smar - TT400WH

OPERATION, MAINTENANCE
INSTRUCTIONS / MANUAL

TEMPERATURE TRANSMITTER
*Wireless*HART

WirelessHART

APR/22
TT400WH
VERSION 2

TT400WME

smar
NOVA SMAR S/A
www.smar.com.br

NOTE
This manual is compatible with version 2.XX, where 2 denote software version and XX software release. The indication 2.XX means that this manual is compatible with any release of software version 2.

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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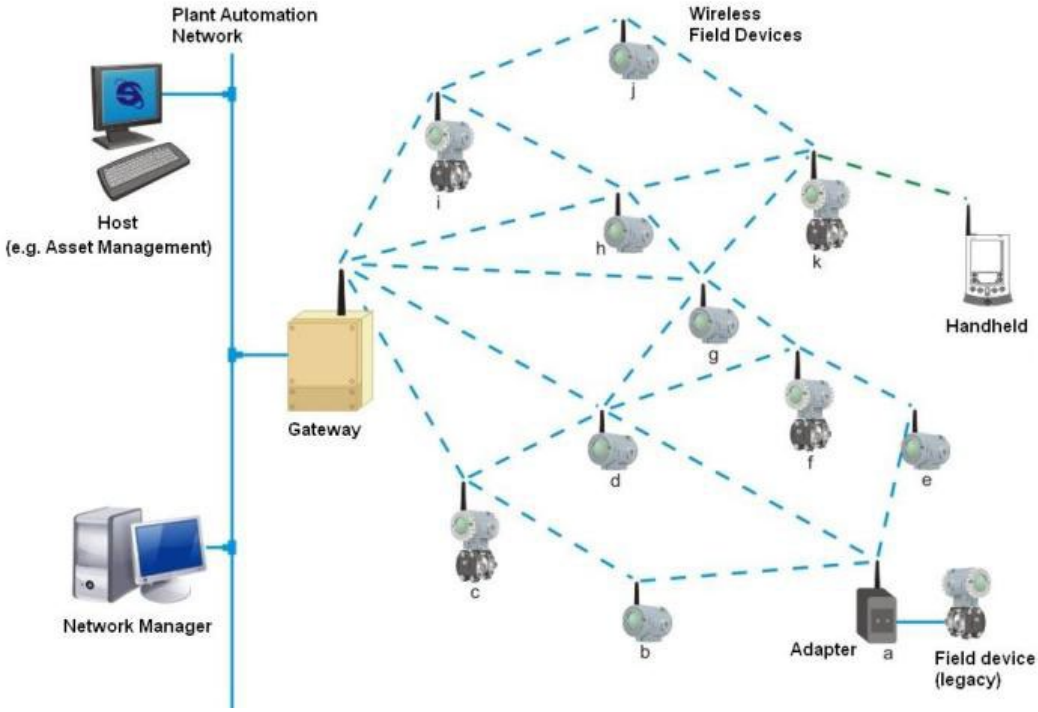
INTRODUCTION

*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.

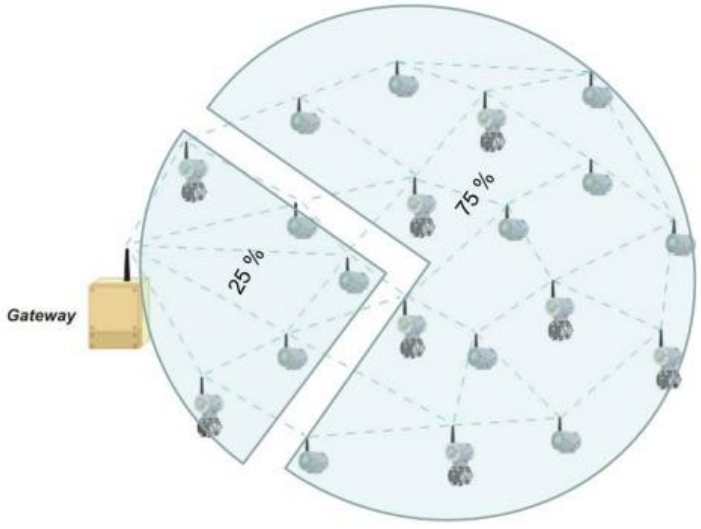
Identify potential sources of interference
Are there radio communications or other wireless networks in the plant? What protocols and frequencies do they use? Use high power? Although unlikely, given the robustness of the radios used by the *Wireless*HART technology, prior knowledge of the answers to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

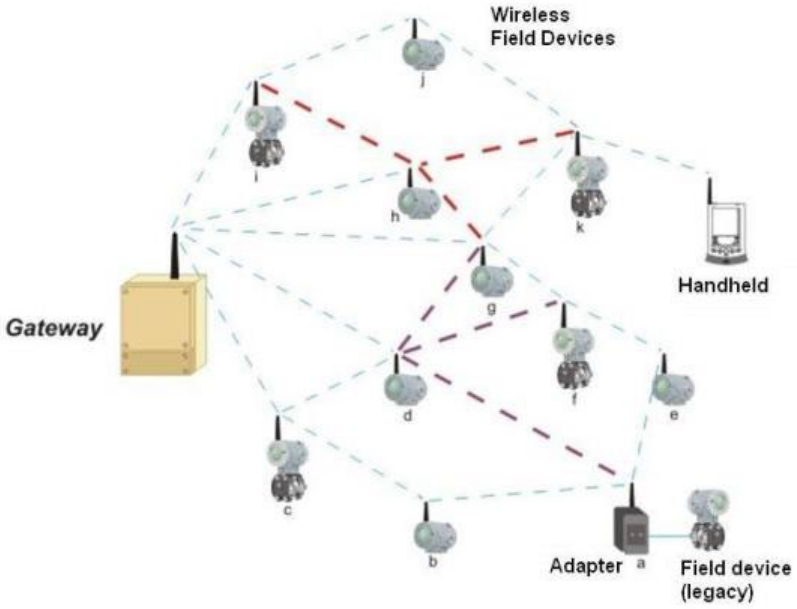
Project

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;



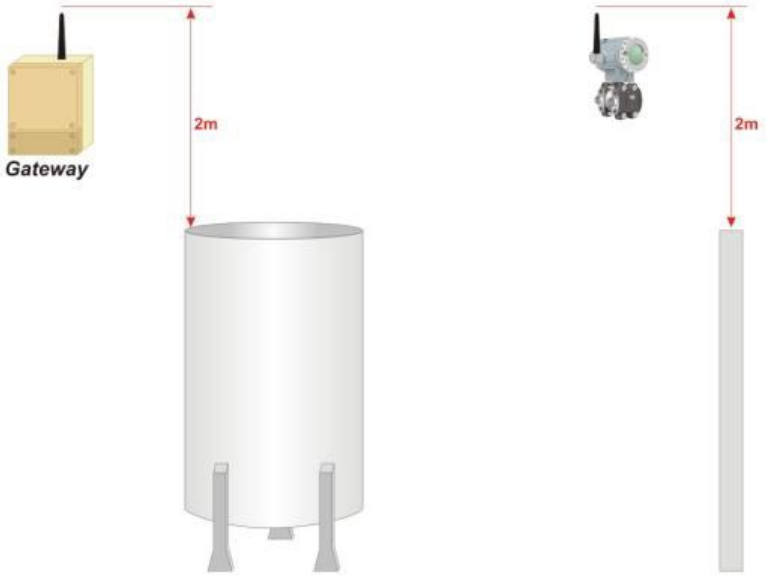
- Place the repeaters as needed.

