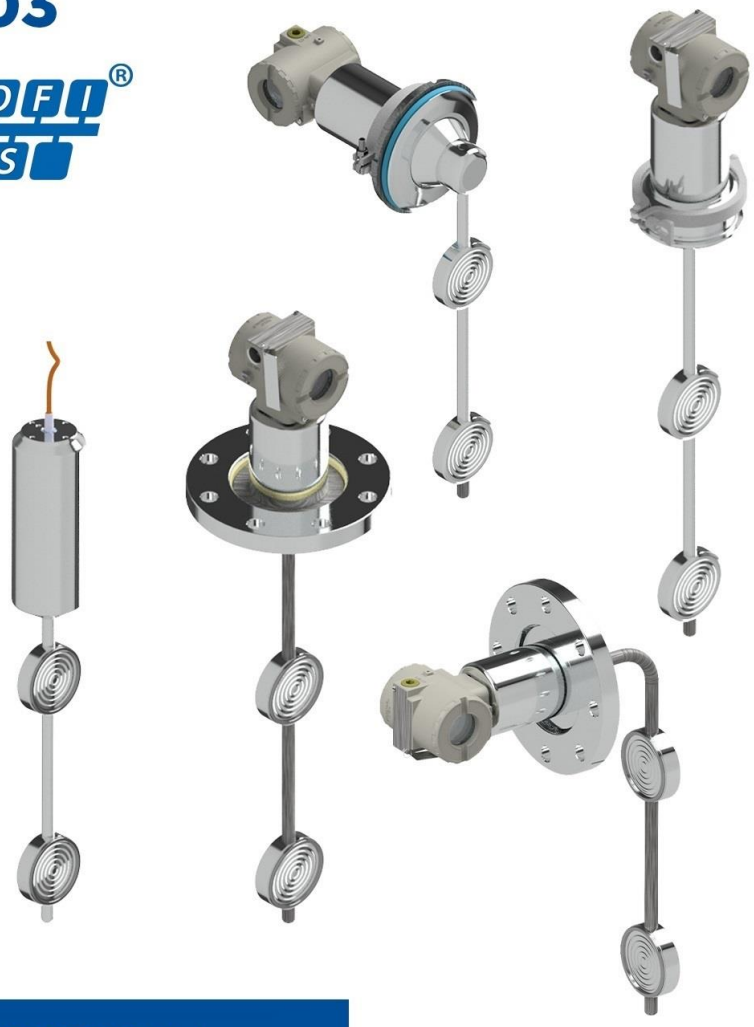
MANUAL

INSTRUCTIONS | OPERATION | MAINTENANCE

DENSITY/CONCENTRATION TRANSMITTER

DT303

PROFIBUS®



DEC/24 - VERSION 4

smar

Technology Company

DT303

Density/Concentration Transmitter

PROFIBUS®

Consult our subsidiary

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INTRODUCTION

DT303 is from the first generation of Profibus-PA devices. It is a transmitter for concentration and density measurements; based on a field-proven capacitive sensor that provides reliable operation and high performance. The digital technology used in **DT303** enables the choice of several types of transfer functions, an easy interface between the field and the control room and several interesting features that considerably reduce the installation, operation and maintenance costs.

The Concentration/Density transmitter **DT303** (Touché) is a device to measure in continuous mode the concentration and density of liquids, directly in industrial process.

The **DT303** is composed of a probe with two repeater diaphragms into the process fluid. The probe is connected to a capacitive sensor, extern to the process, through the capillaries. A fill fluid transmits the process pressure in the two repeater diaphragms to the differential pressure sensor.

A temperature sensor into the probe and between the two repeater diaphragms makes the automatic compensation of any process temperature variation. The factory procedure of the probe and temperature sensor allow that small process temperature variations be fast informed to the transmitter, that using a specific software calculates with precision the density value in the process.

According to the industrial process, the measured concentration by means **DT303** are express in Density, Relative Density, Brix Degree, Baumé Degree, INPM Degree, Plato Degree, Solid percentage, Degree API, General Concentration etc.

The **DT303** is part of Smar's complete 303 line of Profibus-PA devices.

Some of the advantages of bi-directional digital communications are known from existing smart transmitter protocols: Higher accuracy, multi-variable access, remote configuration and diagnostics, and multi-dropping of several devices on a single pair of wires.

The system controls variable sampling, algorithm execution and communication so as to optimize the usage of the network, not loosing time. Thus, high closed loop performance is achieved.

Using Profibus technology, with its capability to interconnect several devices, very large control schemes can be constructed. The function block concept was introduced in order to be user friendly. The **DT303**, like the rest of the 303 family, has some Function Blocks built in, like Analog Input Block.

The need for implementation of Fieldbus in small as well as large systems was considered when developing the entire 303 line of Profibus-PA devices. They have common features and can be configured locally using a magnetic tool, eliminating the need for a configurator or console in many basic applications.

The **DT303** is available as a product on its own, but also replaces the circuit board for the DT301. They use the same sensor board. Refer to the maintenance section of this manual for instructions on upgrading. The **DT303** uses the same hardware and housing for the DT302.The **DT303** is part of Smar's 303 Series of Profibus-PA devices.

The **DT303**, like its predecessor DT301, has some built-in blocks, eliminating the need for a separate control device. The communication requirement is considerably reduced, and that means less dead-time and tighter control is achieved, not to mention the reduction in cost. They allow flexibility in control strategy implementation.

ATTENTION
Get the best results of the **DT303** by carefully reading these instructions. This product is protected by US patent numbers: **6,234,019; D439,855** and **5,827,963.**

NOTE
This manual is compatible with version 4.XX, where 4 denotes software version and XX software release. The indication 4.XX means that this manual is compatible with any release of software version 4.

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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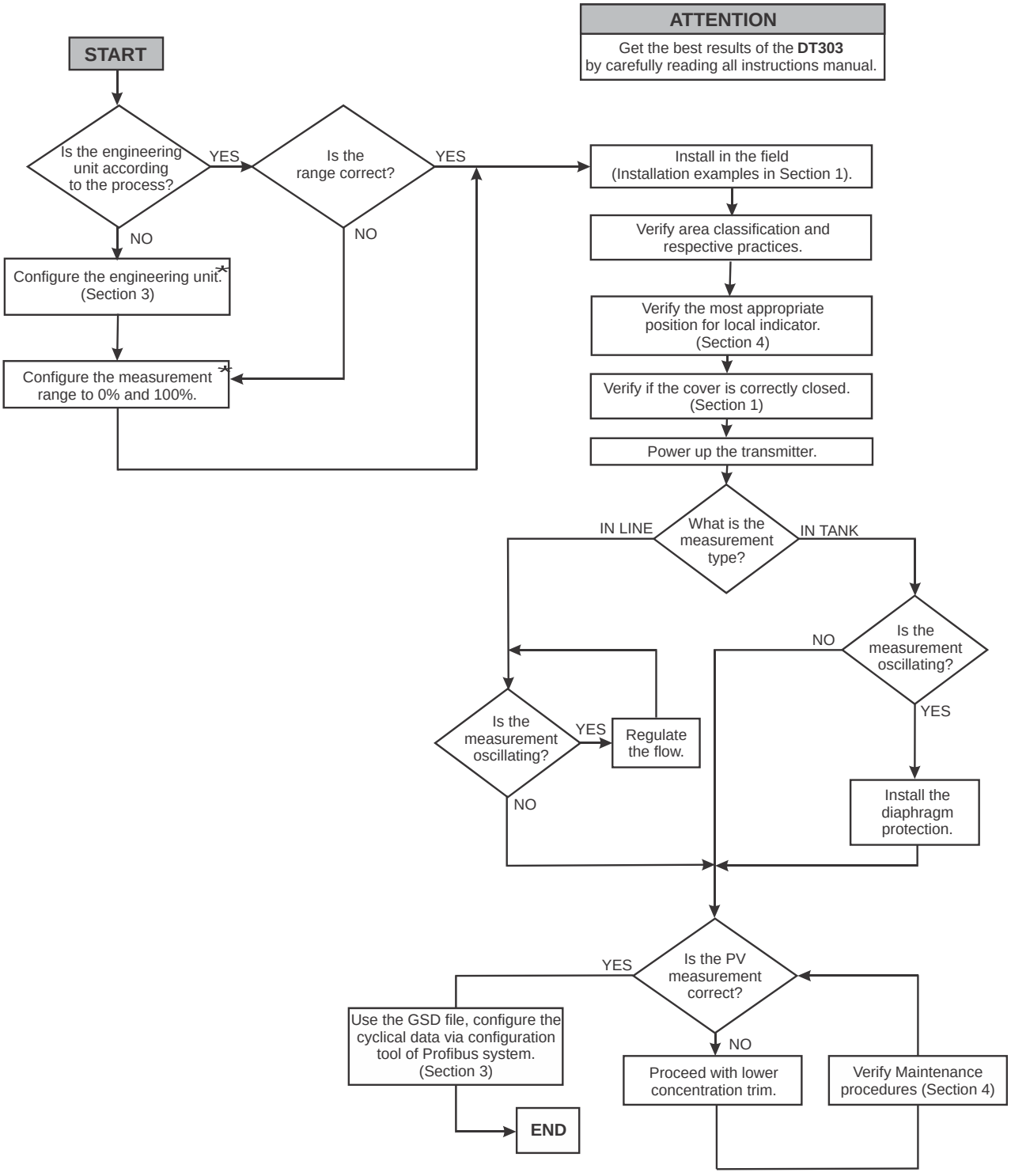
Installation Flowchart



* More information in Section 3 from DT303 Operation, Maintenance and Instructions Manual.
** Tip: The Brix of water is 0 (zero).

Section 1

INSTALLATION

General

The overall accuracy of a density measurement depends on several variables. Although the transmitter has an outstanding performance, proper installation is essential 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.

The **DT303** has a built-in temperature sensor to compensate temperature variations. At the factory, each transmitter is submitted to a temperature cycle process. The characteristics under different pressures and temperatures are recorded in the transmitter memory. At the field, this feature minimizes the temperature variation effect.

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

The transmitter should be installed in such a way as to avoid, as much as possible, direct exposure to the sun or any source of irradiated heat.

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 the o-rings are compressed.

Do not use tools to close the covers. Removal of the electronics cover in the field should be reduced to the minimum necessary, as each time it is removed; the circuits are exposed to the 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, since painting cannot protect these parts.

Although the transmitter is virtually insensitive to vibration, installation close to pumps, turbines or other vibrating equipment should be avoided.

Recommendation of using of DT303

The process fluid must always cover the two repeater diaphragms.

The maximum process fluid velocity over the two repeater diaphragms must be 0.3 m/s, what means a flow of 26 m^3/h in piping of ϕ"6. This information is according to fluids which viscosity is near of water viscosity. For fluids where the viscosity is very different of water viscosity should be analyzed. This limitation is due to the losing of load between the diaphragms.

For applications in corrosive fluids, compatible material with the process fluid must be chosen. Materials that are not in contact with the process but can be in contact with the corrosive atmosphere or process residues also must be considered.

Verify if a possible leak of fill fluid (unless than 5ml), due an orifice in the diaphragm can contaminate the process. If it is not permitted, please, chose a compatible fill fluid.

Verify if the fill fluid does not evaporate in the conditions of limit temperatures and limit pressures of the process.

Models of DT303

DT303I - Industrial Model, for general use.

DT303S - Sanitary Model, for food, pharmaceutical industries and other applications where is necessary sanitary conditions.

DT30XM – Immersion model, for applications where above models or larger tanks are not possible and allow the probe to be submerged.

The industrial model uses flanged connection according to the standard ASME B16.5 or DIN 2526.

The sanitary model uses Tri-Clamp connection, allowing a fast connection to the process. The treatment of wet superficial is made according to the standard of rough 32 Ra. This method is according to the recommendation of 3A standard that is the sanitary standard largely used by food, medicines, and drink industries.

Mounting

DT303I and **DT303S** models have two mounting types: top mounting (straight type) and side mounting (curved type).

For **DT303M** only straight type configuration is possible.

The Figures 1.1 to 1.4 show the dimensions of the **DT303** straight and curved types for industrial and sanitary models. The **DT303M** dimensions are in the figures 1.5 and 1.6. The dimensions are in millimeters (inches).

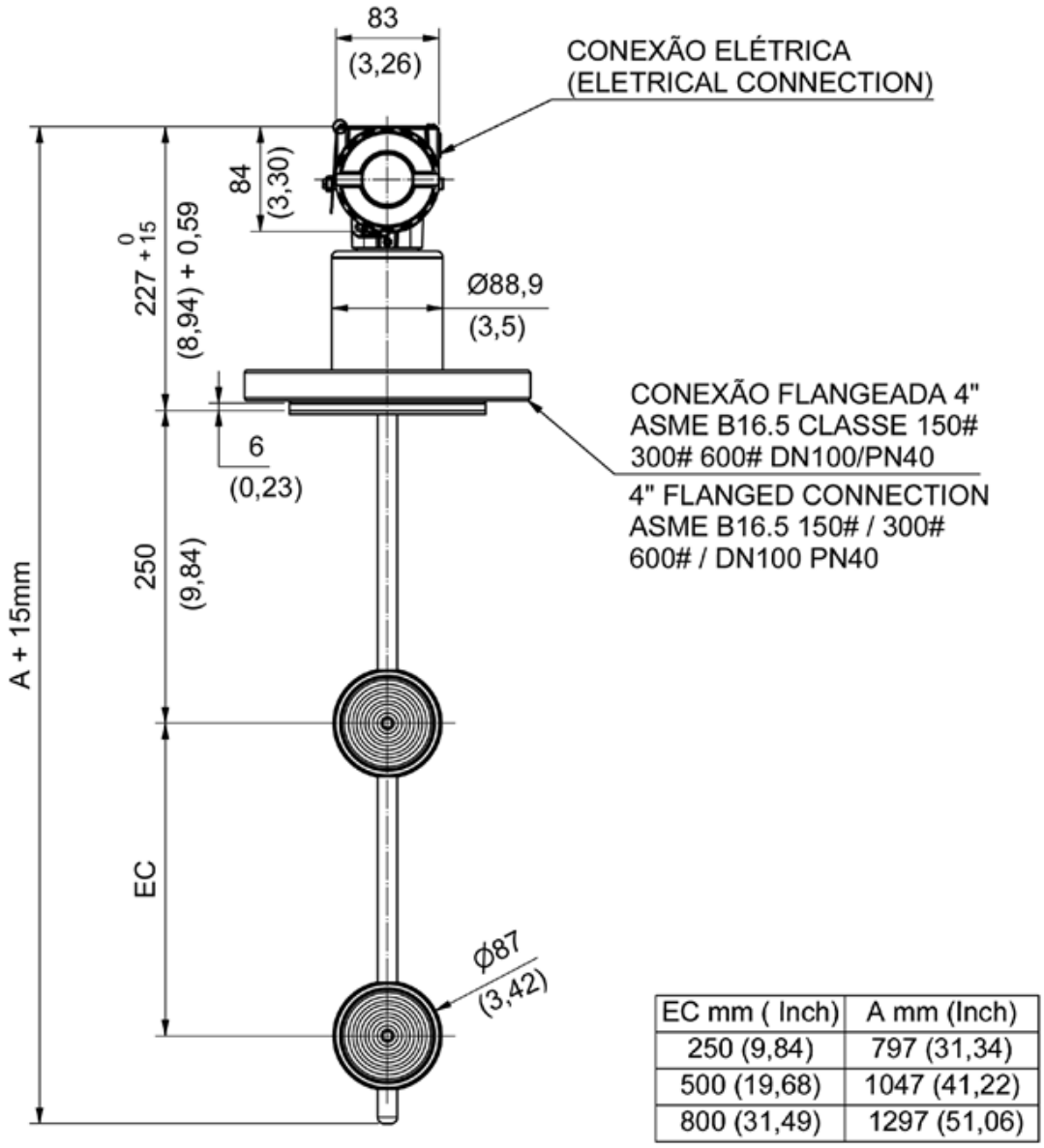
The installation can be done in open or pressurized tanks or through a sampling device, external to the process.

The Figures 1.7 up to 1.21 show some mounting examples. The dimensions are in millimeters.
Choose a place for installation that facilitates the access for the measuring point and that be free from mechanical shocks.

Use a valve in the process connection before the **DT303**. This simplifies the calibration and maintenance of the equipment.

IMPORTANT
For device, installed in areas not covered by CEPEL, it must be demands strictly followed respective certificate.

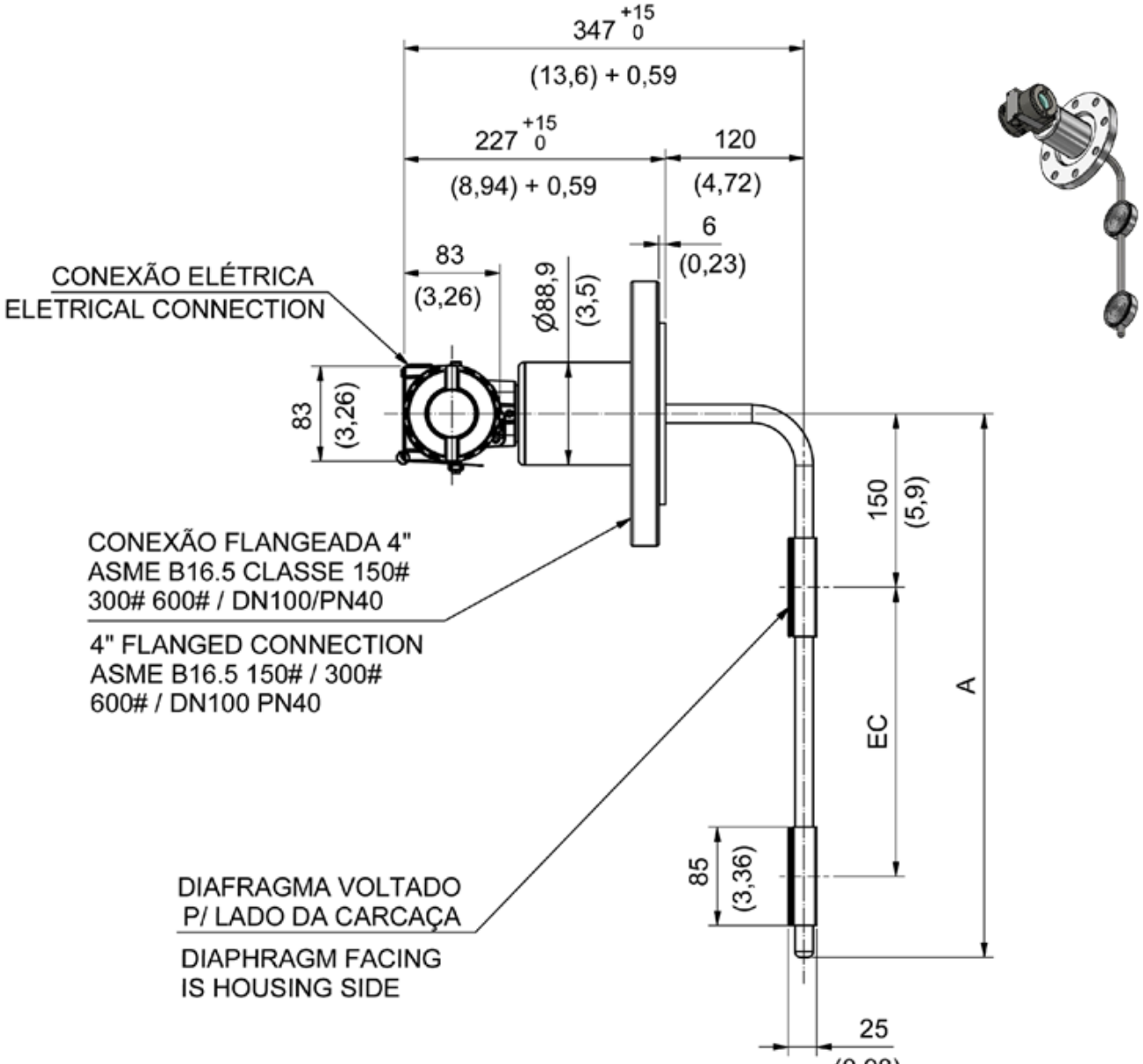
A – Industrial Model - Straight Type



EC mm (Inch)	A mm (Inch)
250 (9,84)	797 (31,34)
500 (19,68)	1047 (41,22)
800 (31,49)	1297 (51,06)

