*HART™**, are the following:

- ✓ **NBS (B, E, J, K, N, R, S, T)**
- ✓ **DIN (L, U)**

## THERMORESISTANCES (RTDs)

Resistance Temperature Detectors, most commonly known as RTD's, are based on the principle that the resistance of a metal increases as its temperature increases.

Standardized RTDs, whose tables are stored in the memory of the **TT400 *Wireless*HART™**, are the following:

- ✓ **JIS [1604-81] (Pt50 & Pt100)**
- ✓ **IEC, DIN, JIS [1604-89] (Pt50, Pt100, Pt500, Pt1000)**
- ✓ **GE (Cu 10)**
- ✓ **DIN (Ni 120)**

For a correct measurement of RTD temperature, it is necessary to eliminate the effect of the resistance of the wires connecting the sensor to the measuring circuit. In some industrial applications, these wires may be hundreds of meters long. This is particularly important at locations where the ambient temperature changes a lot.

A 2-wire connection may cause measuring errors. It will depend on the length of connections wires and on the temperature to which they are exposed (see Figure 2.2).

In a 2-wire connection, the voltage V2 is proportional to the RTD resistance plus the resistance of the wires.

**$V2 = [RTD + 2_x R]_x I$**

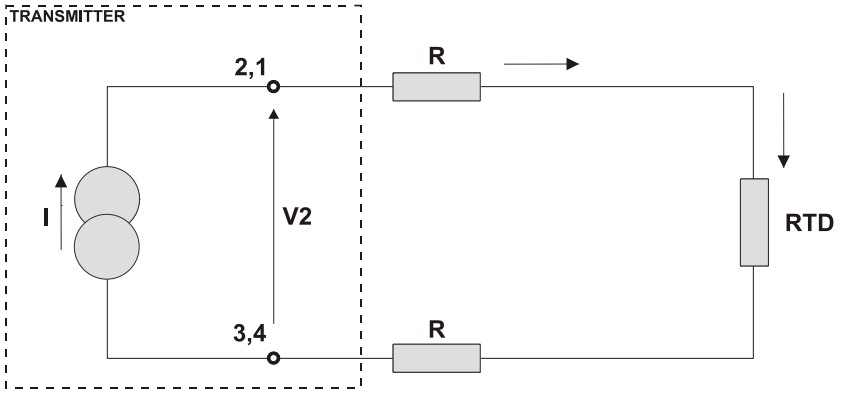



***Figure 2.2 – Two-Wire Connection***

In order to avoid the resistance effect of the connection wires, it is recommended to use a 3-wire connection (see Figure 2.3) or a 4-wire connection (see Figure 2.4).

In a 3-wire connection, terminal 3 is a high impedance input. Thus, no current flows through that wire and no voltage drop is caused. The voltage V2-V1 is independent of the wire resistances since they will be canceled out, and is directly proportional to the RTD resistance alone.

**V2-V1 = [RTD + R] x I – R x I = RTD x I**

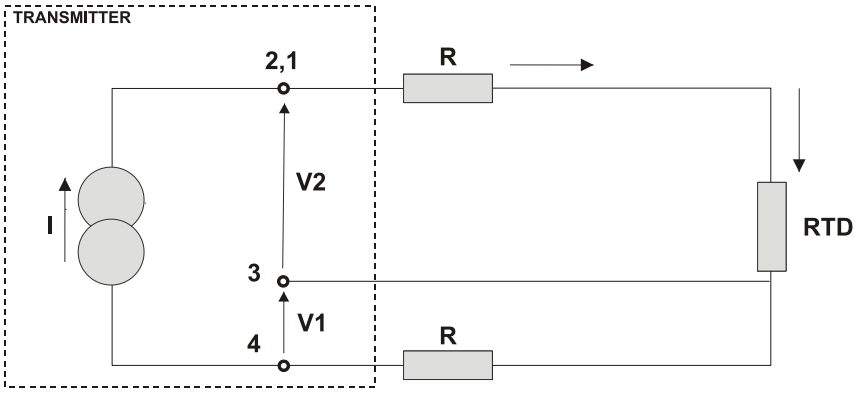



***Figure 2.3 – Tree-Wire Connection***

In a 4-wire connection, terminals 2 and 3 are high impedance inputs. Thus, no current flows through those wires and no voltage drop is caused. The resistances of the other two wires are not interesting since no measurement is done on them. Hence the voltage V2 is directly proportional to the RTD resistance. (V2 = RTD x I).

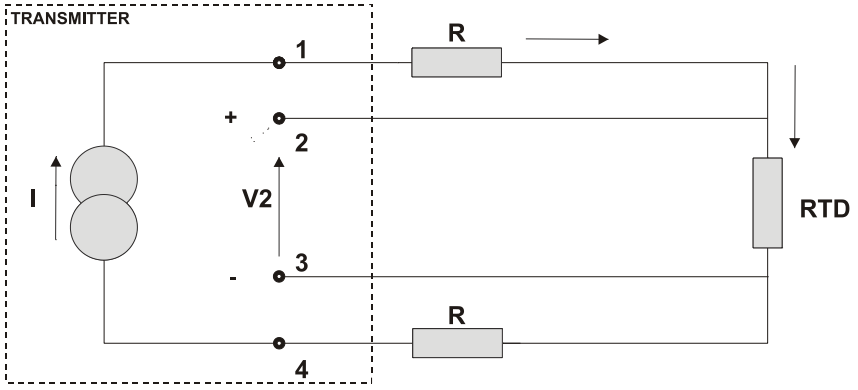



***Figure 2.4 – Four-Wire Connection***

A differential connection is similar to the two-wire connection and gives the same problem (see Figure 2.5). The resistance of the other two wires will be measured and does not cancel each other out in a temperature measurement, since linearization will affect them differently.