Installation

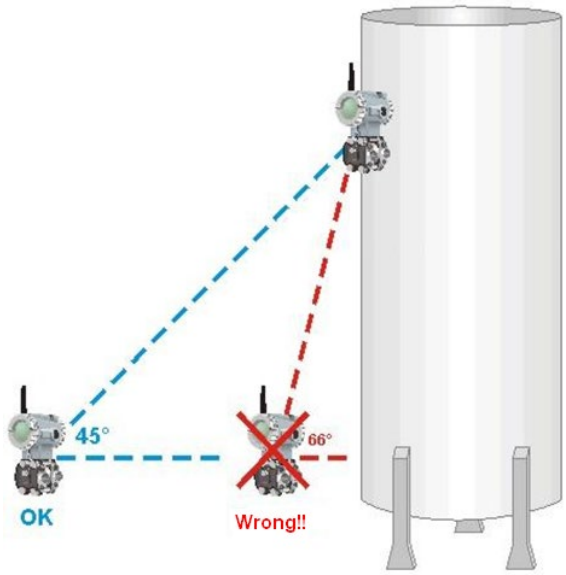
As mentioned before, *Wireless*HART devices should be connected to the process and configured the same way as conventional wired HART devices.

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

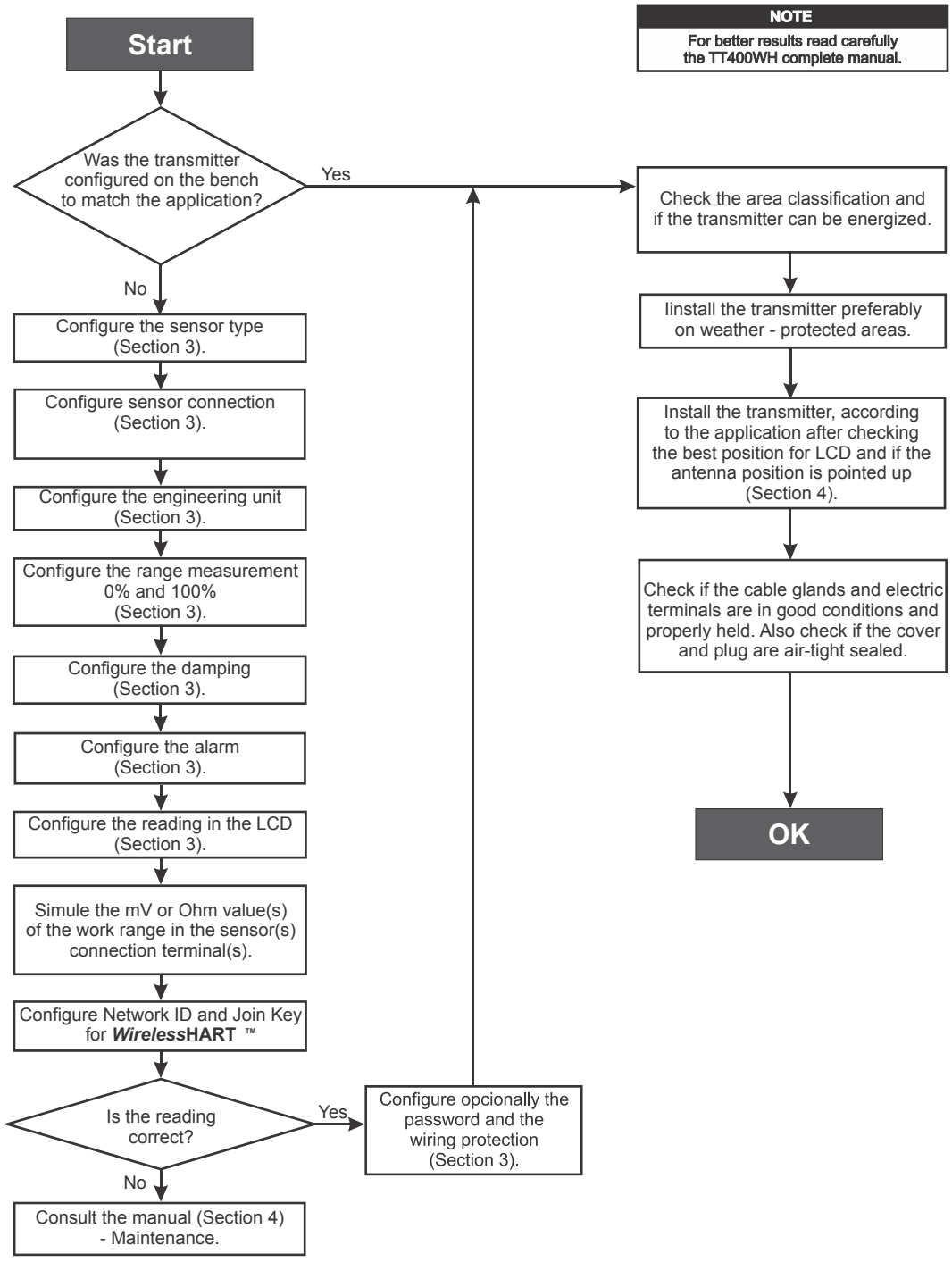
a) Make sure that the gateway is available to the host system;
b) Check the gateway and make sure it has at least five devices directly connected to it;
c) Check if 25 % of the devices are connected directly to the gateway. If necessary, add repeaters;

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

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 cannot 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 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 according to figure 1.1.

For better visibility, the housing can be rotated by loosening the locking screw (Figure 1.3).

