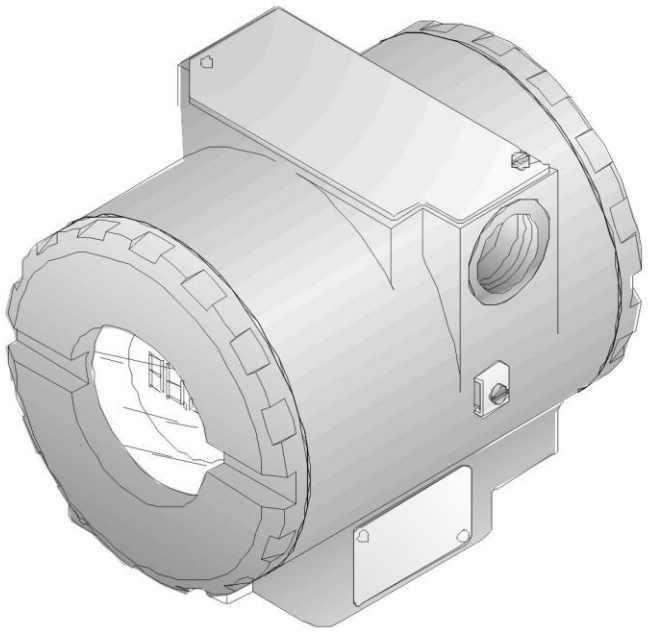
TT302

smar
First in Fieldbus

OPERATION & MAINTENANCE
INSTRUCTION MANUAL

FIELDBUS TEMPERATURE TRANSMITTER



DEC/24
TT302
VERSION 3

FOUNDATION

TT302ME

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INTRODUCTION

The **TT302** is from the first generation of FIELDBUS devices. It is a transmitter mainly intended for measurement of temperature using RTDs or thermocouples, but can also accept other sensors with resistance or mV output such as: pyrometers, load cells, resistance position indicators, etc. The digital technology used in the **TT302** enables a single model to accept several types of sensors, an easy interface between the field and the control room and several others features that considerably reduces the installation, operation and maintenance costs.

FIELDBUS is not only a replacement for 4-20 mA or intelligent/smart transmitter protocols. It contains much more. FIELDBUS is a complete system enabling distribution of the control function to equipment in the field.

Some advantages of bi-directional digital communications are known from existing smart transmitter protocols: higher accuracy, multivariable access, remote configuration and diagnostics and multi-dropping of several devices on a single pair of wires. These protocols were not intended to transfer control data, but maintain information. Therefore they were slow and not efficient enough to be used.

The main requirements for Fieldbus were to overcome these problems. Closed loop control with performance like a 4-20 mA system requires higher speed. Since higher speed means higher power consumption, this clashes with the need for intrinsic safety. Therefore a moderately high communication speed was selected, and the system was designed to have minimum communication overhead. Using scheduling, the system controls the variable sampling, the algorithm execution and the communication to optimize the usage of the network, thus achieving high closed loop performance.

Using Fieldbus technology, with its capability to interconnect several devices, very large control schemes can be constructed. In order to be user friendly, the function block concept was introduced (users of SMAR CD600 should be familiar with this, since it was implemented several years ago). The user may now easily build and overview complex control strategies. Another advantage is adding flexibility, the control strategy may be edited without having to rewire or change any hardware.

Now, thanks to Fieldbus, the transmitter accepts two channels, i.e., two measurements. This reduces the cost per channel. Other function blocks are also available. They allow flexibility in control strategy implementation.

The need for Fieldbus implementation in small as well as large systems was considered when developing the entire 302 line of Fieldbus devices. They have the common features of being able to act as a master on the network.

Get the best result of the TT302 by carefully reading these instructions.

WARNING
This Manual is compatible with version 3.XX, where 3 denote software version and XX software release. The indication 3.XX means that this manual is compatible with any release of software version 3.

Waiver of responsibility

The contents of this manual abides by the hardware and software used on the current equipment version. Eventually there may occur divergencies between this manual and the equipment. The information from this document are periodically reviewed and the necessary or identified corrections will be included in the following editions. Suggestions for their improvement are welcome.

Warning

For more objectivity and clarity, this manual does not contain all the detailed information on the product and, in addition, it does not cover every possible mounting, operation or maintenance cases.

Before installing and utilizing the equipment, check if the model of the acquired equipment complies with the technical requirements for the application. This checking is the user's responsibility.

If the user needs more information, or on the event of specific problems not specified or treated in this manual, the information should be sought from Smar. Furthermore, the user recognizes that the contents of this manual by no means modify past or present agreements, confirmation or judicial relationship, in whole or in part.

All of Smar's obligation result from the purchasing agreement signed between the parties, which includes the complete and sole valid warranty term. Contractual clauses related to the warranty are not limited nor extended by virtue of the technical information contained in this manual.

Only qualified personnel are allowed to participate in the activities of mounting, electrical connection, startup and maintenance of the equipment. Qualified personnel are understood to be the persons familiar with the mounting, electrical connection, startup and operation of the equipment or other similar apparatus that are technically fit for their work. Smar provides specific training to instruct and qualify such professionals. However, each country must comply with the local safety procedures, legal provisions and regulations for the mounting and operation of electrical installations, as well as with the laws and regulations on classified areas, such as intrinsic safety, explosion proof, increased safety and instrumented safety systems, among others.

The user is responsible for the incorrect or inadequate handling of equipments run with pneumatic or hydraulic pressure or, still, subject to corrosive, aggressive or combustible products, since their utilization may cause severe bodily harm and/or material damages.

The field equipment referred to in this manual, when acquired for classified or hazardous areas, has its certification void when having its parts replaced or interchanged without functional and approval tests by Smar or any of Smar authorized dealers, which are the competent companies for certifying that the equipment in its entirety meets the applicable standards and regulations. The same is true when converting the equipment of a communication protocol to another. In this case, it is necessary sending the equipment to Smar or any of its authorized dealer. Moreover, the certificates are different and the user is responsible for their correct use.

Always respect the instructions provided in the Manual. Smar is not responsible for any losses and/or damages resulting from the inadequate use of its equipments. It is the user's responsibility to know and apply the safety practices in his country.

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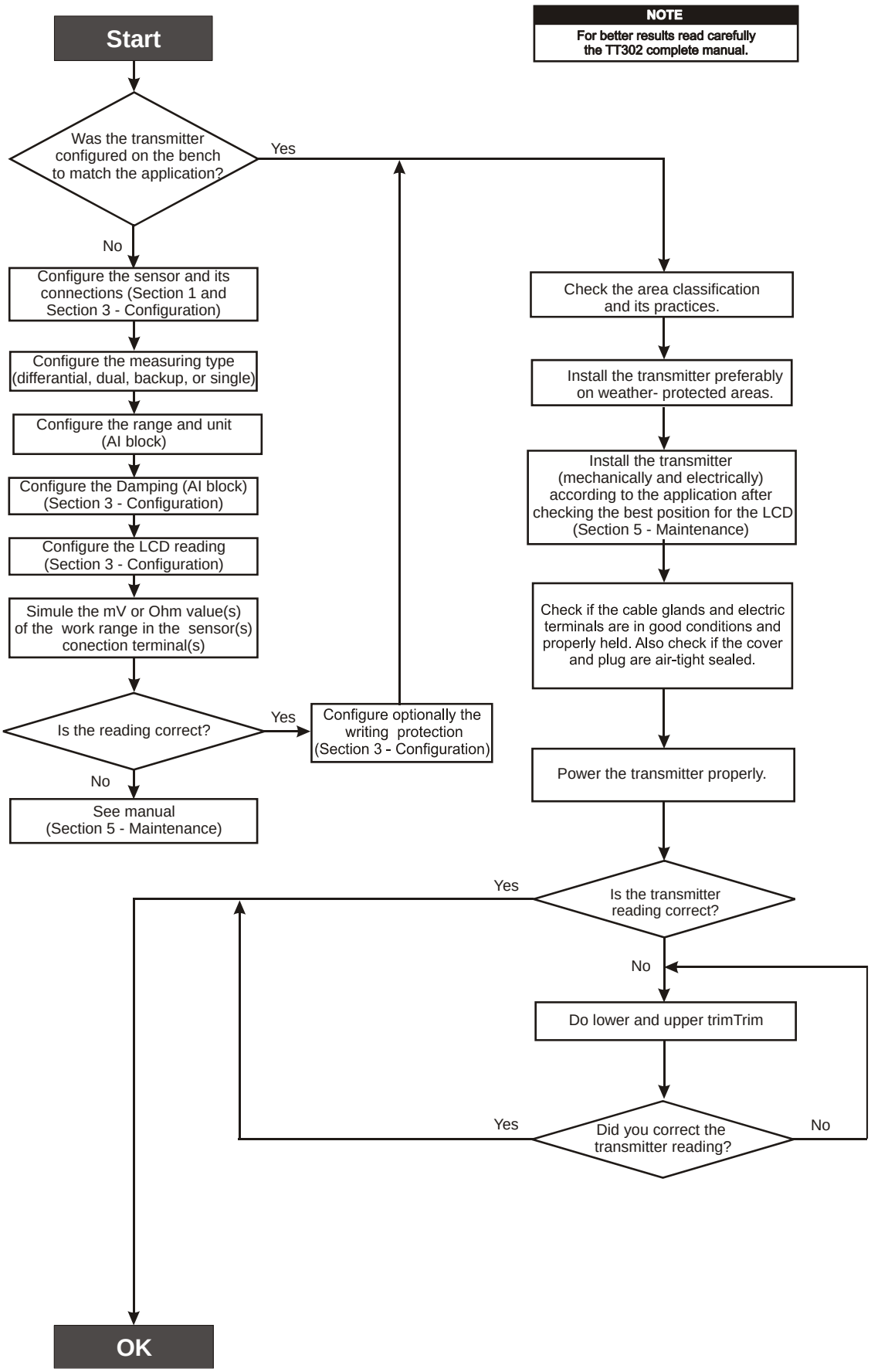
Installation Flowchart



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.

Locating the transmitter in areas protected from extreme environmental changes can minimize temperature fluctuation effects.

In warm environments, the transmitter should be installed in such a way as 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 separately from the transmitter housing.

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

Humidity is fatal for electronic circuits. In areas subjected to high relative humidity, the O-rings for the electronic housing covers must be correctly placed and the covers must be completely closed by tightening them by hand until you feel the O-rings being compressed. Do not use tools to close the covers. Removal of the electronics cover in the field should be reduced to the minimum necessary, since each time it is removed, the circuits are exposed to humidity. The electronic circuit is protected by a humidity proof coating, but frequent exposure 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, as painting cannot protect these parts. Code-approved sealing methods should be employed on conduit entering the transmitter.

Connecting the sensor as close to the transmitter as possible and using proper wires (See Section 2 Operation), can decrease measurement error.

Mounting

The transmitter may be mounted in two basic ways:

- Separated from the sensor, using optional mounting brackets.
- Mounted on the sensor assembly.

It can be mounted in several different positions using the bracket, as shown in Figure 1.3 - Dimensional Drawing and Mounting Positions. You can also see in the Figure 1.3 how the conduit inlets for electrical connection are used to mount the sensor integral to the temperature transmitter.

For better visibility, the digital display may be rotated in steps of 90º. (See Figure 4.1 – Four Possible Positions of the Display).

Network Wiring

Access the terminal block by removing the Electrical Connection Cover. This cover can be locked closed by the cover locking screw (See Figure 1.1 - Cover Locking).To release the cover, rotate the locking screw clockwise.

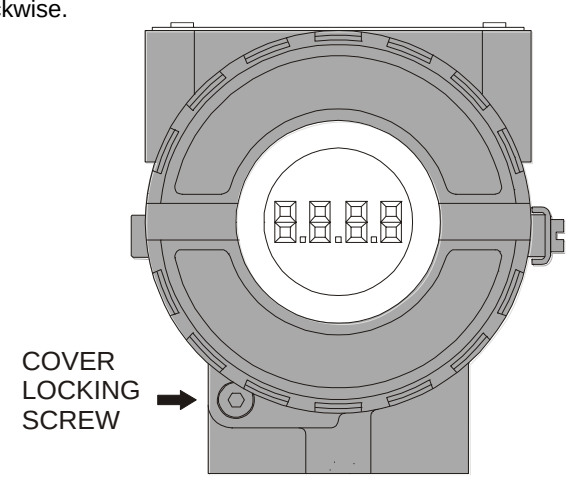


Figure 1.1 - Cover Locking

Cable access to wiring connections are obtained by one of the two conduit outlets. Conduit threads should be sealed by means of code-approved sealing methods. **The unused outlet connection should be plugged accordingly.**

The wiring block has screws on which fork or ring type terminals can be fastened. (See Figure 1.2 - Ground Terminals).

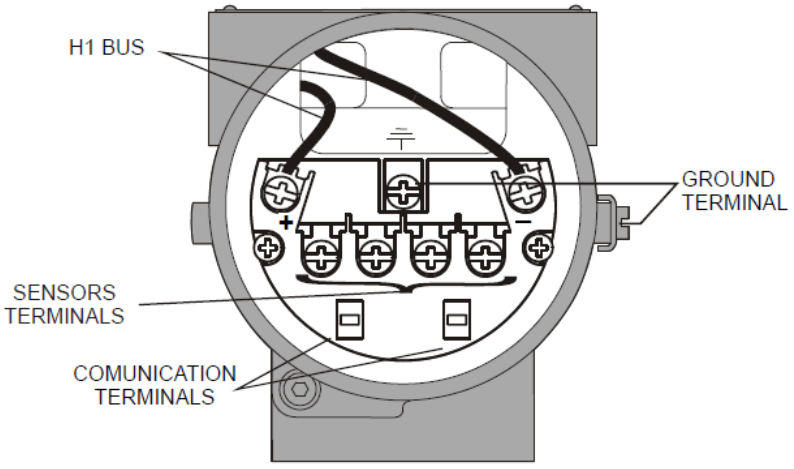


Figure 1.2 - Ground Terminals

For convenience, there are three ground terminals: one inside the cover and two externally, located close to the conduit entries.

WARNING
Do not connect the Fieldbus network wires to the sensor terminals. (Terminals 1, 2, 3 and 4).

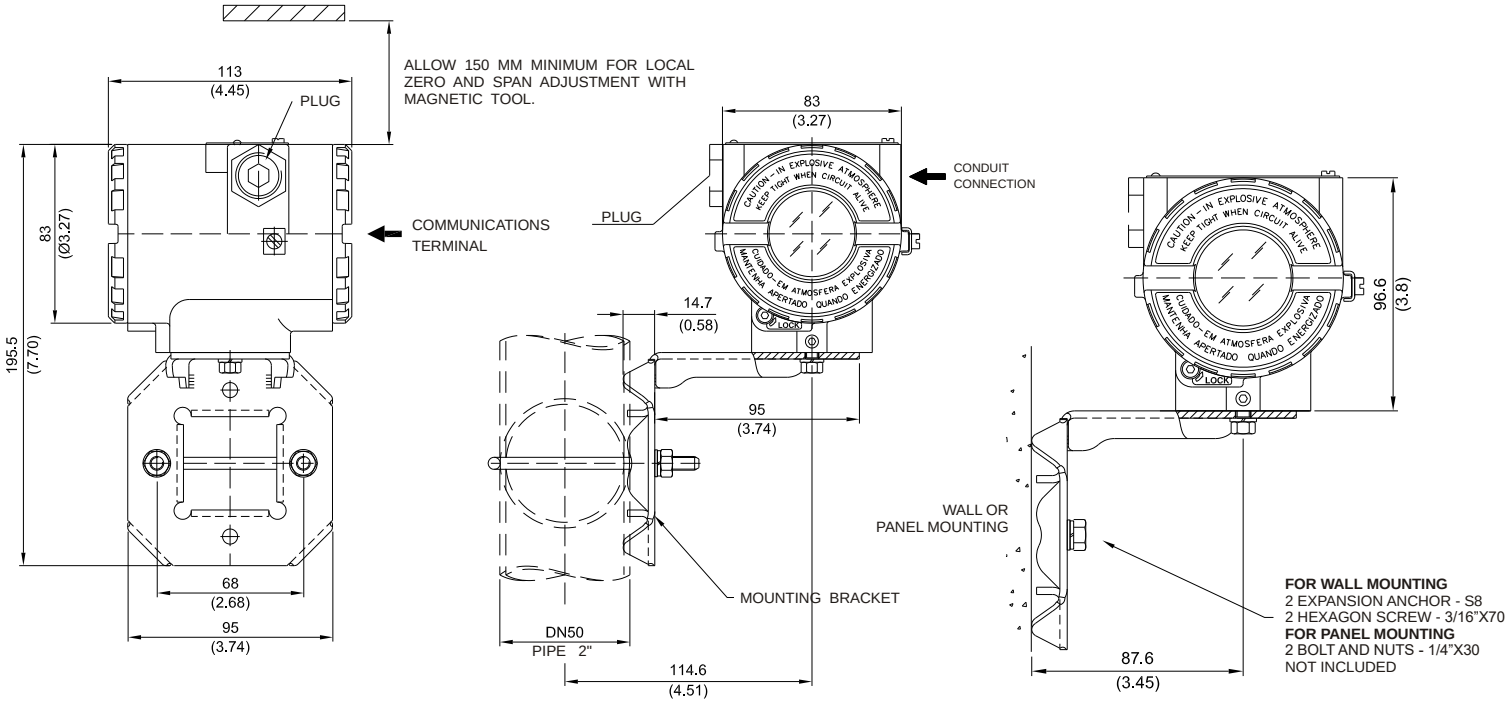


Figure 1.3 - Dimensional Drawing and Mounting Positions

The **TT302** uses the 31.25 kbit/s voltage mode option for the physical signaling. All other devices on the same bus must use the same signaling. All devices are connected in parallel along the same pair of wires.

Various types of Fieldbus devices may be connected on the same bus. The **TT302** is powered via the bus. The limit for such devices is 16 for one bus for non-intrinsically safe requirement.

In hazardous areas, the number of devices may be limited to 6 devices by intrinsically safe restrictions.

The **TT302** is protected against reverse polarity and can withstand ±35 VDC without damage.

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

NOTE
Please refer to the General Installation, Operation and Maintenance Manual for more details.