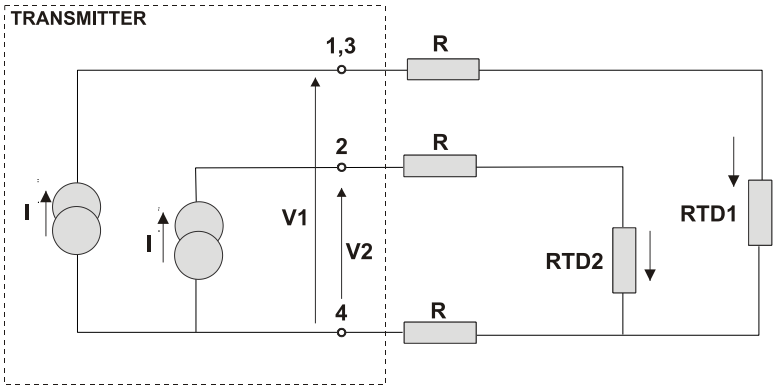



***Figure 2.5 – Two Sensor Connection***

| NOTE |
| --- |
| The material the gauge and the length should be the same connections of 3 or 4 threads. |

## *The Display*

The digital indicator is able to display one or two variables which are user selectable. When two variables are chosen, the display will alternate between the two with an interval of 3 seconds.

The display indicates engineering units, values and parameters simultaneously with most status indicators. The monitoring mode indication is interrupted in case of an alarm been activated.

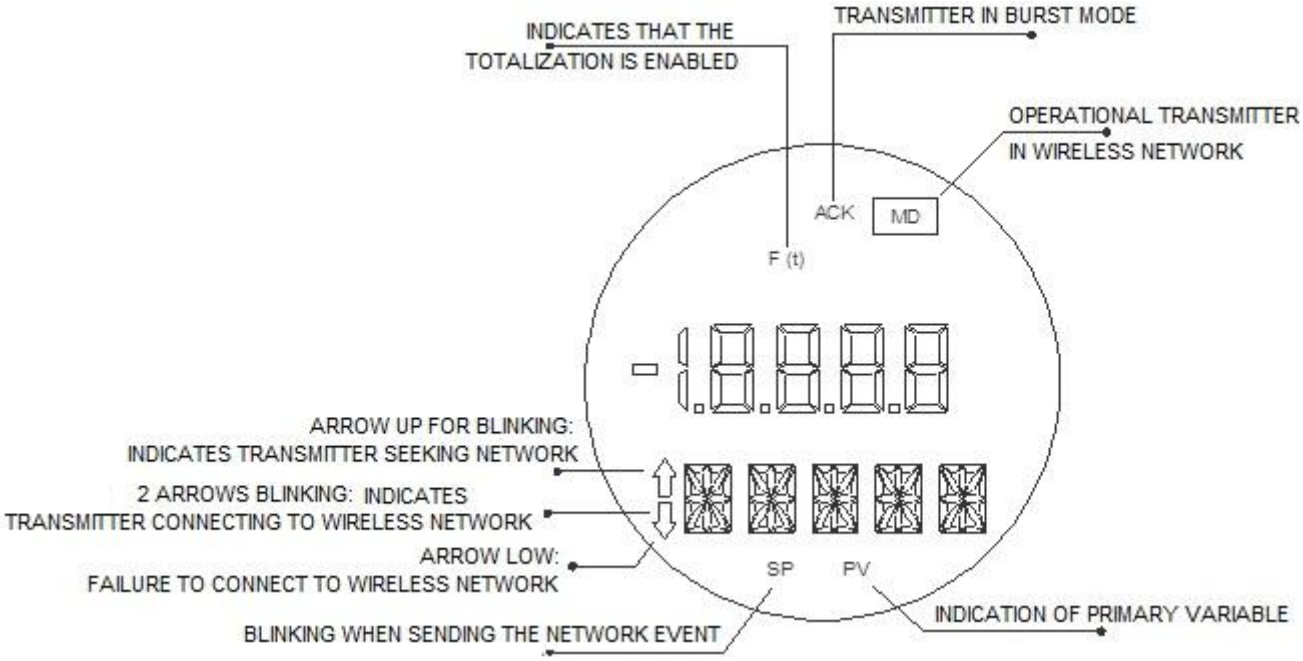



***Figure 2.6 – Typical Monitoring Mode Display***

## *Monitoring*

During normal operation, **TT400 *WirelessHART*®** is in monitoring mode. In this mode, toggles the indication between the first and second variable. See Figure 2.7.