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

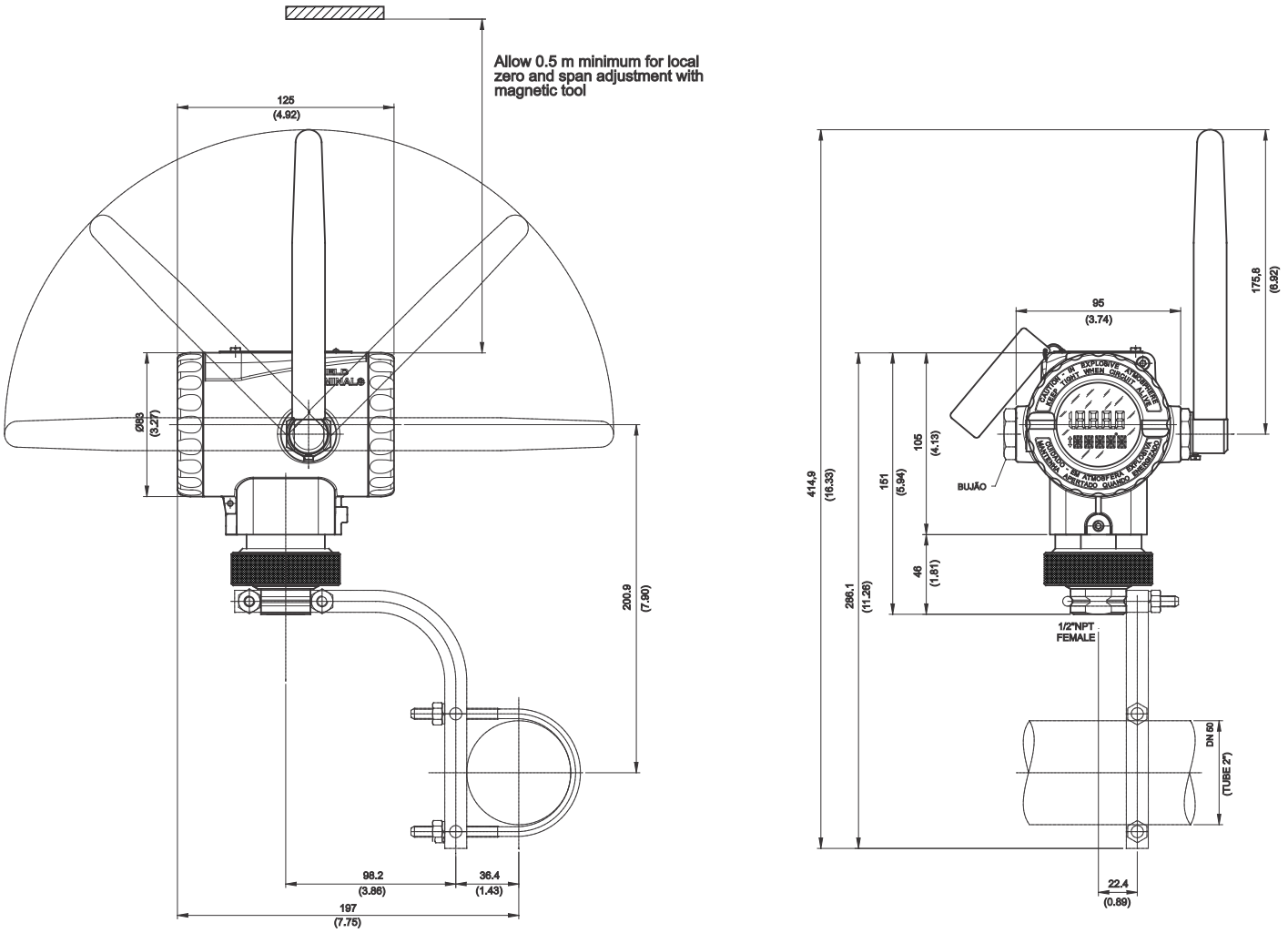


Figure 1.1 - Dimensional Drawing and Mounting Positions

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

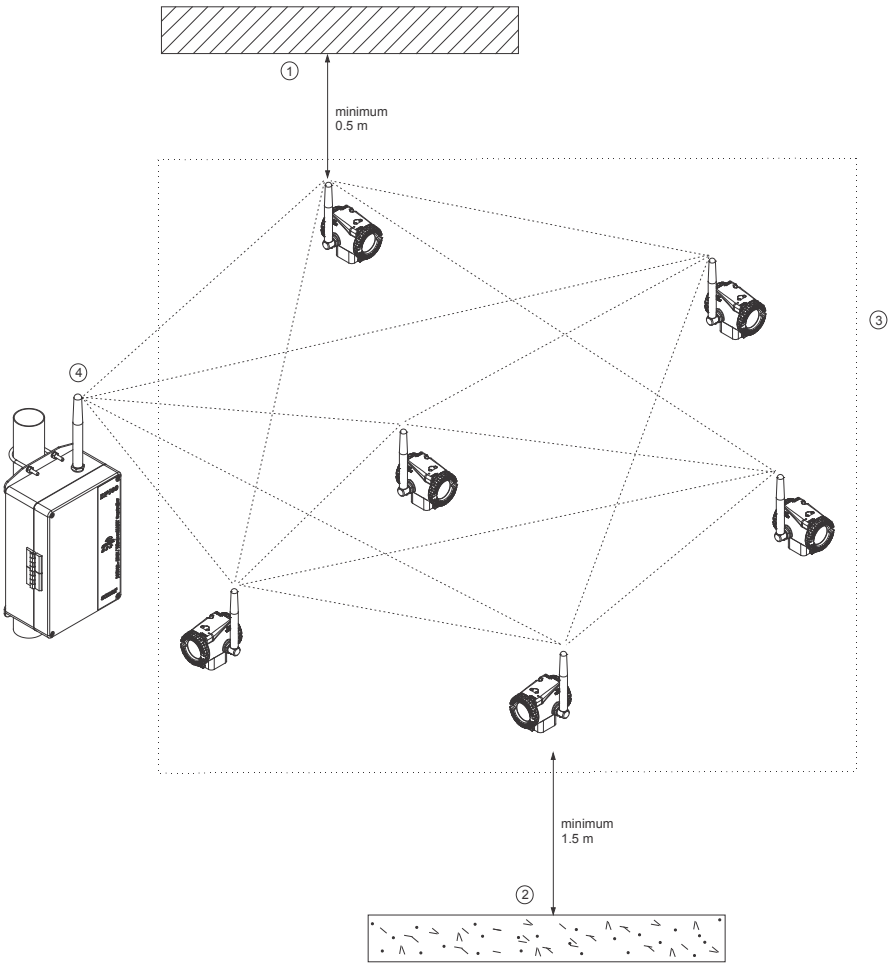


Figure 1.2 – Wiring Diagram for Wireless Transmitter

Battery Module Connection

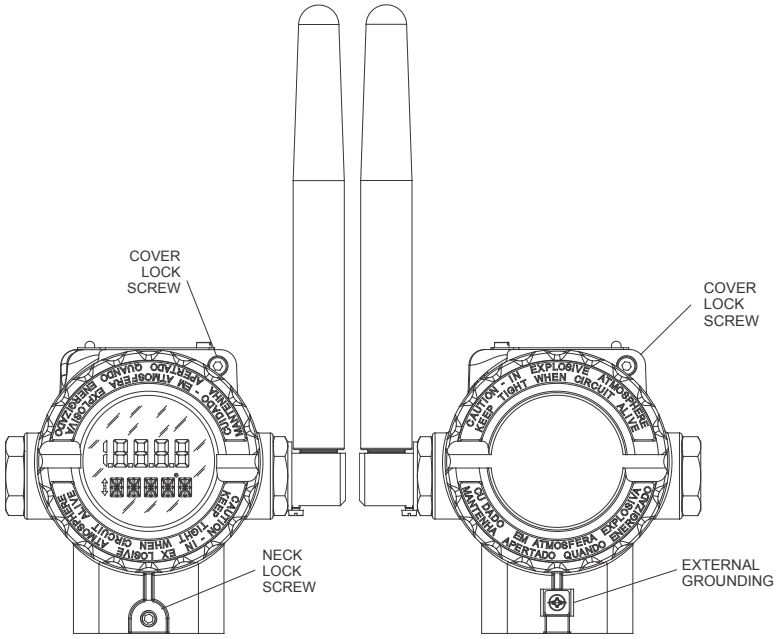


Figure 1.3 – Terminal Locking Screws

The equipment comes from the factory with the Battery Module turned off, for safety reasons and shipping regulations. To turn it on using the front switch, it is necessary to previously connect the Battery Module connector to the radio board, located on the back of the equipment (Figure 1.4).

Figure 1.4 – Connecting the Battery Module to the Radio Board

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 1.5.