Figure 1.1 – DT303 Dimensional

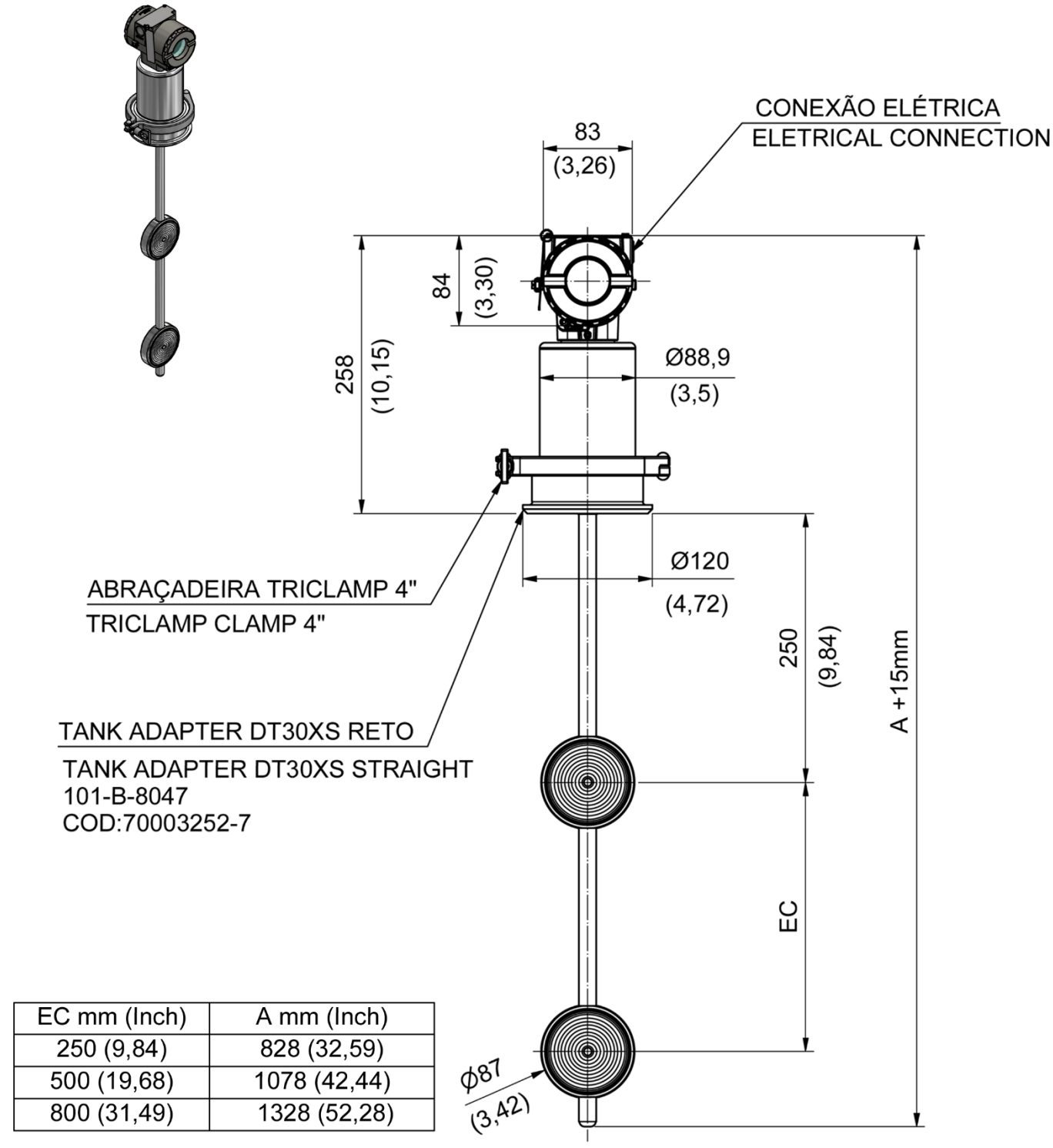
B – Industrial Model - – Curved Type



EC mm (Inch)	A mm (Inch)
250 (9,84)	470 (18,5)
500 (19,68)	720 (28,34)
800 (31,49)	970 (38,19)

Figure 1.2 – DT303 Dimensional

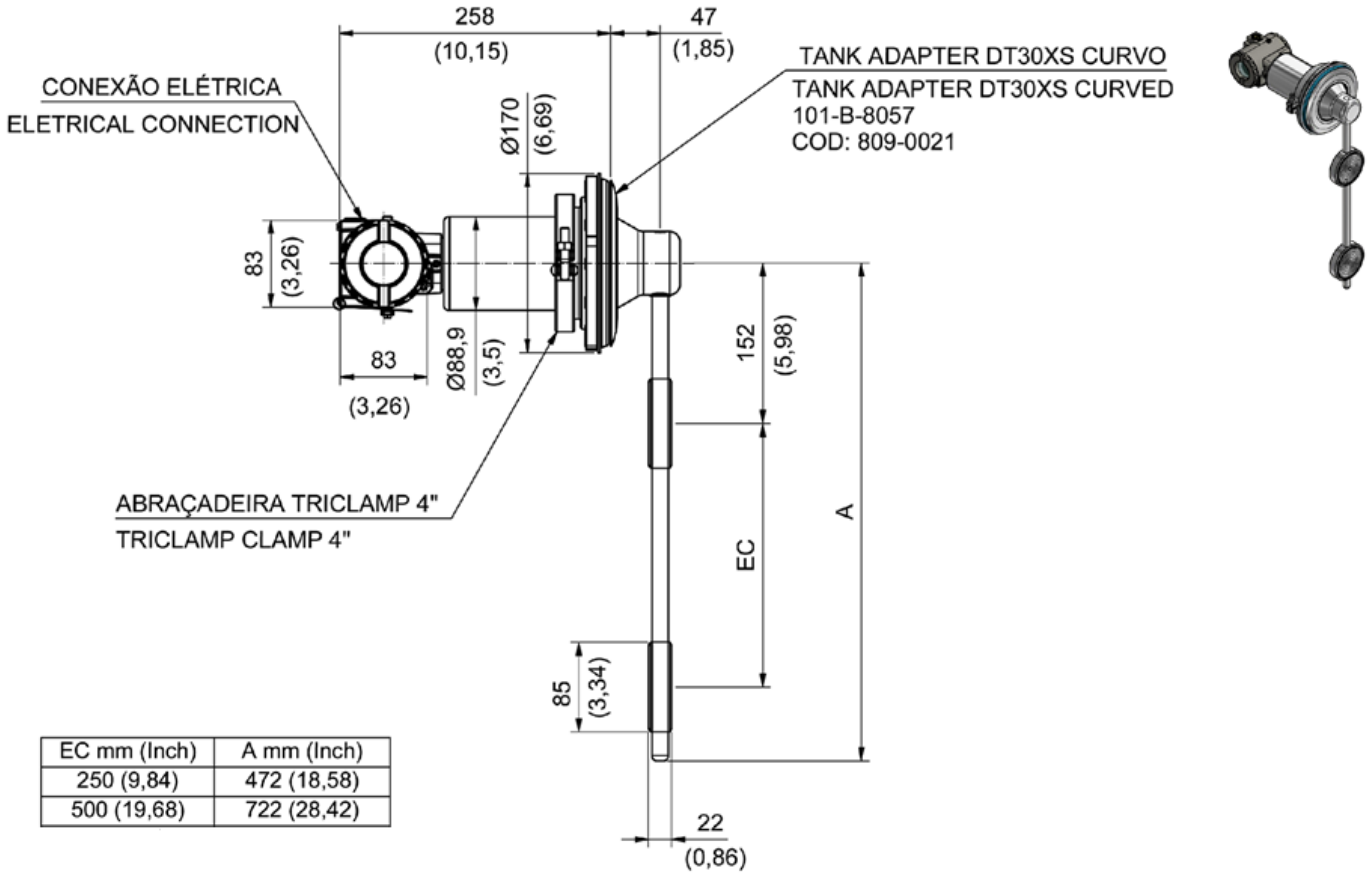
C – Sanitary Model - - Straight Type



EC mm (Inch)	A mm (Inch)
250 (9,84)	828 (32,59)
500 (19,68)	1078 (42,44)
800 (31,49)	1328 (52,28)

Figure 1.3 – DT303 Dimensional

D – Sanitary Model - Curved Type



EC mm (Inch)	A mm (Inch)
250 (9,84)	472 (18,58)
500 (19,68)	722 (28,42)

Figure 1.4 – DT303 Dimensional

E - DT30XM Model (Stainless Steel Tubular Rod)

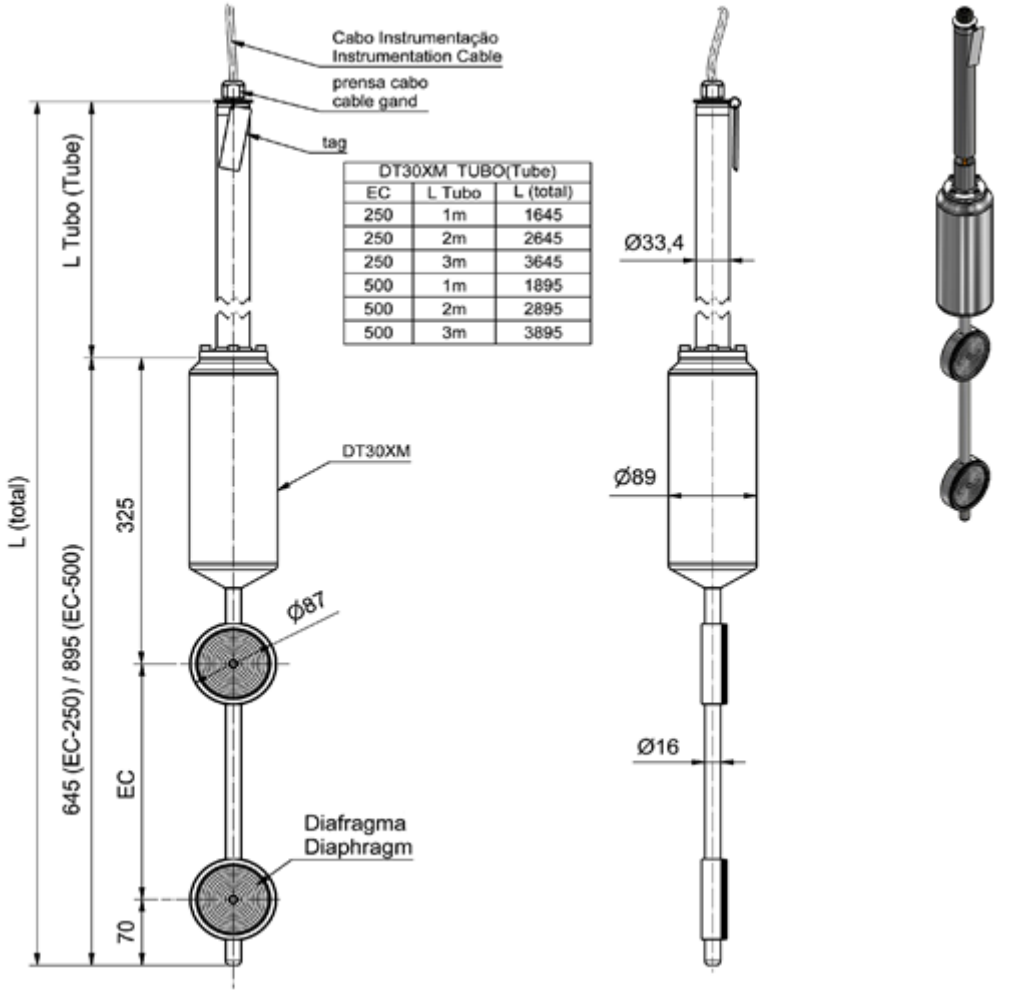
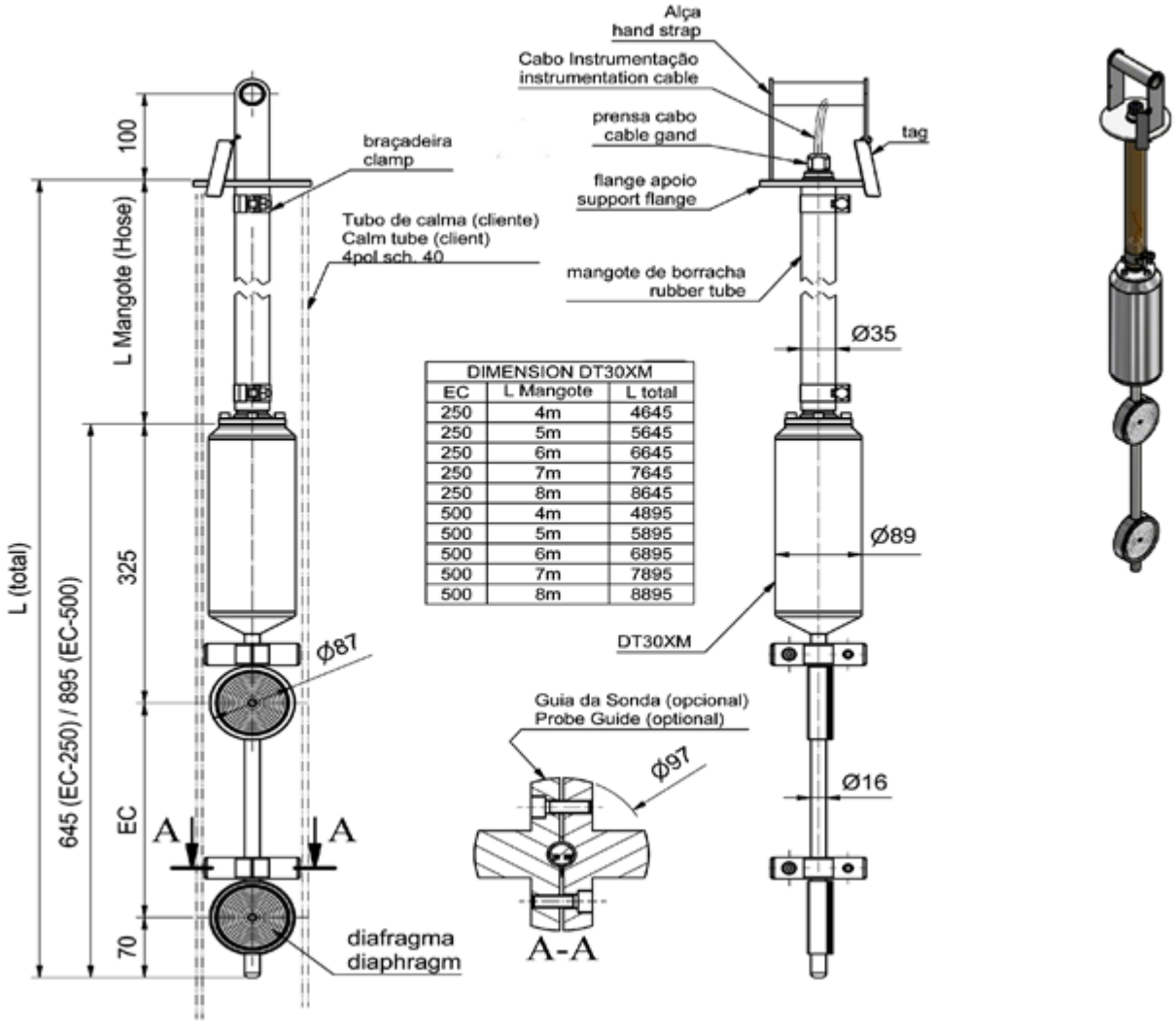


Figure 1.5 – DT303 Dimensional

F – DT30XM Model (Hose Rod)



DIMENSION DT30XM		
EC	L Mangote	L total
250	4m	4645
250	5m	5645
250	6m	6645
250	7m	7645
250	8m	8645
500	4m	4895
500	5m	5895
500	6m	6895
500	7m	7895
500	8m	8895