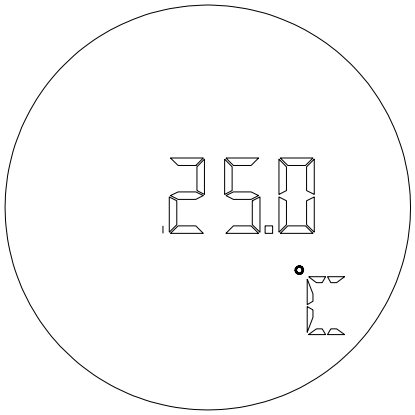



***Figure 2.7 – Typical Display in Monitoring Mode***

# Section 3

# MAINTENANCE

## General

**TT400 *Wireless*HART™** is extensively tested and inspected before delivery to the end user.

A special care must be taken with your transmitter. All maintenance services must be done by qualified people and component exchanges must be done by replacing for certified ones that are supplied by Smar.

## Diagnostics with the Display

The display can show failure messages in the alphanumeric segment. When these messages are displayed, the transmitter will automatically switch to a secure state. These messages are shown in Table 4.1.

| DIAGNOSTIC MESSAGES | POTENTIAL SOURCE OF PROBLEM |
|---|---|
| FAIL RADIO | Indicate problems on the radio. |
| LOW BATT | Indicate battey with low level. |
| FAIL BATT | Indicate battey with critical level. |
| PVbad | Indicate error in the sensor measurement. |
| Tbad | Indicate error in the ambiente temperature measurement |

***Table 3.1 – Diagnóstic with Display***

## Problems and Solutions

**Equipment does not connect to the *Wireless*HART™ network**

**Possible causes:**

- The equipment is off;
- Network/Gateway manager is off;
- The equipment is far from the Network/Gateway Manager or other equipment connected to the same;
- Safety key (Join Key) and Access key (Network Id) are not configured correctly;
- The antena is not connected in the Network/Gateway Manager or in the equipment;
- There is a Access Control List in the Network/Gateway Manager and the device is not on this list;
- Maximum number of equipment configured in the Network/Gateway Manager was reached.

**Equipment disconnecting and connecting to the network continuously to the *Wireless*HART™ network**

**Possible causes:**

- Low battery or bad contact in the power causing the restart of equipment;
- The connectivity in relation to neighbors is unstable (mobile obstacles or distance in the limit);

**Equipment are within the operating range, but the communication stability is not good**

**Possible cause:**

- Interference. Bring the equipment to obtain a better stability.

# *Disassembly Procedure*

| WARNING |
| --- |
| This operation type must be done in a safety área and with the transmitter no energized. |

**Sensor**
If the sensor is mounted on the transmitter, first disconnect the wires in order to prevent them from breaking. To access the terminal block, first remove the sensor housing screw (**27**) and housing (**26**), removing it carefully.

a) Remove the front and back covers.

b) Remove the main board at the front of the housing, unplug the sensor and radio cables;

c) Desconecte o sensor pela parte de baixo, como na foto, desrosqueando-o com cuidado;

d) Disconnect the sensor from the bottom, as pictured, unscrewing it carefully.

***Table 3.2 – Quick Disassembly Procedure Transmitter***

**Antenna**
If necessary remove the antenna set, must necessarily remove the back cover of the device to disconnect the antenna cable from the radio board.

| WARNING |
| --- |
| This procedure is required for the antenna cable is not damaged during its rotation in the disassembly process.<br><br>After disconnecting the cable, it must release the antenna set by means of the set screw (**20**) with the aid of a wrench, turning it counterclockwise. |

To avoid equipment damage, do not rotate the housing more than 270 ° from the limit of the thread, without disconnecting the electronic circuit and sensor power supply. Do not forget to release the sensor rotate locking screw. See Figure 3.1.


***Figure 3.1 – Housing Safety Rotate***

To avoid equipment damage, do not rotate the antenna below the imaginary line of 180 ° relative to the base of the equipment. If there is the need to rotate the antenna, loosen the screw below to tour and

just above this line. See Figure 3.2.


***Figure 3.2 –Antenna Safety Rotate***

**Electrical Circuits**
To remove the main board (**6**) and the display (**4**), it must remove the display cover (**1**) by turning it counterclockwise.

For the steps below, make sure you leave the terminal ON/OFF (Figure 1.4) in the off position (OFF).

To remove the radio board (**13**) and the battery module (**16**), it must remove the back cover (**18**) by turning it counterclockwise. To remove the input board (**24**), it must first disassemble the sensor housing, as explained above. To remove the main board (**6**), release their two screws (**5**) and carefully remove. To remove the display (4), loosen the four screws (**3**) and carefully remove. To remove the radio board (**13**), first disconnect it from the main board (**6**). This is done most easily by removing the main board of the housing, as explained above. After disconnecting the boards, loosen the two screws on the radio board (**14**) and carefully remove. To remove the battery module (**16**), release their two screws (**17**) and carefully remove. To remove the input board (**24**), first disconnect it from the main board (**6**). This procedure must be done removing the main board, as explained above. After disconnecting the boards, loosen the two screws on the input board (**25**) and carefully remove.

| 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. |

## *Reassembly Procedure*

| WARNING |
| --- |
| This operation type must be done in a safety area and with the transmitter no energized. |

Figure 3.3 shows the components position mentioned in this description.

The Table 3.3 shows how to mount the transmitter.

a) First, make mounting the antenna on the side of the housing indicated by "FIELD TERMINALS." Always keep the antenna upright.

b) Tighten the antenna with a wrench. Use the wrench to how the picture is being displayed, always below the antenna;

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

d) Screw Module Batteries and connect it to the radio board at the point indicated;

e) Connect the sensor from the bottom, as shown in the photo, threading it carefully;

f) Place the main board on the front of the housing and connect the sensor cables and radio to it. After connection, screw the board to the housing;

g) Finish putting the front and back covers.