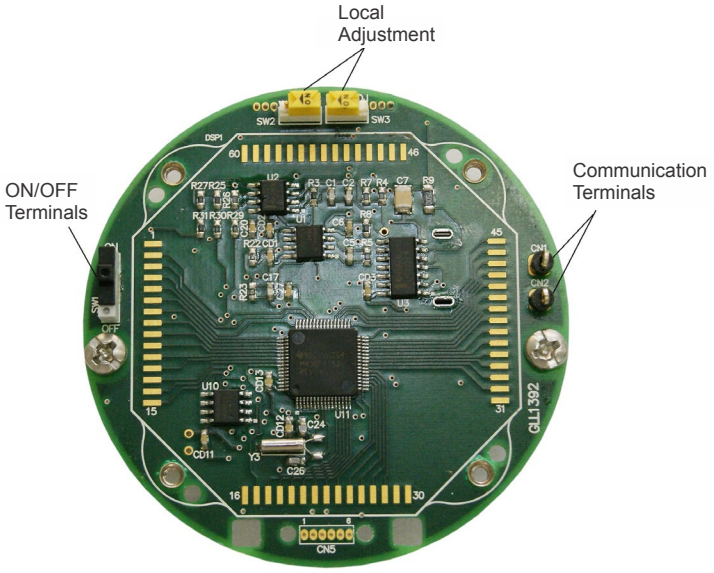


Figure 1.5 – Transmitter Terminals

The maintenance port allows for local configuration of the equipment. To access it, a HART configurator must be connected to the communication terminals “CN1” and “CN2“, shown in Figures 1.5 and 1.6.

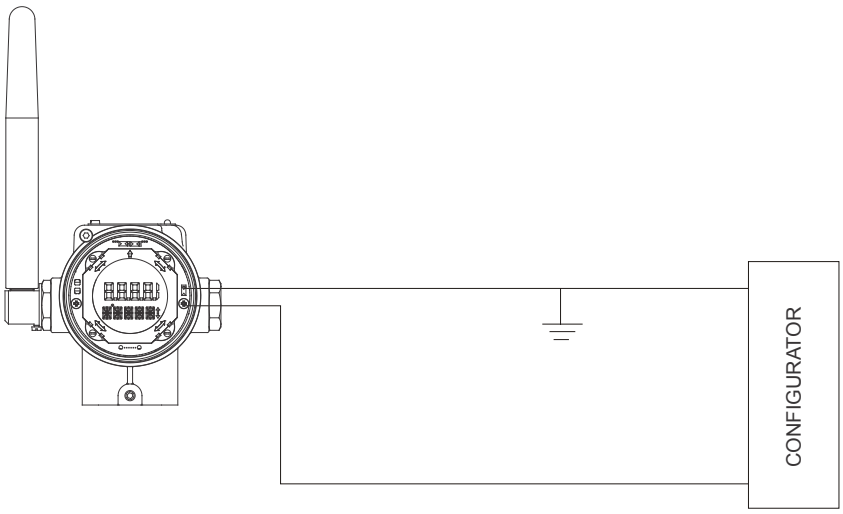


Figure 1.6 - Wiring Diagram

The sensor should be connected as per Figure 1.7.

WARNING
When operating with two sensors, the sensors cannot be both grounded. At least one must be not grounded for proper operation of **TT400 *WirelessHART*®**.

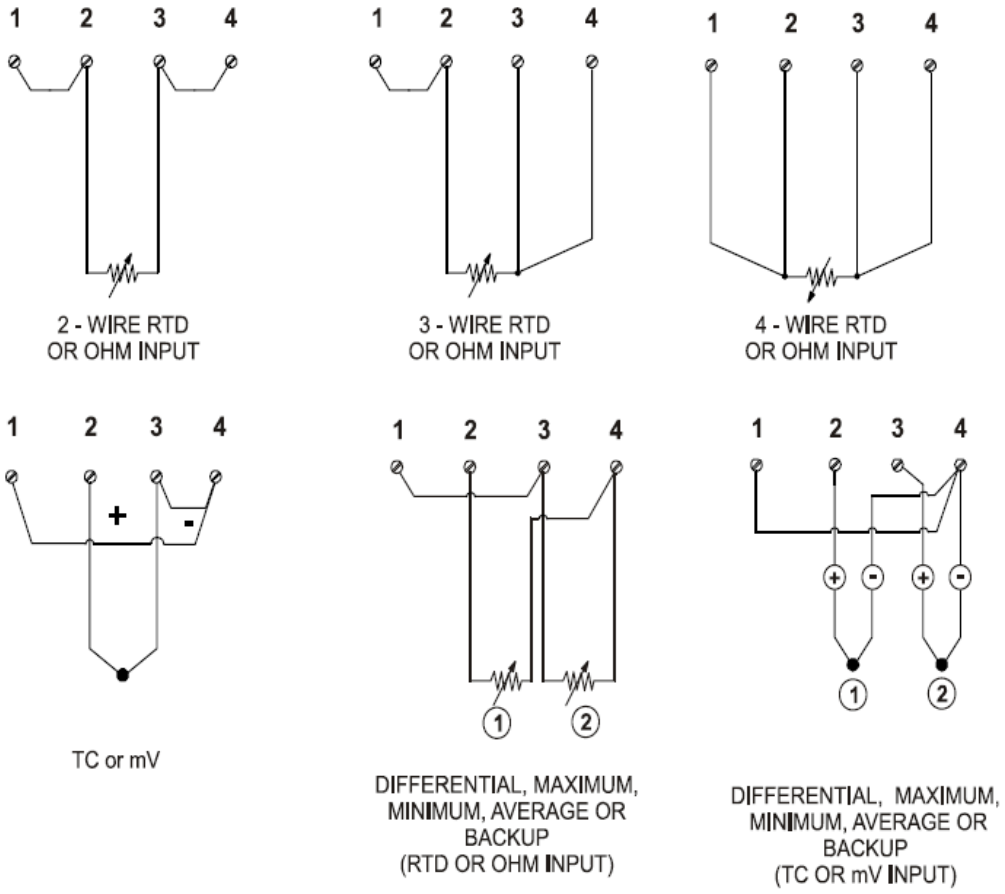


Figure 1.7 – Sensor Wiring

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 1.3). The cover must be tightened with at least 8 turns to avoid the penetration of humidity or corrosive gases. The cover must be tightened until it touches the housing. Then, tighten more 1/3 turn (120°) to guarantee the sealing. Lock the covers using the locking screw (Figure 1.3).

Intrinsically Safe

WARNING
In hazardous areas with intrinsically safe or non-incendive requirements, the circuit entity parameters and applicable installation procedures must be observed. The configurator data to guarantee the intrinsically safe parameters are: **Uo(max.) = 5 V** **Io(max.) = 100 µA** 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.