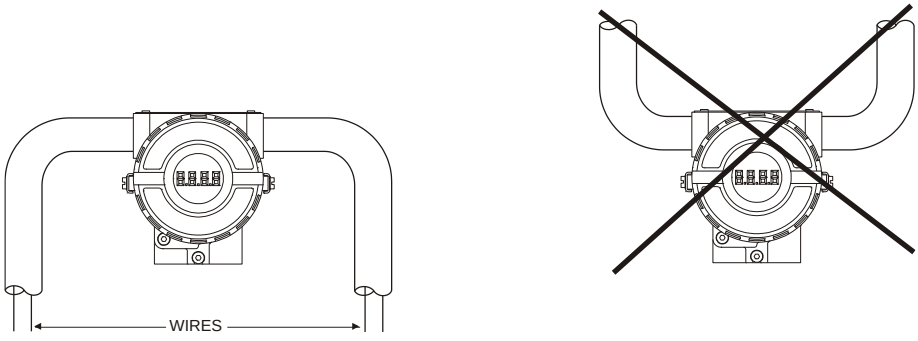


Figure 1.4 – Conduit Installation Diagram

Bus Topology and Network Configuration

Special requirements are applied to the terminator when used in a safety bus.

Intrinsic Safety Barrier
When intrinsic safety is required, a barrier should be inserted on the trunk between the power supply and the terminator.

The barrier's impedance should be greater than 460 Ω at 7.8 to 39 kHz.

The capacitance measured on both ends should not have a difference greater than 250pF from each other. The DF47 is recommended.

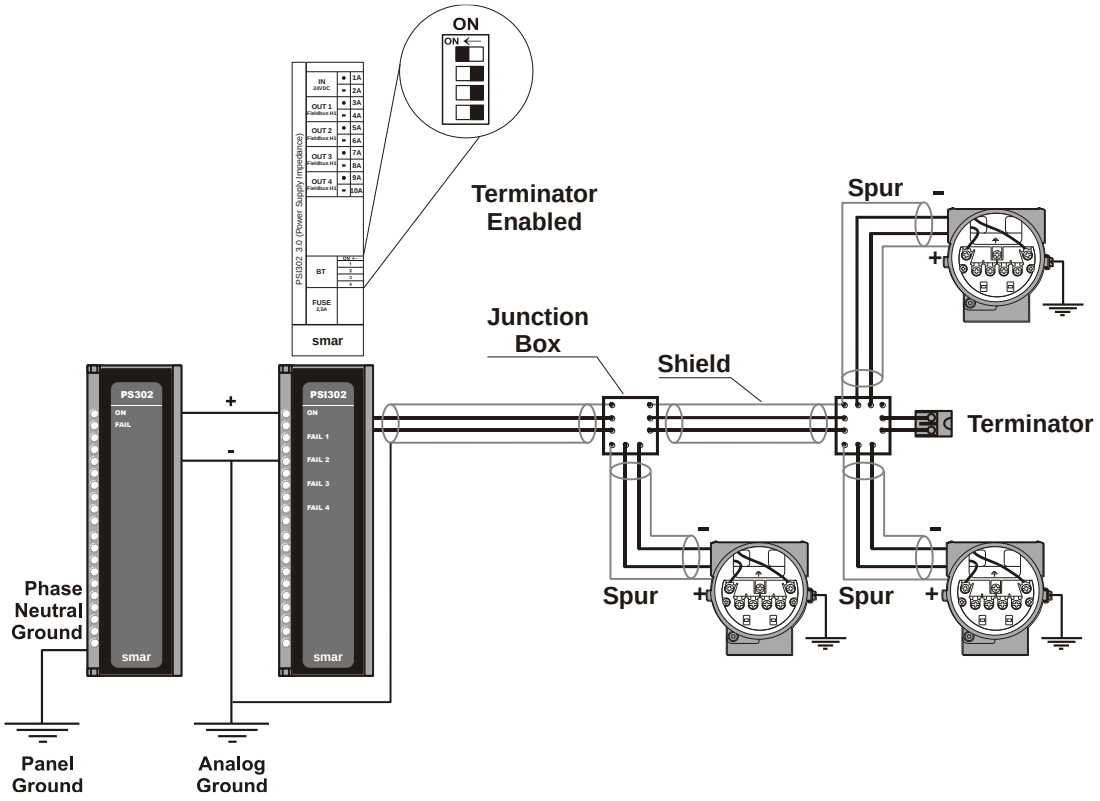


Figure 1.5 - Bus Topology

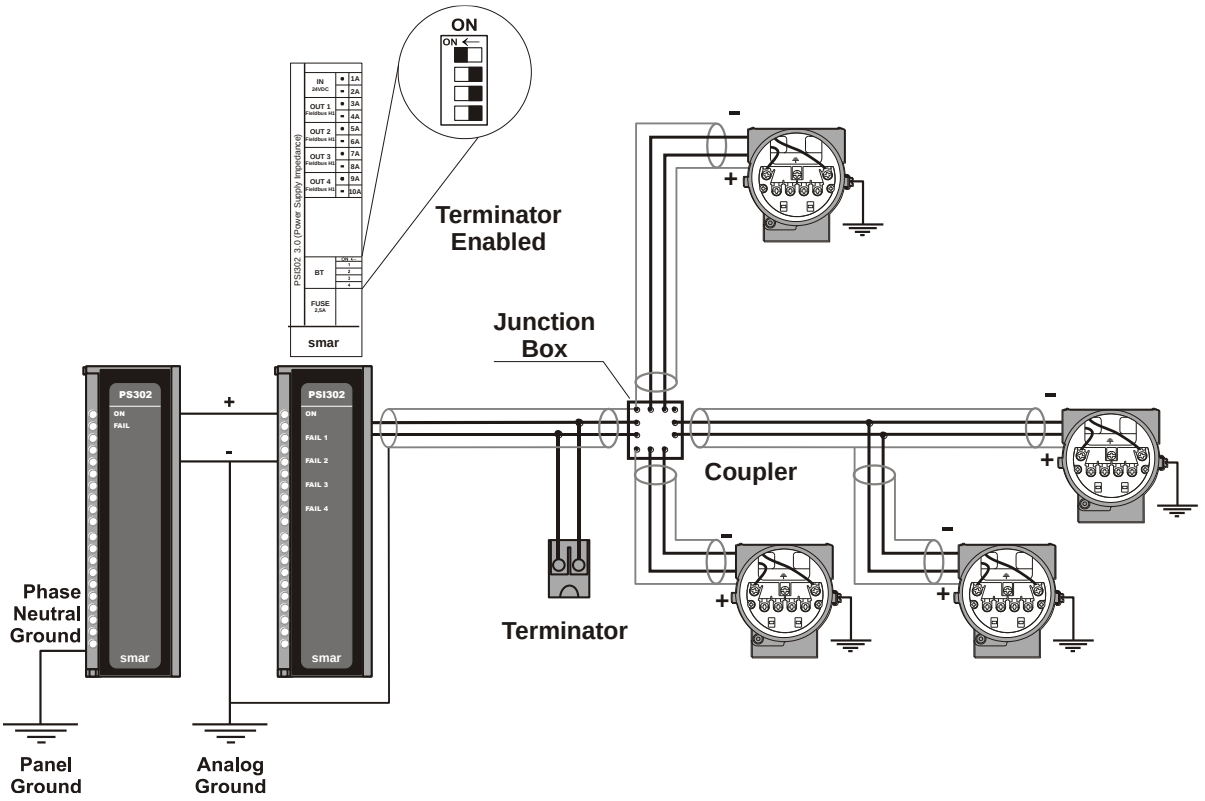


Figure 1.6 - Bus Topology

Sensor Wiring

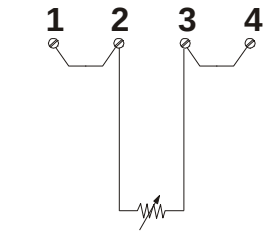
The **TT302** accepts up to two sensors and may operate in one of four modes:

- Single channel single sensor measurement
- Dual channel dual sensor measurement
- Single channel dual sensor differential measurement.
- Single channel dual sensor backup measurement.

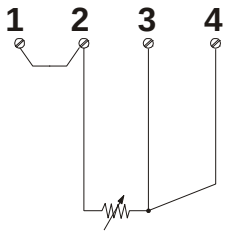
When the sensor is dual, the sensor connected between terminals 3 and 4 is associated with the first transducer, and the sensor connected between terminals 2 and 4 is associated with the second transducer.

NOTE
Avoid routing sensor wiring close to power cables or switching equipment.

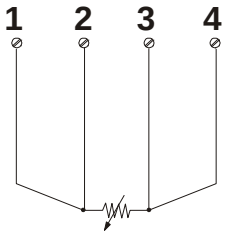
In accordance with connection and sensor types, the terminal blocks shall be wired as shown in figure below (See Figure 1.7).



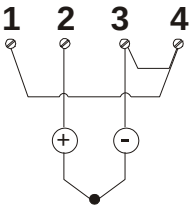
2 - WIRE RTD OR OHM INPUT



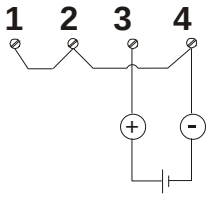
3 - WIRE RTD OR OHM INPUT



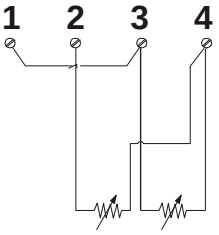
4 - WIRE RTD OR OHM INPUT



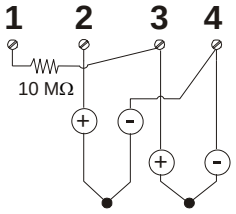
THERMOCOUPLE INPUT



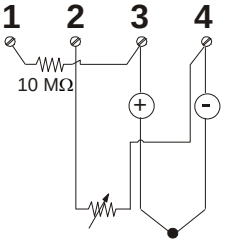
MILLIVOLT INPUT



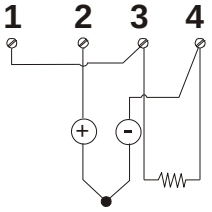
DUAL OR DIFFERENTIAL RTD OR OHM INPUT



DUAL OR DIFFERENTIAL THERMOCOUPLE OR MILLIVOLT INPUT



DUAL AND DIFFERENCTIAL RTD AND TC INPUT



DUAL AND DIFFERENTIAL RTD AND TC INPUT

Figure 1.7 - Sensor Wiring

Installation in Hazardous Areas

See Appendix A.

OPERATION

The **TT302** accepts signals from mV generators such as thermocouples or resistive sensors such as RTDs. The criterion is that the signal is within the range of the input. For mV, the range is -50 to 500 mV and for resistance, 0-2000 Ohm.

Functional Description – Hardware

The function of each block is described below.

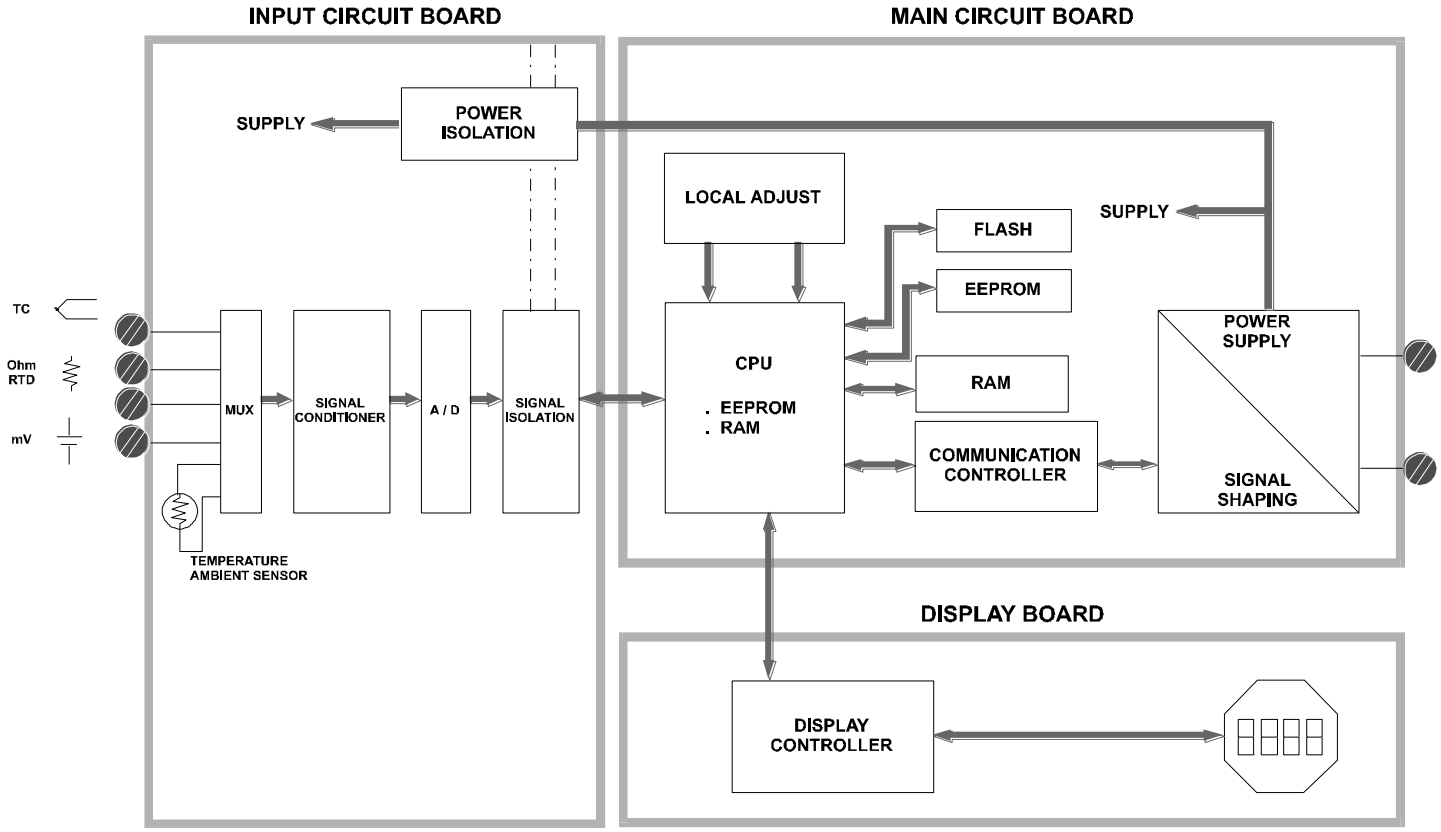


Figure 2.1 - TT302 Block Diagram

MUX Multiplexer
The MUX multiplexes the sensor terminals to the signal conditioning section ensuring that the voltages are measured between the correct terminals.

Signal Conditioner
Its function is 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.

Signal Isolation
Its function is to isolate the control and data signal between the input and the CPU.

(CPU) Central Processing Unit, RAM, PROM and EEPROM
The CPU is the intelligent portion of the transmitter, being responsible for the management and operation of measurement, block execution, self-diagnostics and communication. The program is stored in a PROM. For temporary storage of data there is a RAM. The data in the RAM is lost if the power is switched off. However there is a nonvolatile EEPROM where data that must be retained is stored. Examples, of such data are trim, calibration, block configuration and identification data.

Communication Controller
It monitors line activity, modulates and demodulates communication signals and inserts and deletes start and end delimiters.

Power Supply
Takes power of the loop-line to power the transmitter circuitry.

Power Isolation
Just like the signals to and from the input section, the power to the input section must be isolated. Isolation is achieved by converting the DC supply into a high frequency AC supply and galvanically separating it using a transformer.

Display Controller
Receives data from the CPU informing which segments of the Liquid Crystal Display, should be turned on.

Local Adjustment
There are two switches that are magnetically activated. They can be activated by the magnetic tool without mechanical or electrical contact.

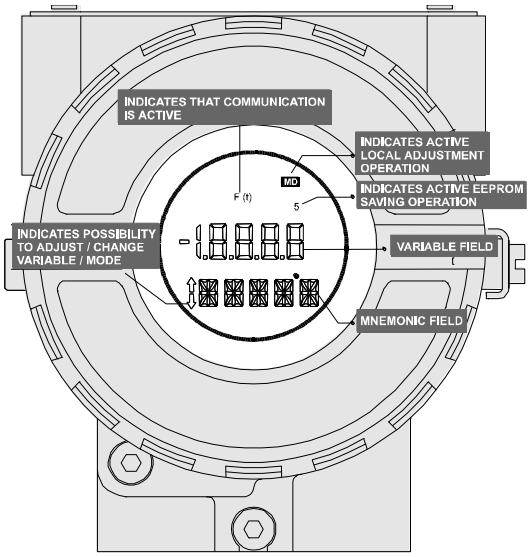


Figure 2.2 - LCD Indicator

Temperature Sensors

The **TT302**, as previously explained, accepts several types of sensors. The **TT302** is specially designed for temperature measurement using thermocouples or Resistive Temperature Detectors (RTDs).

Some basic concepts about these sensors are presented below.

Thermocouples
Thermocouples are constructed with two wires made from different metals or alloys joined at one end, called measuring junction or "hot 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 as following:

How the Thermocouple Works (Seebeck Effect)
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 dissimilar metals are joined at one end, and left open at the other, a temperature difference between the two ends will result in a voltage since the potentials generated by the dissimilar materials are different and do not cancel each other out. Now, 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 **TT302**, 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 marshaling box) will form new junctions with additional Seebeck effects. It will be created and ruin the measurement in most cases, since the cold-junction compensation will be done at the wrong point.

NOTE
Use thermocouple wires or appropriate extension wires all the way from sensor to transmitter.

The relation between the measuring junction temperature and the generated mili-voltage is tabulated in thermocouple calibration tables for standardized thermocouple types, the reference temperature being 0 ºC.

Standardized thermocouples that are commercially used, whose tables are stored in the memory of the **TT302**, are the following:

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

Resistive Temperature Detectors (RTDs)
Resistance Temperature Detectors, most commonly known as RTD's, are based on the principle that the resistance of metal increases as its temperature increases.
Standardized RTDs, whose tables are stored in the memory of the **TT302**, are the following:

- JIS [1604-81] (Pt50 & Pt100)
- IEC, DIN, JIS [1604-89] (Pt50, Pt100 & Pt500)
- GE (Cu10)
- DIN (Ni120)

For 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 constantly.

The **TT302** permits a 2-wire connection that may cause measuring errors, depending on the length of connection wires and on the temperature to which they are exposed. (See Figure 2.3 - Two-Wire Connection).