***Table 3.3 – Quick Assembly Procedure Transmitter***

Considering the complete assembly of the device must be initiated by the same antenna set.

To mount the antenna set (**20**) simply screwing it on the side of the equipment with the aid of a wrench, as shown in Figure 3.2. To mount the radio board (**13**) first connect it to the main board (**6**) and then attach to the substrate through its screws (**14**). Connect the antenna cable to the connector on the radio (Figure 3.2). To assemble the battery module (**16**) simply screwing it to the substrate, using its screw (**17**). To assemble the input board (**24**) first connect it to the main board (**6**) and then attach to the substrate through its screws (**25**) and spacers (**23**). The sensor must be done with the use of the cable gland (to ensure sealing) in the housing (**26**) and ends with the closing of the thread sensor (**27**).

To mount the main board (**6**) make sure that the cables to the radio board (**13**) and input board (**24**) are connected. Secure the board to the housing through its screws (**5**) and be sure to leave the terminal ON/OFF (Figure 1.4) in the off position (OFF). To fix the display (**4**) on the main board (**6**) just mount it in the correct position (up arrow) using the four screws (**3**). To complete the assembly of the equipment, display screw covers (**1**) and rear (**18**) clockwise.

## Interchangeability

Calibration data is stored in the EEPROM of the main board; hence READING TRIM must be done if main board or input board has been changed.

| NOTE |
| --- |
| The input and main boards are matched at the factory to ensure accuracy. If you need to return, replace the set. |

## 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.

If it becomes necessary to return the transmitter and/or configurator to Smar, simply contact our office, informing the defective instrument's 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 the Service Request Form (SRF – Appendix B) properly filled with a description of the failure observed and with as much details as possible. Other information concerning to 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.