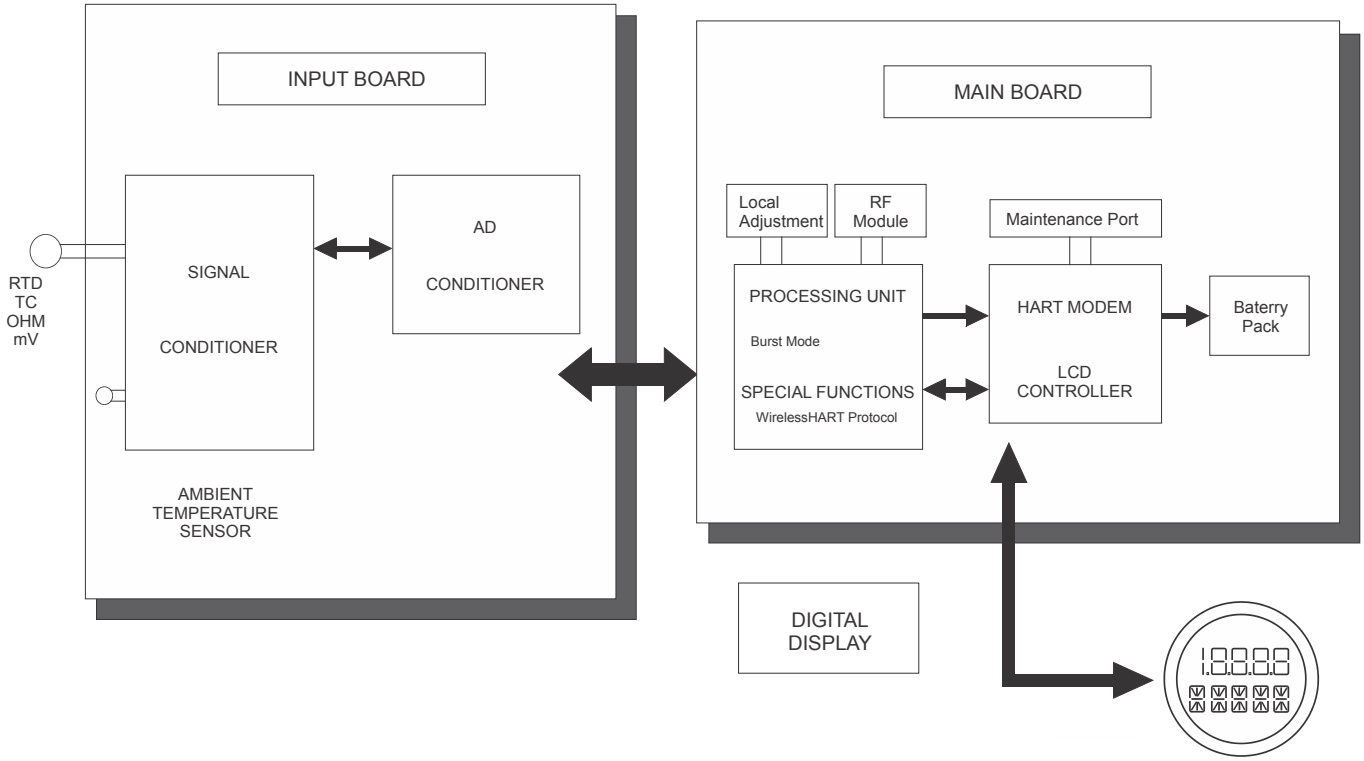


Figure 2.1 – TT400 WirelessHART™ Block Diagram

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 the power is turned off, data stored in RAM is lost.

For data storage that requires persistence, such as configuration data, calibration and identification, a non-volatile memory type FRAM for **TT400 *Wireless*HART™** is used. 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. 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 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 ºC.

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 known as RTDs, 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.

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

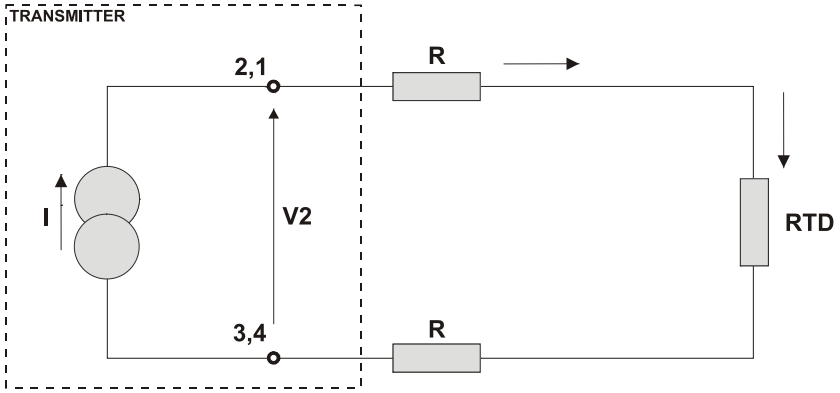


Figure 2.2 – Two-Wire Connection

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

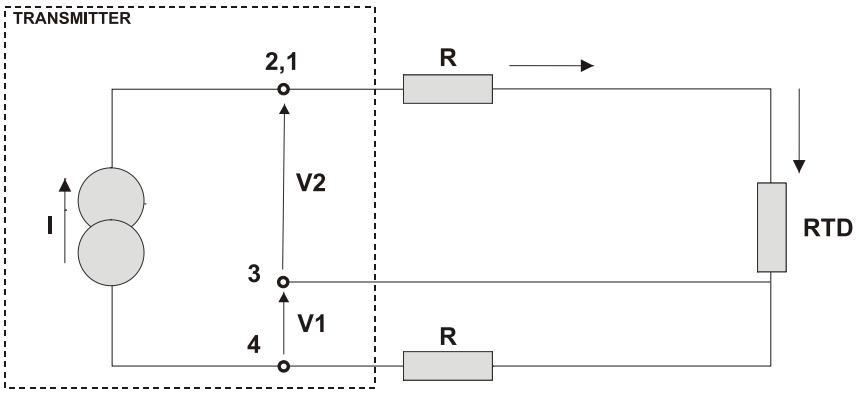


Figure 2.3 – Tree-Wire Connection

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).

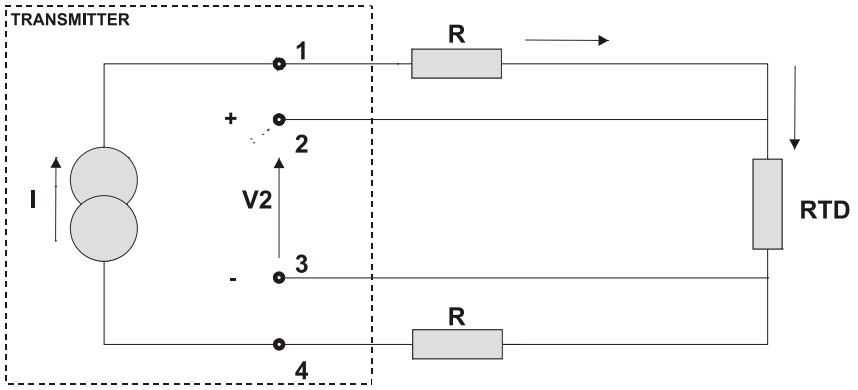


Figure 2.4 – Four-Wire Connection

A differential connection is like 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.

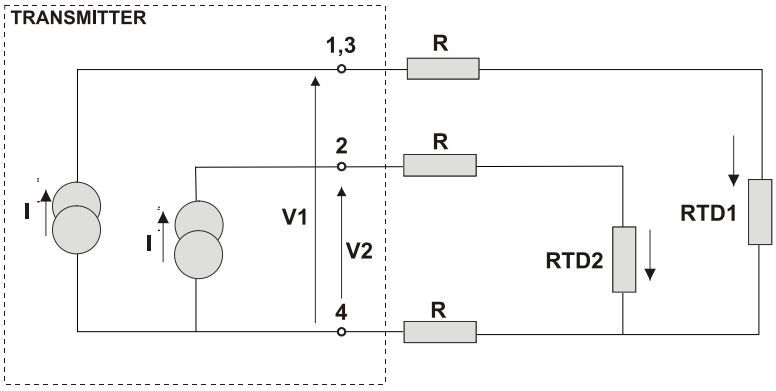


Figure 2.5 – Two Sensor Connection

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

The Display

The digital indicator can 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.