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

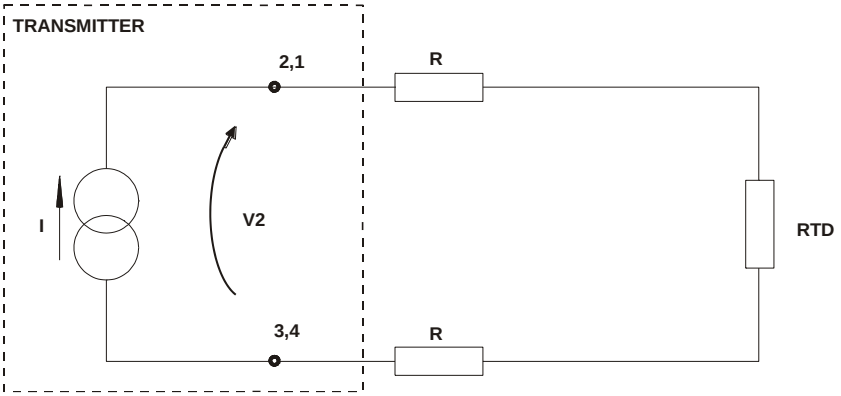


Figure 2.3 - Two-Wire Connection

In order to avoid the resistance effect of the connection wires, it is recommended to use a 3-wire connection (See Figure 2.4 – Three-Wire Connection) or a 4-wire connection (See Figure 2.5 - Four - Wire Connection).

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 cancelled, and is directly proportional to the RTD resistance alone.

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

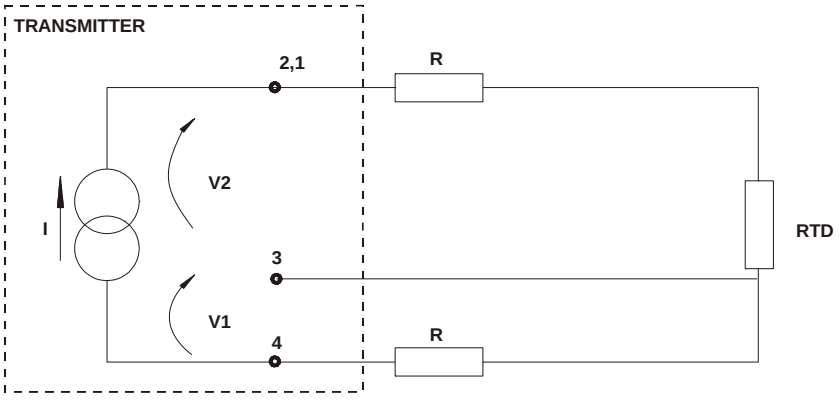


Figure 2.4 - Three – Wire Connection

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 resistance of the other two wires is not of interest, since there is no measurement registered on them. Hence the voltage V2 is directly proportional to the RTD resistance.

(V2 = RTD x I)

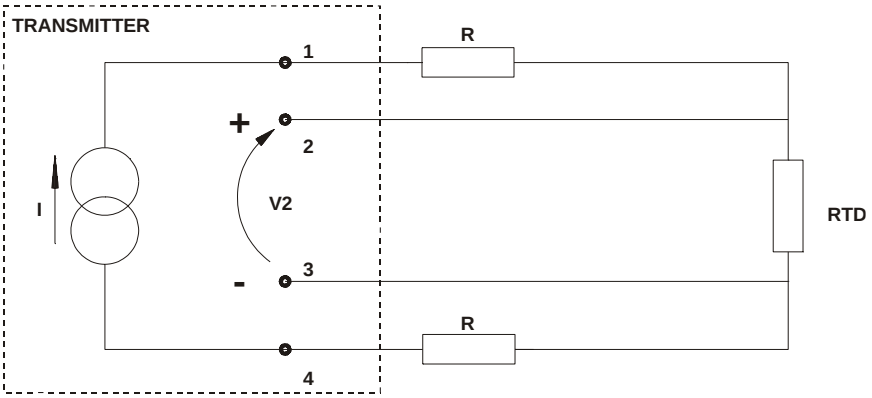


Figure 2.5 - Four - Wire Connection

A differential or dual channel connection is similar to the two-wire connection and gives the same problem (See Figure 2.6 - Differential or Dual Connection). The resistance of the wires will be measured and do not cancel each other out in a temperature measurement, since linearization will affect them differently.

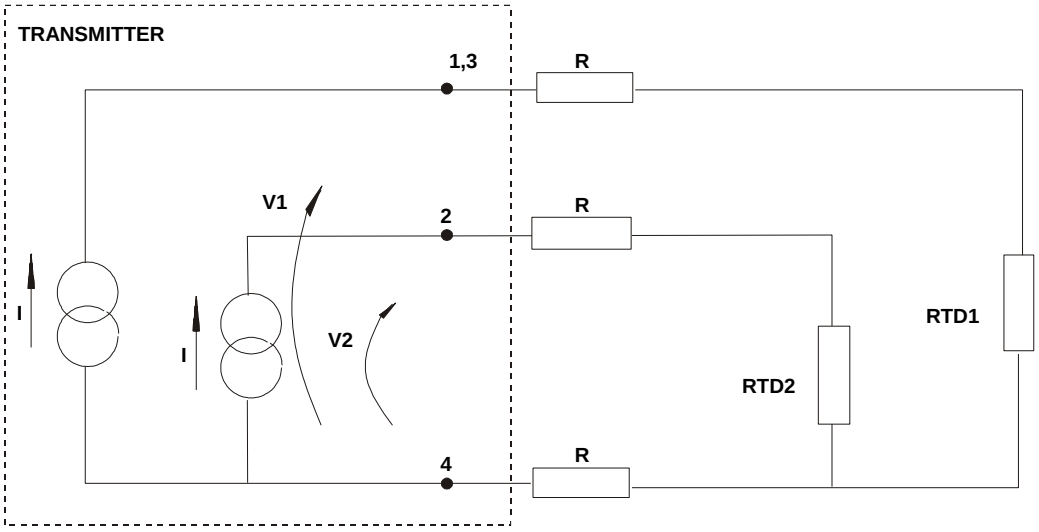


Figure 2.6 - Differential or Dual Connection

Section 3

CONFIGURATION

One of the many advantages of Fieldbus is that device configuration is independent of the configurator. The **TT302** may be configured by a third party terminal or console operator. Any particular configurator is therefore not addressed here.

The **TT302** contains two input transducer blocks, one resource block, one display transducer block and other function blocks.

For explanation and details of function blocks, see the “Function Blocks Manual”.

Transducer Block

Transducer block insulates function blocks from the specific I/O hardware (sensors and actuators). The transducer block controls the access to I/O through manufacturer specific implementation. This allows the transducer block to be executed as frequently as necessary to obtain good data from sensors without burdening the function blocks that uses the data. It also insulates the function blocks from the manufacturer specific characteristics of certain hardware.

By accessing the hardware, the transducer block can get data from the I/O or pass control data to it. The connection between Transducer block and Function block is called channel. These blocks can exchange data through the interface.

Normally, transducer blocks perform functions, such as linearization, characterization, temperature compensation, hardware control and data exchange.

Transducer Block Parameters Description

The parameters described below are used to configure the transducer block, having direct influence in the hardware.

PARAMETER	DESCRIPTION
ST_REV	Number of changes in the static parameter.
TAG_DESC	Transducer block tag.
STRATEGY	Parameter not processed by the Transducer block.
ALERT_KEY	Identification number in the plant.
MODE_BLK	Operation mode of the Transducer block.
BLOCK_ERR	Hardware and software status associated with the Transducer.
UPDATE_EVT	Static parameters alarm.
BLOCK_ALM	Alarm used by the configuration or by the hardware.
TRANSDUCER_DIRECTORY	Number and initial index of the Transducer inside the Transducer block.
TRANSDUCER_TYPE	Type of Transducer according to its class. **101** - Standard Temperature with calibration
XD_ERROR	Used to show the calibration status.
COLLECTION_DIRECTORY	Number, initial index and description device item of the Transducer, inside the Transducer block.
PRIMARY_VALUE_TYPE	Measurement type represented by the primary variable. **104** – Process Temperature **106** – Differential Temperature **120** – Backup Temperature
PRIMARY_VALUE	Measured variable and available status for the function block.
PRIMARY_VALUE_RANGE	Upper and lower limits, engineering unit, and number of decimal places used to designate the primary variable.
CAL_POINT_HI	Upper calibration value.
CAL_POINT_LO	Lower calibration value.
CAL_MIN_SPAN	Minimum span value allowed in the calibration. This minimum span is necessary to make sure that the two calibrated points (lower and upper) are not too close, when the calibration is done.
CAL_UNIT	Engineering unit used in the lower and upper calibration.
SENSOR_TYPE	Sensor type **128** – Pt100 IEC **129** – Pt100 JIS **131** – Pt500 IEC **132** – Ni 120 DIN **133** – Cu 10 GE **170** – Pt 50 IEC **171** – Pt 50 JIS **181** – Ohm 100

PARAMETER	DESCRIPTION
	180 – Ohm 400 **104** – Ohm 2000 **134** – TC B NBS **136** – TC E NBS **137** – TC J NBS **138** – TC K NBS **139** – TC N NBS **140** – TC R NBS **141** – TC S NBS **142** – TC T NBS **143** – TC L DIN **144** – TC U DIN **191** – mV 22 **190** – mV 100 **103** – mV 500
SENSOR_RANGE	Lower and upper limits, engineering unit and number of decimal point of the sensor.
SENSOR_SN	Sensor serial number.
SENSOR_CAL_METHOD	Last method of calibration of the sensor.
SENSOR_CAL_LOC	Localization of the last calibration of the sensor. That is the place where the calibration was done.
SENSOR_CAL_DATE	Date of the latest calibration of the sensor.
SENSOR_CAL_WHO	Name of the person responsible for the last calibration of the sensor.
SENSOR_CONNECTION	Number of sensor wires connected to the equipment terminal blocks. **1** – Dual two wires **2** – Two wires **3** – Three wires **4** – Four wires
SECONDARY_VALUE	Secondary variable related to the sensor.
SECONDARY_VALUE_UNIT	Engineering unit used by the secondary variable.
MODULE_SN	Module serial number.
SECONDARY_VALUE_ACTION	Type of action of the cold junction compensation. **0** – disabled **1** – enabled
BACKUP_RESTORE	Parameter used to restore or save the configuration data. **1** – Factory Cal Restore **2** – Last Cal Restore **3** – Default Data Restore **4** – Shut-Down Data Restore **5** – Sensor Data Restore **11** – Factory Cal Backup **12** – Last Cal Backup **14** – Shut-Down Data Backup **15** – Sensor Data Backup **0** – None
CAL_POINT_HI_LAST	Upper calibration saved by the backup_restore.
CAL_POINT_LO_LAST	Lower calibration saved by the backup_restore.
CAL_POINT_HI_FACTORY	Factory upper calibration saved by the backup_restore
CAL_POINT_LO_FACTORY	Factory lower calibration saved by the backup_restore
ORDERING_CODE	Product information to manufacture.
TWO_WIRES_COMPENSATION	Automatic compensation of the lead resistance for two wire RTD sensors or dual two wire RTD sensors. **0** – Disabled **1** – Enabled
SENSOR_TRANSDUCER_NUMBER	Number of Transducer being used: **1** – First Transducer (this one should always exist) **2** – Second Transducer (It exists if the type of connection of the first transducer is dual or two wires)

Transducer Block Parameters Types

Parameter	Data Type	Storage	Size	Initial Value	Class	View
ST_REV	Unsigned16	S	2	0	R	1,2,3,4
TAG_DESC	Octet String	S	32	Nulls	R/W	
STRATEGY	Unsigned16	S	2	0	R/W	4
ALERT_KEY	Unsigned8	S	1	0	R/W	4
MODE_BLK	DS-69	Mix	4	AUTO	R/W	1,3
BLOCK_ERR	Bit String	D	2	*	R	1,3
UPDATE_EVT	DS-73	D	5	*	R	

Parameter	Data Type	Storage	Size	Initial Value	Class	View
BLOCK_ALM	DS-72	D	13	*	R	
TRANSDUCER_DIRECTORY	Array of Unsigned16	N	Variable	*	R	
TRANSDUCER_TYPE	Unsigned16	N	2	101	R	1,2,3,4
XD_ERROR	Unsigned8	D	1	*	R	1,3
COLLECTION_DIRECTORY	Array of Unsigned16	N	Variable	*	R	
PRIMARY_VALUE_TYPE	Unsigned16	S	2	104	R/W	2
PRIMARY_VALUE	DS-65	D	5	0	R	1,3
PRIMARY_VALUE_RANGE	DS-68	NS	11	-200/850/1001/1	R	4
CAL_POINT_HI	Float	S	4	850.0	R/W	2
CAL_POINT_LO	Float	S	4	-250.0	R/W	2
CAL_MIN_SPAN	Float	N	4	10.0	R	4
CAL_UNIT	Unsigned16	S	2	1001	R/W	4
SENSOR_TYPE	Unsigned16	S	2	128	R/W	4
SENSOR_RANGE	DS-68	N	11	-200/850/1001/1	R	4
SENSOR_SN	Unsigned Long	N	4	0	R	4
SENSOR_CAL_METHOD	Unsigned8	S	1	103	R	4
SENSOR_CAL_LOC	Visible String	S	32	NULL	R/W	4
SENSOR_CAL_DATE	Time of Day	S	7	0	R/W	4
SENSOR_CAL_WHO	Visible String	S	32	NULL	R/W	4
SENSOR_CONNECTION	Unsigned8	S	1	3	R/W	4
SECONDARY_VALUE	DS-65	D	5	0	R	3
SECONDARY_VALUE_UNIT	Unsigned16	S	2	1001	R/W	4
MODULE_SN	Unsigned Long	N	4	0	R	4
SECONDARY_VALUE_ACTION	Unsigned8	S	1	1	R/W	
BACKUP_RESTORE	Unsigned8	S	1	0	R/W	4
CAL_POINT_HI_LAST	Float	S	4	850.0	R	2
CAL_POINT_LO_LAST	Float	S	4	-200.0	R	2
CAL_POINT_HI_FACTORY	Float	S	4	850.0	R	2
CAL_POINT_LO_FACTORY	Float	S	4	-200.0	R	2
ORDERING_CODE	Visible String	S	50	Null	R/W	
TWO_WIRE_COMPENSATION	Unsigned8	D	1	1	R/W	
SENSOR_TRANSD_NUMBER	Unsigned8	S	1	0	R/W	4

D: Dynamic
N: Non-volatile
S: Static

How to Configure a Transducer Block

The transducer block has an algorithm, a set of contained parameters (it means you are not able to link these parameters to other blocks or publish the link via communication), and a channel connecting it to a function block.

The algorithm describes the behavior of the transducer as a data transfer function between the I/O hardware and other function block. The set of contained parameters defines the user interface to the transducer block. They can be divided into Standard and Manufacturer Specific.

The standard parameters are defined specifically to each device class such as, pressure, temperature, etc., no matter is the manufacturer. Oppositely, the manufacturers specific are only defined by the manufacturer. As common manufacturer specific parameters, we have calibration settings, material information, linearization curve, etc.

When you perform a standard routine such as calibration, you are conducted step by step by a method. The method is generally defined as guideline to help the user make common tasks. **SYSCON** identifies each method associated to the parameters and enables the interface to it.

Sensor Transducer Number

The Sensor Transducer Number associates the sensor to the transducer. It can be set from one up to two, in case of dual sensor.

Jumper Configuration

In order to work properly, the jumpers **J1** and **W1** located in the **TT302** main board must be correctly configured.

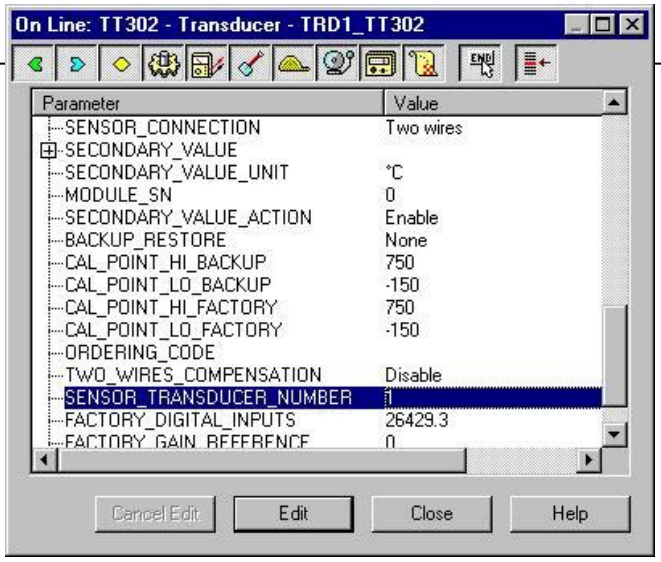
J1 is responsible to enable the AI block simulate mode.

W1 is responsible to enable the local adjustment.

Sensor Configuration

It is necessary to configure the transducer number allocated to its task. The parameter SENSOR_TRANSDUCER_NUMBER should be set to 1.

This parameter sets the transducer number, according to the type of temperature measurement.

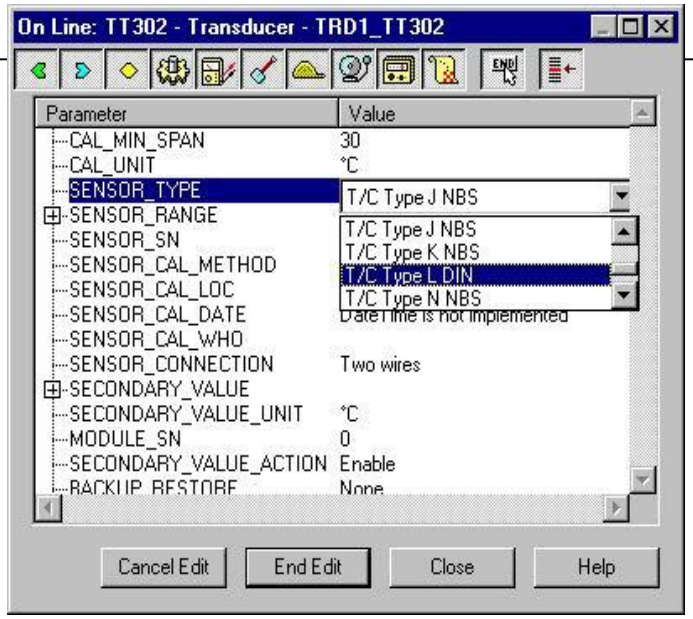


This parameter could be 1 or 2, for indicating respectively first or second transducers.