Figure 1.6 – DT303 Dimensional

A – Typical Installation for Standpipe Tank

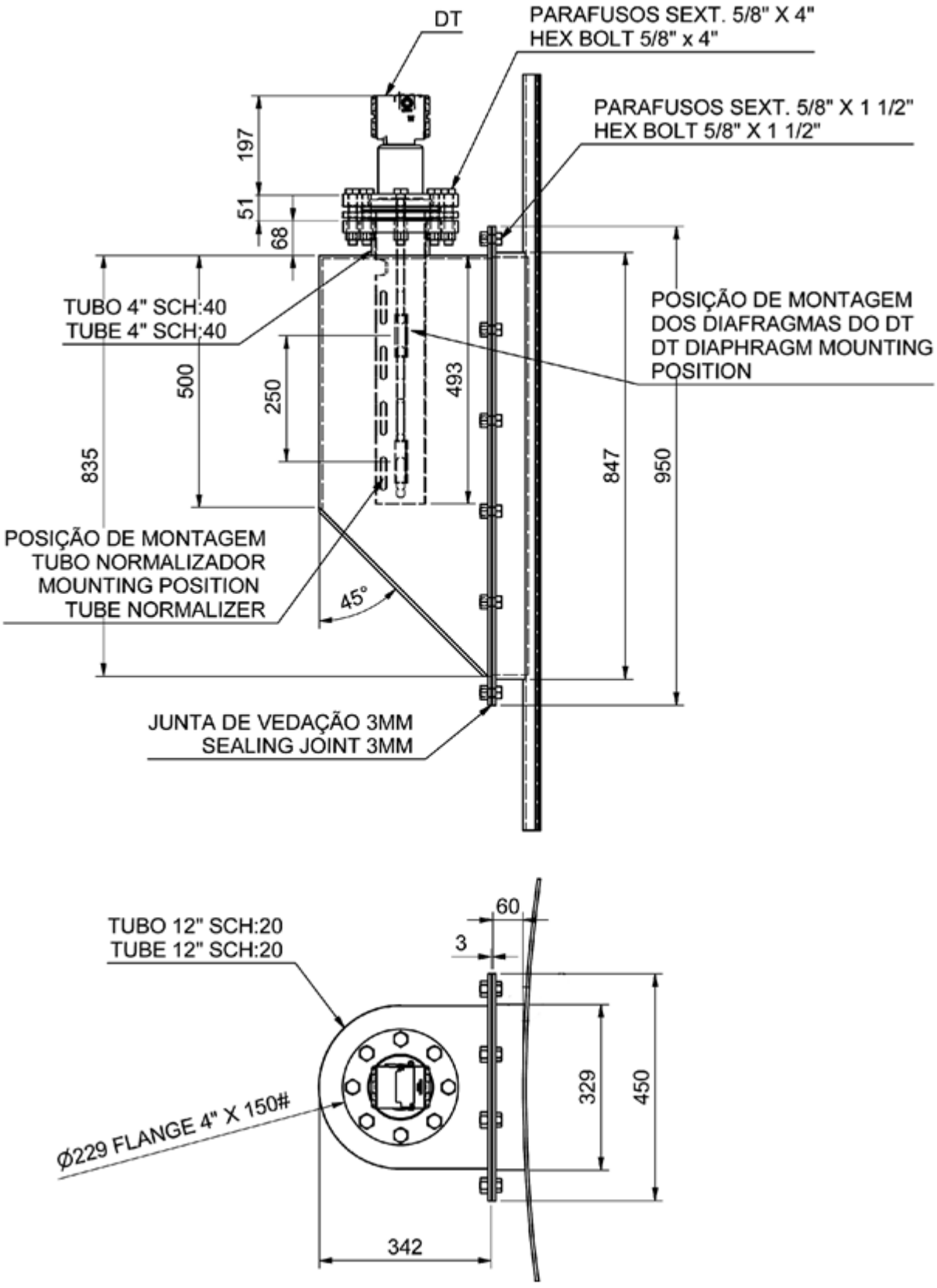


Figure 1.7 – Typical Installation for DT303

B – Typical Installation for 6¨ Up Flow Tank with Normalizer Tube

MAXIMUM FLOW =15m^3/h

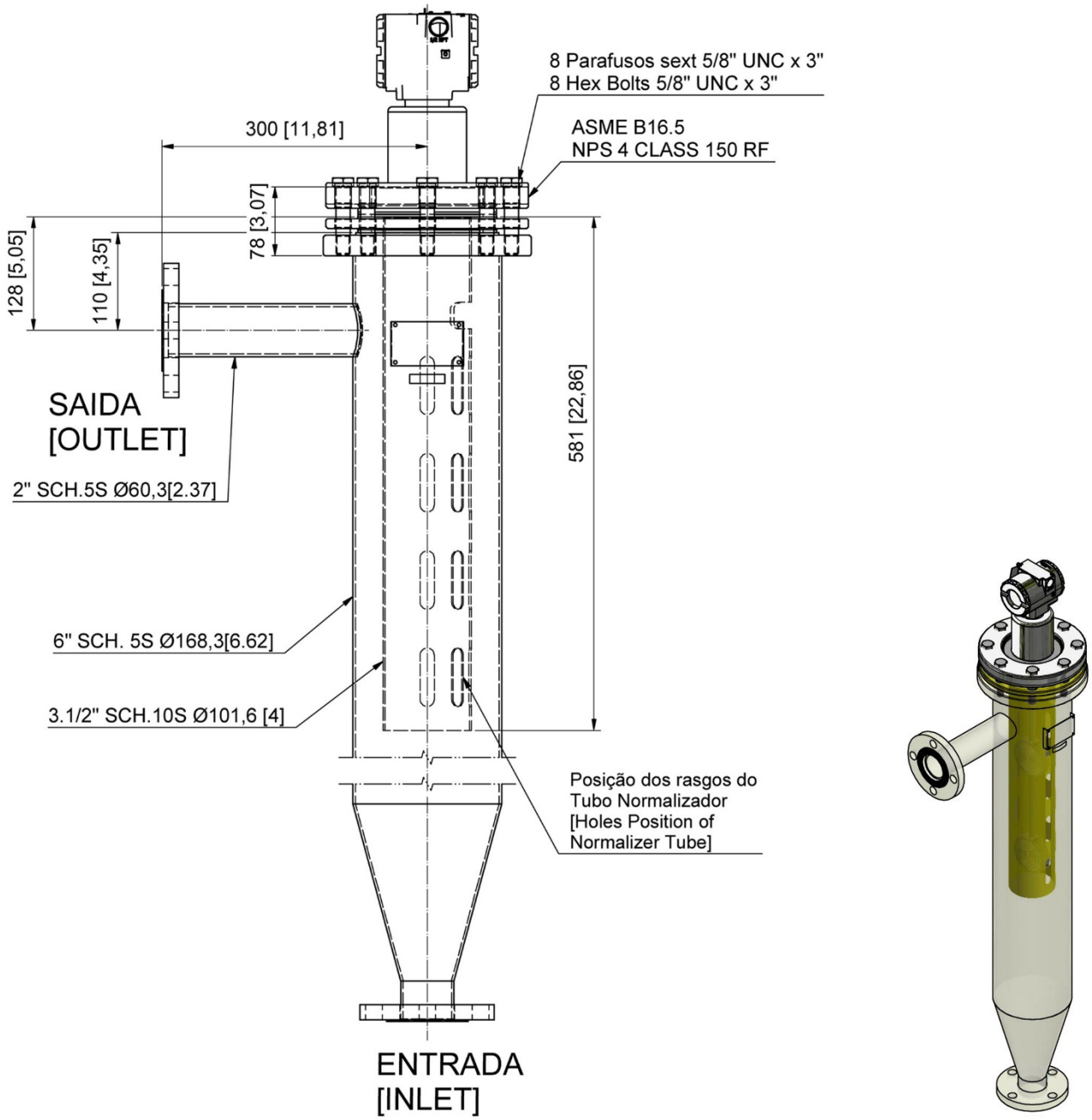


Figure 1.8 – Typical Installation for DT303 (C)