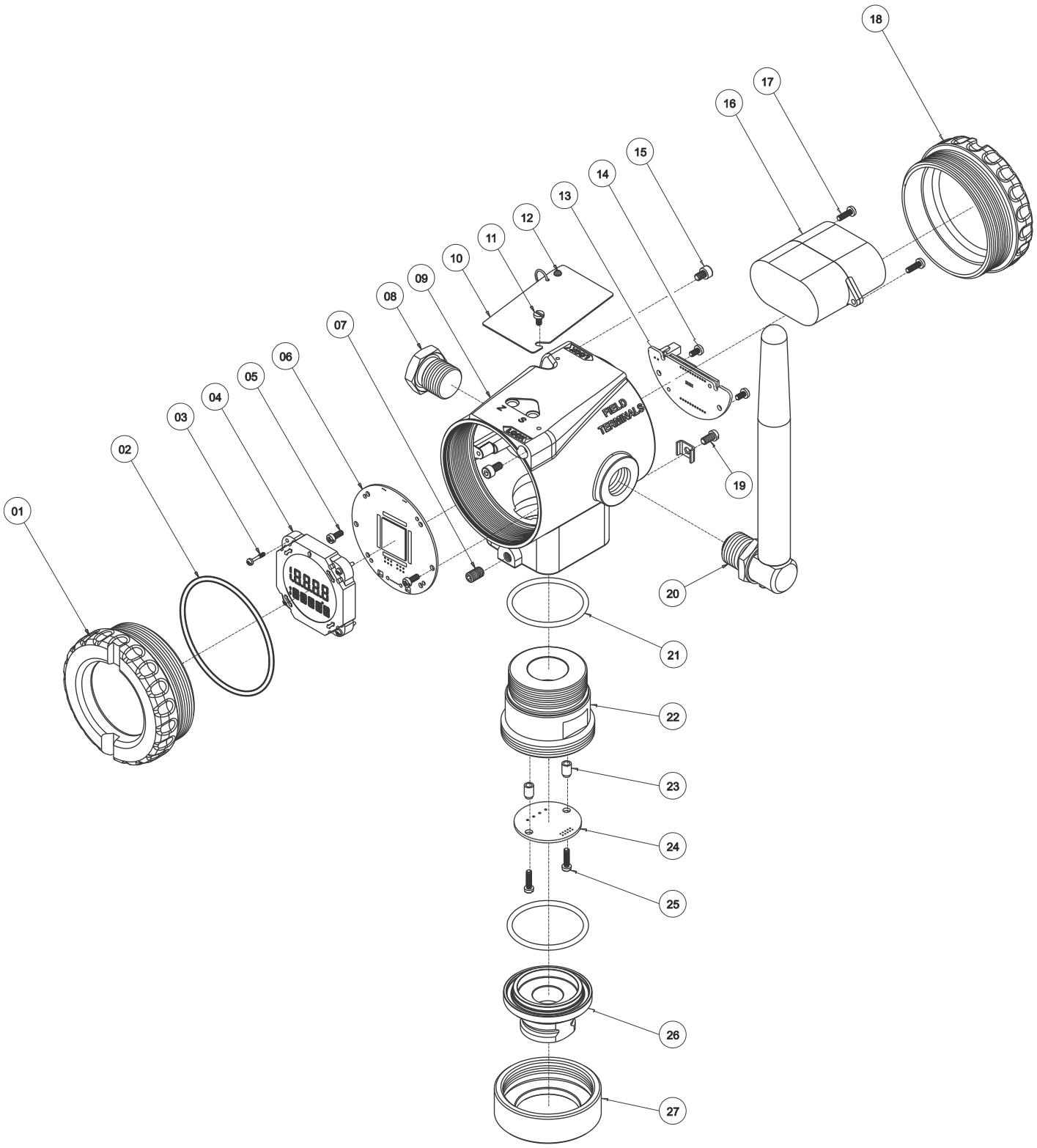



***Figure 3.1 – Exploded View***

| ACCESSORIES | |
|---|---|
| **ORDERING CODE** | **DESCRIPTION** |
| **SD-1** | Magnetic tool for local adjustment. |
| **Palm*** | 16 Mbytes Palm Handheld, Including HPC401 initialization and installation software. |
| **HPC401*** | HART® interface (HPI311) for Palm, including the configuration package for Smar transmitters and generic transmitters. |
| **HPI311*** | HART® interface. |
| **CONF401*** | Configurator Smar based on PC |
| **HI321*** | Interface HART FOR CONF401 |

* For equipment updates and HPC401 and CONF401 softwares, access our website: **http://www.smarresearch.com**.

| SPARE PARTS LIST FOR TRANSMITTER | | | | |
|---|---|---|---|---|
| **DESCRIPTION OF PARTS** | | **POSITION** | **CODE** | **CATEGORY (NOTE1)** |
| HOUSING M20 x 1.5 (NOTE 2) | ALUMINIUM<br>316 SST | 9<br>9 | 400-1205<br>400-1206 | |
| COVER WITHOUT DISPLAY | ALUMINIUM<br>316 SST | 18<br>18 | 400-1207<br>400-1208 | |
| COVER WITH DISPLAY | ALUMINIUM<br>316 SST | 1<br>1 | 400-0824<br>400-0825 | |
| O'RING | | 2 | 204-0122 | B |
| DISPLAY LOCKING SCREW | | 3 | | |
| ROTATIVE DISPLAY | | 4 | | |
| MAIN BOARD LOCKING SCREW | | 5 | 400-0832 | |
| COVER LOCKING SCREW | | 15 | 204-0120 | |
| SENSOR LOCKING SCREW | | 7 | | |
| HEXAGONAL PLUG M20 x 1,5 | | 8 | 400-0810 | |
| EXTERNAL GROUNDING SCREW | HOUSING IN 316 SST<br>HOUSING IN ALUMINIUM | 28<br>28 | 400-0826<br>400-0904 | |
| BATTERY PACK | | 16 | 400-1209 | |
| BATTERY PACK LOCKING SCREW | | 17 | 400-1210 | |
| IDENTIFICATION PLATE SCREW | | 11 | 204-0116 | |
| RADIO BOARD | | 13 | 400-1211 | |
| RADIO BOARD LOCKING SCREW | | 14 | 400-1212 | |
| PLACA PRINCIPAL | | 6 | 400-1218 | A |
| IDENTIFICATION PLATE | | 10 | | |
| RIVET OF IDENTIFICATION PLATE IN SST | | 12 | 400-0834 | |
| ANTENNA | | 20 | 400-1214 | |
| EXTERNAL GROUNDING | | 19 | | |
| NECK O'RING | | 21 | 400-1215 | |
| TERMINAL BLOCK | | 22 | 400-1216 | |
| TERMINAL BLOCK SPACER | | 23 | 400-1217 | |
| ELECTRONIC BOARD | | 24 | | |
| ELECTRONIC BOARD LOCKING SCREW | | 25 | | |
| SENSOR CONNECTION | | 26 | 400-1219 | |
| NUT ROUND | | 27 | 400-1220 | |

| NOTE |
|---|
| **1 -** For category A, it is recommended to keep, in stock, 25 parts installed for each set, and for category B, 50. |
| **2 -** It includes terminal holder insulator, bolts (cover lock, grounding and terminal holder insulator) and identification plate without certification. |
| **3 -** O'Rings are packaged in packs of 12 units. |

# *Section 4*

# TECHNICAL CHARACTERISTICS

| Functional Specifications | |
|---|---|
| **Input** | See Tables 4.1, 4.2 and 4.3. |
| **Battery** | The pack consists of 2 primary lithium batteries (Li-SOCl2) of 3.6 V, totaling 7.2 V.<br><br>Battery Life:<br>- Burst mode to 8s, @25 ºC, network with at least 3 devices neighbor: 4 years<br><br>PS: The module used batteries in the transmitters must be provided exclusively by Smar (PACK BATTERY - Code 400-1209). |
| **Indicator** | 4 1/2 -digit numerical and 5-character alphanumerical LCD indicator (optional).<br>Function and status icon. |
| **Communication Protocol** | HART Protocol Version 7, with set of commands **TT400 *Wireless*HART™**.<br><br>A specific review of the HART transmitter must be managed according to the transmitter **TT400 *Wireless*HART™**. |
| **Measurement Type** | Temperature with one sensor;<br>Differential temperature between two sensors;<br>Temperature with two sensors considering the highest;<br>Temperature with two sensors considering lower;<br>Average temperature with two sensors;<br>Backup temperature with two sensors;<br>Temperature generated by Callendar Van Dusen equation. |
| **Configuration** | By digital communication (HART® protocol) using the configuration software CONF401, DDCON 100 (for windows), or HPC401 (for Palms). It can also be configured using DD and FDT/DTM tools, and can be partially configured through local adjustment.<br>In order to maintain the integrity of the equipment configuration, the **TT400 *Wireless*HART™** has a mechanism of writing protection into memory configuration, both hardware and software. The mechanism by hardware, selectable via H-H key, takes precedence over the software. |