Figure 3.1 – Transducer Number Configuration

It is possible to configure the type of connection and sensor by means of SENSOR_TYPE and SENSOR_CONNECTION parameters. The connection and sensor types available are listed in Table 3.1 - Sensor Type Table and Table 3.2 - Type of Connection Table, as well as the corresponding value.

This parameter selects the type of sensor attached to the **TT302** in order to measure temperature.



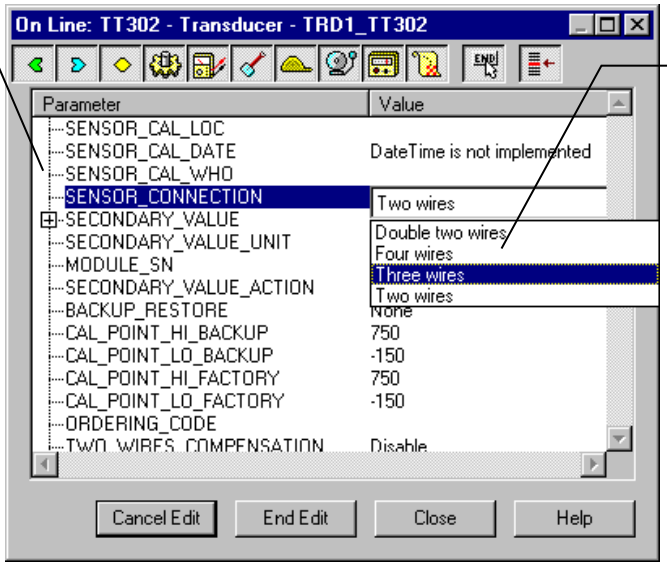
This list contains:

Thermocouples, RTDs, Ohm and millivoltage.

Figure 3.2 – Sensor Type Configuration

NOTE
There are no 3 or 4 wire connections for millivoltage sensors.

This parameter selects the type of sensor connection. The options here will depend on Sensor Type chosen as described above.



This list contains the number of wires available for each type of sensor.

Figure 3.3 – Sensor Type Connection Configuration

SENSOR_TYPE	ADJUST LOCAL VALUE
Pt 100 IEC	**128**
Pt 100 JIS	**129**
Pt 500 IEC	**131**
Ni 120 DIN	**132**
Cu 10 CE	**133**
Pt 50 IEC	**170**
Pt 50 JIS	**171**
Ohm 100	**181**
Ohm 400	**180**
Ohm 2,000	**104**
TC B NBS	**134**
TC E NBS	**136**
TC J NBS	**137**
TC K NBS	**138**
TC N NBS	**139**
TC R NBS	**140**
TC S NBS	**141**
TC T NBS	**142**
TC L DIN	**143**
TC U DIN	**144**
mV 22	**191**
mV 100	**190**
mV 500	**103**

Table 3.1 - Sensor Type Table

CONNECTION	ADJUST LOCAL VALUE
DOUBLE TWO WIRE	**1**
TWO WIRE	**2**
THREE WIRE	**3**
FOUR WIRE	**4**

Table 3.2 - Type of Connection Table

How to Connect Two Sensors to TT302

Transmitters series **TT302** are capable of operating simultaneously with two sensors, using two transducer blocks, if necessary. Configuration types in two sensors operation are as follows:

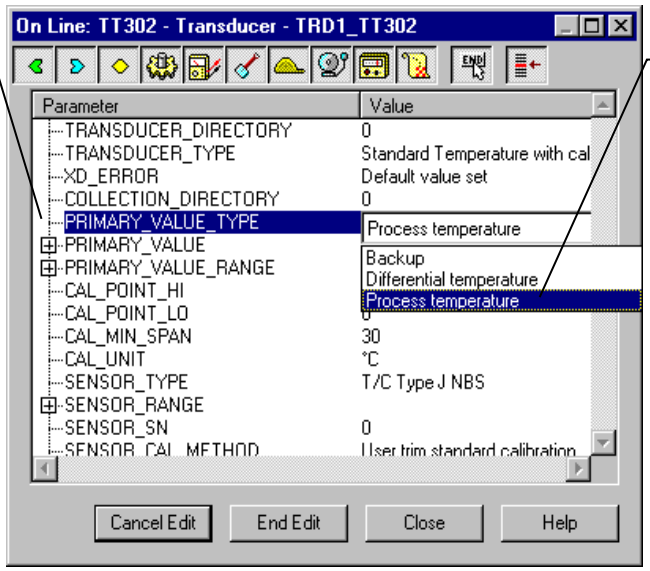
Differential – In this case there is only one transducer. Transducer output is the difference between the readout of sensor 1 (between terminals 3 and 4) and the readout of sensor 2 (between terminals 2 and 4). The PRIMARY_VALUE_TYPE parameter should be configured as differential temperature.

Backup – In this case there is only one transducer.
When the first sensor (between terminals 3 and 4) breaks down, the second sensor (between terminals 2 and 4) will supply the signal to the transducer.

Double - In this case there are two transducers. Each sensor provides a signal to its respective transducer.

In order to be able to operate with sensors in the backup or differential modes, the parameter PRIMARY_VALUE_TYPE must be set. In order to operate with double sensors, the parameter SENSOR_CONNECTION must be set.

This parameter sets the type of calculation that should be done for each transducer.



This list contains the normal option, Backup and Differential type of temperature calculation.

Figure 3.4 – Primary Variable Type Configuration

Compensation of Lead Resistance for Double Sensor (RTD or Ohm)

When 2 wire resistive sensors are used, the readout is not a very accurate because of the resistance of leads connecting sensor to transmitter. In order to reduce this error, it is possible to configure the transmitter to compensate for a constant lead resistance by means of parameter LEAD_RESISTANCE_VALUE.

As explained, 2 wire resistive sensors are not accurate due to lead resistance. For this reason, 3 or 4 wire sensors are usually preferred.

With **TT302** is possible to connect two sensors to the terminal block. Due to space limitations in the terminal block, it is only possible to connect two 2-wire sensors. In order to optimize lead resistance compensation for these sensors and to minimize error, there is the parameter TWO_WIRES_COMPENSATION that automatically calculates the lead resistance. All the user is required to do is to short-circuit the sensor in the field and to actuate this parameter (Enable). After undo the short circuit the measurement will be more accuracy.

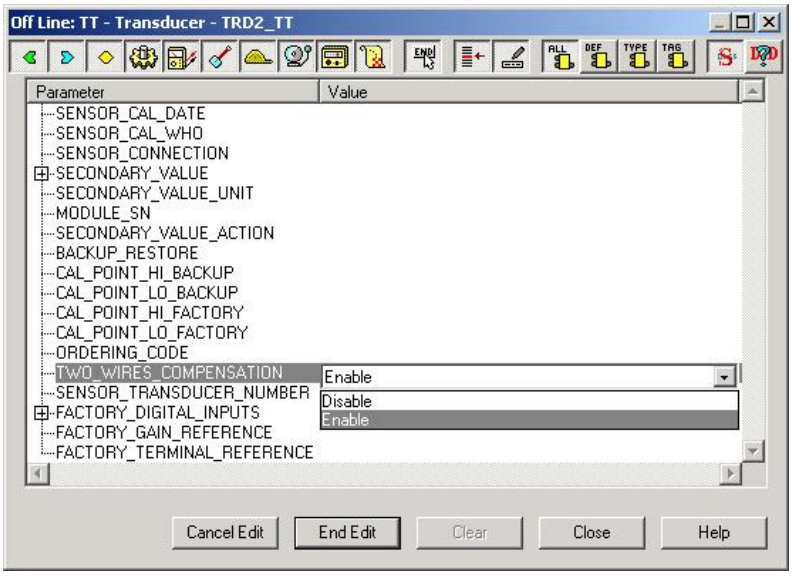


Figure 3.5 – Lead Resistance Compensation

Cold Junction Compensation

The cold junction compensation for thermocouple sensors is done automatically, but it can be disabled by writing DISABLE on the parameter SECONDARY_VALUE_ACTION.

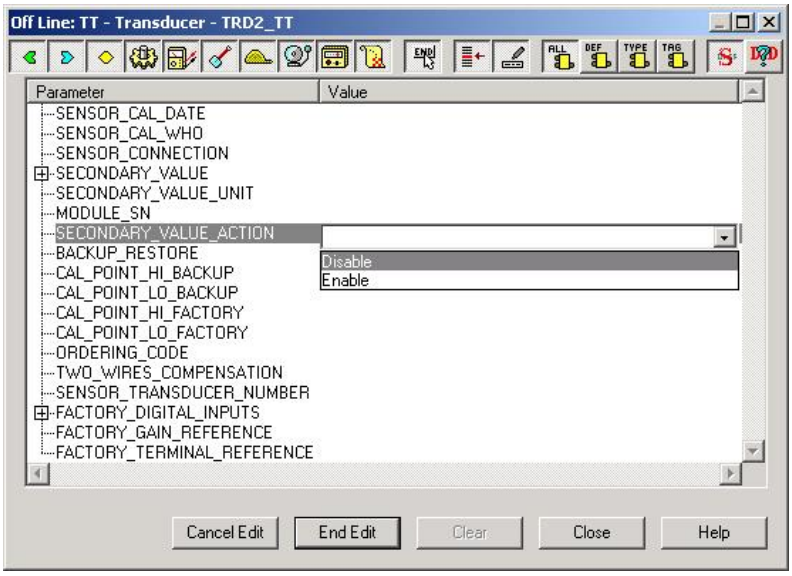


Figure 3.6 – Cold Junction Compensation

Calibration in TT302 by the User

The electronics of **TT302** is very stable in time, not requiring further calibrations after manufacturer's calibration. However, if the client decides to use his reference to calibrate the **TT302**, this may be done through the parameters CAL_POINT_LO and CAL_POINT_HI. Always use two points as reference when trim is performed; never consider only one point as a reference.

NOTE
Every time the sensor is changed, the TRIM values are reset. If a TC is used, it is not necessary to disable the cold Junction Compensation before starting calibration procedures. Trim is not available for TT using two sensors and it is not necessary to set the Transducer Block to Out of Service.

The PRIMARY_VALUE parameter is always used to inform the current reading of the input sensor.

In order to do the Lower Trim, first put the sensor into a place with known temperature. If the PRIMARY_VALUE parameter shows a temperature different from the expected, the Lower trim should be done by writing the desired temperature in the CAL_POINT_LO parameter. The adjust trim results can be seen in the PRIMARY_VALUE parameter.

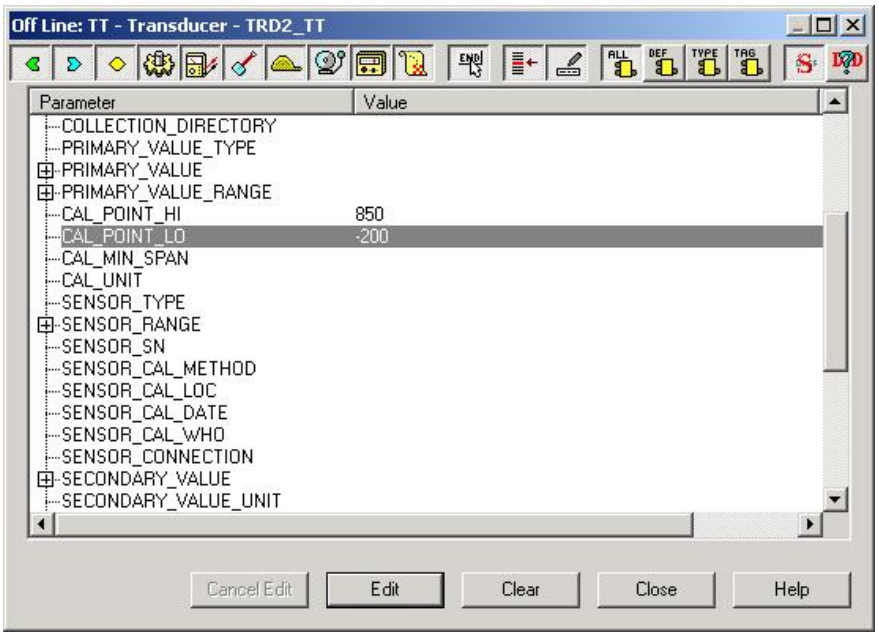


Figure 3.7 – Calibration of the Lower Trim - TT302

In order to do the Upper Trim, first put the sensor into a place with a higher temperature than the lower calibration point. If the PRIMARY_VALUE parameter shows a temperature different from the expected, the Upper trim should be done by writing the desired temperature in the CAL_POINT_HI parameter. The adjust trim results can be seen in the PRIMARY_VALUE parameter.

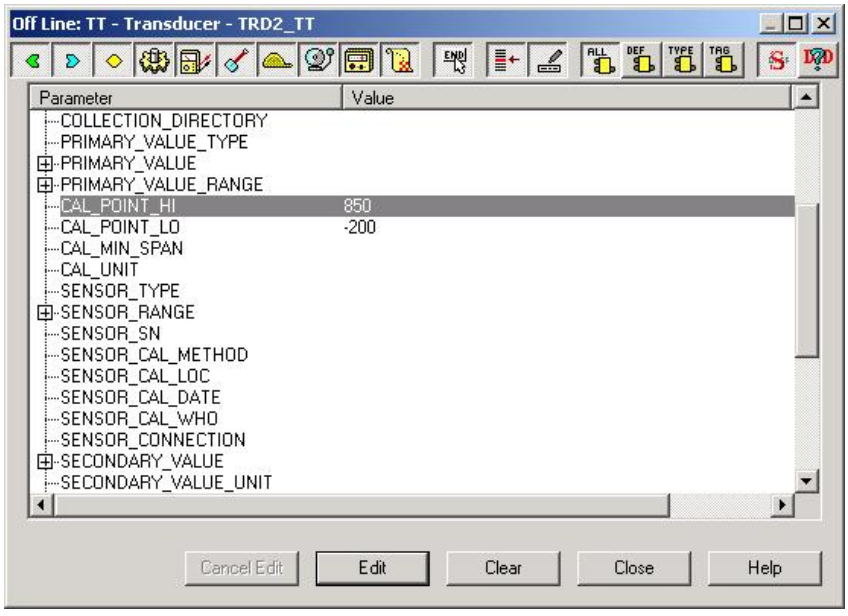


Figure 3.8 – Calibration of the Upper Trim - TT302

Trim is not available for **TT302** using two sensors in the backup or differential mode.

Changing Units in Temperature Sensors

The following units are available for temperature sensors: Celsius, Rankine, Kelvin and Fahrenheit. The units values are shown in Table 3.3 - Unit Table.

The unit can be changed in the AI block by the parameter XD_SCALE.

UNIT	VALUE
KELVIN	1000
CELSIUS	1001
FAHRENHEIT	1002
RANKINE	1003

Table 3.3 - Unit Table

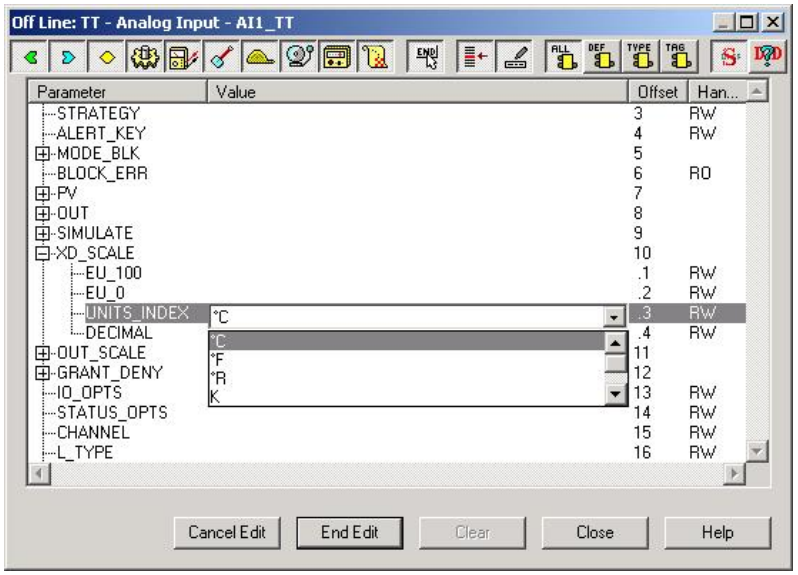


Figure 3.9 –Temperature Sensor Unit

Transducer Display – Configuration

Using the SYSCON is possible to configure the Display Transducer block. As the name described it is a transducer due the interfacing of its block with the LCD hardware.

The Transducer Display is treated as a normal block by **SYSCON**. It means, this block has some parameters can be configured according to customer's needs. (See the Figure 3.11 – Creating Transducers and Function Blocks).

The user can choose the parameters to be shown at LCD display, they can be parameters just for monitoring purpose or for acting locally in the field devices by using a magnetic tool.