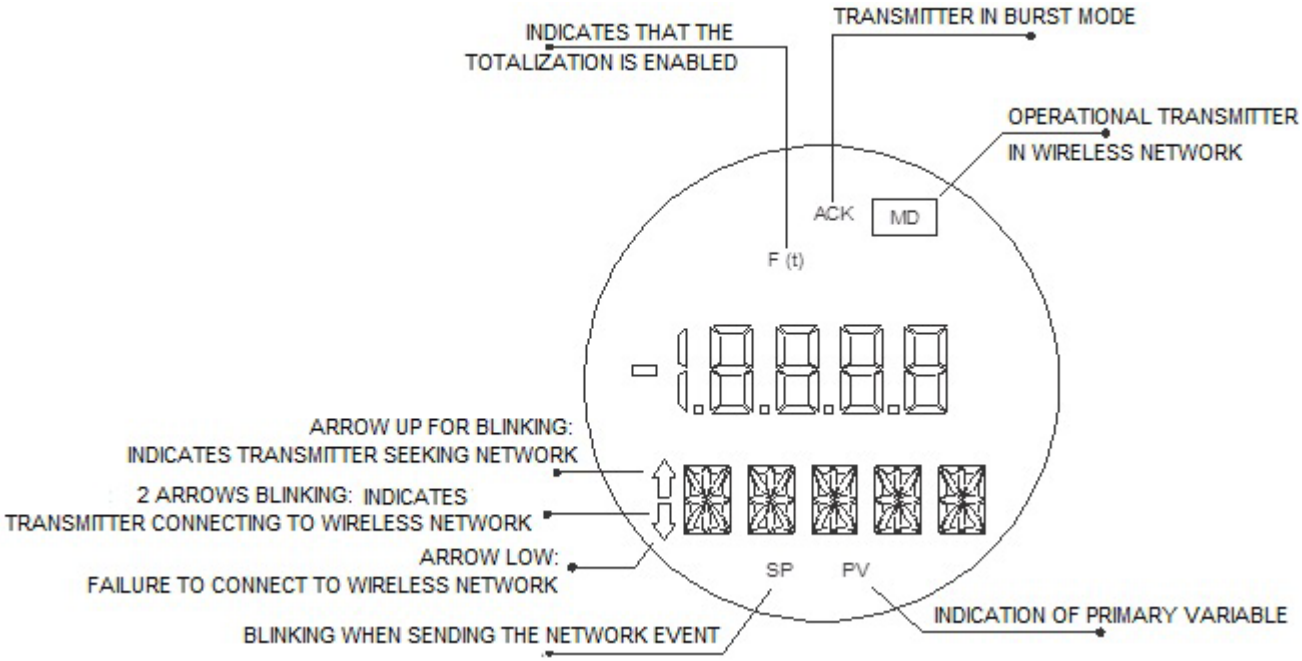


Figure 2.6 – Typical Monitoring Mode Display

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.

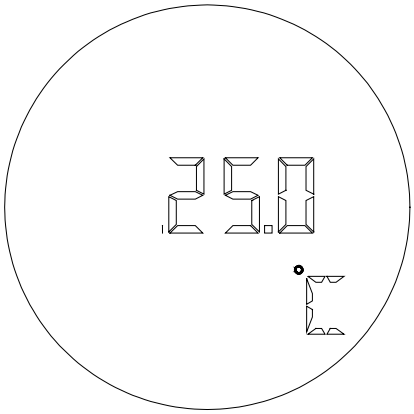


Figure 2.7 – Typical Display in Monitoring Mode

Local Adjustment

For configuration via local adjustment to be possible:

- The write protection jumper must be disabled;
- Local adjustment jumper must be enabled.

See Figure 1.4 for the positions of the Local Adjustment and Write Protection jumpers on the main electronic board.

The transmitter has, under the identification plate, two holes that allow the placement of the magnetic tool for the Local Adjustment. See Figure 2.8.

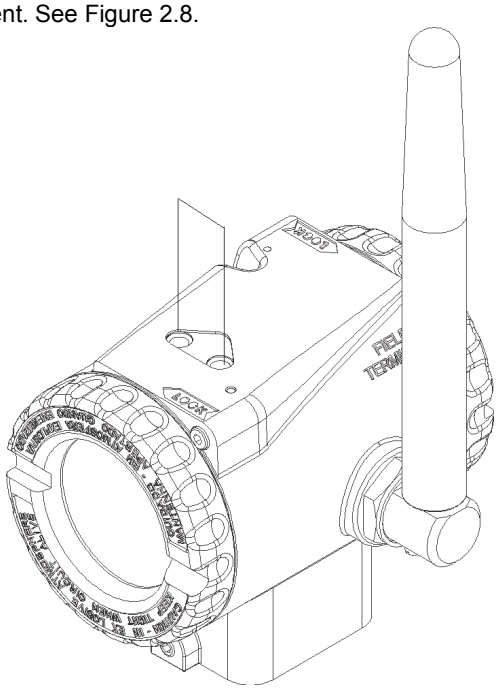


Figure 2.8 – Local Adjustment

The holes are marked with **Z** (Zero) and **S** (Span) and henceforth will be designated by only (**Z**) and (**S**), respectively.

The movement through the functions and their branches works as follows:

- By inserting the handle of the magnetic tool in (**Z**), the transmitter leaves the normal measurement state to the transmitter configuration state. The transmitter software automatically starts indicating the available functions on the display, cyclically;
- Leave the key at (**Z**) to cycle through all available configuration options;
- Once the display shows the desired option, change the key to (**S**) to select the option and navigate within the branch of the selected option. Removing the key will make the equipment save the changes made (in case of change).

The availble options for local adjustment of **TT400 *Wireless*HART™** are:

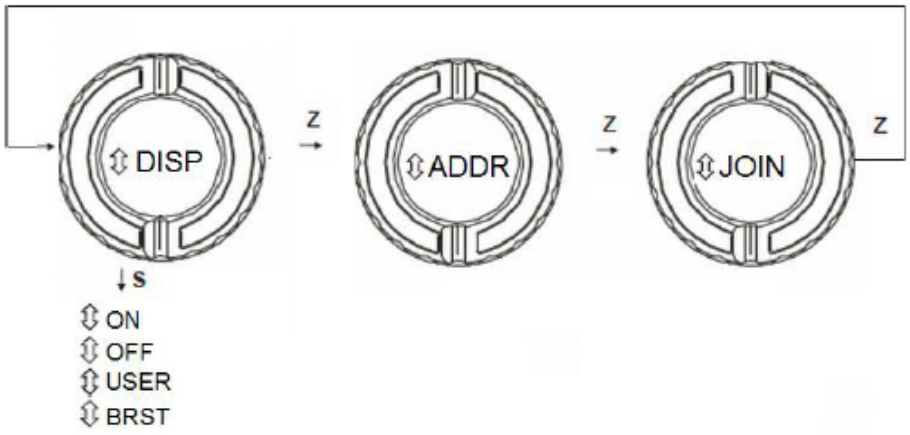


Figure 2.9 – Local Adjustment Configuration Tree

The DISP option changes the configuration of display mode. Four modes are supported:
-OFF: display is always turned off.
-ON: display is always turned on.
-USER: display normally off but activated when user inserts the magnetic tool in (**S**).
-BRST: display normally off but activated when the equipment sends a Burst command.

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

Writing Protection

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

Another way to protect the writing, but in a partial way, is the option to Lock Device, for ***Wireless*HART™**.

This option is used in ***Wireless*HART™** equipment to block writing by only one configuration means, Maintenance Port or Gateway. In this way, the user avoids conflicting configurations when acting through one of the configurators, in dangerous situations.