| Performance Specifications | |
|---|---|
| **Accuracy** | See Tables 4.1, 4.2 and 4.3. |
| **Response Time** | 2 s. |
| **Sensor Reading** | Accuracy of A/D Converter: ±0.02% of the span. |
| **Stabilization Time after the Power up – hot start up** | Less than 17 seconds. |

| Physical Specifications | |
|---|---|
| **Terminal Block** | Four terminals for sensor connection. |
| **Mounting** | In carbon steel SAE 1020 with electrostatic polyester painting or 316 SST;<br>Accessories (bolts, nuts, washers and U-clamps) in carbon steel or 316 SST. |
| **Weight** | Up to 0.93 Kg (2.067 lb) without any optional part. |
| **Identification Plate** | 316 SST plate with bounded special plastic label. |

| Transmitter Specifications | |
|---|---|
| **Sensor input treatment** | AD with 50 and 60 Hz input noise rejection, programmed gain, input multiplex and 16-bits resolution;<br>Input Sensor trim in two points;<br>Environment Temperature trim in two point. |

| | |
|---|---|
| **Primary Variable Treatment** | Engineering unit conversion;<br>Cold junction compensation;<br>Input Sensor characterization (Callendar Van Dusen);<br>Measured Type (single, differential, maximum, minimum, average). |

| **Protected Operation Specifications** | |
|---|---|
| **Configuration operation counter** | Counting of the configuration change operations. |
| **Configuration Protection** | Configurations blocked by password;<br>Write Protection via hardware; |
| **Certification / Compliance to the standards** | Intrinsic Safety (pending), Weather Proof. |

**Human Machine Interface Specifications**

**Indication of the state in the display**

| Item | Ícone | Definição |
|---|---|---|
| 1 | PV | Primary Variable |
| 2 | ⇧ | Blinking when the transmitter is seeking wireless network |
| 3 | ⇧⇩ | Blinking when connecting to the wireless network |
| 4 | MD | Transmitter operating on the wireless network |
| 5 | ⇩ | Failed to connect to the wireless |
| 6 | ACK | Transmitter in burst mode |
| 7 | F(t) | Blinking when sending command in burst mode |
| 8 | SP | Lights when an event is sent by the device to the wireless network |

| | 2, 3 or 4 wires | | | | | |
|---|---|---|---|---|---|---|
| **SENSOR** | **TYPE** | | **RANGE °C** | **RANGE °F** | **MINIMUM SPAN °C** | ***DIGITAL ACCURACY °C** |
| **RTD** | Cu10 | GE | -20 a 250 | -4 a 482 | 50 | ± 1,5 |
| | Ni120 | Edson Curve #7 | -50 a 270 | -58 a 518 | 5 | ± 0,2 |
| | Pt50 | IEC 751-83 (0,00385) | -200 a 850 | -328 a 1562 | 10 | ± 0,32 |
| | Pt100 | IEC 751-83 (0,00385) | -200 a 850 | -328 a 1562 | 10 | ± 0,3 |
| | Pt500 | IEC 751-83 (0,00385) | -200 a 450 | -328 a 842 | 10 | ± 0,3 |
| | Pt1000 | IEC 751-83 (0,00385) | -200 a 300 | -328 a 572 | 10 | ± 0,3 |
| | Pt50 | JIS 1604-81 (0,003916) | -200 a 600 | -328 a 1112 | 10 | ± 0,32 |
| | Pt100 | JIS 1604-81 (0,003916) | -200 a 600 | -328 a 1112 | 10 | ± 0,32 |
| | Pt100 | MILT-T24388C (0,00392) | -40 a 540 | -40 a 1000 | 10 | ± 0,3 |
| | Ni120 | MILT-T24388C (0,00392) | -40 a 205 | -40 a 400 | 5 | ± 0,25 |
| | Pt100 | IEC 751-95 (0,00385) | -200 a 850 | -328 a 1562 | 10 | ± 0,3 |
| | Pt100 | GOST 6651-09 (0,003911) | -200 a 850 | -328 a 1562 | 10 | ± 0,3 |
| | Pt50 | GOST 6651-09 (0,003911) | -200 a 850 | -328 a 1562 | 10 | ± 0,3 |
| | Cu100 | GOST 6651-09 (0,003911) | -50 a 200 | -58 a 392 | 10 | ± 0,25 |
| | Cu50 | GOST 6651-09 (0,003911) | -50 a 200 | -58 a 392 | 10 | ± 0,25 |
| **THERMOCOUPLER** | B | NBS | 100 a 1800 | 212 a 3272 | 50 | ± 1,5** |
| | E | NBS | -100 a 1000 | -148 a 1832 | 20 | ± 0,3 |
| | J | NBS | -150 a 750 | -238 a 1382 | 30 | ± 0,4 |
| | K | NBS | -200 a 1350 | -328 a 2462 | 60 | ± 0,7 |
| | N | NBS | -100 a 1300 | -148 a 2372 | 50 | ± 0,6 |
| | R | NBS | 0 a 1750 | 32 a 3182 | 40 | ± 0,8 |
| | S | NBS | 0 a 1750 | 32 a 3182 | 40 | ± 1,0 |
| | T | NBS | -200 a 400 | -328 a 752 | 15 | ± 0,35 |
| | L | DIN | -200 a 900 | -328 A 1652 | 35 | ± 0,4 |
| | U | DIN | -200 a 600 | -328 a 1112 | 50 | ± 0,5 |