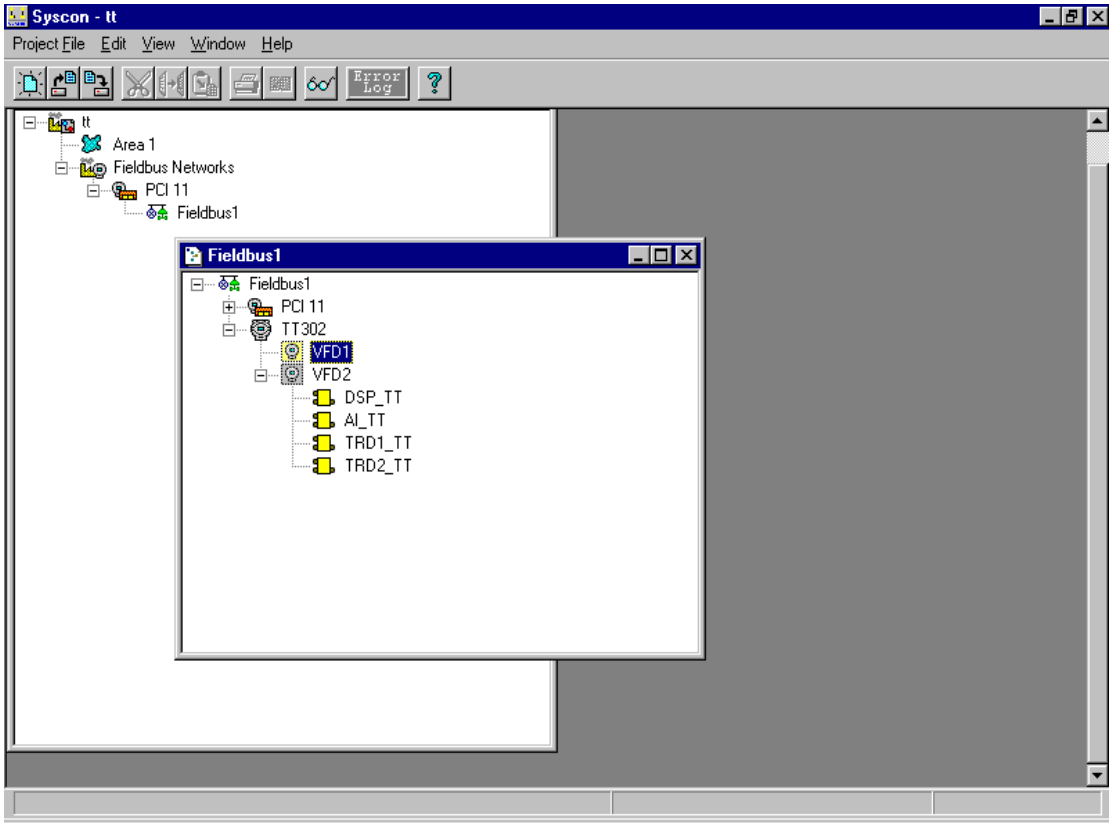


Figure 3.10 – Creating Transducers and Function Blocks

Display Transducer Block

There are seven groups of parameters which may be pre-configured by the user in order to enable a possible configuration by means of the local adjustment. As an example, let's suppose that you don't want to show some parameters; in this case, simply write an invalid Tag in the parameter. By doing this, the device will not take the parameters related (indexed) to its Tag as valid parameters.

Definition of Parameters and Values

Idx	Parameter	DataType (length)	Valid Range/ Options	Default Value	Units	Store	Description
7	BLOCK_TAG_PARAM	VisibleString			None	S	This is a tag of the block to which the parameter belongs to use up to a maximum of 32 characters.
8	INDEX_RELATIVE	Unsigned16	0-65535		None	S	This is the index related to the parameter to be actuated or viewed (1, 2...).
9	SUB_INDEX	Unsigned8	1-255		None	S	To visualize a certain tag, opt for the index relative equal to zero, and for the sub-index equal to one.
10	MNEMONIC	VisibleString			None	S	This is the mnemonic for the parameter identification (maximum of 16 characters). Choose the mnemonic, preferably with no more than 5 characters because, this way, it will not necessary to rotate it on display.
11	INC_DEC	Float			None	S	It is the increment and decrement in decimal units when the parameter is Float or Float Status time, or integer, when the parameter is in whole units.
12	DECIMAL_POINT_NUMBER	Unsigned8	0-4		None	S	This is the number of digits after the decimal point (0 to 3 decimal digits)

Idx	Parameter	DataType (length)	Valid Range/ Options	Default Value	Units	Store	Description
13	ACCESS	Unsigned8	Monit/Action		None		The access allows the user to read, in the case of the “Monitoring” option, and to write when “action” option is selected, and then the display will show the increment and decrement arrows.
14	ALPHA_NUM	Unsigned8	Mnem/Value		None	S	These parameters include two options: value and mnemonic. In option value it is possible to display data both in the alphanumeric and in the numeric fields, this way, in the case of a data higher than 10000, it will be shown in the alphanumeric field.
63	DISPLAY_REFLESH	Unsigned8	1		None	D	Update the display transducer block configuration. Used in online monitoring.

In option mnemonic, the display may show the data in the numeric field and the mnemonic in the alphanumeric field.

In case you wish to visualize a certain tag, opt for the index relative equal to zero, and for the sub-index equal to one (refer to paragraph Structure Block in the Function Blocks Manual).

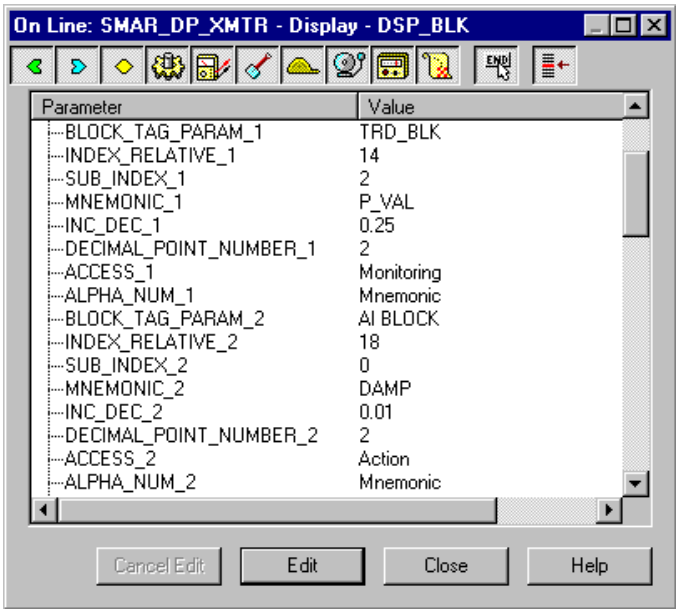


Figure 3.11 - Parameters for Local Adjustment Configuration

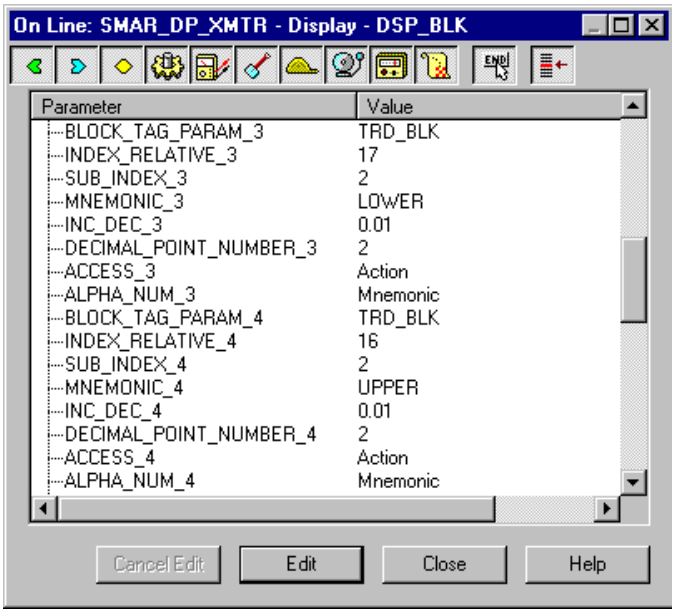


Figure 3.12 - Parameters for Local Adjustment Configuration

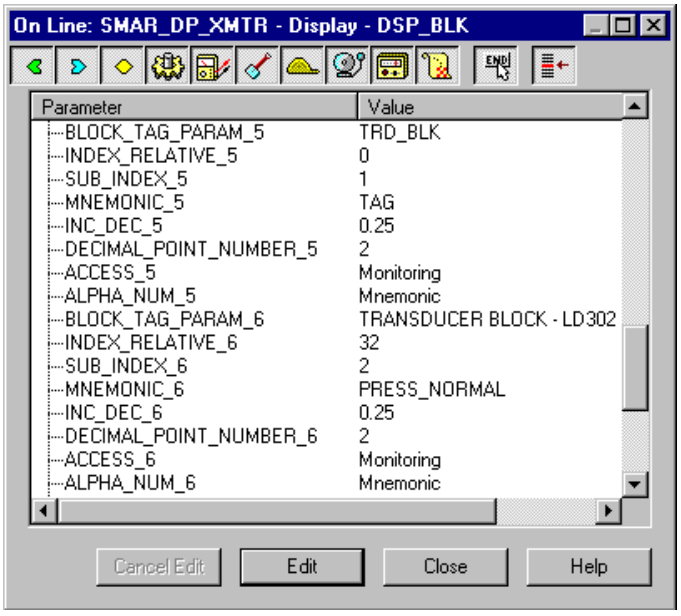


Figure 3.13 - Parameters for Local Adjustment Configuration

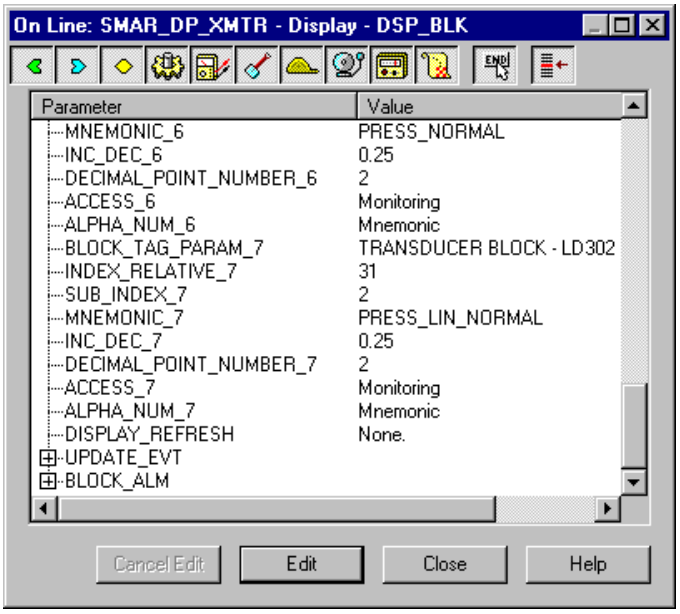
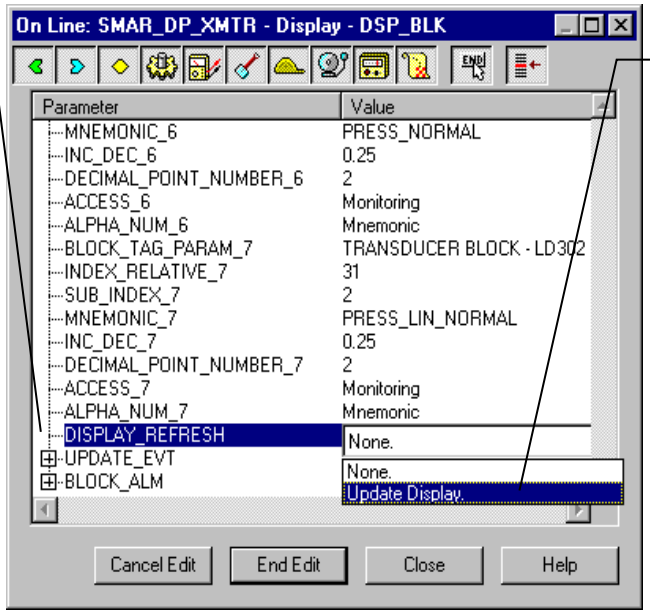


Figure 3.14 - Parameters for Local Adjustment Configuration

This parameter updates the local adjustment programming tree configured on each device.



The option "update" should be selected in order to execute the upgrade of local adjustment programming tree.

After its step all the parameters selected will be show on the LCD display.

Figure 3.15 - Parameters for Local Adjustment Configuration

Programming Using Local Adjustment

The local adjustment can not configure all the parameters as SYSCON can. It means the user can select the best options for this application. From the factory, it is configured with the options to set the Upper and Lower trim, for monitoring the transducer output and check the Tag. Usually, the transmitter is much better configured by SYSCON, but the local functionality of the LCD allows an easy and fast action on certain parameters, since it does not rely on communication and network wiring connections. Among the possibilities of the Local Adjustment, the following options can be emphasized: Mode block, Outputs monitoring, Tag visualization and Tuning Parameters setting.

The interaction between the user and the transmitter is also described in detail on the "General Installation, Operation and Maintenance Procedures Manual". Take a look at this manual in the chapter related to "Programming Using Local Adjustment".

The **TT302** has, underneath its identification plate, two holes marked with the letters S and Z beside them. These holes give access to two magnetic switches (Reed Switch), which can be activated by the magnetic tool (See Figure 3.16).

This magnetic tool enables adjustment of the most important parameters of the blocks.

The jumper W1 on top of the main circuit board must be in place and the positioner must be fitted with digital display for access to the local adjustment. Without the display, it is not possible to do the local adjustment.

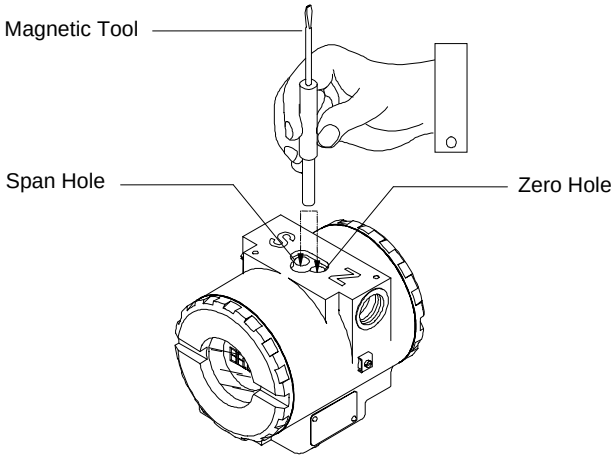


Figure 3.16 - Local Adjustment Holes

Table 3.4 shows the actions on the Z and S holes on the **TT302** when Local Adjustment is enabled.

HOLE	ACTION
Z	Initializes and rotates through the available functions.
S	Selects the function shown in the display.

Table 3.4 - Purpose of the holes on the Housing

J1 Jumper Connections

If J1 (see figure 3.18) is connected to ON, it is possible to simulate values and status through the SIMULATE parameter, from the Analog Input block.

W1 Jumper Connections

If W1 (see figure 3.18) is connected to ON, the local adjustment programming tree is enabled, and so the block parameters can be adjusted via local adjustment.

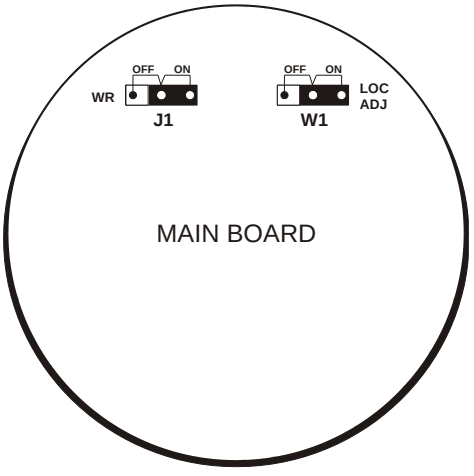
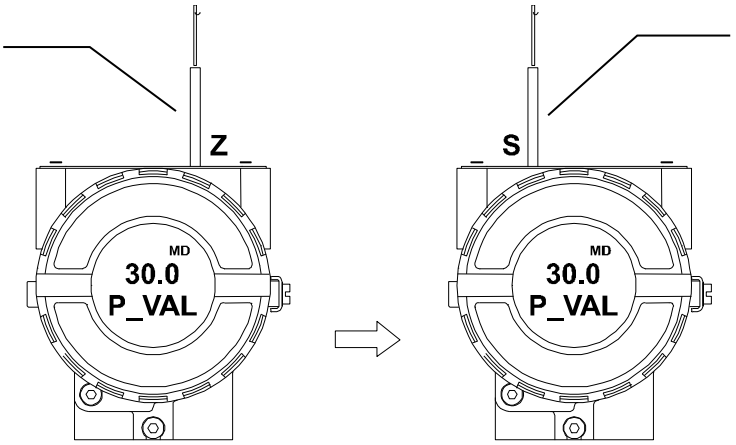


Figure 3.17 - J1 and W1 Jumpers

Local Programming Tree

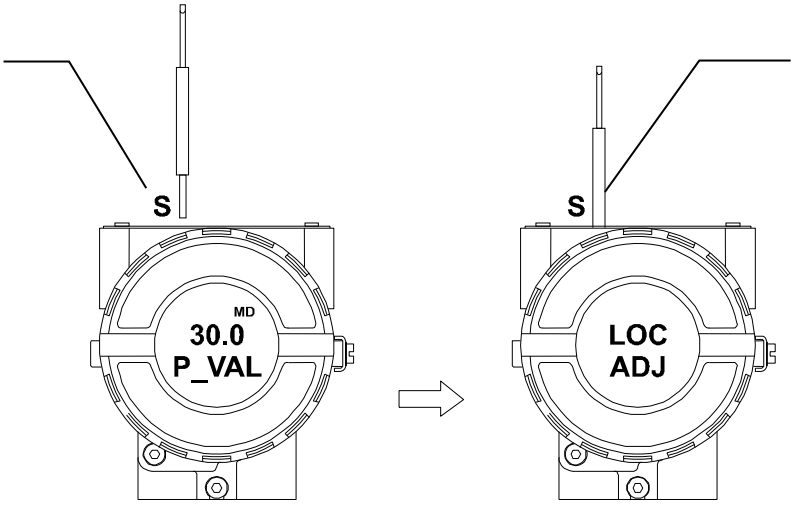
In order to start the local adjustment, place the magnetic tool in orifice **Z** and wait until letters **MD** are displayed.



Place the magnetic tool in orifice **S** and wait during **5** seconds.

Figure 3.18 - Step 1 - TT302

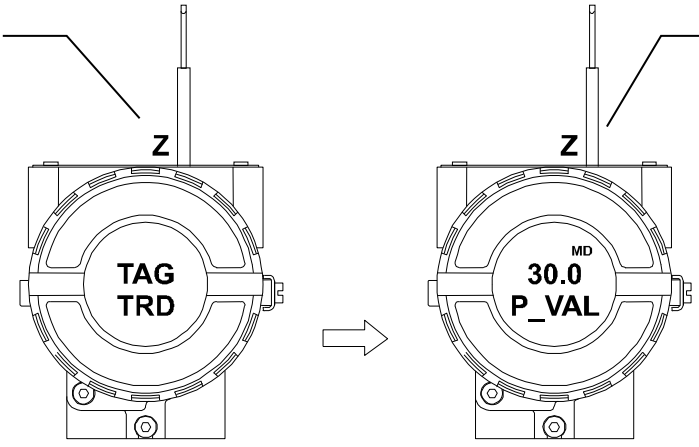
Remove the magnetic tool from orifice **S**.



Insert the magnetic tool in orifice **S** once more and **LOC ADJ** should be displayed.