C – Typical Installation for Up Flow Tank of Overflow With Normalizer Tube

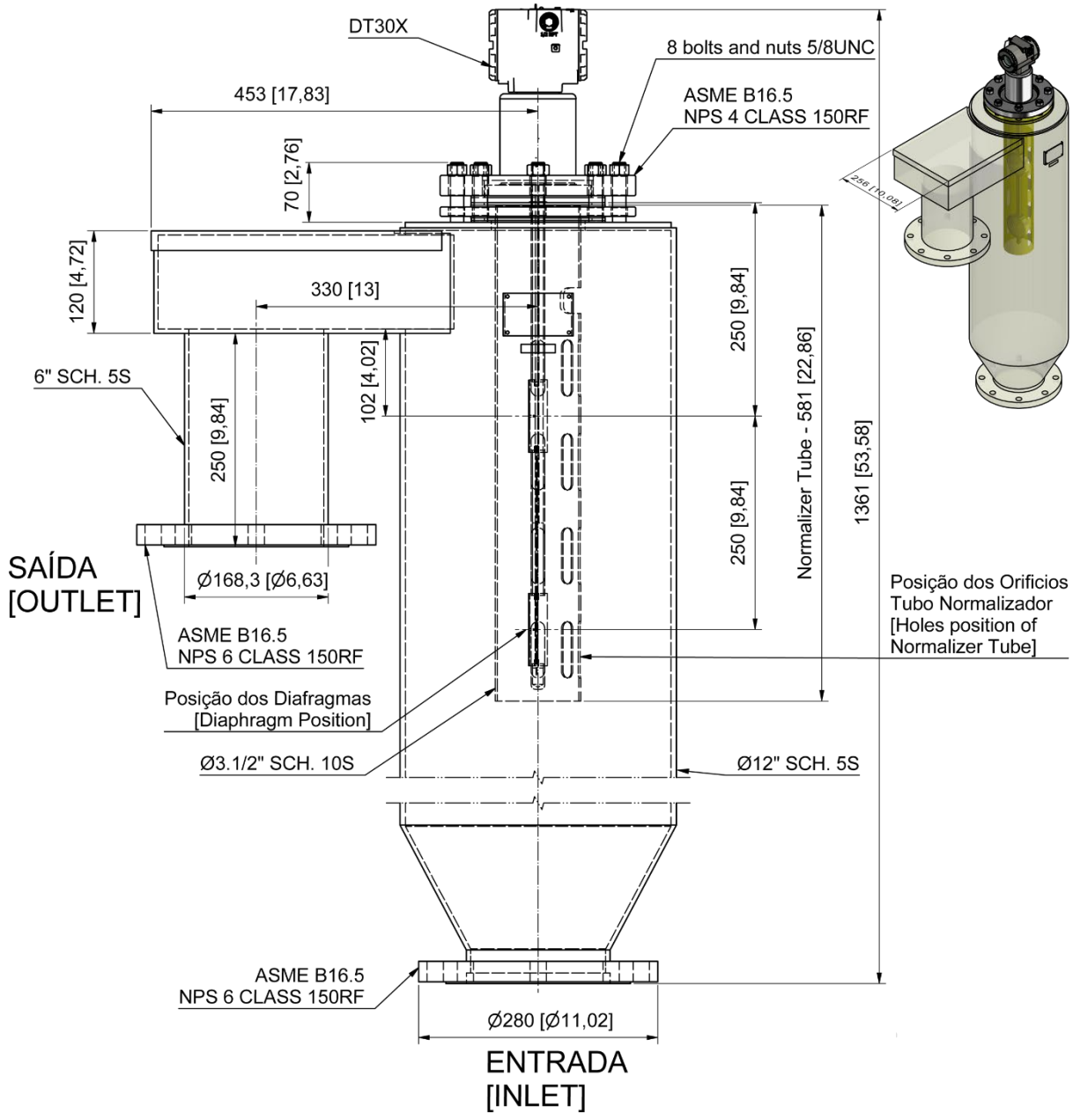


Figure 1.9 – Typical Installation for DT303

D – Typical Installation for 6 Up flow Tank – Sanitary Model

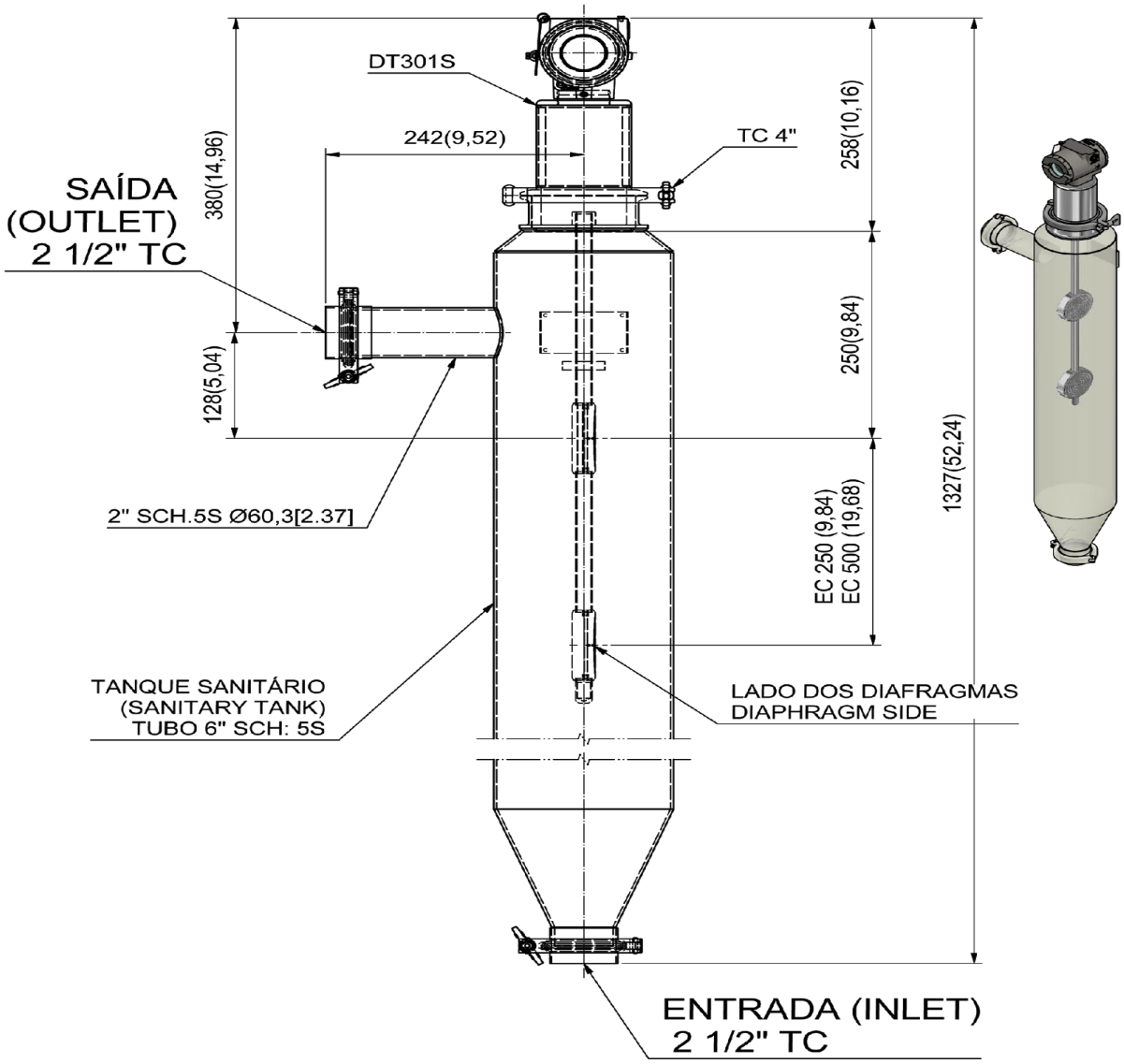


Figure 1.10 – Typical Installation for DT303

E – Typical Installation for 6¨ Up Flow Tank

MAXIMUM FLOW =15m^3/h

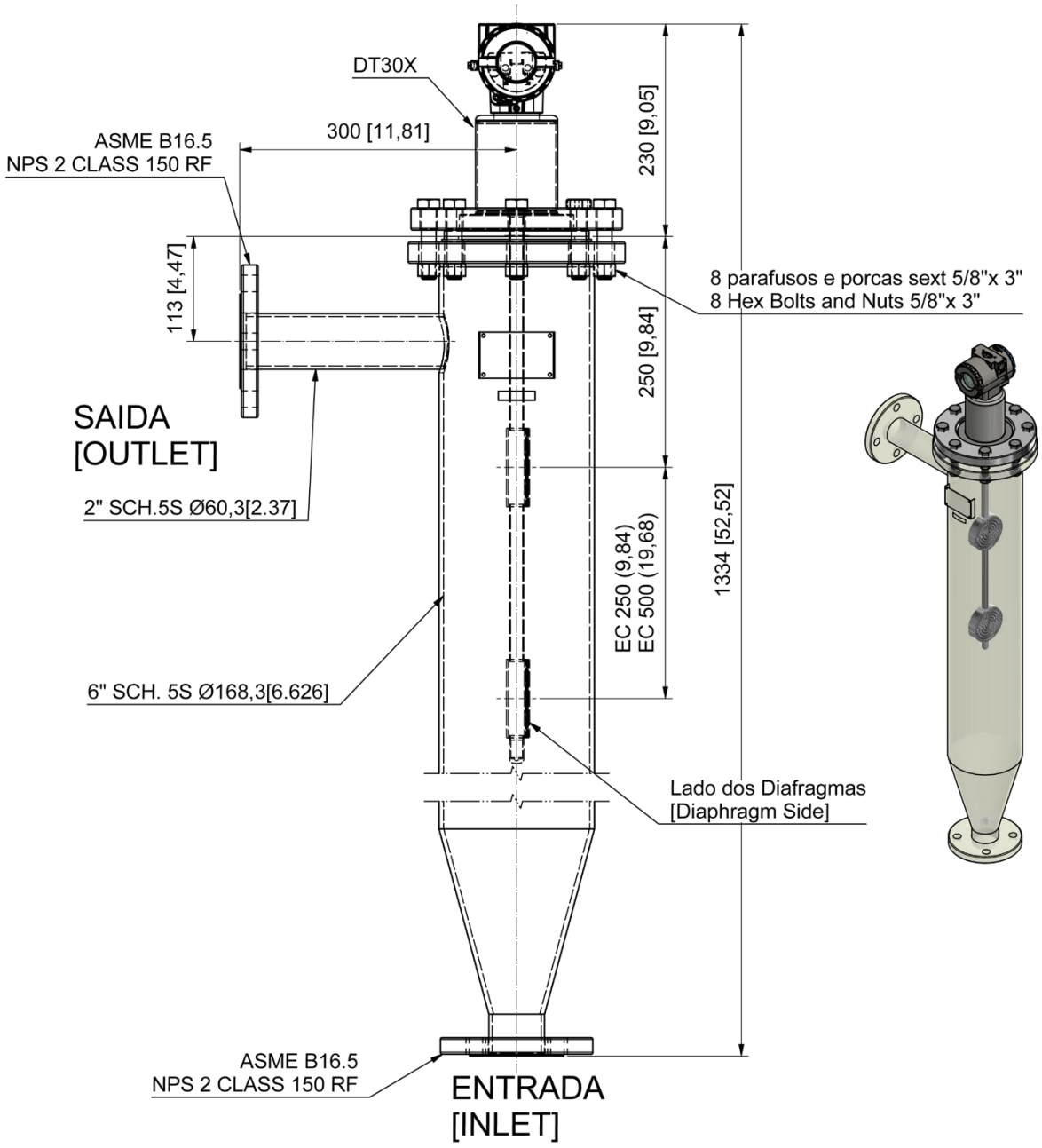


Figure 1.11 – Typical Installation for DT303

F - Typical Installation for 8¨ Up Flow Tank

MAXIMUM FLOW =27 m^3/h

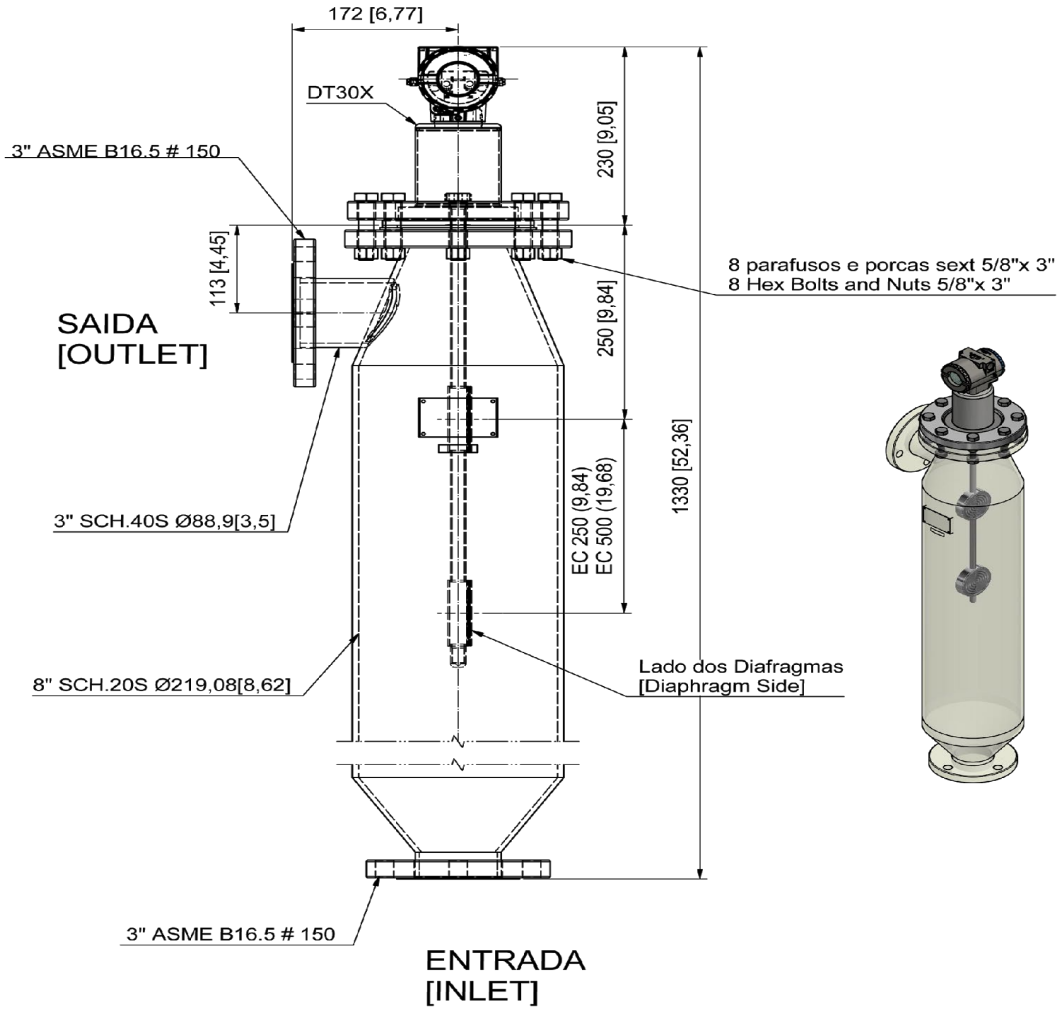


Figure 1.12 – Typical Installation for DT303

G - Typical Installation for 8¨ Up Flow Rubberized Tank

MAXIMUM FLOW =27 m^3/h

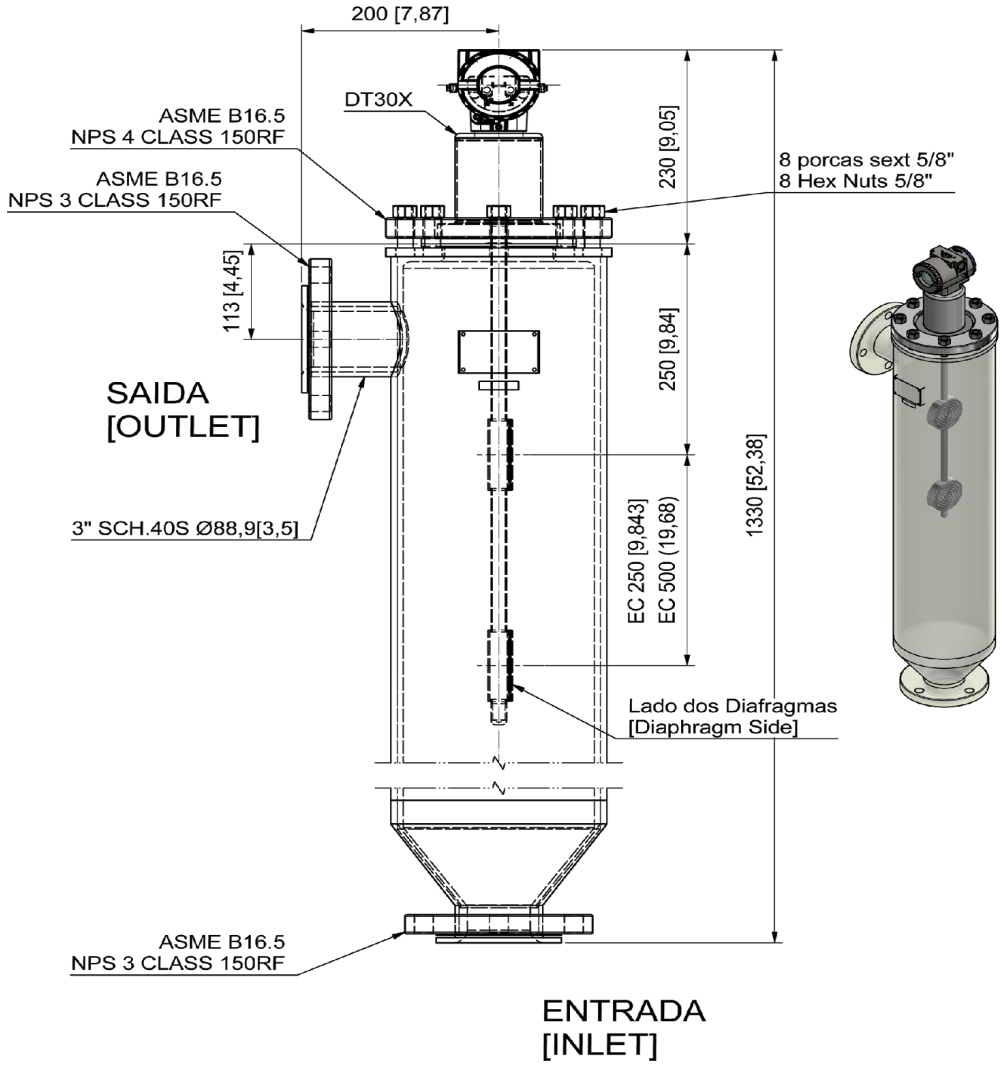


Figure 1.13 – Typical Installation for DT303

H - Typical Installation for 12¨ Up Flow Tank of Overflow

MAXIMUM FLOW =65 m^3/h

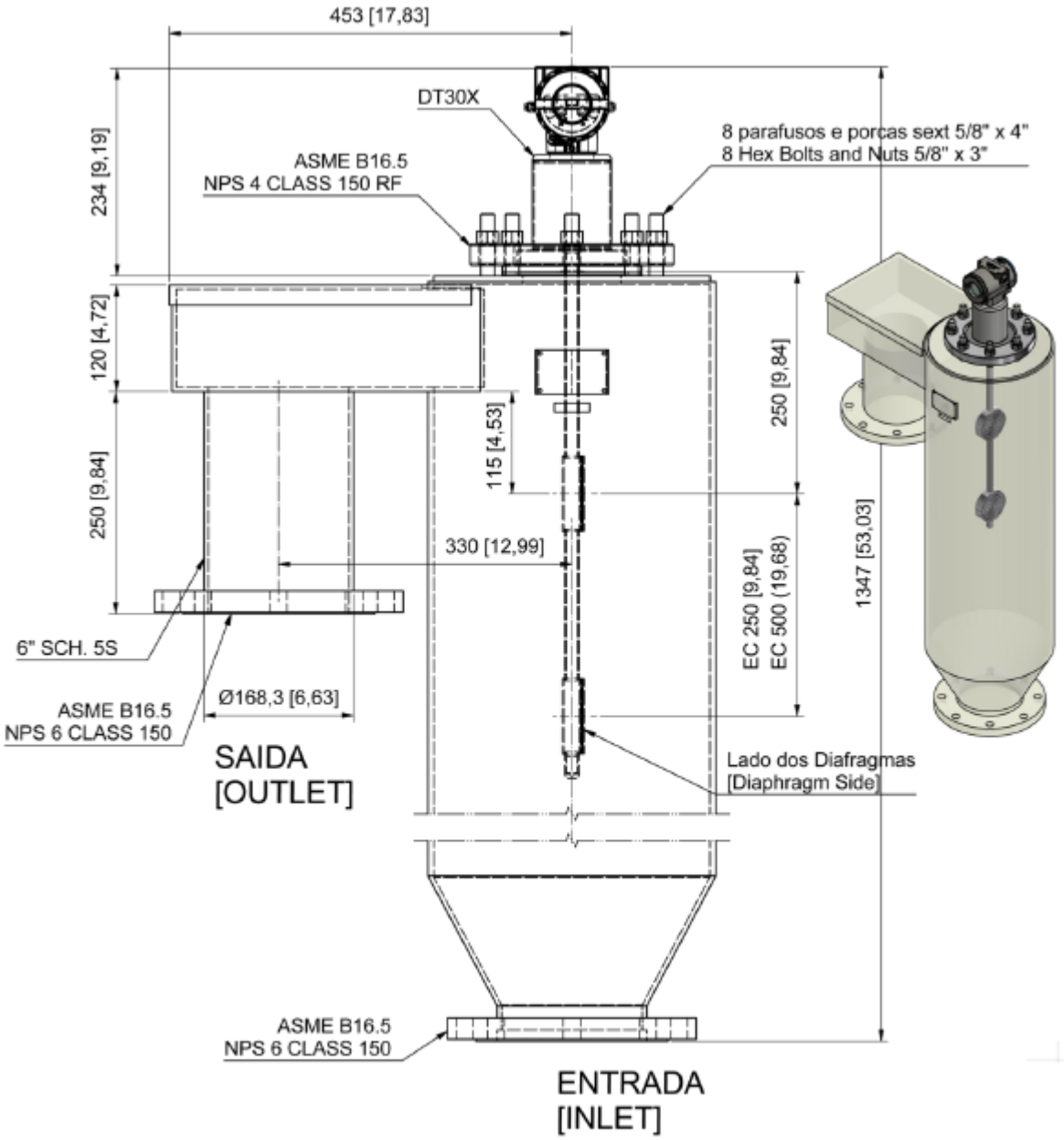


Figure 1.14 – Typical Installation for DT303

I - Typical Installation for 12¨ Up Flow Rubberized Split Tank

MAXIMUM FLOW =65 m^3/h

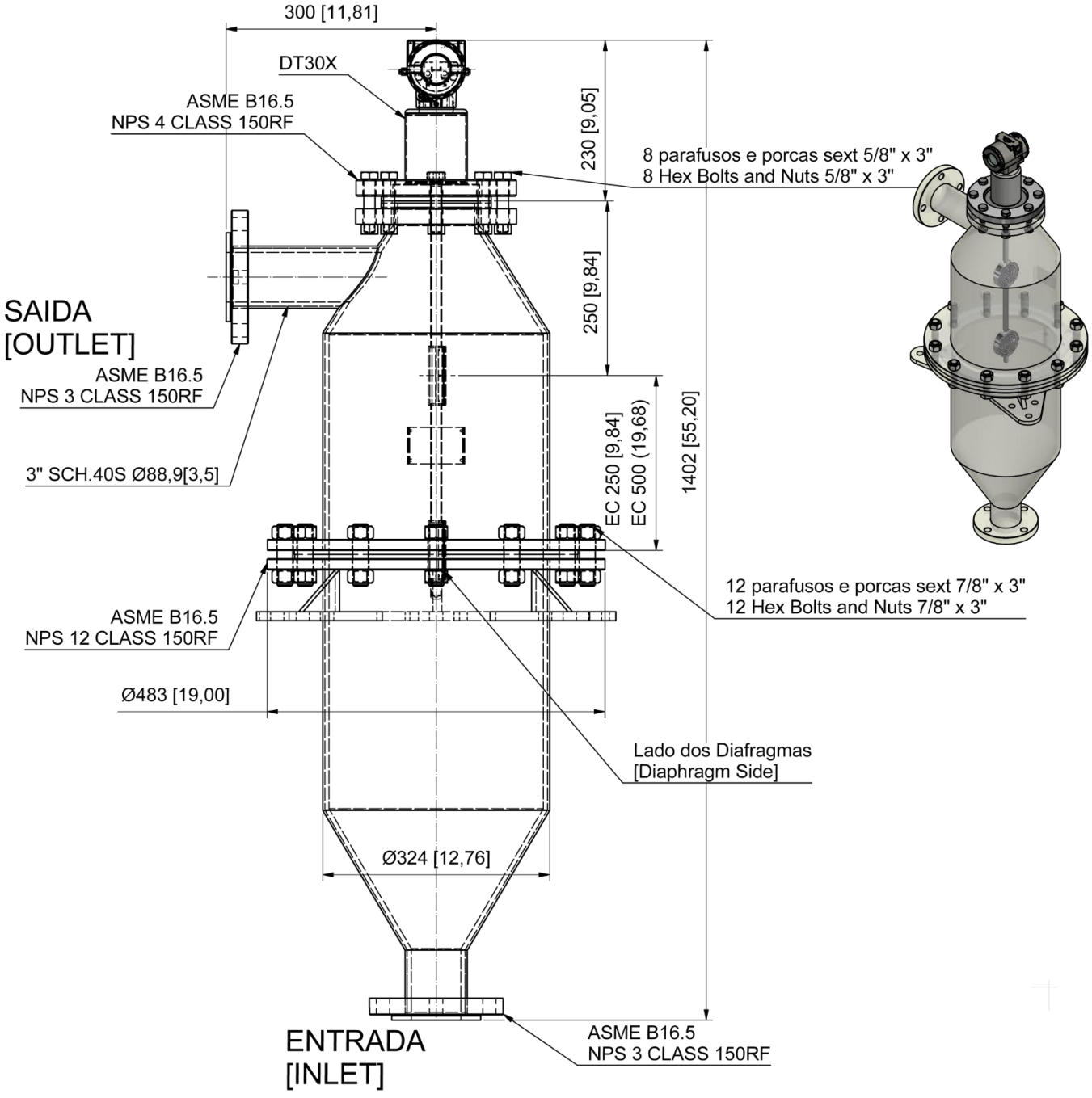


Figure 1.15 – Typical Installation for DT303

J -Typical Installation in Tank (Industrial Model)

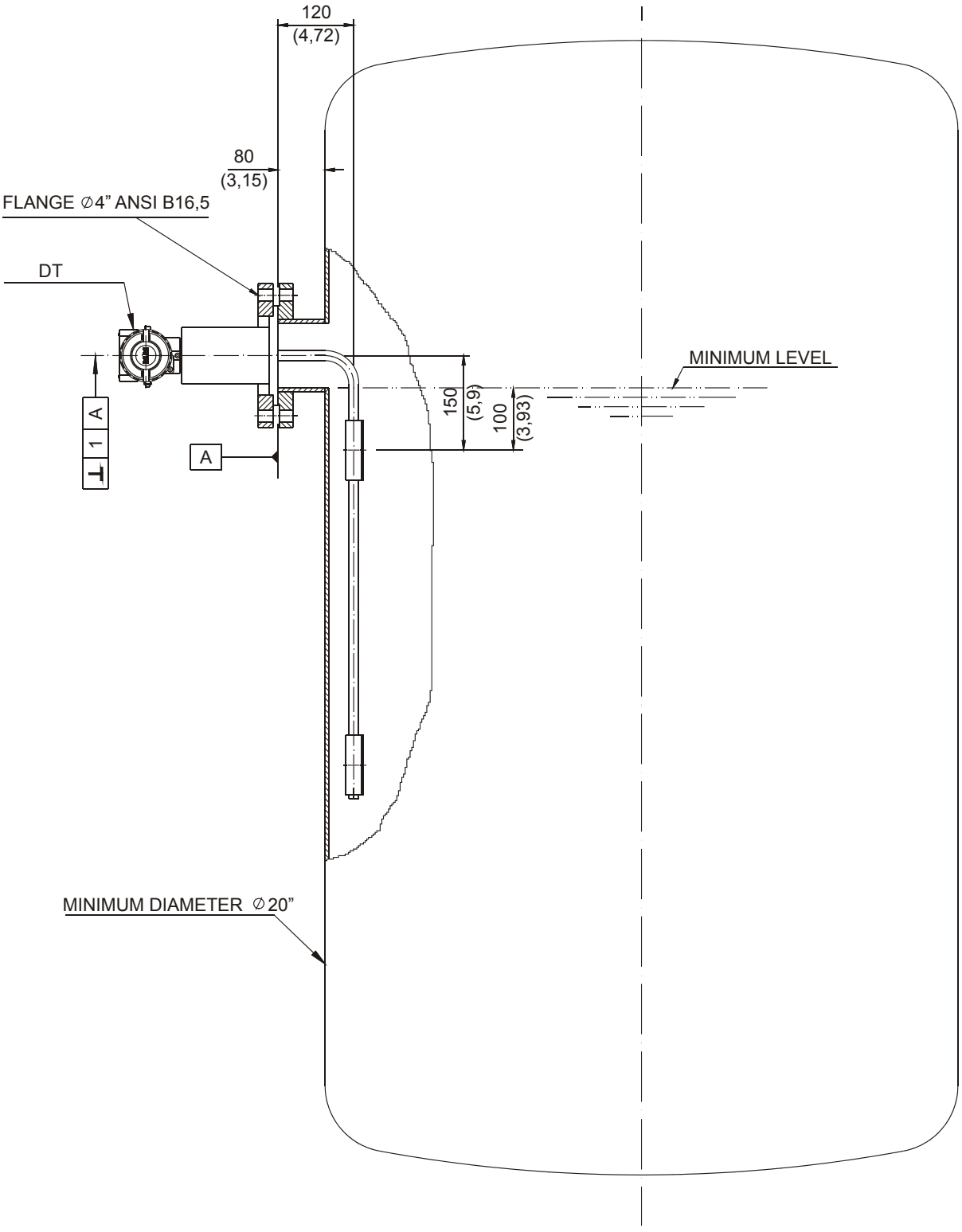


Figure 1.16 – Typical Installation for DT303

K - Typical Installation in Tank (Sanitary Model)

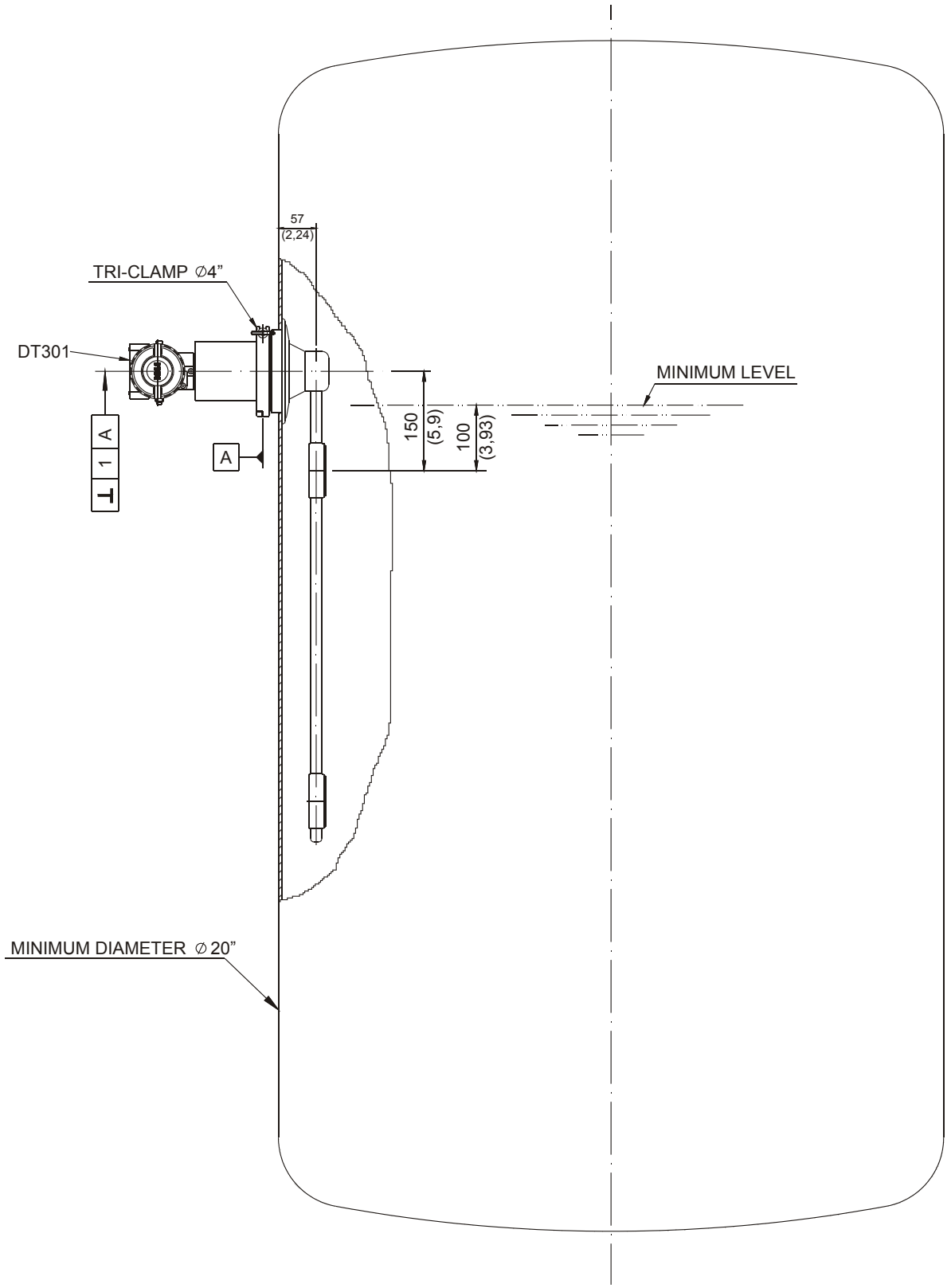


Figure 1.17 – Typical Installation for DT303

L - Typical Installation in Tank with Diaphragm Protection (Industrial Model)