***Table 4.1 - 2, 3 or 4 wires Sensor Characteristics***

*Reading accuracy on the display and accessed by communication.
**Not applicable for the first 20% of range (up to 440 º C).

| SENSOR | FAIXA mV | SPAN MÍNIMO mV | * PRECISÃO DIGITAL % |
|---|---|---|---|
| mV | -6 a 22 | 0,40 | ± 0,03% ou ± 10 µV |
| | -10 a 100 | 2,00 | ± 0,03% ou ± 20 µV |
| | -50 a 500 | 10,00 | ± 0,03% ou ± 50 µV |

***Table 4.2 - mV Sensor Characteristics***

| SENSOR | FAIXA Ohm | SPAN MÍNIMO Ohm | * PRECISÃO DIGITAL % |
|---|---|---|---|
| Ohm | 0 a 100 | 3 | ± 0,03% ou ± 0,05 Ohm |
| | 0 a 400 | 12 | ± 0,03% ou ± 0,08 Ohm |
| | 0 a 2000 | 60 | ± 0,03% ou ± 0,3 Ohm |

***Table 4.3 - Ohm Sensor Characteristics***

*Reading accuracy on the display and accessed by communication.
**Not applicable for the first 20% of range (up to 440 º C).
NA Non applicable.

## *Ordering Code*

**MODEL TT400 — SMART TEMPERATURE TRANSMITTER**

**COD. W — Communication Protocol**
- W — *Wireless*HART™

**COD. 0 — Security Option**
- 0 — For use in measurement and control

**COD. — Local Indicator (1)**
- 0 — Without Indicador
- 1 — With Indicador Digital

**COD. — Electrical Connection**
- 0 — 1/2 – 14 NPT
- 1 — 3/4 – 14 NPT (with 316 SST adapter for 1/2 - 14 NPT) **(5)**
- 2 — 3/4 – 14 BPS (with 316 SST adapter for 1/2 - 14 NPT) **(2)**
- 3 — 1/2 – 14 BPS (with 316 SST adapter for 1/2 - 14 NPT) **(2)**
- A — M20 X 1.5 **(5)**
- B — PG13.5 DIN **(6)**
- Z — User's specification

**COD. — Blanket Plug**
- I — 316 SST
- C — Carbon Steel **(3) (7) (10)**

**COD. — Mounting Bracket**
- 0 — Without Bracket
- 1 — Carbon Steel Bracket with Carbon Steel Fasteners
- 2 — 316 SST Bracket with 316 SST Fasteners
- 7 — Carbon Steel Bracket with 316 SST Fasteners

**COD. — Housing Material**
- A — Aluminium (default) (IP/TYPE)
- I — 316 SST – CF8M (ASTM – A351) (IP/TYPE)
- J — 316 SST – saline atmospheres **(4)** (IPW/TYPEX)
- B — Aluminum – saline atmospheres **(4)** (IPW/TYPEX)
- H — Aluminium Copper Free **(4)** (IPW/TYPEX)

**COD. — Painting**
- 0 — Gray Munsell N 6.5 Polyester (Default)
- 8 — Without Painting **(8)**
- 9 — Safety Blue Epoxy – Electrostatic Painting
- C — Safety Blue Polyester – Electrostatic Painting
- Z — Special Painting

**COD. — Certification Type (11)**
- N — Without Certification
- I — Intrinsic Safety (pending)

**COD. — Organ Certifier (11)**
- 0 — Without Organ Certifier
- 5 — CEPEL (pending)

**COD. — Tag Plate (12)**
- 0 — With TAG, when specified
- 1 — Blanket
- 2 — User's specification

**COD. — Sensor Type**
- 1 — RTD Cu10 – GE
- 2 — RTD Ni120 – Edison Curve #7
- 3 — RTD Pt50 – IEC
- 4 — RTD Pt100 – IEC
- 5 — RTD Pt500 – IEC
- 6 — RTD Pt1000 – IEC
- 7 — RTD Pt50 – JIS
- 8 — RTD Pt100 – JIS
- 9 — Thermocouple type B - NBS
- A — Thermocouple type E - NBS
- B — Thermocouple type J - NBS
- C — Thermocouple type K - NBS
- D — Thermocouple type N - NBS
- E — Thermocouple type R - NBS
- F — Thermocouple type S - NBS
- G — Thermocouple type T - NBS
- K — Thermocouple type L – DIN
- P — Thermocouple type U – DIN
- M — 22 mV
- N — 100 mV
- O — 500 mV
- R — 100 Ohm
- S — 400 Ohm
- U — 2K Ohm
- Z — Other