Figure 3.19 - Step 2 - TT302

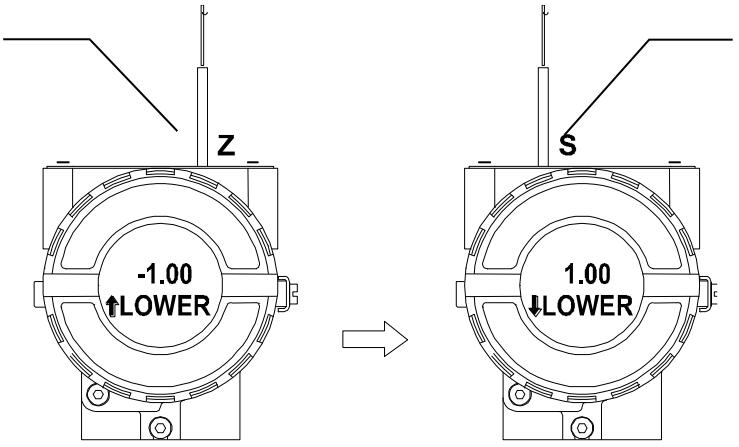
Place the magnetic tool in orifice **Z**. In case this is the first configuration, the option shown on the display is the **TAG** with its corresponding mnemonic configured by the SYSCON. Otherwise, the option shown on the display will be the one configured in the prior operation. By keeping the tool inserted in this orifice, the local adjustment menu will rotate.



In this option the first variable (**P_VAL**) is showed with its respective value (if you to want that it keep static, put the tool in **S** orifice and stay there.

Figure 3.20 - Step 3 - TT302

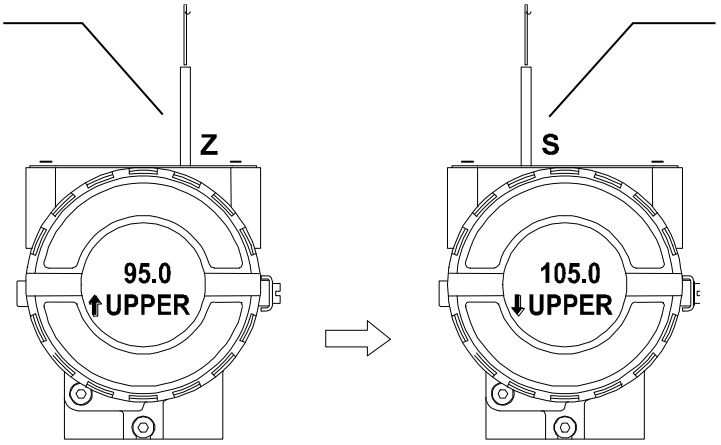
In order to configure the lower value (lower), simply insert the magnetic tool in orifice **S** as soon as LOWER is shown on the display. An arrow pointing upward (↑) increments the valve and an arrow pointing downward (↓) decrements the value. In order to increment the value, keep the tool insert in **S** up to set the value desired.



In order to decrement the lower value, insert the magnetic tool in orifice **Z** to shift the arrow to the downward position. After this, lift it from orifice **Z** and insert it in the orifice **S**, and wait to achieve the desired value.

Figure 3.21 - Step 4 - TT302

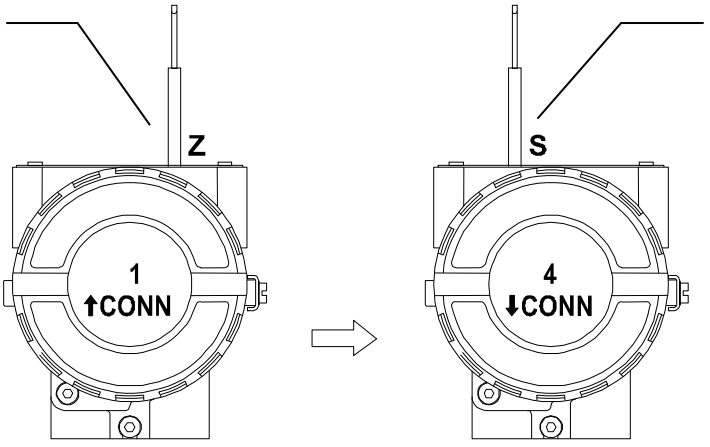
In order to range the upper value (upper), simply insert the magnetic tool in orifice **S** as soon as upper is shown on the display. An arrow pointing upward (↑) increment the value and an arrow pointing downward (↓) decrements the value. In order to increment the value, keep the tool insert in **S** up to set the value desired.



In order to decrement the upper value, insert the magnetic tool in orifice **Z** to shift the arrow to the downward position. After this, insert it in the orifice **S**, and wait to achieve the desired value.

Figure 3.22 - Step 5 - TT302

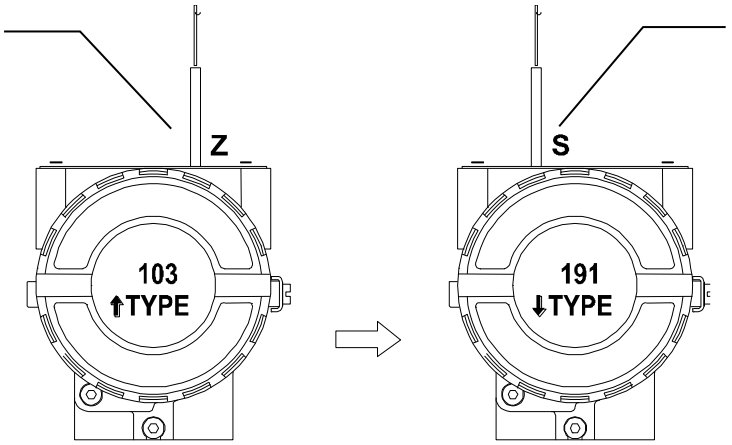
In order to configure the connection (**CONN**), simply insert the magnet tool in orifice **S** as soon as **CONN** is shown on the display. An arrow pointing upward (↑) increment the value and an arrow pointing downward (↓) decrement the value. The number over **CONN** mnemonic is the value corresponding of the table 3.2. See it to do the correct choice of the connection value.



In order to decrement the connection value, insert the magnetic tool in orifice **Z** to shift the arrow to the downward position. After this, insert it in the orifice **S**, and wait to achieve the desired value.

Figure 3.23 - Step 6 - TT302

In order to configure the connection (**TYPE**), simply insert the magnet tool in orifice **S** as soon as **TYPE** is shown on the display. An arrow pointing upward (↑) increment the value and an arrow pointing downward (↓) decrement the value. The number over **TYPE** is the value corresponding of the table 3.1. See it to do the correct choice of the connection value.



In order to decrement the connection type value, place the magnetic tool in orifice **Z** to shift the arrow to the downward position. After this, insert it in the orifice **S**, and wait to achieve the desired value.

Figure 3.24 - Step 7 - TT302

Section 4

MAINTENANCE PROCEDURES

Troubleshouting

SMAR TT302 transmitters are extensively tested and inspected before delivery to the end user. Nevertheless, during their design and development, consideration was given to the possibility of repairs being made by the end user, if necessary.

In general, it is recommended that end users do not try to repair printed circuit boards. Spare circuit boards may be ordered from **SMAR** whenever necessary.

SYMPTOM	PROBABLE SOURCE OF PROBLEM
NO COMMUNICATION	▪ ***Transmitter Connections*** Check wiring polarity and continuity. Check for shorts or ground loops. Check if the power supply connector is connected to main board. Check if the shield is not used as a conductor. It should be grounded at one end only.
	▪ ***Power Supply*** Check power supply output. The voltage must be between 9 - 32 VDC at the **TT302** terminals. Noise and ripple should be within the following limits: a) 16 mV peak to peak from 7.8 to 39 KHz. b) 2 V peak to peak from 47 to 63 Hz for non-intrinsic safety applications and 0.2 V for intrinsic safety applications. c) 1.6 V peak to peak from 3.9 MHz to 125 MHz.
	▪ ***Network Connection*** Check that the topology is correct, and all devices are connected in parallel. Check that two Terminators are OK and correctly positioned. Check that the Terminators are according to the specifications. Check length of trunk and spurs. Check spacing between couplers.
	▪ ***Network Configuration*** Make sure the device tag is configured if system configuration is desired. Make sure that device address, connection and index for all variables are configured correctly if pre-configuration is used.
	▪ ***Electronic Circuit Failure*** Check the main board for defect by replacing it with a spare one.
NCORRECT READING	▪ ***Transmitter Connections*** Check for intermittent short circuits, open circuits and grounding problems. Check if the sensor is correctly connected to the **TT302** terminal block. Check if the sensor signal is reaching the **TT302** terminal block by measuring it with a multimeter at the transmitter end.
	▪ ***Noise, Oscillation*** Adjust damping Check grounding of the transmitters housing, extra important for mV and thermocouple input. Check the terminal block for moisture. Check that the shielding of the wires between sensor/ transmitter and transmitter/ panel is grounded only in one end.
	▪ ***Sensor*** Check the sensor operation; it shall be within its characteristics. Check sensor type; it shall be the type and standard that the **TT302** has been configured to. Check if process is within the range of the sensor and the **TT302**.
	▪ ***Electronic Circuit Failure*** Check the integrity of circuit replacing it with a spare one.
	▪ ***Transmitter Configuration*** Check if the sensor and wires configuration are correct.

Table 4.1 - Messages of Errors and Potential Cause

If the problem is not presented in the table above follow the Note below:

NOTE

The Factory Init should be tried as a last option to recover the equipment control when the equipment presents some problem related to the function blocks or the communication. **This operation must only be carried out by authorized technical personnel and with the process offline, since the equipment will be configured with standard and factory data.**

This procedure resets all the configurations run on the equipment, after which a partial download should be performed. With exception to the equipment physical address and the gsd identifier number selector parameter. After doing this, all configurations must be remade according to their applications.

To run the factory Init, use two magnetic screwdrivers. Remove the screw on the equipment that fixes the identification tag on the carcass top to access the orifices bearing the letters “S” and “Z”.

The operations to follow are:

1) Turn off the equipment; insert the magnetic tools in each orifice (S and Z). Leave them in the orifices;

2) Power the equipment;

3) As soon as Factory Init is shown on the display, take off the tools and wait for the "5" symbol on the right upper corner of the display to unlit, thus indicating the end of the operation.

This operation has factory configuration that eliminates possible problems with the functional blocks or the transmitter communication.

Caution: this operation must be carried out by an authorized technician, with the process offline, as the process will be configured with factory standard data.

Disassembly Procedure

Refer to Figure 4.2 - Exploded View. Make sure to disconnect the power supply before disassembling the transmitter.

Sensor
If the sensor is mounted on the transmitter, first disconnect the wires to prevent the wires from breaking. To access the terminal block, first loosen the cover locking screw on the side marked “Field Terminals”, then unscrew the cover.

Electronic Circuits
The main board (**5**) and input board (**7**) are matched pairs and must be changed together and not mixed with others. To remove the circuit boards (**5** and **7**) and the display (**4**), first loosen the cover locking (**8**) on the side not marked “Field Terminals” then unscrew the cover (**1**).

Loosen the two screws (**3**) that anchor the display and the main circuit board. Gently pull out the display, and then the main board (**5**). To remove the input board (**7**), first unscrew the two screws (**6**) that anchors it to the housing (**9**), gently pull out the board.

WARNING

The boards have CMOS components, which may be damaged by electrostatic discharges. Observe correct procedures for handling CMOS components. It is also recommended to store the circuit boards in electrostatic-proof cases.

Reassembly Procedure

- Put input board (**7**) into housing (**9**).
- Anchor input board with its screws (**6**).
- Put main board (**5**) into the housing, ensuring all interconnecting pins are connected.
- Put display (**4**) into the housing, observing the four mounting positions (See Figure 4.1) “_” should point in the direction desired as UP.
- Anchors main board and display with their screws (**3**).
- Fit the cover (**1**) and lock it using the locking screw (**8**).

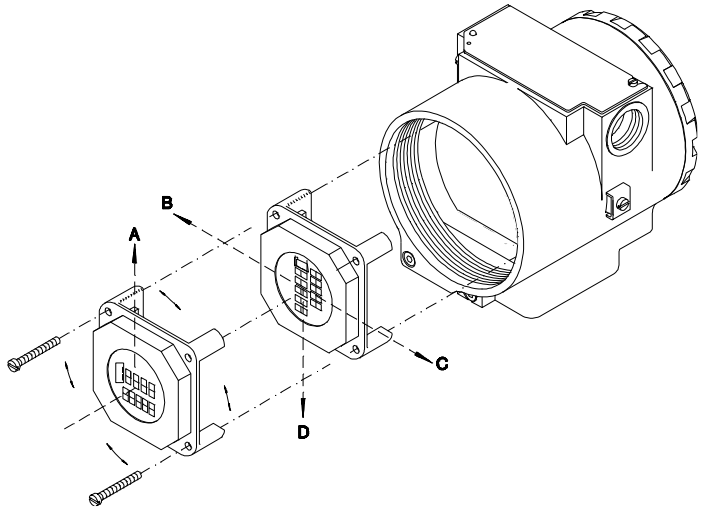


Figure 4.1 - Four Possible Positions of the Display

Interchangeability

The Main and Input boards must be kept together because of the calibration data that is stored in the main board EEPROM. In the case of one board being faulty, both must be replaced.

Returning Materials

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

To expedite analysis and solution of the problem, the defective item should be returned with a description of the failure observed, with as many details as possible. For faster problem evaluation, the material sent must describe the installation data, type of measure adopted and process conditions.

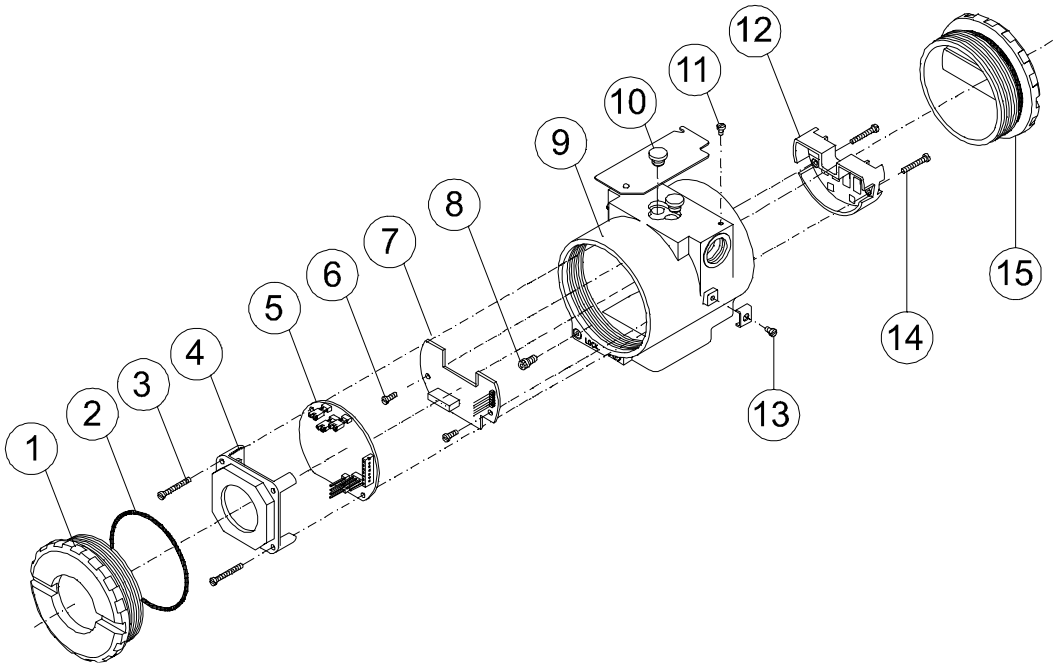


Figure 4.2 - Exploded View

NOTE
For aluminum housing there is an insert in the position 13. This insert is used to improve the grounding.

ACCESSORIES	
ORDERING CODE	**DESCRIPTION**
SD1	Magnetic Tool for Local Adjustment
SYSCON	System Configurator
PS302	Power Supply
BT302	Terminator
DFI302	Fieldbus Universal Bridge

Table 4.2 - Accessories of SYSTEM302

SPARE PARTS LIST			
DESCRIPTION OF PARTS	**POSITION**	**CODE**	**CATEGORY (NOTA 1)**
HOUSING, Aluminum (NOTE 2)			
. 1/2 - 14 NPT	9	314-0130	
. M20 x 1.5	9	314-0131	
. PG 13.5 DIN	9	314-0132	
HOUSING, 316 SS (NOTE 2)			
. 1/2 - 14 NPT	9	314-0133	
. M20 x 1.5	9	314-0134	
. PG 13.5 DIN	9	314-0135	
COVER (INCLUDES O'RING)			
. Aluminum	1 and 15	204-0102	
. 316 SS	1 and 15	204-0105	
COVER WITH WINDOW FOR INDICATION (INCLUDES O'RING)			
. Aluminum	1	204-0103	
. 316 SS	1	204-0106	
COVER LOCKING SCREW	8	204-0120	
EXTERNAL GROUND SCREW	13	204-0124	
IDENTIFICATION PLATE FIXING SCREW	11	204-0116	
DIGITAL INDICATOR	4	214-0108	
TERMINAL INSULATOR	12	314-0123	
MAIN INPUT CIRCUIT BOARD ASSEMBLY	5 and 7	400-0234	**A**
O'RINGS (NOTE 3)			
. Cover, Buna-N	2	204-0122	**B**
TERMINAL HOLDING SCREW.			
. Housing in Aluminum	14	304-0119	
. Housing in 316 Stainless Steel	14	204-0119	
MAIN BOARD SCREW HOUSING IN ALUMINUM			
. Units with indicator	3	304-0118	
. Units without indicator	3	304-0117	
MAIN BOARD SCREW HOUSING IN 316 STAINLESS STEEL			
. Units with indicator	3	204-0118	
. Units without indicator	3	204-0117	
INPUT BOARD SCREW			
. Housing in Aluminum	6	314-0125	

SPARE PARTS LIST			
DESCRIPTION OF PARTS	**POSITION**	**CODE**	**CATEGORY (NOTA 1)**
. Housing in 316 Stainless Steel	6	214-0125	
MOUNTING BRACKET FOR 2" PIPE MOUNTING (NOTE 4)			
. Carbon Steel	-	214-0801	
. Stainless Steel 316	-	214-0802	
. Carbon Steel bolts, nuts, washers and U-clamp in Stainless Steel	-	214-0803	
LOCAL ADJUSTMENT PROTECTION CAP	10	204-0114	

Table 4.3 - Spare Part List

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. 0-Rings are packaged in packs of 12 units.
4. Including U-clamp, nuts, bolts, and washers.