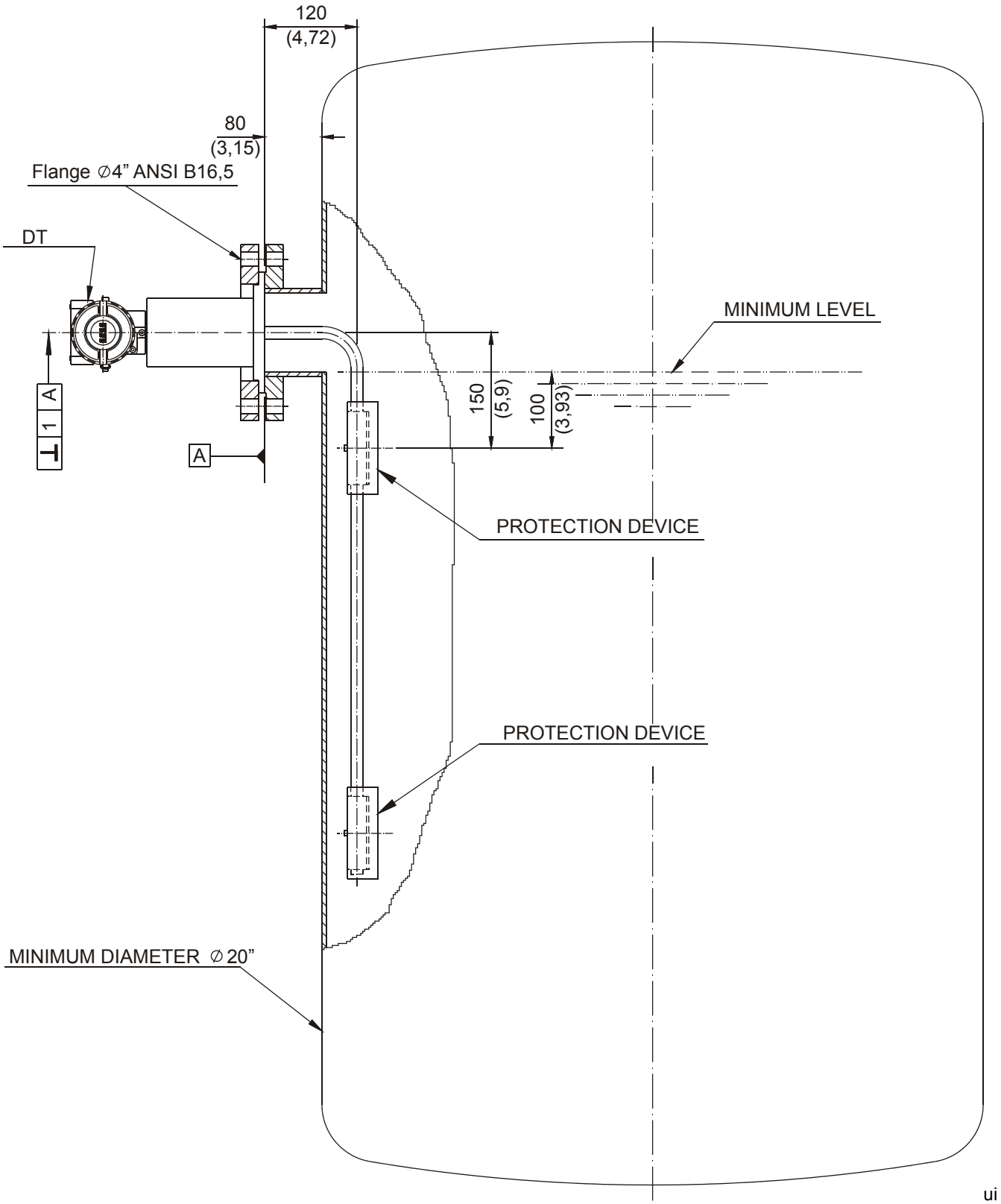


Figure 1.18 – Typical Installation for DT303

M - Typical Installation for Low Flow Tank with Bubble Breaker (Industrial Model)

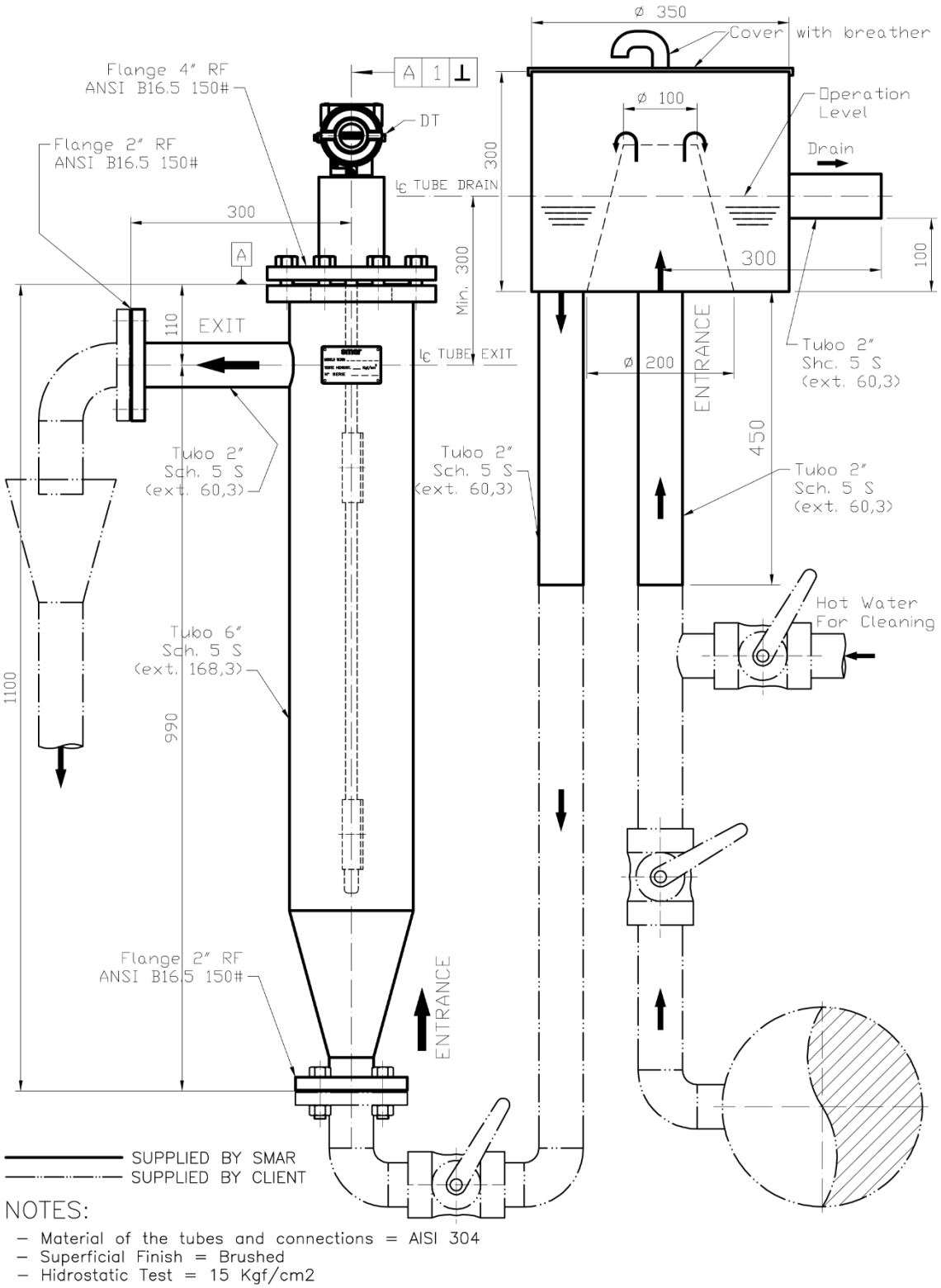


Figure 1.19 – Typical Installation for DT303

N - Typical Installation in Tank for Level Interface (Industrial Model)

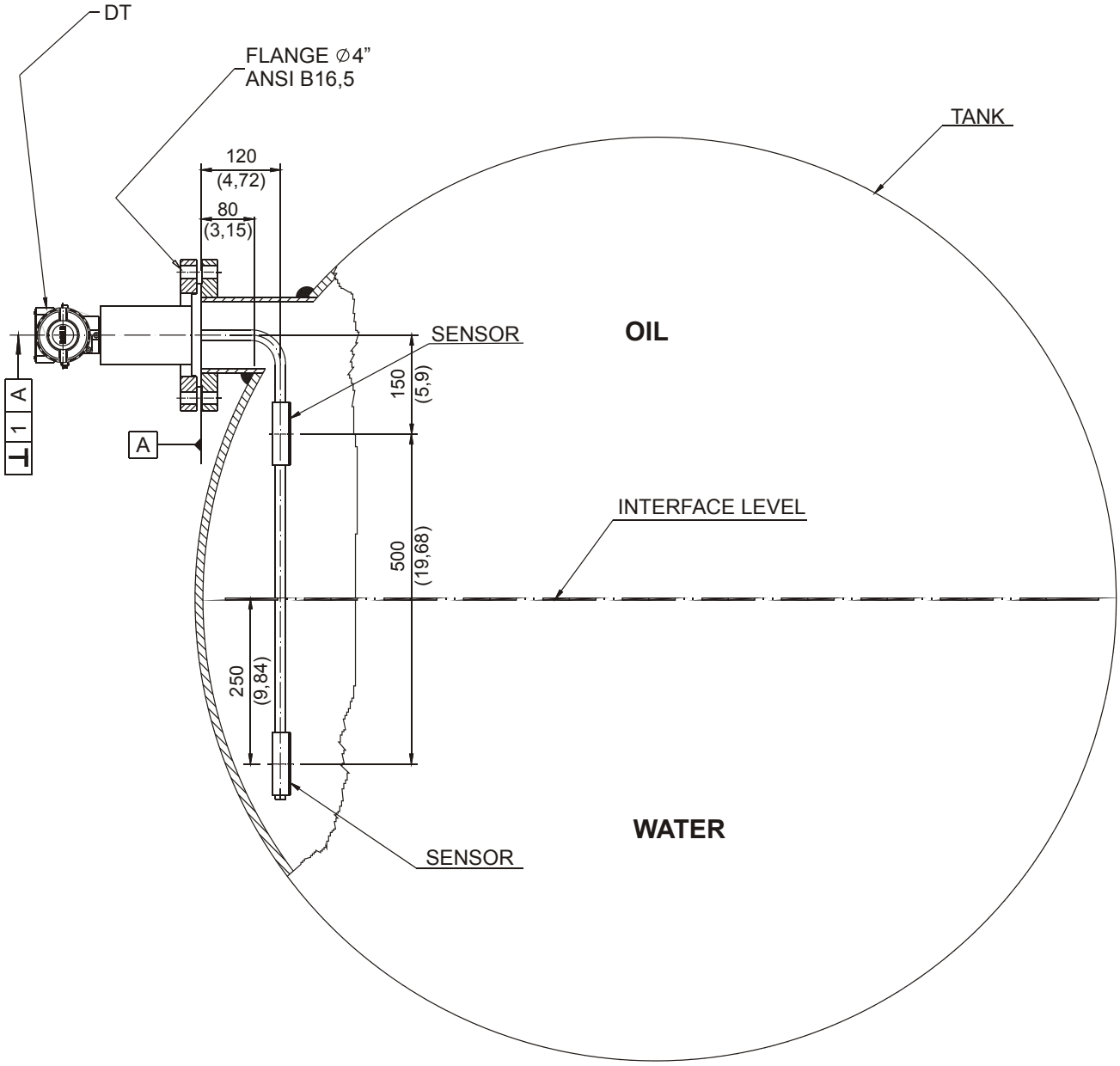


Figure 1.20 – Typical Installation for DT303

O - Typical Installation in Tank for Level Interface Stand Pipe (Industrial Model)

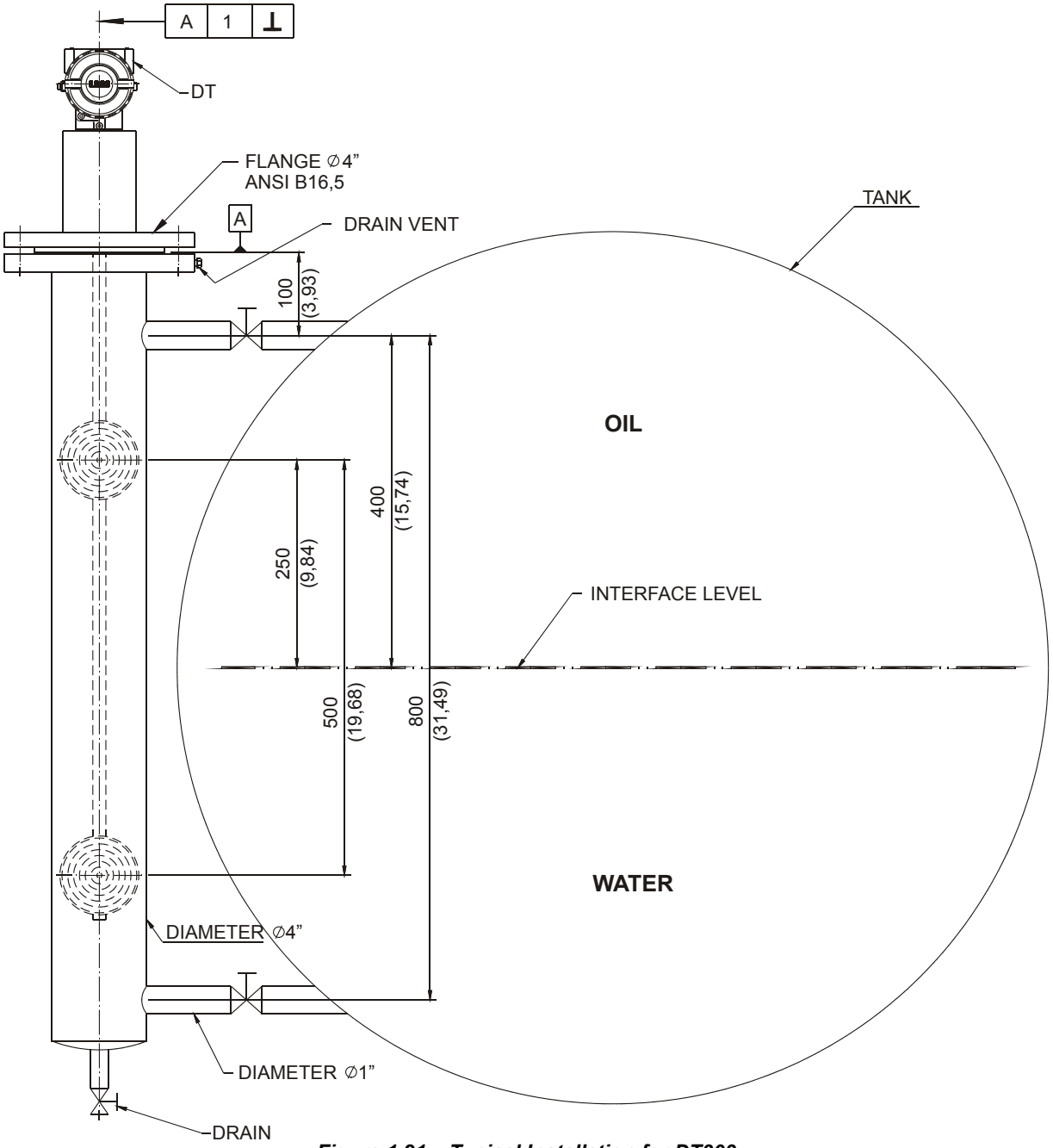


Figure 1.21 – Typical Installation for DT303

Housing Rotation

The housing can be rotated to get the digital display in better position. To rotate it, releases the housing rotation set screw. See figure 1.22.

The digital display can also be rotated. See figure 4.2.

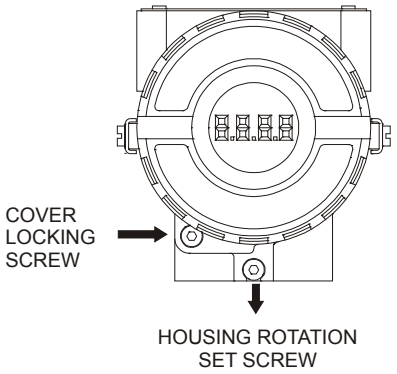


Figure 1.22 - Housing Rotation Set Screw

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

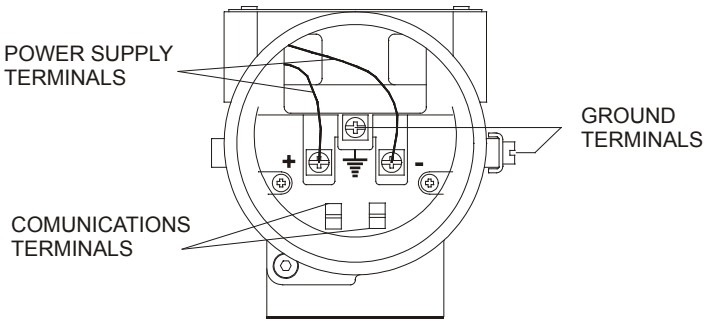


Figure 1.23 - Terminal Block

The **DT303** 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 **DT303** is powered via bus. The limit for such devices is according to the DP/PA coupler limitation for one bus for non-intrinsically safe requirement.

In hazardous area, the number of devices may be limited by intrinsically safe restrictions, according to the DP/PA coupler and barriers limitation.

The **DT303** is protected against reverse polarity, and can withstand ±35 VDC without damage, but it will not operate when in reverse polarity.

It is recommended to use twisted pair cables. The shield must also be grounded only at one end. The ungrounded end must be carefully insulated.

Bus Topology and Network Configuration

Wiring

Other types of cable may be used, other than for conformance testing. Cables with improved specifications may enable longer trunk length or superior interface immunity. Conversely, cables with inferior specifications may be used subject to length limitations for trunk and spurs plus possible nonconformance to the RFI/EMI susceptibility requirements. For intrinsically safe applications, the inductance/ resistance ratio (L/R) should be less than the limit specified by the local regulatory agency for the implementation.

Bus topology (see figure 1.24) and tree topology (see figure 1.25) are supported. Both types have a trunk cable with two terminators. The devices are connected to the trunk via spurs. The spurs may be integrated in the device giving zero spur length. A spur may connect more than one device, depending on the length. Active couplers may be used to extend spur length.

Active repeaters may be used to extend the trunk length.

The total cable length, including spurs, between any two devices in the Fieldbus should not exceed 1900m.

The couplers connection must be between 15 and 250m. In following figures, the DP/PA link depends on the application needs.

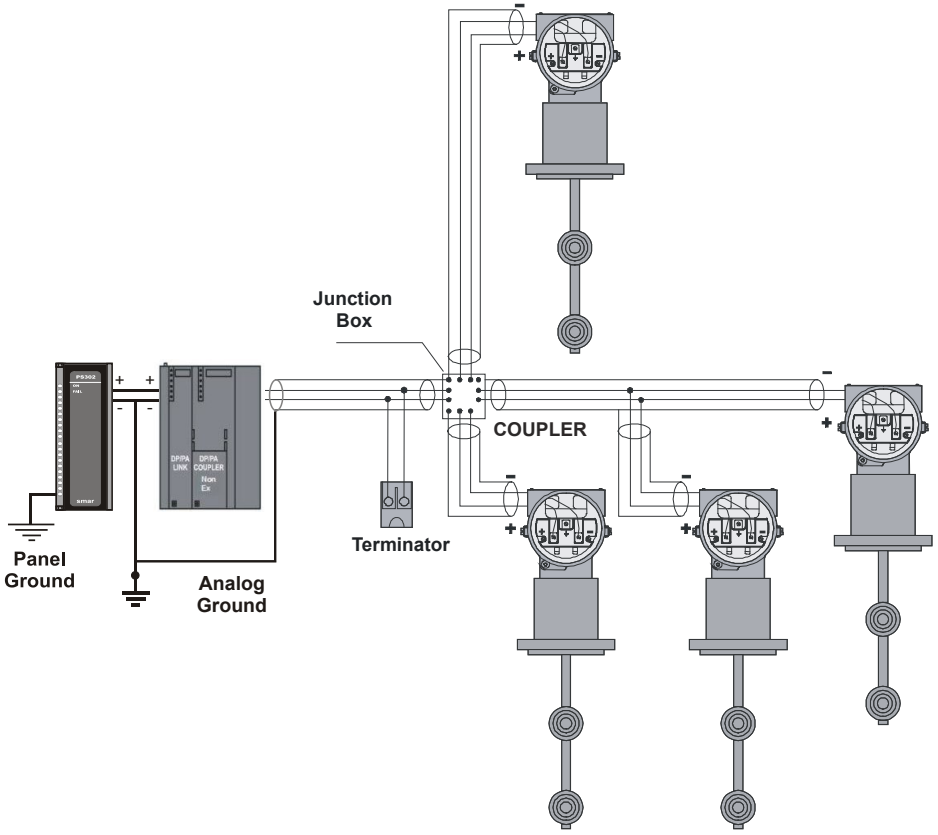


Figure 1.24 - Bus Topology

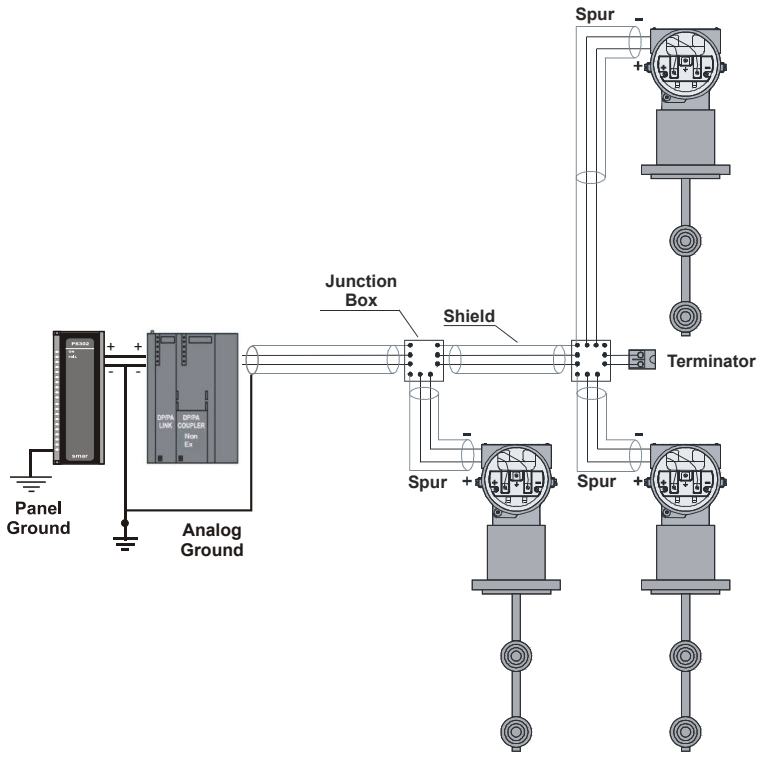


Figure 1.25 - Tree Topology

Intrinsic Safety Barrier

When the Fieldbus is in hazardous location with Explosive Atmosphere, the protection type “intrinsic safety (Ex-i)” can be used with a barrier inserted on the trunk between the power supply and the Fieldbus bus. Use of DF47-12 or DF47-17 is recommended.