The types of lock are:
-Unlocked: both configurators have writing permission.
-Temporarily Locked: only the configurator that locked the device has writing permission. However, after the equipment is restarted, the status reverts to Unlocked.
-Permanently Locked: only the configurator that locked the device has writing permission and this state remains even after the device is restarted.
-All locked: no configurator has writing permission until the device is unlocked by the same configurator that locked it.

ATTENTION
The use of this function should only be used on special occasions, where the guarantee of writing the parameter is critical and fast. Afterwards, the configurator must return the equipment to unlocked mode.

Section 3

MAINTENANCE

General

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

All maintenance services must be carried out by a qualified person and the replacement of components (supplied by Smar) must only be carried out by qualified personnel.

Diagnostics with the Display

The display can show failure messages in the alphanumeric segment. These messages are shown in Table 3.1.

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 ambient 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 turned off;
- Network/Gateway manager is turned off;
- The equipment is far from the Network/Gateway Manager or other equipment connected to it;
- 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 an 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 is within the operating range, but the communication stability is not good

Possible cause:

- Interference. Move the equipment closer until better stability is achieved.

Disassembly Procedure

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

Sensor
If the sensor is mounted on the transmitter, first disconnect the wires 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) Disconnect the sensor from the bottom, as pictured, unscrewing it carefully;

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

Table 3.2 – Quick Disassembly Procedure Transmitter

Antenna
If it is necessary to disassemble the antenna set, it is mandatory to remove the back cover of the equipment 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. 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 ° in relation to the base of the equipment. To avoid damage to the equipment, do not rotate the antenna below the

imaginary line 180° in relation to the base of the equipment. If there is a need to rotate the antenna, loosen the lower fixing screw and travel 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 it. To remove the display (**4**), loosen the four screws (**3**) and carefully remove it. 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 it. 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 it.

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

e) Connect the sensor from the bottom, as shown in the picture, 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 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 housing 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 housing, using its screw (**17**). To assemble the input board (**24**) first connect it to the main board (**6**) and then attach to the housing 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 finish the equipment assembling, screw the display (**1**) and rear (**18**) covers clockwise.

Interchangeability

Calibration data is stored in the FRAM 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 replacement is necessary, 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.

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

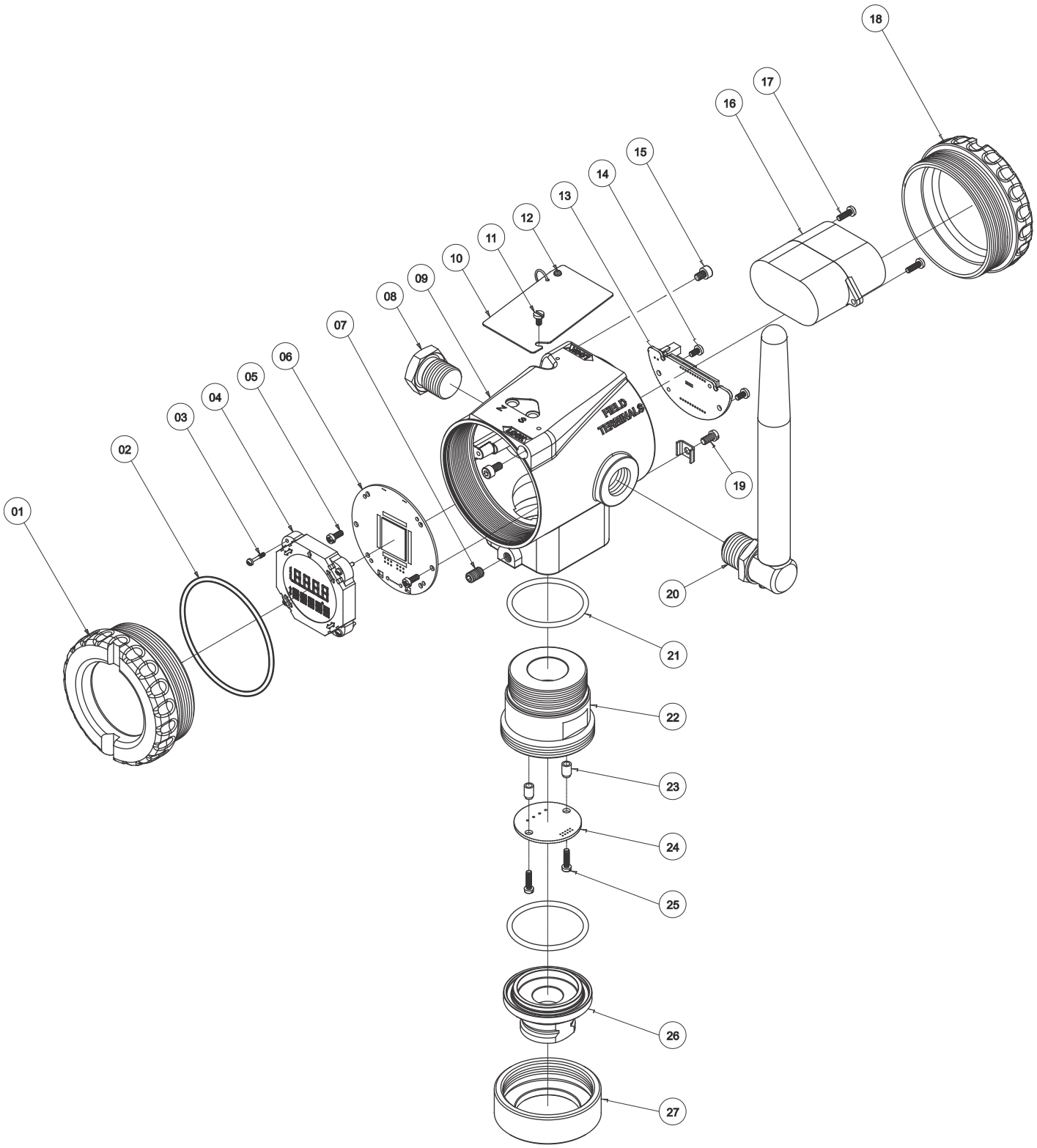


Figure 3.1 – Exploded View

ACCESSORIES	
ORDERING CODE	**DESCRIPTION**
SD-1	Magnetic tool for local adjustment.
DEVCODROID	The DevComDroid APP uses DDs to access data stored in memory and configure HART equipment.
HI331	HART® Bluetooth Interface

SPARE PARTS LIST FOR TRANSMITTER				
DESCRIPTION OF PARTS		**POSITION**	**CODE**	**CATEGORY (NOTE1)**
HOUSING M20 x 1.5 (NOTE 2)	ALUMINUM 316 SST	9 9	400-1205 400-1206	
COVER WITHOUT DISPLAY	ALUMINUM 316 SST	18 18	400-1207 400-1208	
COVER WITH DISPLAY	ALUMINUM 316 SST	1 1	400-0824 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 HOUSING IN ALUMINUM	28 28	400-0826 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	
MAIN BOARD		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	

NOTES
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 block, bolts (cover lock, grounding and terminal block) 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	Composed of 2 primary Lithium batteries (Li-SOCl2) of 3.6 V, totaling 7.2 V of nominal voltage and nominal capacity @3 mA, at 2V 8.5Ah. Not rechargeable. Battery Life: - Update every 8s: 5.5 years - Burst mode to 8s, @25 ºC, network with at least 3 neighbor devices: 6 years **Notes:** The batteries module used in the transmitters must be provided exclusively by Smar (PACK BATTERY - Code 400-1209) and must be replaced in full when necessary. For specific battery composition details see Appendix B.
Indicator	4 1/2 -digit numerical and 5-character alphanumerical LCD indicator (optional). Function and status icon. Indication on the display of sensor failure or saturation.
Communication Protocol	HART Protocol Version 7, with set of commands **TT400 *Wireless*HART™**. A specific review of the HART transmitter must be managed according to the transmitter **TT400 *Wireless*HART™**.
Measurement Type	Temperature with one sensor; Differential temperature between two sensors; Temperature with two sensors considering the highest; Temperature with two sensors considering lowest; Average temperature with two sensors; Backup temperature with two sensors; Temperature generated by Callendar Van Dusen equation.
Configuration	Remote configuration with external configurator via HART® Protocol, using DDL/EDDL.
Temperature Limits	Ambient, process and storage: -40 to 85 °C (-40 to 185 °F) Digital Display: -20 to 80 °C (-4 to 176 °F) (Operation) -40 to 85 °C (-40 to 185 °F) (Without damage)

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; 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 special plastic label.