Isolation Test on Equipment Housings

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

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

3. Jumper (connect) the power terminals (positive and negative) with the cable coming from the Megohmmeter (megger). In the case of a temperature transmitter, also jumper all the connectors with the same cable. In these instruments, in addition to the power terminals, there are sensor terminals. All these terminals must be connected to apply voltage in relation to the housing.

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

ATTENTION
 Never test with a voltage greater than 500 Vdc.

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

6. If the value obtained by the megohmmeter is below 2GΩ, the possibility of moisture entering the electrical connection compartment must be analysed.

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

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

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

Section 5

TECHNICAL CHARACTERISTIC

Functional Specifications	
Inputs	See table 5.1, 5.2, 5.3 and 5.4
Output and Communication Protocol	Digital only. Complies with IEC 61158-2: 2000 (H1): 31.25 kbit/s voltage mode, bus powered.
Power Supply / Current Consumption	**Bus powered:** 9 - 32 Vdc. **Quiescent current consumption:** 12 mA.
Indicator	4 1/2 -digit numerical and 5-character alphanumerical LCD indicator (optional).
Hazardous Area Certifications	See Appendix A
Zero and Span Adjustments	No interactive, via local adjustment and digital communication.
Failure Alarm (Diagnostics)	For sensor or circuit failures, status is sent to link outputs. Detailed diagnostics are available in the contained parameters.
Temperature Limits	**Operation:** -40 ºC to 85 ºC (-40 to 185 ºF) **Storage:** -40 ºC to 120 ºC (-40 to 248 ºF) **Display:** -20 ºC to 80 ºC (-4 to 176 ºF) -40 ºC to 85 ºC (-40 to 185 ºF) (without damage)
Turn-on Time	Performs within specifications in less than 10 seconds after power is applied to the transmitter.
Configuration	Basic configuration may be done using the local adjustment magnetic tool if device is fitted with display. Complete configuration is possible using configuration tools such as Syscon302 (System Configuration Tool), AMS™, FieldCare™ and HHT375.
Humidity Limits	0 to 100% RH

Performance Specifications	
Accuracy	See table 5.1, 5.2, 5.3 and 5.4
Temperature Effect	**For a 10 ºC variation:** **mV (-6 to 22 mV), TC (NBS: B, R, S,T):** ± 0.03% of the input milivoltage or 0.002 mV whichever is greater; **mV (-10 to 100 mV), TC (NBS: E, J, K, N; DIN: L, U):** ± 0.03% of the input milivoltage or 0.01 mV whichever is greater; **mV (-50 to 500 mV):** ± 0.03% of the input milivoltage or 0.05 mV whichever is greater; **Ohms (0 to 100Ω), RTD (GE: Cu10):** ± 0.03% of the input resistence or 0.01Ω whichever is greater; **Ohms (0 to 400Ω), RTD (DIN: Ni120; IEC: Pt50, Pt100; JIS: Pt50, Pt100):** ± 0.03% of the input resistence or 0.04Ω whichever is greater; **Ohms (0 to 2000Ω), RTD (IEC: Pt500):** ± 0.03% of the input resistence or 0.2Ω whichever is greater; **TC:** cold-junction compensation rejection 60:1 (Reference: 25.0 ± 0.3 °C).
Power Supply Effect	± 0.005% of calibrated span per volt
Electrical Connection	1/2 - 14 NPT M20 X 1.5 PG 13.5 DIN 1/2 - 14 NPT X 3/4 NPT (AI 316) - with adapter 1/2 - 14 NPT X 3/4 BSP (AI 316) - with adapter 1/2 - 14 NPT X 1/2 BSP (AI 316) - with adapter **Note:** Explosion proof approvals do not apply to adapter, only to transmitter.
Mounting	Can be attached directly to the sensor. With an optional bracket can be installed on a 2" pipe or fixed on a wall or panel.

Physical Specifications	
Approximate Weights	**Without display and mounting bracket:** 0.80 kg **Add for digital display:** 0.13 kg **Add for mounting bracket:** 0.60 kg
Control Functions Characteristics (Optional)	RES, TRD, DSP, DIAG, AI, PID, EPID, ARTH, INTG, ISEL, CHAR, SPLT, AALM, SPG, TIME, LLAG, OSLD and CT

	2, 3 or 4 wires					
SENSOR	**TYPE**		**RANGE °C**	**RANGE °F**	**MINIMUM SPAN °C**	**°C DIGITAL ACCURACY***
RTD	Cu10	GE	-20 to 250	-4 to 482	50	± 1.0
	Ni120	DIN	-50 to 270	-58 to 518	5	± 0.1
	Pt50	IEC	-200 to 850	-328 to 1562	10	± 0.25
	Pt100	IEC	-200 to 850	-328 to 1562	10	± 0.2
	Pt500	IEC	-200 to 450	-328 to 842	10	± 0.2
	Pt1000	IEC	-200 to 300	-328 to 572	10	± 0.2
	Pt50	JIS	-200 to 600	-328 to 1112	10	± 0.25
	Pt100	JIS	-200 to 600	-328 to 1112	10	± 0.25
THERMOCOUPLE	B	NBS	100 to 1800	212 to 3272	50	± 0.5**
	E	NBS	-100 to 1000	-148 to 1832	20	± 0.2
	J	NBS	-150 to 750	-238 to 1382	30	± 0.3
	K	NBS	-200 to 1350	-328 to 2462	60	± 0.6
	N	NBS	-100 to 1300	-148 to 2372	50	± 0.5
	R	NBS	0 to 1750	32 to 3182	40	± 0.4
	S	NBS	0 to 1750	32 to 3182	40	± 0.4
	T	NBS	-200 to 400	-328 to 752	15	± 0.15
	L	DIN	-200 to 900	-328 to 1652	35	± 0.35
	U	DIN	-200 to 600	-328 to 1112	50	± 0.5

Table 5.1 - 2, 3 or 4 wires Sensor Characteristics

* Accuracy of value read on display and accessed by communication. The 4-20 mA accuracy is the digital accuracy ±0.03%
** Not applicable for the first 20% of the range (up to 440 °C).

	DIFFERENTIAL					
SENSOR	**TYPE**		**RANGE °C**	**RANGE °F**	**MINIMUM SPAN °C**	**°C DIGITAL ACCURACY***
RTD	Cu10	GE	-270 to 270	-486 to 486	50	± 2.0
	Ni120	DIN	-320 to 320	-576 to 576	5	± 0.5
	Pt50	IEC	-1050 to 1050	-1890 to 1890	10	± 1.0
	Pt100	IEC	-1050 to 1050	-1890 to 1890	10	± 1.0
	Pt500	IEC	NA	NA	NA	NA
	Pt1000	IEC	NA	NA	NA	NA
	Pt50	JIS	-800 to 800	-1440 to 1440	10	± 1.0
	Pt100	JIS	-800 to 800	-1440 to 1440	10	± 1.5
THERMOCOUPLE	B	NBS	-1700 to 1700	-3060 to 3060	60	± 1.0**
	E	NBS	-1100 to 1100	-1980 to 1980	20	± 1.0
	J	NBS	-900 to 900	-1620 to 1620	30	± 0.6
	K	NBS	-1550 to 1550	-2790 to 2790	60	± 1.2
	N	NBS	-1400 to 1400	-2520 to 2520	50	± 1.0
	R	NBS	-1750 to 1750	-3150 to 3150	40	± 2.0
	S	NBS	-1750 to 1750	-3150 to 3150	40	± 2.0
	T	NBS	-600 to 600	-1080 to 1080	15	± 0.8
	L	DIN	-1100 to 1100	-1980 to 1980	35	± 0.7
	U	DIN	-800 to 800	-1440 to 1440	50	± 2.5

Table 5.2 - Differential Sensor Characteristics

* Accuracy of value read on display and accessed by communication.
** Not applicable for the first 20% of the range (up to 440 °C).

SENSOR	RANGE mV	*DIGITAL ACCURACY %
mV	-6 to 22	± 0.02% or ± 2 µV
	-10 to 100	± 0.02% or ± 10 µV
	-50 to 500	± 0.02% or ± 50 µV
mV DIF.	-28 to 28	± 0.1% or ± 10 µV
	-110 to 110	± 0.1% or ± 50 µV

Table 5.3 - mV Sensor Characteristics

SENSOR	RANGE Ohm	*DIGITAL ACCURACY %
Ohm	0 to 100	± 0.02% or ± 0.01 Ohm
	0 to 400	± 0.02% or ± 0.04 Ohm
	0 to 2000	± 0.02% or ± 0.20 Ohm
Ohm DIF.	-100 to 100	± 0.08% or ± 0.04 Ohm
	-400 to 400	± 0.1% or ± 0.2 Ohm

Table 5.4 - Ohm Sensor Characteristics

* Accuracy of value read on display and accessed by communication.
** Not applicable for the first 20% of the range (up to 440 °C).
NA Not applicable.

Ordering Code

MODEL	TEMPERATURE TRANSMITTER

COD. — Local Indicator

0	Without Indicator	**1**	With Digital Indicator

COD. — Mounting Bracket

0	Without Bracket	**2**	316 SST Bracket	**A**	Flat, 304 SST bracket and 316 SST accessories
1	Carbon Steel Bracket	**7**	Carbon Steel Bracket with 316 SST Fasteners		

COD. — Electrical Connections

0	1/2 - 14 NPT **(3)**	**3**	1/2 - 14 NPT x 1/2 BSP (316 SST) - With adapter **(2)**	**Z**	According to user´s notes
1	1/2 - 14 NPT x 3/4 NPT (316 SST) - With adapter **(4)**	**A**	M20 x 1.5 **(3)**		
2	1/2 - 14 NPT x 3/4 BSP (316 SST) - With adapter **(2)**	**B**	PG 13.5 DIN **(2)**		

COD. — Housing Material (6) (7)

H0	Aluminum (IP/TYPE)	**H3**	316 SST for use in saline atmosphere (IPW/TYPEX) **(8)**
H1	316 SST (IP/TYPE)	**H4**	Copper Free Aluminum Aluminum (IPW/TYPEX) **(8)**
H2	Aluminum for use in saline atmosphere (IP/TYPE) **(8)**		

COD. — Identification Plate

I1	FM: XP, IS, NI, DI	**I5**	INMETRO (EX-I, EX-D) Gas	**I7**	ATEX (EX-I) Mining	**IO**	INMETRO (Dust)
I4	ATEX (EX-I, EX-D) Gas	**I6**	Without Certification	**IL**	IECEX (EX-D) Gas		

COD. — Tag Plate (5)

J0	With tag, when specified (Default)	**J2**	According to user's notes
J1	Blank		

COD. — Sensor Connection

L2	2-wire	**LF**	Differential
L3	3-wire	**LD**	Double 2-wire
L4	4-wire	**LB**	Backup

COD. — Painting

P0	Gray Munsell N 6,5 Polyester (Default)	**P5**	Yellow Polyester	**PC**	Safety Blue Polyester - Electrostatic Painting
P3	Black Polyester	**P8**	Without Painting		
P4	White Epoxy	**P9**	Safety Blue Epoxy – Electrostatic Painting		

COD. — Sensor Type

T1	Cu10 - GE	**TA**	Thermocouple type B - NBS	**TP**	Thermocouple type U - DIN
T2	Ni120 - DIN	**TB**	Thermocouple type E - NBS	**TN**	100 OHM
T3	PT50 - IEC	**TC**	Thermocouple type J - NBS	**TQ**	22 mV
T4	PT100 - IEC	**TD**	Thermocouple type K - NBS	**TR**	100 mV
T5	PT500 - IEC	**TE**	Thermocouple type N - NBS	**TS**	500 mV
T6	PT50 - JIS	**TF**	Thermocouple type R - NBS		
T7	PT100 - JIS	**TG**	Thermocouple type S - NBS		
T8	2K OHM	**TH**	Thermocouple type T - NBS		
T9	400 OHM	**TK**	Thermocouple type L – DIN		

TT302	1	2	0	H1	I1	J0	L2	P8	T1

NOTE

(1) Values limited to 4 1/2 digits; units limited to 5 characters.

(2) Not certified for use in hazardous locations.

(3) Certification Ex-d for FM / ATEX / IECEx / INMETRO.

(4) Certification Ex-d for INMETRO.

(5) Rectangular plate in 316 SST

(6) IPX8 tested in 10 meters of water column for 24 hours.

(7) Ingress Protection:

Product	CEPEL	NEMKO / EXAM	FM	CSA	NEPSI
TT300	IP66/68W	IP66/68W	Type 4X/6(6P)	Type 4X	IP67

(8) IPW/TYPE testes for 200 hours according to NBR 8094 / ASTM B 117 standard.

Appendix A

CERTIFICATIONS INFORMATION

European Directive Information

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

Authorized representative/importer located within the Community:
Smar Europe BV De Oude Wereld 116 2408 TM Alphen aan den Rijn Netherlands

ATEX Directive 2014/34//EU - "Equipment for explosive atmospheres" (applicable from 20 April 2016)
The EC-Type Examination Certificate is released by DNV Product Assurance AS (NB 2460) and DEKRA Testing and Certification GmbH (NB 0158).
Designated certification body that monitors manufacturing and released QAN (Quality Assurance Notification) is Nemko AS (NB 0470) and UL International Demko AS (NB 0539).

LVD Directive 2014/35/EU – "Low Voltage" (applicable from 20 April 2016)
According the LVD directive Annex II, electrical equipment for use in an explosive atmosphere is outside the scope of this directive.
According to IEC standard: IEC 61010-1 - Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements.

ROHS Directive 2011/65/EU - "Restriction of the use of certain hazardous substances in electrical and electronic equipment"
For the evaluation of the products the following standards were consulted: EN IEC 63000.

EMC Directive 2014/30/EU - "Electromagnetic Compatibility" (applicable from 20 April 2016)
For products evaluation the standard IEC 61326-1 were consulted and to comply with the EMC directive the installation must follow these special conditions:
Use shielded, twisted-pair cable for powering the instrument and signal wiring.
Keep the shield insulated at the instrument side, connecting the other one to the ground.

Hazardous locations general information

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

Warning:
Explosions could result in death or serious injury, besides financial damage.
Installation of this instrument in hazardous areas must be in accordance with the local standards and type of protection. Before proceedings with installation make sure that the certificate parameters are in accordance with the classified hazardous area.

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

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

Intrinsic Safety / Non Incendive application

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

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

The instrument must be connected to a proper intrinsic safety barrier. Check the intrinsically safe parameters involving the barrier and equipment including the cable and connections. Associated apparatus ground bus shall be insulated from panels and mounting enclosures. Shield is optional, when using shielded cable, be sure to insulate the end not grounded.

Cable capacitance and inductance plus Ci and Li must be smaller than Co and Lo of the Associated Apparatus.

It is recommended do not remove the housing covers when powered on.

Explosionproof / Flameproof application

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

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

Do not remove the housing covers when powered on.

Enclosure

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

Lock the housing and covers using the locking screw.

The enclosure contains aluminum and is considered to present a potential risk of ignition by impact or friction.

Care must be taken during installation and use to prevent impact or friction.

Degree of Protection of enclosure (IP)

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

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

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

Hazardous Locations Approvals

FM Approvals
FM 4Y3A4.AX
XP Class I Division 1, Groups A, B, C, D
DIP Class II, Class III Division 1, Groups E, F, G
IS Class I, II, III Division 1, Groups A, B, C, D, E, F G
NI Class I, Division 2, Groups A, B, C, D
T4; Tamb = +60°C Max; Type 4, 4X, 6, 6P

Entity Parameters Fieldbus Power Supply Input (report 3015629):
Vmax = 24 Vdc, Imax = 250 mA, Pi = 1.2 W, Ci = 5 nF, Li = 12 uH
Vmax = 16 Vdc, Imax = 250 mA, Pi = 2 W, Ci = 5 nF, Li = 12 uH

Drawings 102A-0079, 102A-1231, 102A-1354

ATEX DNV
Explosion Proof (PRESAFE 20 75160X)
II 2 G Ex db IIC T6 Gb
Ambient Temperature: -20 ºC to +60 ºC
Options: IP66W/68W or IP66/68

Special conditions for safe use:
Repairs of the flameproof joints must be made in compliance with the structural specifications provided by the manufacturer. Repairs must not be made on the basis of values specified in tables 1 and 2 of EN/IEC 60079-1.

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

Drawings 102A-1529, 102A-1473

IECEx DNV
Explosion Proof (IECEx DNV 21.0090X)
Ex db IIC T6 Gb
Ta -20 ºC to +60 ºC
Options: IP66/68W or IP66/68

Special Conditions for Safe Use
Repairs of the flameproof joints must be made in compliance with the structural specifications provided by the manufacturer. Repairs must not be made on the basis of values specified in tables 1 and 2 of EN/IEC 60079-1.

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

Drawings 102A-2189, 102A-2190

ATEX DEKRA
Intrinsic Safety (DMT 00ATEX E 061)
II 2G Ex ia IIC T4/T5/T6 Gb
I M2 Ex ia I Mb

FISCO Field Device
Supply circuit for the connection to an intrinsically safe FISCO fieldbus-circuit:
Ui = 24 Vdc, Ii = 380 mA, Pi = 5.32 W, Ci ≤ 5 nF, Li = Neg
Parameters of the supply circuit comply with FISCO model according to Annex G EN60079-11:2012, replacing EN 60079-27:2008.