**COD. — Sensor Connection**
- 2 — 2-wires
- 3 — 3-wires
- 4 — 4-wires
- F — 2-wires (2 sensors) **(9)**

**TT400 - W 0 1 - 0 C 1 - A 0 N 0 0 - 4 3**

| NOTES | |
|---|---|
| **(1)** Values limited to 4 ½ digits; units limited to 5 characters. | **(7)** Not applicable for saline atmosphere. |
| **(2)** Explosion proof approvals do not apply to these adapters, only to transmitters. | **(8)** Not available for aluminum housing. |
| **(3)** Only available for electrical connections 1/2". | **(9)** For the choice of the sensor, consult HART table, Measurement Mode item in the page 4.4. |
| **(4)** IP66/68W tested for 200h to according with standard NBR 8094 / ASTM B 117. | **(10)** Only available for electrical connection ½". |
| **(5)** Certificate for use in Explosion Proof (CEPEL and FM). | **(11)** For hazardous locations. |
| **(6)** Certificate for use in Explosion Proof (CEPEL). | **(12)** Rectangular plate in 316 SST. |
| | **(13)** Not available for *Wireless*HART™ protocol. |

**TT400** — **MAIN CODE OF HART TRANSMITTER (CONTINUATION)**

| COD. | Burn-out |
|---|---|
| BD | Start Scale (According NAMUR NE43 specifications) (Default) |
| BU | End Scale (According NAMUR NE43 specifications) |

| COD. | LCD1 Indication |
|---|---|
| Y0 | LCD1: Percentage (Default) |
| Y1 | LCD1: Current - I (mA) |
| Y2 | LCD1: Temperature (Engineering Unit) |

| COD. | LCD2 Indication |
|---|---|
| Y0 | LCD2: Percentage (Default) |
| Y1 | LCD2: Current (mA) |
| Y2 | LCD2: Temperature (Engineering Unit) |

| COD. | PID Avaliability |
|---|---|
| P0 | PID not available |

| COD. | Special Measurement Type (2) |
|---|---|
| F3 | Callendar Van Dusen |
| F4 | Special Sensor |

| COD. | Measurement Mode (3) |
|---|---|
| T0 | Differential |
| T1 | Backup |
| T2 | Average |
| T3 | Maximum |
| T4 | Minimum |

| COD | Special Features |
|---|---|
| ZZ | User´s specifications |

| TT400-H11-0C1-A0N00-43 | BD | Y2 | Y1 | P0 | F3 | T0 | * |
|---|---|---|---|---|---|---|---|

**TYPICAL MODEL NUMBER**

*Leave it blank for item no options.

| NOTES |
|---|
| **(1)** Fill out with optional codes only if different from default. |
| **(2)** Callendar Van Dusen defines user-specific linearization of resistance temperature sensor. |
| **(3)** When working with two sensors connected to the terminal block. |

# *Appendix A*

| smar | SRF – Service Request Form for Temperature Transmitter | Proposta No.: (1) |
|---|---|---|

| Company: | Unit: | Receipt of Remittance: |
|---|---|---|

| COMMERCIAL CONTACT | CUSTUMER CONTACT |
|---|---|
| Full name: | Full name: |
| Position: | Position: |
| Phone: Extension: | Phone: Extension: |
| Fax: | Fax: |
| Email: | Email: |

**EQUIPMENT DATA**

| Model: | Serial Number: | Firmware Version: |
|---|---|---|

**Technology:**
**( ) 4-20 mA ( ) HART® ( ) HART® SIS ( ) WIRELESS HART® ( ) ISP ( ) FOUNDATION fieldbus™ ( ) PROFIBUS PA**

**PROCESS DATA**

| Ambient Temperature ( ºC ) | | Work Temperature ( ºC ) | | Calibration Range | |
|---|---|---|---|---|---|
| Min: | Max: | Min: | Max: | Min: | Max: |

| Operation Time: | Failure Date: |
|---|---|

**Sensor Type:**

| Measurement type:<br>( ) Double Sensor ( ) Average between Sensors ( ) Differential ( ) Backup ( ) Single | Application: (3)<br>( ) Transmitter ( ) Repeater |
|---|---|

**FAILURE DESCRIPTION**
(Please, describe the behavior of the fail, if it is repetitive, how it exactly happens, and so on.)

| Did device detect the fail? (2)<br>Yes ( ) No ( ) | What is the final value of the current? (2)<br>_____ (mA) | Message showed in the display: (2) |
|---|---|---|

**MAINTENANCE INFORMATION**

| Did you allow the upgrade in the firmware?<br>Yes ( ) No ( ) | Certification Plate: Will it maintained the certification?<br>Yes ( ) No ( ) |
|---|---|

**Main Board Configuration**
**( ) Original Factory Configuration ( ) Default Configuration**
**( ) Special Configuration (Should be informed by the client. Please, use the space below)**

**OBSERVATIONS**

**SUBMITTER INFORMATION**

Company:

Submitted by: Title: Section:

Phone: Extension: E-mail:

Date: Signature:

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**.

**NOTA**

| | |
|---|---|
| **(1)** This field should be filled out by the Smar.<br>**(2)** Required for SIS devices. | **(3)** Required for Wireless HART® devices. |

# 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 (SOCl2) | <47% |
| Carbon (C) | <6% |
| Aluminum Chloride (AlCl3) | <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 ($SO_2$) can be formed during thermal decomposition of $Cl_2$.

## 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 ($Na_2CO_3$) 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