Transmitter Specifications	
Sensor Input Treatment	AD with 50 and 60 Hz input noise rejection; Input Sensor trim in two points. Environment Temperature trim.
Primary Variable Treatment	Engineering unit conversion; Cold junction compensation; Input Sensor characterization (Callendar Van Dusen); Measured Type (single, differential, maximum, minimum, average).

Protected Operation Specifications	
Operation counter	Counting of the configuration change operations.
Configuration Protection	Configurations blocked by password; Write Protection via hardware and software;
Certification	Intrinsic Safety (pending), weatherproof.

Human Machine Interface Specifications

Status Indication on Display

Item	Icon	Description
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 network
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 to 250	-4 to 482	50	± 1.0
	Ni120	Edison Curve #7	-50 to 270	-58 to 518	5	± 0.1
	Pt50	IEC 751-83 (0.00385)	-200 to 850	-328 to 1562	10	± 0.25
	Pt100	IEC 751-83 (0.00385)	-200 to 850	-328 to 1562	10	± 0.2
	Pt500	IEC 751-83 (0.00385)	-200 to 450	-328 to 842	10	± 0.2
	Pt1000	IEC 751-83 (0.00385)	-200 to 300	-328 to 572	10	± 0.2
	Pt50	JIS 1604-81 (0.003916)	-200 to 600	-328 to 1112	10	± 0.25
	Pt100	JIS 1604-81 (0.003916)	-200 to 600	-328 to 1112	10	± 0.25
	Pt100	MIL-T-24388C (0.00392)	-40 to 540	-40 to 1000	10	± 0.2
	Ni120	MIL-T-24388C (0.00672)	-40 to 205	-40 to 400	5	± 0.13
	Pt100	IEC 751-95 (0.00385)	-200 to 850	-328 to 1562	10	± 0.2
	Pt100	GOST 6651-09 (0.003911)	-200 to 850	-328 to 1562	10	± 0.2
	Pt50	GOST 6651-09 (0.003911)	-200 to 850	-328 to 1562	10	± 0.2
	Cu100	GOST 6651-09 (0.00426)	-50 to 200	-58 to 392	10	± 0.15
	Cu50	GOST 6651-09 (0.00426)	-50 to 200	-58 to 392	10	± 0.15
TERMOCOUPLER	B	NBS Monograph 125	100 to 1800	212 to 3272	50	± 0.5**
	E	NBS Monograph 125	-100 to 1000	-148 to 1832	20	± 0.2
	J	NBS Monograph 125	-150 to 750	-238 to 1382	30	± 0.3
	K	NBS Monograph 125	-200 to 1350	-328 to 2462	60	± 0.6
	N	NBS Monograph 125	-100 to 1300	-148 to 2372	50	± 0.5
	R	NBS Monograph 125	0 to 1750	32 to 3182	40	± 0.4
	S	NBS Monograph 125	0 to 1750	32 to 3182	40	± 0.4
	T	NBS Monograph 125	-200 to 400	-328 to 752	15	± 0.15
	L	DIN 43710	-200 to 900	-328 to 1652	35	± 0.35
	U	DIN 43710	-200 to 600	-328 to 1112	50	± 0.5
	L	GOST 8.585-01	-200 to 800	-328 to 1472	60	± 0.4
	W5Re/W26Re	ASTM E 988-06	0 to 2200	32 to 3992	60	± 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	RANGE mV	MINIMUM SPAN mV	* DIGITAL ACCURACY %
mV	-6 to 22	0.40	± 0.02% or ± 2 µV
	-10 to 100	2.00	± 0.02% or ± 10 µV
	-50 to 500	10.00	± 0.02% or ± 50 µV

Table 4.2 - mV Sensor Characteristics

SENSOR	RANGE Ohm	MINIMUM SPAN Ohm	* DIGITAL ACCURACY %
Ohm	0 to 100	1	± 0,02% or ± 0.01 Ohm
	0 to 400	4	± 0,02% or ± 0.04 Ohm
	0 to 2000	20	± 0,02% or ± 0.20 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. Communication Protocol

COD.	
W	*Wireless*HART™

COD. Security Option

COD.	
0	For use in measurement and control

COD. Local Indicator (1)

COD.	
0	Without Indicator
1	With Indicator Digital

COD. Electrical Connection

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

COD. Blanket Plug

COD.	
I	316 SST
C	Carbon Steel **(3) (7) (10)**

COD. Mounting Bracket

COD.		COD.	
0	Without Bracket	2	316 SST Bracket with 316 SST Accessories
1	Carbon Steel Bracket with Carbon Steel Accessories	7	Carbon Steel Bracket with 316 SST Accessories

COD. Housing Material

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

COD. Painting

COD.	
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)

COD.	
N	Without Certification
I	Intrinsic Safety (pending)

COD. Certifying Body (11)

COD.	
0	Without Certifying Body
5	CEPEL (pending)

COD. Tag Plate (12)

COD.		COD.	
0	With TAG, when specified	2	User's specification
1	Blanket		

COD. Sensor Type

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

COD. Sensor Connection (9)

COD.		COD.	
2	2-wires	4	4-wires
3	3-wires	F	2-wires (2 sensors)

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.
(2) Explosion proof approvals do not apply to these adapters, only to transmitters.
(3) Only available for electrical connections 1/2".
(4) IP66/68W tested for 200h to according with standard NBR IEC 60529.
(5) Certificate for use in Explosion Proof (CEPEL and FM).
(6) Certificate for use in Explosion Proof (CEPEL).
(7) Not applicable for saline atmosphere.
(8) Not available for aluminum housing.
(9) For sensor selection, consult the sensor characteristics tables.
(10) Only available for electrical connection ½".
(11) For hazardous locations.
(12) Rectangular plate in 316 SST.

****OPTIONAL HART CONFIGURATION (1)**

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 Availability
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-W01-0C1-A0N00-43	BD	Y2	Y0	P0	F3	T2	*	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: ( ) Double Sensor ( ) Average between Sensors ( ) Differential ( ) Backup ( ) Single	Application: (3) ( ) Transmitter ( ) Repeater

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

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

MAINTENANCE INFORMATION

Did you allow the upgrade in the firmware? Yes ( ) No ( )	Certification Plate: Will it maintained the certification? 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 https://www.smar.com/en/support

NOTES

(1) This field should be filled out by the Smar.
(2) Required for SIS devices.
(3) Required for Wireless HART® devices.

Appendix B

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