Jumper Configuration

To work properly, the jumpers J1 and W1 located in the **DT303** main board must be correctly configured (see table 1.1).

J1	This jumper enables the simulation mode parameter in the AI block.
W1	This jumper enables the local adjustment programming tree.

Table 1.1 - Description of the Jumpers

Power Supply

The **DT303** receives power from the bus via signal wiring. The power supply may come from a separate unit or from another device such as a controller or DCS.

The voltage should be between 9 to 32 Vdc for non-intrinsic safe applications. A special requirement applies to the power supply used in an intrinsically safe bus and depends on the type of barrier used.

Use of PS302 is recommended as power supply.

Installation in Hazardous Areas

See Appendix A for certifications information.

OPERATION

The **DT303** Concentration/ Density Transmitters uses capacitive sensors (capacitive cells) as pressure sensing elements. (See figure 2.1). This is the same sensor as the DT301 series uses, the sensor modules are therefore interchangeable.

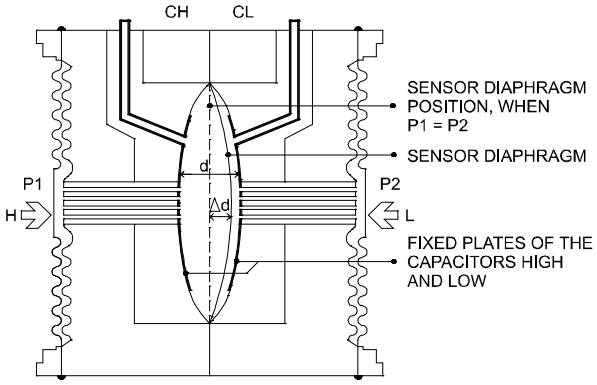


Figure 2.1 - Capacitive Cell

Functional Description - Sensor

Where:
P_1 and P_2 are the pressures and $P_1 \geq P_2$.
CH = Capacitance between the fixed plate on P_1 side and the sensing diaphragm.
CL = Capacitance between the fixed plate on P_2 side and the sensing diaphragm.
d = Distance between CH and CL fixed plates.
Δd = Sensing diaphragm's deflection due to the differential pressure $\Delta P = P_1 - P_2$.

Knowing that the capacitance of a capacitor with flat, parallel plates may be expressed as a function of plate area (A) and distance (d) between the plates:

$$C \approx \frac{\varepsilon \times A}{d}$$

Where,
ε = Dielectric constant of the medium between the capacitor's plates.

$$CH \approx \frac{\varepsilon \times A}{(d/2) + \Delta d} \text{ and } \frac{\varepsilon \times A}{(d/2) - \Delta d} \approx CL$$

However, should *CH* and *CL* be considered as capacitances of flat and parallel plates with identical areas, then:
However, should the differential pressure (ΔP) applied to the capacitive cell not deflects the sensing diaphragm beyond d/4; it is possible to assume ΔP as proportional to Δd, that is:

$$\Delta P \propto \Delta \mathrm{d}$$

By developing the expression (CL - CH)/ (CL + CH), it follows that:

$$\frac{CL - CH}{CL + CH} = \frac{2\Delta d}{d}$$

As the distance (d) between the fixed plates CH and CL is constant. It is possible to conclude that the expression (CL - CH)/(CL + CH) is proportional to Δd and, therefore, to the differential pressure to be measured. Thus, it is possible to conclude that the capacitive cell is a pressure sensor formed by two capacitors whose capacitances vary according to the differential pressure applied.

Functional Description – Electronics

Refer to the block diagram (See figure 2.2). The function of each block is described below.

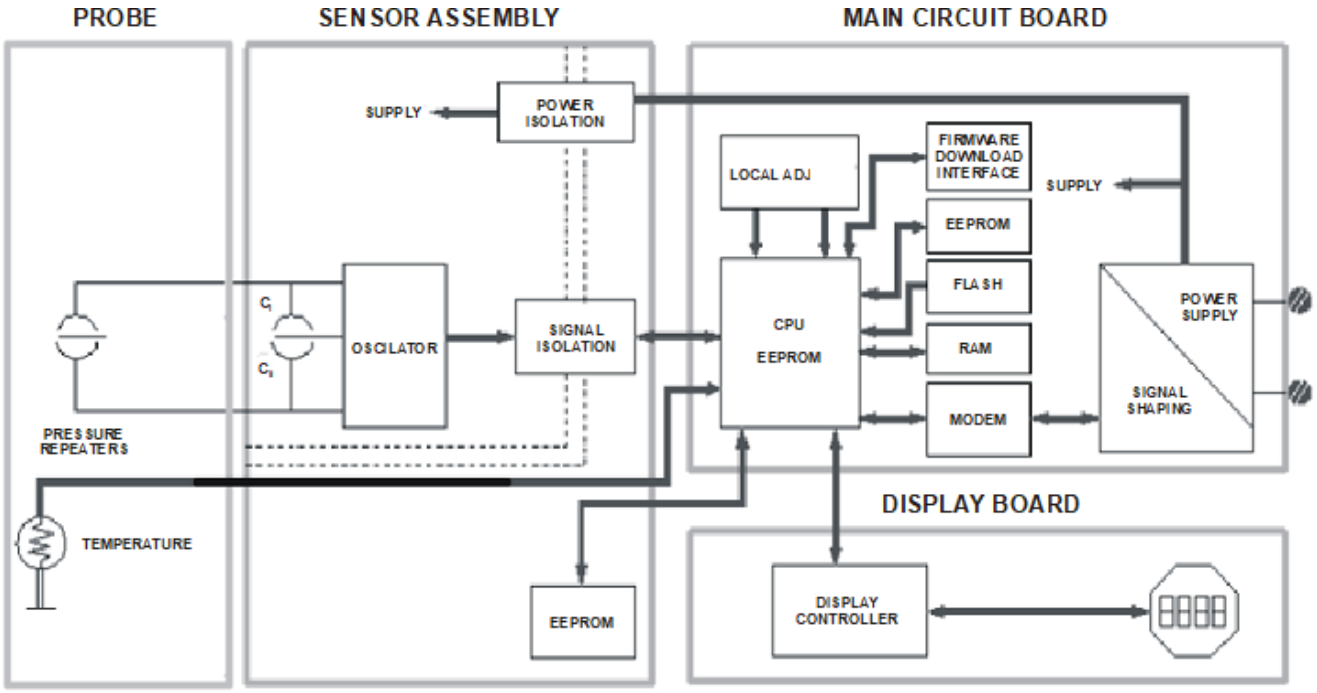


Figure 2.2 - DT303 Block Diagram Hardware

Probe
Part of the transmitter that is directly in contact with the process.

Pressure Repeaters
Transfers to the capacitive sensor the differential pressure detected in the process.

Temperature Sensor
Captures the process fluid temperature.

Oscillator
Generates a frequency as a function of sensor capacitance.

Signal Isolator
The control signals from the CPU and the signal from the oscillator are isolated to avoid ground loops.

Central Processing Unit (CPU), RAM, FLASH 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 FLASH memory for easy upgrade and saving data on power-down event occurrence. For temporary storage of data there is a RAM. The data in the RAM is lost if the power is switched off, however the main board has a nonvolatile EEPROM memory where the static data configured that must be retained is stored. Examples of such data are the following: calibration, links, and identification data.

Sensor EEPROM
Another EEPROM is located within the sensor assembly. It contains data pertaining to the sensor's characteristics at different pressures and temperatures. This characterization is done for each sensor at the factory. It also contains the factory settings; they are useful in case of main board replacement when it does an automatic upload of data from the sensor board to main board.

Fieldbus Modem
Monitors line activity, modulate and demodulate communication signals, inserts and deletes start and end delimiters and checks integrity of frame received.

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

Power Isolation
Isolates the signals to and from the input section, the power to the input section must be isolated.

Display Controller
Receives data from the CPU identifying which segments on the liquid crystal Display use to turn on. The controller drives the backplane and the segment control signals.

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

Display

The indicator, constituted by the liquid crystal display, can show one or two variables in according to the user's selection. When it is shown two variables, the indicator will alternate between both with an interval of approximately 3 seconds.

Beyond the numeric and alphanumeric fields, the display shows some alphanumeric icons to indicate the transmitter states. The figure 2.3 shows the segment configuration used by DT303 transmitter.

Monitoring

The DT303 transmitter is continually in the monitoring mode. In this mode, the indication at the display alternates between the primary and secondary variable, according to the user's configuration. The indicator has the capacity to show the value, the engineering unit, and the variable type, simultaneously with most of the state indications. See in the figure 2.4 a sample of a DT303 standard indication.

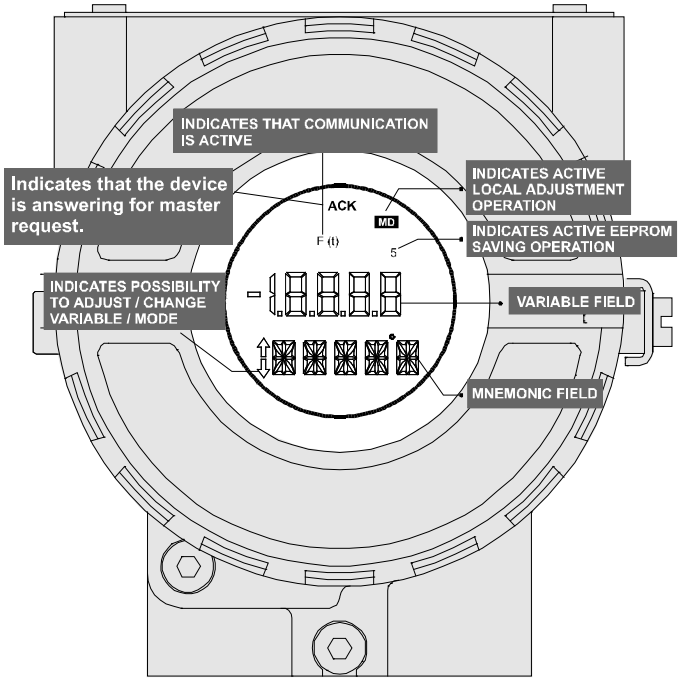


Figure 2.1 - LCD Indicator

Figure 2.4 – Typical Monitoring Mode Display Showing PV, in this case 25.0 BRIX

CONFIGURATION

This section describes the characteristics of the blocks in the **DT303**. They follow the Profibus PA specifications, such as transducer blocks, analog input, and display.

The 303 Smar families are integrated in ProfibusView from Smar and Simatic PDM from Siemens. It is possible to integrate any 303 Smar devices into any configuration tool for Profibus PA devices. It is necessary to provide a Device Description or Drive according to the configuration tool. In this manual is taken several examples using ProfibusView and Simatic PDM.

To assure correct values in the offline configuration, first run “Download to PG/PC” option to assure valid values. After, run the Menu Device option to configure the required parameters using the related menus.

NOTE
In offline configuration, it is not recommended to use the “Download to Device” option. This function can misconfigure the equipment.

DT303 Cyclical Configuration

PROFIBUS-DP as well as PROFIBUS-PA foresees protocol mechanisms against communication failures and errors and, as an example, during the initialization, several errors sources are verified.

After the power up the field equipment (slaves) are ready for the cyclical data exchange with the Class1 master, but, for that, the master parameterization for the correspondent slave must be correct. This information is obtained through the GSD files, which should be one for each device.

Through the commands below, the master executes every initialization process with PROFIBUS-PA devices:

- Get_Cfg: carries the slaves’ configuration and verifies the net configuration;
- Set_Prm: writes in the slaves' parameters and executes net parameterization services;
- Set_Cfg: configures the slaves according to inputs and outputs;
- Get_Cfg: a second command, where the master will verify the slaves' configuration.

All these services are based on the information obtained of GSD slaves' files.

The GSD file of DT303 presents details of hardware revision and software, bus timing of the device and information on cyclical data exchange. For previous version to 2.00, the DT303 has one AI block. For version 2.00 or higher, the DT303 has three AI blocks: AI1, AI2 and AI3.

The three AI blocks are (the GSD file, smar0905a.gsd must be used):
1° AI Block: for concentration unit configuration;
2° AI Block: for density unit configuration;
3° AI Block: for temperature unit configuration.

Most of the PROFIBUS configurators use 2 directories. These directories must have the GSD’s and bitmap’s files of several manufacturers.
The GSD and bitmap’s files for Smar devices can be purchased via internet in www.smar.com.

See below a typical example with the necessary steps to the integration of a DT303 device in a PA system and that can be extended for any device:

- Copy the GSD file of the device for the search directory of the PROFIBUS configurator, usually named GSD.

- Copy the bitmap file of the device for the search directory of the PROFIBUS configurator, usually named BMP.

- Once the master is chosen, the communication rate must be chosen, remembering that when we had the couplers, we can have the following rates: 45.45 kbits/s (Siemens), 93.75 kbits/s (P+F) and 12 Mbits/s (P+F, SK2) .If we had the link device, it can be up to 12 Mbits/s. Add the DT303, specifying the address in the bus.

- Choose the cyclical configuration via parameterization with the GSD file, dependent of the application, as indicated previously. For the AI blocks, DT303 will supply the master the value of the process variable in 5 bytes. The four first bytes in float point format and the fifth byte the status that carries information about measurement quality.

- The watchdog condition can also be activated, where after the communication loss detection for

the slave device with the master, the equipment can change to a fail safe condition.

Transducer Block

Transducer block insulates function block from the specific I/O hardware, such as sensors, actuators. Transducer block controls access to I/O through manufacturer specific implementation. This permits the transducer block to execute as frequently as necessary to obtain good data from sensors without burdening the function blocks that use the data. It also insulates the function block from the manufacturer specific characteristics of certain hardware.

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

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

Transducer Block Diagram

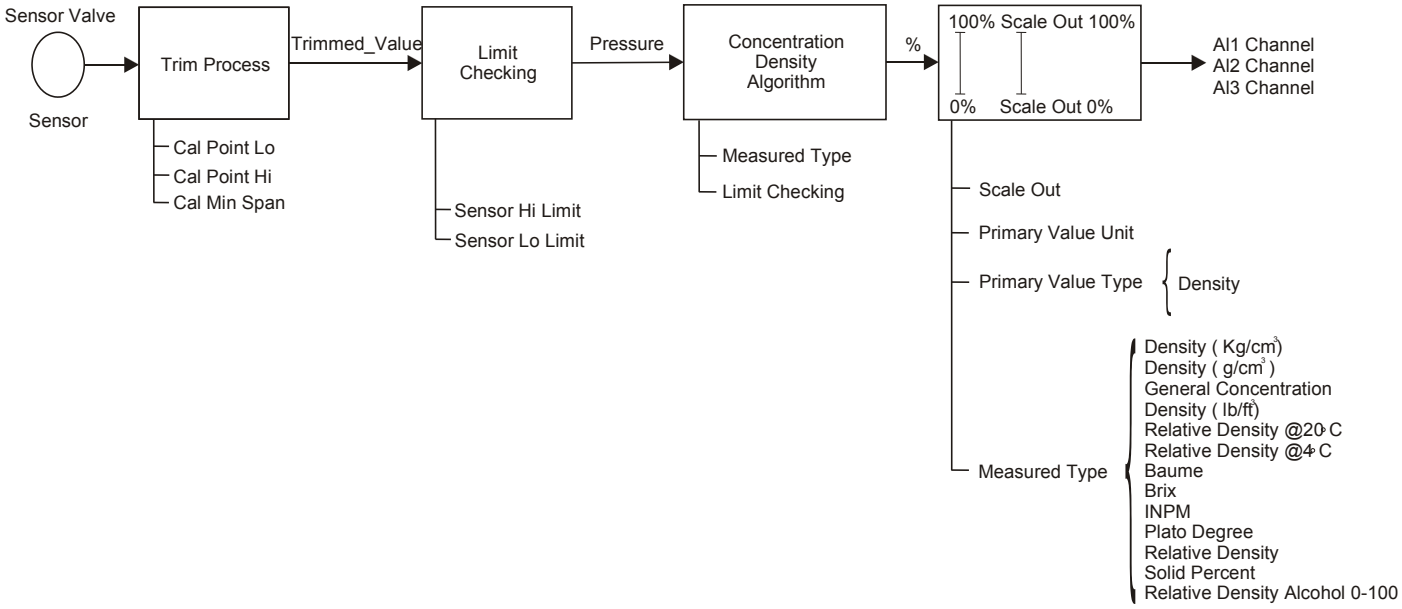


Figure 3.1 – Transducer Block Diagram

Concentration Density Transducer Block Parameter Description

Parameter	Description
AUTO_CAL_POINT_LO	This parameter enables the lower self-calibration point. Unit derives from SENSOR_UNIT or according to the measured type. The lower point is equal to zero.
AUTO_CAL_POINT_HI	This parameter enables the upper self-calibration point. Unit derives from SENSOR_UNIT or according to the measured type. The upper point is equal to 500 mmH20.
BACKUP_RESTORE	This parameter allows to save and to restore data according to factory and user calibration procedures. It has the following options: • 0, "None", • 1, "Factory Cal Restore", • 2, "Last Cal Restore", • 3, "Default Data Restore", • 5, "Sensor Data Restore", • 11, "Factory Cal Backup", • 12, "Last Cal Backup", • 15, "Sensor Data Backup"
CAL_MIN_SPAN	This parameter contains the minimum calibration span value allowed. This minimum span information is necessary to ensure that when calibration is done, the two calibrated points (high and low) are not too close together. Unit derives from SENSOR_UNIT.
CAL_POINT_HI	This parameter contains the highest calibrated value. For calibration of the high limit point you give the high measurement value to the sensor and transfer this point as HIGH to the transmitter. Unit derives from SENSOR_UNIT or according to the measured type.
CAL_POINT_LO	This parameter contains the lowest calibrated value. For calibration of the low limit point you give the low measurement value to the sensor and transfer this point as LOW to the transmitter. Unit derives from SENSOR_UNIT or according to the measured type.
CAL_TEMPERATURE	This parameter contains the calibrated temperature value. Unit derives from TEMPERATURE_UNIT.
COEFF_POL	This parameter contains the polynomial coefficients.
CUTOFF_FLAG	This parameter is used to enable the zero cut-off for pressure measuring.
EEPROM_FLAG	This parameter is used to indicate EEPROM saving process.
DT_RANGE_CODE	Indicates the DT303 range code, depending on the probe size: 250 mm: Range 1 (0 to 3 g/cm^3) Range 2 (0 to 10 g/cm^3) 500 mm: Range 1 (0 to 2 g/cm^3) Range 2 (0 to 10 g/cm^3) 800 mm: Range 1 (0.35 to 1,6 g/cm^3) Range 2 (0.35 to 7 g/cm^3)
FACTORY_CURVE_BYPASS	This parameter is used to enable factory characterization curve.
FACTORY_CURVE_X	This parameter contains input points of factory characterization curve X.
FACTORY_CURVE_Y	This parameter contains input points of factory characterization curve Y.
FACTORY_CURVE_LENGTH	This parameter contains the number of points of factory characterization curve.
FLANGE_MTRL	Construction material of flange type.
FLANGE_TYPE	Flange Type - Hardware, adjacent to the sensor that physically connects the process to the sensor.
GRAVITY	The gravity acceleration used in concentration/density calculation. The unit is m/s².
HEIGHT	Distance between the two pressure sensors. The unit is meter (m).
HEIGHT MEASUREMENT_TEMP	Temperature of distance measurement between the pressure sensors.
HI_LIMIT_TEMP	Superior Limit for Temperature when in General Concentration calculation. The unit is °C.
HI_LIMIT_DENS	Superior Limit for Density when in General Concentration calculation. The unit is g/cm³.
LINEAR_DILATATION_COEFFICIENT	Linear Dilatation Coefficient.
LO_LIMIT_TEMP	Inferior Limit for Temperature when in General Concentration calculation. The unit is °C.
LO_LIMIT_DENS	Inferior Limit for Density when in General Concentration calculation. The unit is g/cm³.
K_TEMP	Correction Factor for Temperature when in General Concentration calculation.
K_DENS	Correction Factor for Density when in General Concentration calculation.
K0_CONC_COEFF to K17_CONC_COEFF	Polynomial coefficients for General Concentration.
MAIN_BOARD_SN	This is the main board serial number.
MAX_SENSOR_VALUE	Holds the maximum process SENSOR_VALUE. A write access to this parameter resets to the momentous value. The unit is defined in SENSOR_UNIT.