2-wire / 3-wire / 4-wire measuring circuit in type of protection Ex ia I / IIC for the connection to intrinsically safe thermocouples or resistance temperature indicators:
Uo = 6.5 Vdc, Io = 20 mA, Po = 30 mW, Ci ≤ 300 nF, Li = Neg, Co ≤ 700 nF, Li ≤ 20 mH

The 2-wire / 3-wire / 4-wire measuring circuit provides safe galvanic separation from the fieldbus circuit.
Ambient Temperature:

-40ºC ≤ Ta ≤ +60ºC (T4)
-40ºC ≤ Ta ≤ +50ºC (T5)
-40ºC ≤ Ta ≤ +40ºC (T6)

The Essential Health and Safety Requirements are assured by compliance with:
EN 60079-0:2012 + A11:2013 General Requirements
EN 60079-11:2012 Intrinsic Safety “i”

Drawings 102A-1473, 102A-1529, 102A-1475, 102A-1531

INMETRO NCC
Segurança Intrínseca (NCC 24.0167X)
Equipamento de campo FISCO
Ex ia IIC T* Ga
Ex ia IIIC T* Da
Ui = 30 V Ii = 380 mA Pi = 5,32 W Ci = 5,0 nF Li = desp
Tamb: -20 °C a +50 °C para T5 ou T_{200}100 ºC
Tamb: -20 °C a +65 °C para T4 ou T_{200}135 ºC
IP66/68 ou IP66/68W

Prova de Explosão (NCC 24.0170)
Ex db IIC T6 Gb
Ex tb IIIC T85 ºC Db
Tamb: -20 °C a +40 °C
IP66/68 ou IP66/68W

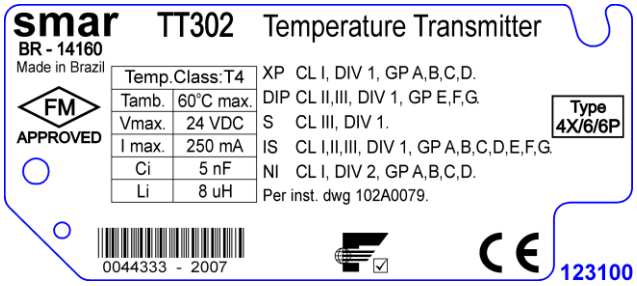
Observações:
O número do certificado é finalizado pela letra "X": Para indicar que para a versão do Transmissor de Temperatura, modelos TT302 e TT303 equipado com invólucro fabricado em liga de alumínio, somente pode ser instalado em localização que exigem o “EPL Ga”, se durante a instalação for excluído o risco de ocorrer impacto ou fricção entre o invólucro e peças de ferro/aço.
O produto adicionalmente marcado com a letra suplementar "W" indica que o equipamento foi ensaiado em uma solução saturada a 5% de NaCl p/p, à 35 °C, pelo tempo de 200 h e foi aprovado para uso em atmosferas salinas, condicionado à utilização de acessórios de instalação no mesmo material do equipamento e de bujões de aço inoxidável ASTM-A240, para fechamento das entradas roscadas não utilizadas.
Os planos de pintura P1 são permitidos apenas para equipamento fornecido com plaqueta de identificação com marcação para grupo de gás IIB.
O grau de proteção IP68 só é garantido se nas entradas roscadas de ½” NPT for utilizado vedante não endurecível à base de silicone.
O segundo numeral oito indica que o equipamento foi ensaiado para uma condição de submersão de dez metros por vinte e quatro horas. O acessório deve ser instalado em equipamentos com grau de proteção equivalente.
É responsabilidade do fabricante assegurar que todos os transformadores da placa analógica tenham sido submetidos com sucesso aos ensaios de rotina de 1500 V durante um minuto.
Este certificado é válido apenas para os produtos dos modelos avaliados. Qualquer modificação nos projetos, bem como a utilização de componentes ou materiais diferentes daqueles definidos pela documentação descritiva dos produtos, sem a prévia autorização, invalidará este certificado.
As atividades de instalação, inspeção, manutenção, reparo, revisão e recuperação dos equipamentos são de responsabilidade dos usuários e devem ser executadas de acordo com os requisitos das normas técnicas vigentes e com as recomendações do fabricante.

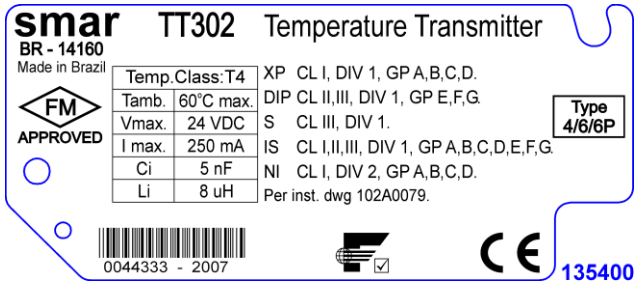
Normas Aplicáveis:
ABNT NBR IEC 60079-0:2020 Atmosferas explosivas - Parte 0: Equipamentos – Requisitos gerais
ABNT NBR IEC 60079-1:2016 Atmosferas explosivas - Parte 1: Proteção de equipamento por invólucro à prova de explosão “d”
ABNT NBR IEC 60079-11:2013 Atmosferas explosivas - Parte 11: Proteção de equipamento por segurança intrínseca "i"
ABNT NBR IEC 60079-26:2022 Atmosferas explosivas - Parte 26: Equipamentos com elementos de separação ou níveis de proteção combinados
ABNT NBR IEC 60079-31:2022 Atmosferas explosivas - Parte 31: Proteção de equipamentos contra ignição de poeira por invólucros “t”
ABNT NBR IEC 60529:2017 Graus de proteção providos por invólucros (Código IP)

Desenhos 102A1382, 102A1261, 102A2052, 102A2051, 102A2101

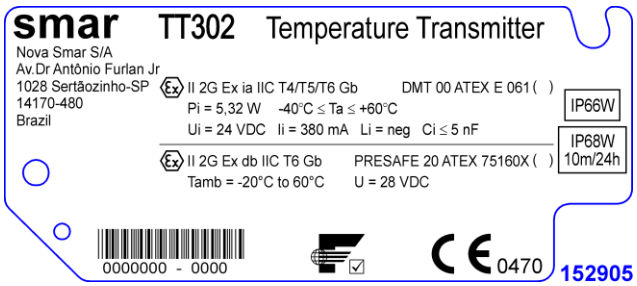
Identification Plate

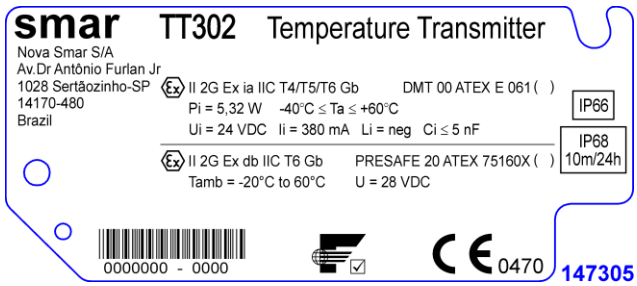
FM Approvals

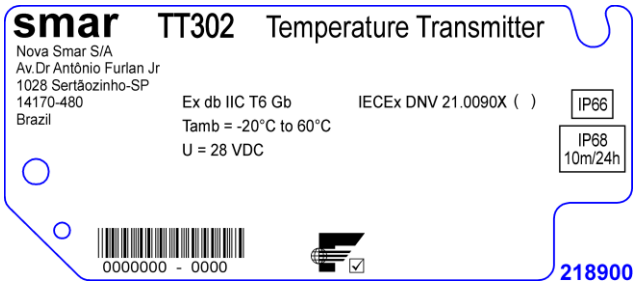


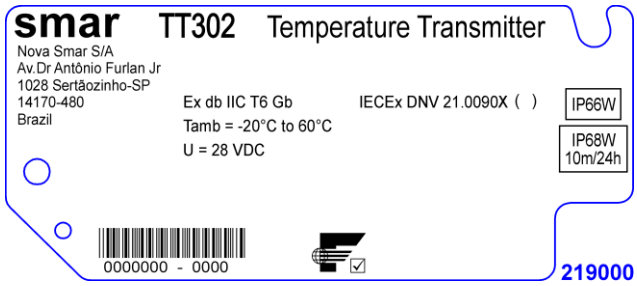


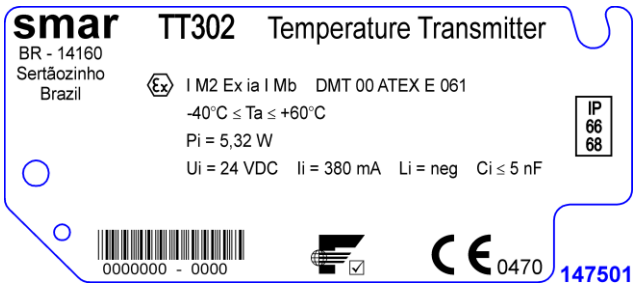
ATEX/ IECEx

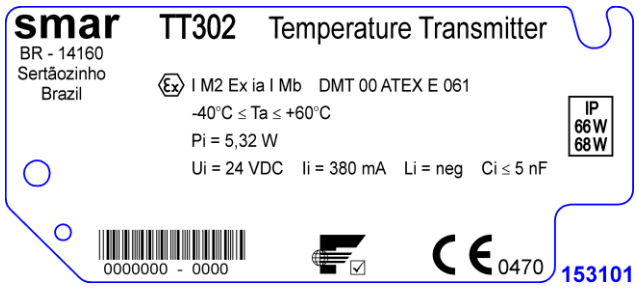




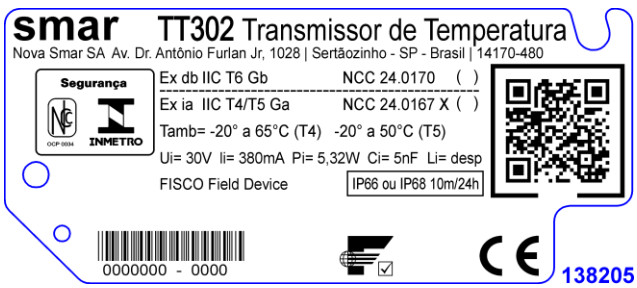


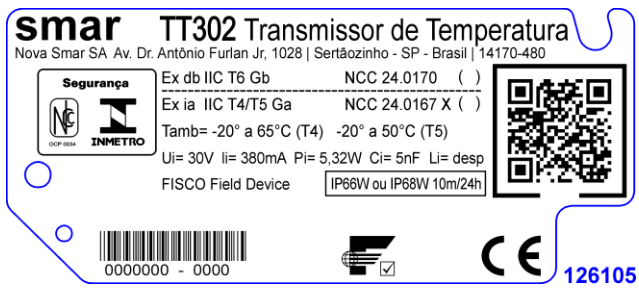


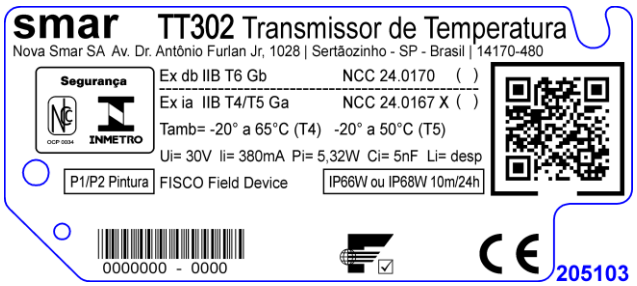


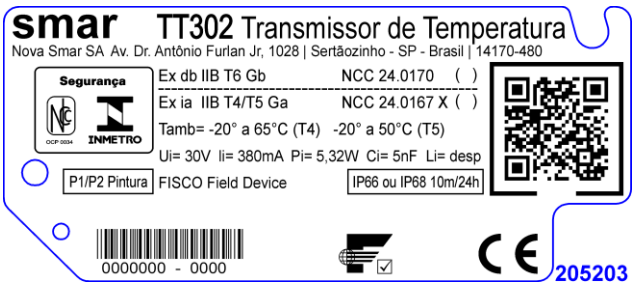


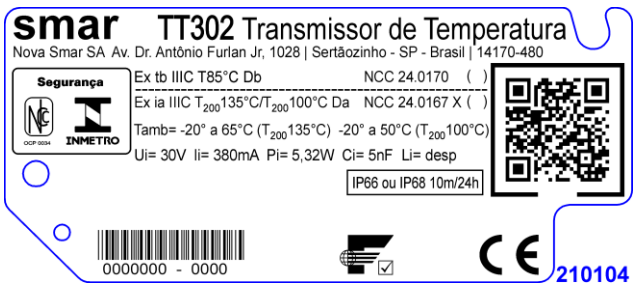
INMETRO NCC



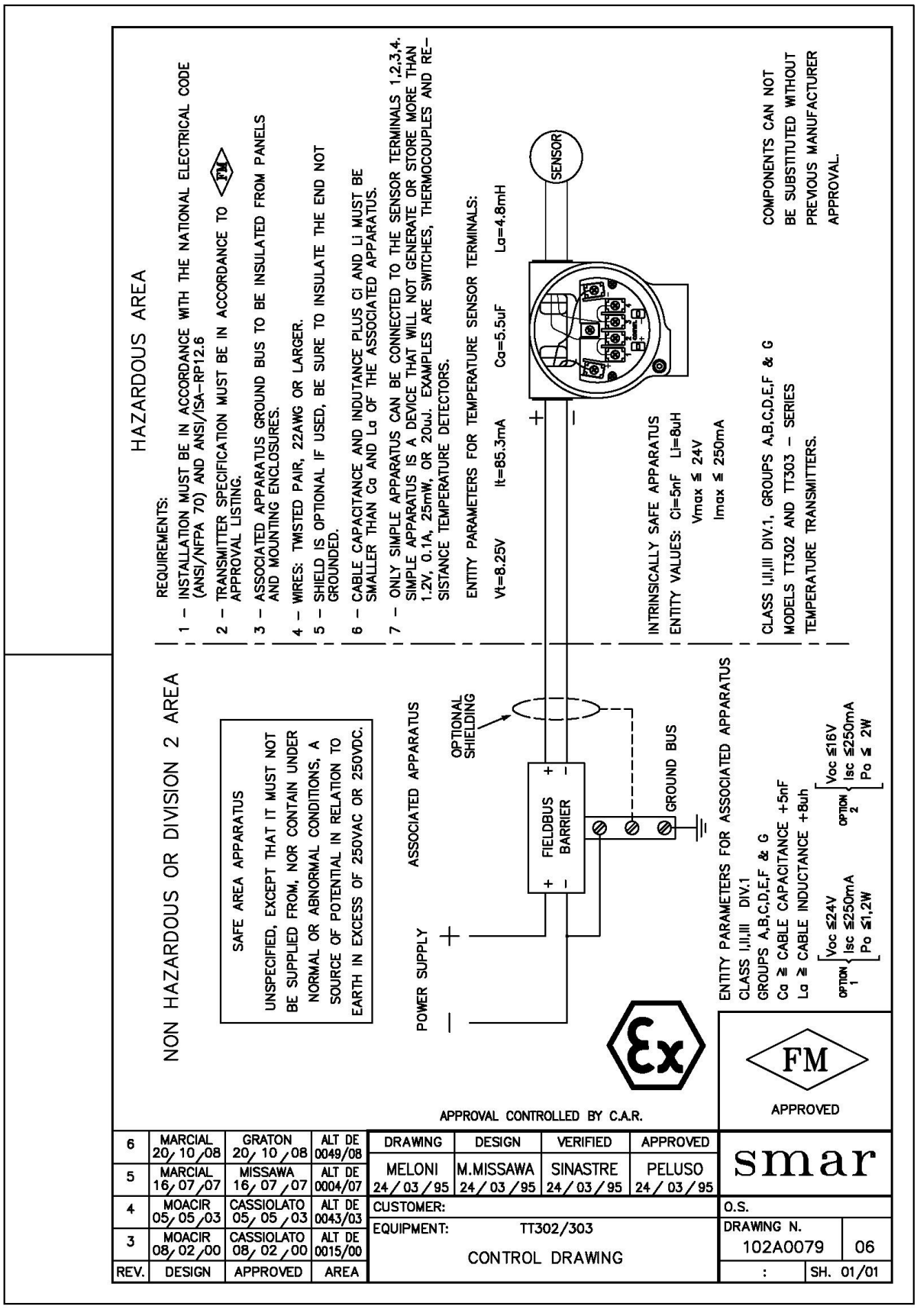



smar TT302 Transmissor de Temperatura
Nova Smar SA Av. Dr. Antônio Furlan Jr, 1028 | Sertãozinho - SP - Brasil | 14170-480
Segurança
INMETRO
Ex db IIB T6 Gb NCC 24.0170 ( )
Ex ia IIB T4/T5 Ga NCC 24.0167 X ( )
Tamb= -20° a 65°C (T4) -20° a 50°C (T5)
Ui= 30V Ii= 380mA Pi= 5,32W Ci= 5nF Li= desp
P1/P2 Pintura
FISCO Field Device
IP66W ou IP68W 10m/24h
0000000 - 0000
205103


smar TT302 Transmissor de Temperatura
Nova Smar SA Av. Dr. Antônio Furlan Jr, 1028 | Sertãozinho - SP - Brasil | 14170-480
Segurança
INMETRO
Ex db IIB T6 Gb NCC 24.0170 ( )
Ex ia IIB T4/T5 Ga NCC 24.0167 X ( )
Tamb= -20° a 65°C (T4) -20° a 50°C (T5)
Ui= 30V Ii= 380mA Pi= 5,32W Ci= 5nF Li= desp
P1/P2 Pintura
FISCO Field Device
IP66 ou IP68 10m/24h
0000000 - 0000
205203


smar TT302 Transmissor de Temperatura
Nova Smar SA Av. Dr. Antônio Furlan Jr, 1028 | Sertãozinho - SP - Brasil | 14170-480
Segurança
INMETRO
Ex tb IIIC T85°C Db NCC 24.0170 ( )
Ex ia IIIC T200135°C/T200100°C Da NCC 24.0167 X ( )
Tamb= -20° a 65°C (T200135°C) -20° a 50°C (T200100°C)
Ui= 30V Ii= 380mA Pi= 5,32W Ci= 5nF Li= desp
IP66 ou IP68 10m/24h
0000000 - 0000
210104

FM Approvals



Appendix B

smar	SRF–SERVICE REQUEST FORM	Proposal No.:

Company:	Unit:	Receipt of Remittance:	Warranty	
			Yes ( ) Purchase Order:	No ( )

COMMERCIAL CONTACT	TECHNICAL CONTACT
Full name:	Full name:
Position:	Position:
Phone: Extension:	Phone: Extension:
Fax:	Fax:
Email:	Email:

EQUIPMENT DATA / TEMPERATURE SENSOR

Model:	Serial Number:	Sensor Type and Connection:
TT301 ( ) TT302 ( ) TT303 ( ) TT400SIS ( ) TT411 ( ) TT421 ( )		Measurement type: ( ) Double Sensor ( ) Average between Sensors ( ) Differential ( ) Backup ( ) Single

INFORMATION AND DESCRIPTION OF THE FAILURE

Environment Temperature (ºC)		Work Temperature (ºC)		Calibration Range	
Min:	Max:	Min :	Max:	Min:	Max:
Operation Time:		Failure Data:			

IMPORTANT COMMENTS ABOUT EQUIPMENT APPLICATION AND PROCESS

(Please, inform more details about the application, installation, etc.).

FAILURE DESCRIPTION OR BAD OPERATION

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

NOTES

For warranty or non-warranty repair, please contact your representative.
Further information about address and contacts can be found on https://www.smar.com.br/en/contact-us