Parameter	Description
MEASURED_TYPE	When the Primary Value Type is density, it allows to measure: • Density (g/cm³), • Density (Kg/m³), • Relative Density @ 20°C (g/cm³), • Relative Density @ 4°C (g/cm³), • Baume, • Brix, • Plato Degree, • INPM, • GL, • Solid Percent, • Density (lb/ft³), • API – degree API, • General Concentration.
MIN_SENSOR_VALUE	Holds the minimum process SENSOR_VALUE. A write access to this parameter resets to the momentous value. The unit is defined in SENSOR_UNIT.
MAX_TEMPERATURE	Holds the maximum temperature. A write access to this parameter resets to the momentous value.
MIN_TEMPERATURE	Holds the minimum temperature. A write access to this parameter resets to the momentous value.
ORDERING_CODE	Indicates information about the sensor and control from production factory.
POLYNOMIAL_VERSION	Indicates the pressure polynomial version.
PRESS_CAL_POINT_HI	The lower calibrated point.
PRESS_CAL_POINT_LO	The upper calibrated point.
PRESSURE_COEFFICIENT	Coefficient of Pressure.
PRESS_LIN_NORMAL	Indicates Linear Normalized Pressure.
PRESS_NORMAL	Indicates Normalized Pressure.
PRESS_SIMULATE_ENABLE	Enables to simulate a pressure value.
PRESS_SIMULATE_VAL	Simulated pressure value.
PRIMARY_VALUE	This parameter contains the measured value and status available to the Function Block. The unit of PRIMARY_VALUE is the PRIMARY_VALUE_UNIT.
PRIMARY_VALUE_TYPE	This parameter contains the application of the device. • 0: Pressure • 129: Density When the user wants to make the pressure calibration, he needs to select this parameter to “Pressure”.
PRIMARY_VALUE_UNIT	This parameter contains the engineering unit’s index code for the primary value and depends on the Primary Value Type and Measured Type parameters.
SCALE_IN	Scale for Pressure measurement.
SCALE_OUT	Scale for the output. The related values are according to the measured type. The related unit is the PRIMARY_VALUE_UNIT.
SENSOR_DIAPHRAGM_MATERIAL	This parameter contains the index code for the material of the diaphragm, which comes in contact with the process media.
SENSOR_FILL_FLUID	This parameter contains the index code for the fill fluid inside the sensor. The index code is manufacturer specific.
SENSOR_O_RING_MATERIAL	Construction material of a seal that exists between the module and flange.
SENSOR_HI_LIM	This parameter contains the sensor upper limit value. Unit derives from SENSOR_UNIT.
SENSOR_LO_LIM	This parameter contains the sensor lower limit value. Unit derives from SENSOR_UNIT.
SENSOR_RANGE_CODE	Indicates the sensor range code: • Range 1 (20 in H2O) (0x0) • Range 2 (200 in H2O) (0x1) • Range 3 (1000 in H2O) (0x2) • Range 4 (360 psi) (0x3) • Range 5 (3600 psi) (0x4) • Range 6 (5800 psi) (0x5) • Special (0xfd)
SENSOR_SERIAL_NUMBER	This parameter contains the sensor serial number.
SENSOR_TYPE	This parameter contains the index code for the sensor type described in the manufacturer’s specific table.
SENSOR_UNIT	This parameter contains the engineering units index code for the calibration values.
SENSOR_VALUE	This parameter contains the raw sensor value. The uncalibrated measurement value from the sensor. Unit derives from SENSOR_UNIT.
SIMULATED_TEMPERATURE	The temperature (°C) that is simulated for the user for test.
SOLID_PERC_POL_COEFF_0	Solid Percent Polynomial Coefficient 0.
SOLID_PERC_POL_COEFF_1	Solid Percent Polynomial Coefficient 1.
SOLID_PERC_POL_COEFF_2	Solid Percent Polynomial Coefficient 2.
SOLID_PERC_POL_COEFF_3	Solid Percent Polynomial Coefficient 3.
SOLID_PERC_POL_COEFF_4	Solid Percent Polynomial Coefficient 4.
SOLID_PERC_POL_COEFF_5	Solid Percent Polynomial Coefficient 5.
SOLID_LIMIT_LO	Solid limit Low.
SOLID_LIMIT_HI	Solid limit High.

Parameter	Description
TEMPERATURE	This parameter contains the temperature (e.g. sensor temperature used for measurement compensation) with the associated status used within the transducer. The unit of TEMPERATURE is the TEMPERATURE_UNIT.
TEMPERATURE_GAIN	This parameter contains the gain value of temperature sensor
TEMPERATURE_OFFSET	This parameter contains the offset value of temperature sensor
TEMPERATURE_UNIT	This parameter contains the units of the temperature. The unit codes are: K (1000), °C (1001), °F (1002).
TRANSDUCER_TYPE	Indicates the type of pressure transmitter: 107, differential; 65535, others/special.
TRD_MOUNTING_POSITION	This parameter indicates the mounting position: 0: direct 1: reverse
TRIMMED_VALUE	This parameter contains the sensor value after the trim processing. Unit derives from SENSOR_UNIT.
XD_ERROR	Indicates the condition of calibration process according to: • 16 - Default value set, • 22 - Applied process out of range, • 26 - Invalid configuration for request, • 27 - Excess correction, • 28 - Calibration failed.
ZERO_ADJUST_TEMP	Temperature of zero adjustment.

Table 3.1 - Concentration Density Transducer Block Parameter Description

Concentration Density Transducer Block Parameter Attributes

Index	Parameter Mnemonic	Object Type	Data Type	Store	Size	Access	Parameter usage/ Type of transport	Default – value
8	SENSOR_VALUE	Simple	Float	D	4	r	C/a	0
9	SENSOR_HI_LIM	Simple	Float	N	4	r	C/a	0
10	SENSOR_LO_LIM	Simple	Float	N	4	r	C/a	0
11	CAL_POINT_HI	Simple	Float	N	4	r,w	C/a	5080.0
12	CAL_POINT_LO	Simple	Float	N	4	r,w	C/a	0.0
13	CAL_MIN_SPAN	Simple	Float	N	4	r	C/a	0
14	SENSOR_UNIT	Simple	Unsigned 16	N	2	r,w	C/a	1151
15	TRIMMED_VALUE	Record	DS-33	D	5	r	C/a	0.0
16	SENSOR_TYPE	Simple	Unsigned 16	N	2	r	C/a	117
17	SENSOR_SERIAL_NUMBER	Simple	Unsigned 32	N	4	r,w	C/a	0
18	PRIMARY_VALUE	Record	DS-33	D	5	r	C/a	0.0
19	PRIMARY_VALUE_UNIT	Simple	Unsigned 16	N	2	r,w	C/a	1151
20	PRIMARY_VALUE_TYPE	Simple	Unsigned 16	N	2	r,w	C/a	100
21	SENSOR_DIAPHRAGM_MATERIAL	Simple	Unsigned 16	S	2	r,w	C/a	2
22	SENSOR_FILL_FLUID	Simple	Unsigned 16	S	2	r,w	C/a	2
23	SENSOR_MAX_STATIC_PRESSURE	Not used						
24	SENSOR_O_RING_MATERIAL							
25	PROCESS_CONNECTION_TYPE	Not used						
26	PROCESS_CONNECTION_MATERIAL	Not used						
27	TEMPERATURE	Record	DS-33	D	5	r	C/a	0.0
28	TEMPERATURE_UNIT	Simple	Unsigned 16	N	2	r,w	C/a	1001
29	SECONDARY_VALUE_1	Record	DS-33	D	5	r	C/a	0.0
30	SECONDARY_VALUE_1_UNIT	Simple	Unsigned 16	N	2	r,w	C/a	1151
31	SECONDARY_VALUE_2	Record	DS-33	D	5	r	C/a	0
32	SECONDARY_VALUE_2_UNIT	Simple	Unsigned 16	N	2	r,w	C/a	1151
33	LIN_TYPE	"No Linearization"						
34	SCALE_IN	Array	Float	S	8	r,w	C/a	5080.0
35	SCALE_OUT	Array	Float	S	8	r,w	C/a	0.0
36-44	NOT USED	Not used						
45	MAX_SENSOR_VALUE	Simple	Float	N	4	r,w	C/a	0.0
46	MIN_SENSOR_VALUE	Simple	Float	N	4	r,w	C/a	0.0
47	MAX_TEMPERATURE	Simple	Float	N	4	r,w	C/a	0.0
48	MIN_TEMPERATURE	Simple	Float	N	4	r,w	C/a	0.0
49-59	RESERVED	Reserved						
60	CAL_TEMPERATURE	Simple	Float	N	4	r,w	C/a	25.0
61	BACKUP_RESTORE	Simple	Unsigned 8	S	1	r,w	C/a	0
62	FACTORY_CURVE_BYPASS	Simple	Unsigned 16	S	2	r,w	C/a	0x0F
63	FACTORY_CURVE_X	Array	Float	S	20	r,w	C/a	-

Index	Parameter Mnemonic	Object Type	Data Type	Store	Size	Access	Parameter usage/ Type of transport	Default – value
64	FACTORY_CURVE_Y	Array	Float	S	20	r,w	C/a	-
65	FACTORY_CURVE_LENGTH	Simple	Unsigned 8	S	1	r,w	C/a	5
66	PRESS_LIN_NORMAL	Record	DS-33	D	5	r	C/a	0.0
67	PRESS_NORMAL	Record	DS-33	D	5	r	C/a	0.0
68	CUTOFF_FLAG	Simple	Unsigned 8	S	1	r,w	C/a	TRUE
69	COEFF_POL	Array	Float	S	48	r,w	C/a	-
70	POLYNOMIAL_VERSION	Simple	Unsigned 8	S	1	r,w	C/a	0x32
71	SENSOR_RANGE_CODE	Simple	Unsigned 8	S	1	r,w	C/a	1
72	TRD_TRANSDUCER_TYPE	Simple	Unsigned 16	S	2	r,w	C/a	107
73	XD_ERROR	Simple	Unsigned 8	D	1	r	C/a	0x10
74	MAIN_BOARD_SN	Simple	Unsigned 32	S	4	r,w	C/a	0
75	EEPROM_FLAG	Simple	Unsigned 8	D	1	r	C/a	FALSE
76	ORDERING_CODE	Array	Unsigned 8	S	50	r,w	C/a	-
77	FLANGE_MATERIAL	Simple	Unsigned 8	S	1	r,w	C/a	-
78	FLANGE_TYPE	Simple	Unsigned 8	S	1	r,w	C/a	-
79	O_RING_MATERIAL	Simple	Unsigned 8	S	1	r,w	C/a	-
80	METER_INFORMATION	Simple	Unsigned 8	S	1	r,w	C/a	-
81	DRAIN_VENT_MTRL	Simple	Unsigned 8	S	1	r,w	C/a	-
82	REMOTE_SEAL_TYPE	Simple	Unsigned 8	S	1	r,w	C/a	-
83	REMOTE_SEAL_FLUID	Simple	Unsigned 8	S	1	r,w	C/a	-
84	REMOTE_SEAL_ISO_MTRL	Simple	Unsigned 8	S	1	r,w	C/a	-
85	REMOTE_SEAL_NUMBER	Simple	Unsigned 8	S	1	r,w	C/a	-
86	DEV_MODEL	Array	Unsigned 8	S	5	r,w	C/a	DT303
87	MANUFACT_ID	Simple	Unsigned 16	S	2	r	C/a	0x003e
88	GRAVITY	Simple	Float	S	4	r,w	C/a	9.80665
89	HEIGHT	Simple	Float	S	4	r,w	C/a	0.500
90	MEASURED_TYPE	Simple	Unsigned 8	S	1	r,w	C/a	0
91	LINEAR_DILATATION_COEFFICIENT	Simple	Float	S	4	r,w	C/a	0.000016
92	HEIGHT_MEASUREMENT_TEMP	Simple	Float	S	4	r,w	C/a	0.5
93	ZERO_ADJUST_TEMP	Simple	Float	S	4	r,w	C/a	20.0
94	DIAPHRAGM_TEMPERATURE	Simple	Float	S	4	r,w	C/a	20.0
95	AUTO_CAL_POINT_LO	Simple	Float	S	4	r,w	C/a	0.0
96	AUTO_CAL_POINT_HI	Simple	Float	S	4	r,w	C/a	500.0
97	SOLID_COEFF_POL_0	Simple	Float	S	4	r,w	C/a	0.0
98	SOLID_COEFF_POL_1	Simple	Float	S	4	r,w	C/a	1.0
99	SOLID_COEFF_POL_2	Simple	Float	S	4	r,w	C/a	0.0
100	SOLID_COEFF_POL_3	Simple	Float	S	4	r,w	C/a	0.0
101	SOLID_COEFF_POL_4	Simple	Float	S	4	r,w	C/a	0.0
102	SOLID_COEFF_POL_5	Simple	Float	S	4	r,w	C/a	0.0
103	PRESS_SIMULATE_ENABLE	Simple	Unsigned 8	S	1	r,w	C/a	Disable
104	PRESS_SIMULATE_VAL	Simple	Float	S	4	r,w	C/a	0.0
105	PRESS_CAL_POINT_HI	Simple	Float	S	4	r,w	C/a	0.0
106	PRESS_CAL_POINT_LO	Simple	Float	S	4	r,w	C/a	5080.0
107	SOLID_LIM_HI	Simple	Float	S	4	r,w	C/a	100.0
108	SOLID_LIM_LO	Simple	Float	S	4	r,w	C/a	0.0
109	DT_RANGE_CODE	Simple	Unsigned 8	S	1	r,w	C/a	0
110-127	K0_CONC_COEFF to K17_CONC_COEFF	Simple	Float	S	4	r,w	C/a	0.0
128	HI_LIMIT_DENS	Simple	Float	S	4	r,w	C/a	0.0
129	LO_LIMIT_DENS	Simple	Float	S	4	r,w	C/a	0.0
130	HI_LIMIT_TEMP	Simple	Float	S	4	r,w	C/a	0.0
131	LO_LIMIT_TEMP	Simple	Float	S	4	r,w	C/a	0.0
132	K_DENS	Simple	Float	S	4	r,w	C/a	1.0
133	K_TEMP	Simple	Float	S	4	r,w	C/a	1.0
134	SIMULATED_TEMPERATURE	Simple	Float	S	4	r,w	C/a	0.0
135	TEMP_GAIN	Simple	Float	S	4	r, w	C/a	0.0
136	TEMP_OFFSET	Simple	Float	S	4	r, w	C/a	0.0
137	TRD_MOUNTING_POSITION	Simple	Unsigned 8	S	1	r, w	C/a	-

Table 3.2 - Concentration Density Transducer Blocks Parameter Attributes

Concentration Density Transducer Block View Object

Relative Index	Parameter Mnemonic	View_1	View_2	View_3	View_4
1	ST_REV	2			
2	TAG_DESC				
3	STRATEGY				
4	ALERT_KEY				
5	TRAGET_MODE				
6	MODE_BLK	3			
7	ALARM_SUM	8			
8	SENSOR_VALUE				
9	SENSOR_HI_LIM				
10	SENSOR_LO_LIM				
11	CAL_POINT_HI				
12	CAL_POINT_LO				
13	CAL_MIN_SPAN				
14	SENSOR_UNIT				
15	TRIMMED_VALUE				
16	SENSOR_TYPE				
17	SENSOR_SERIAL_NUMBER				
18	PRIMARY_VALUE	5			
19	PRIMARY_VALUE_UNIT				
20	PRIMARY_VALUE_TYPE				
21	SENSOR_DIAPHRAGM_MATERIAL				
22	SENSOR_FILL_FLUID				
23	SENSOR_MAX_STATIC_PRESSURE				
24	SENSOR_O_RING_MATERIAL				
25	PROCESS_CONNECTION_TYPE				
26	PROCESS_CONNECTION_MATERIAL				
27	TEMPERATURE				
28	TEMPERATURE_UNIT				
29	SECONDARY_VALUE_1				
30	SECONDARY_VALUE_1_UNIT				
31	SECONDARY_VALUE_2				
32	SECONDARY_VALUE_2_UNIT				
33	LIN_TYPE				
34	SCALE_IN				
35	SCALE_OUT				
36-44	**NOT USED**				
45	MAX_SENSOR_VALUE				
46	MIN_SENSOR_VALUE				
47	MAX_TEMPERATURE				
48	MIN_TEMPERATURE				
49-59	**RESERVED**				
60	CAL_TEMPERATURE				
61	BACKUP_RESTORE				
62	FACTORY_CURVE_BYPASS				
63	FACTORY_CURVE_X				
64	FACTORY_CURVE_Y				
65	FACTORY_CURVE_LENGTH				
66	PRESS_LIN_NORMAL				
67	PRESS_NORMAL				
68	CUTOFF_FLAG				
69	COEFF_POL				
70	POLYNOMIAL_VERSION				
71	SENSOR_RANGE_CODE				
72	TRD_TRANSDUCER_TYPE				
73	XD_ERROR				
74	MAIN_BOARD_SN				
75	EEPROM_FLAG				

Relative Index	Parameter Mnemonic	View_1	View_2	View_3	View_4
76	ORDERING_CODE				
77	FLANGE_MATERIAL				
78	FLANGE_TYPE				
79	O_RING_MATERIAL				
80	METER_INFORMATION				
81	DRAIN_VENT_MTRL				
82	REMOTE_SEAL_TYPE				
83	REMOTE_SEAL_FLUID				
84	REMOTE_SEAL_ISO_MTRL				
85	REMOTE_SEAL_NUMBER				
86	DEV_MODEL				
87	MANUFACT_ID				
88	GRAVITY				
89	HEIGHT				
90	MEASURED_TYPE				
91	LINEAR_DILATATION_COEFFICIENT				
92	HEIGHT_MEASUREMENT_TEMP				
93	ZERO_ADJUST_TEMP				
94	DIAPHRAGM_TEMPERATURE				
95	AUTO_CAL_POINT_LO				
96	AUTO_CAL_POINT_HI				
97	SOLID_COEFF_POL_0				
98	SOLID_COEFF_POL_1				
99	SOLID_COEFF_POL_2				
100	SOLID_COEFF_POL_3				
101	SOLID_COEFF_POL_4				
102	SOLID_COEFF_POL_5				
103	PRESS_SIMULATE_ENABLE				
104	PRESS_SIMULATE_VAL				
105	PRESS_CAL_POINT_HI				
106	PRESS_CAL_POINT_LO				
107	SOLID_LIM_HI				
108	SOLID_LIM_LO				
109	DT_RANGE_CODE				
110-127	K0_CONC_COEFF to K17_CONC_COEFF				
128	HI_LIMIT_DENS				
129	LO_LIMIT_DENS				
130	HI_LIMIT_TEMP				
131	LO_LIMIT_TEMP				
132	K_DENS				
133	K_TEMP				
134	SIMULATED_TEMPERATURE				
135	TEMP_GAIN				
136	TEMP_OFFSET				
137	TRD_MOUNTING_POSITION				
	TOTAL	**18 bytes**			

Table 3.3 - Concentration Density Transducer Block View Object

How to Configure the Transducer Block

Configuration via ProfibusView or Simatic PDM

The transducer block has an algorithm, a set of contained parameters and a channel connecting it to an analog input 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, it means, you are not able to link them to other blocks and publish the link via communication, defines the user interface to the transducer block. They can be divided into Standard and Manufacturer Specific.
The standard parameters will be present for such class of device, as density, pressure, temperature, actuator, etc., whatever is the manufacturer. Oppositely, the manufacturer's specific ones are defined only for its manufacturer. As common manufacturer specific parameters, we have calibration settings, material information, linearization curve, etc.

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

The ProfibusView configuration software from Smar or the Simatic PDM (Process Device Manager) configuration software from Siemens, for example, can configure many parameters of the Input Transducer block. See the Figures 3.2 and 3.3 below.

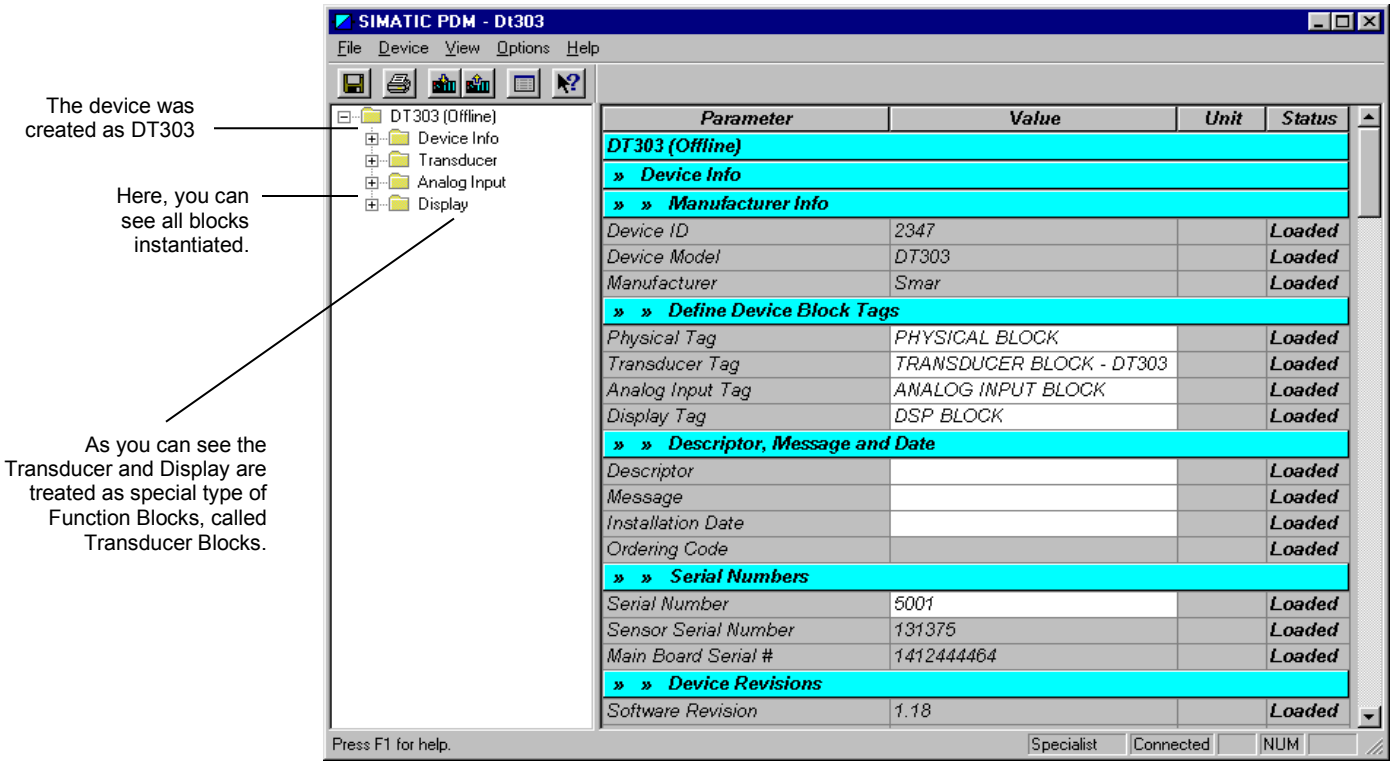


Figure 3.2 – Function and Transducer Block – Simatic PDM

The Primary Value Type indicates the density measurement.

The user can select the Measured Type selecting:
- Density (g/cm³)
- Density (Kg/m³)
- Relative Density @ 20°C
- Relative Density @ 4°C
- Baume
- Brix
- Plato Degree
- INPM
- GL
- Solid Percent
- Density (lb/ft³)
- API – degree API

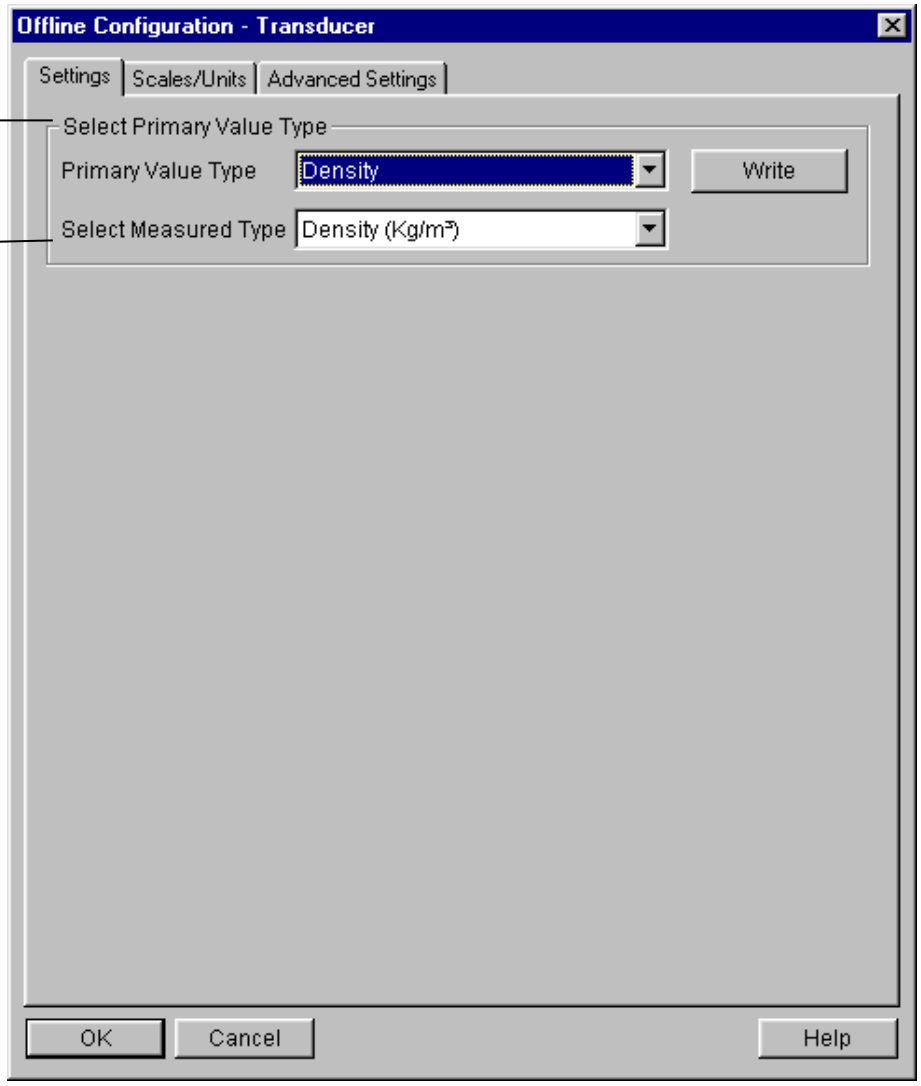


Figure 3.3 – Offline Configuration – Transducer

Using this window, the user can set the Primary Value Type according to the application, selecting "Density".

Also, the user can select the Measured Type, choosing Density (g/cm³), Density (Kg/m³), Relative Density @ 20°C (g/cm³), Relative Density @ 4°C (g/cm³), Baume, Brix, Plato Degree, INPM, GL, Solid Percent, Density (lb/ft³), API (degree API) and General Concentration.

The Primary Value Unit and the output scale unit are according to the Measured Type parameter and the output scale value is also according to the sensor range code.

Using the next window, the user can configure the units according to the Transducer Block Diagram:

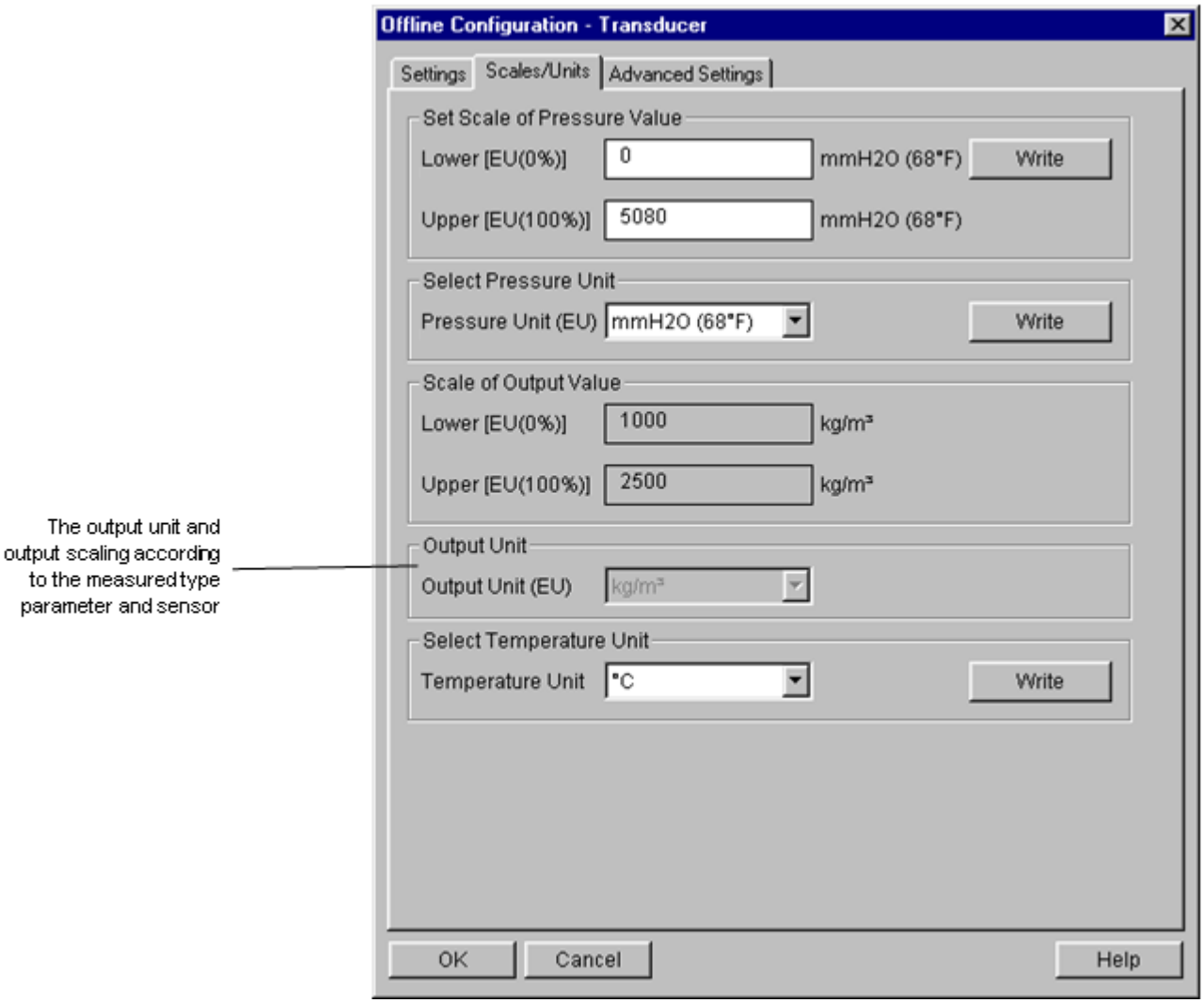


Figure 3.4 – Scale Units for Transducer Block

Advanced Settings

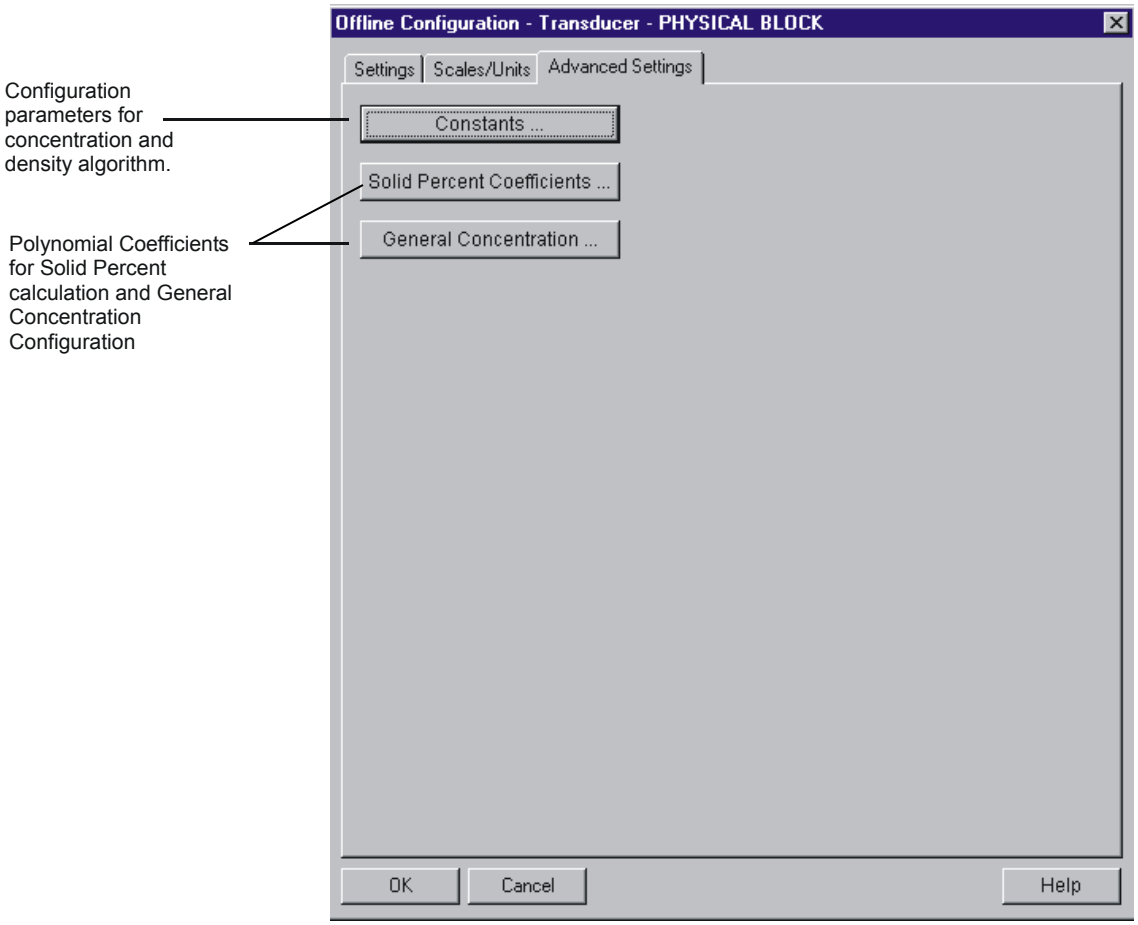


Figure 3.5 – Transducer Offline – Advanced Settings

Engineering Unit Selection

The user can also choose the Measured_Type:

- Density (g/cm³)
- Density (Kg/m³)
- Relative Density @ 20°C
- Relative Density @ 4°C
- Baume
- Brix
- Plato Degree
- INPM
- GL
- Solid Percent
- Density (lb/ft³)
- API.

Solid Percent (% sol)
The concentration/ density transmitter **DT303** offers resources with the objective of relating Baume degree to solid percent.

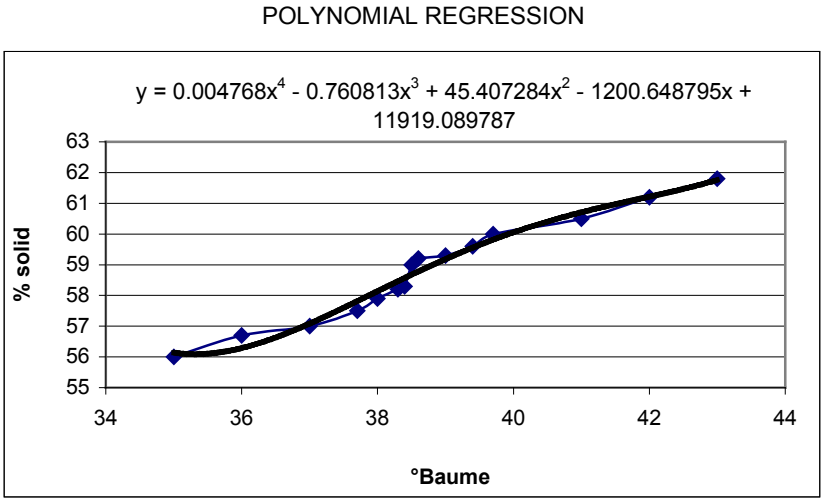
The general equation to determine the solid percent is:

%sol = a0 + a1 bme1 + a2 bme2 + a3 bme3 + a4bme4 + a5 bme5

The table and the graph below indicate the application of the **DT303** polynomial that relates Baume degree to solid percent, generating the polynomial:

y = 0.004768x4 - 0.760813x3 + 45.407284x2 - 1200.648795x + 11919.089787.

	X	
1	Bme	%SOL.
2	35	56
3	36	56,7
4	37	57
5	37,7	57,5
6	38	57,9
7	38,3	58,2
8	38,4	58,3
9	38,5	59
10	38,6	59,2
11	39	59,3
12	39,4	59,6
13	39,7	60
14	41	60,5
15	42	61,2
16	43	61,8

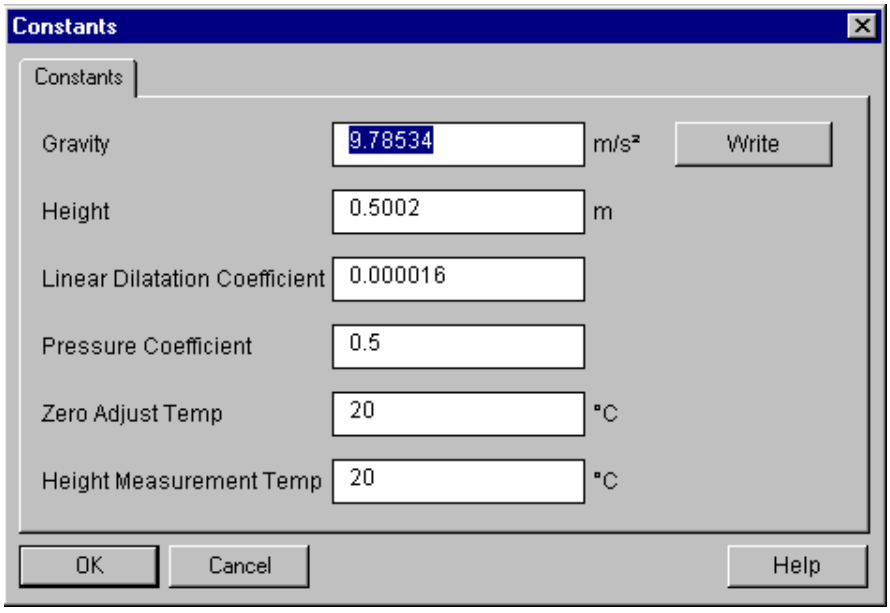


Concentration Percentage (% conc)
For applications that demand other relation among measures, the polynomial used is:

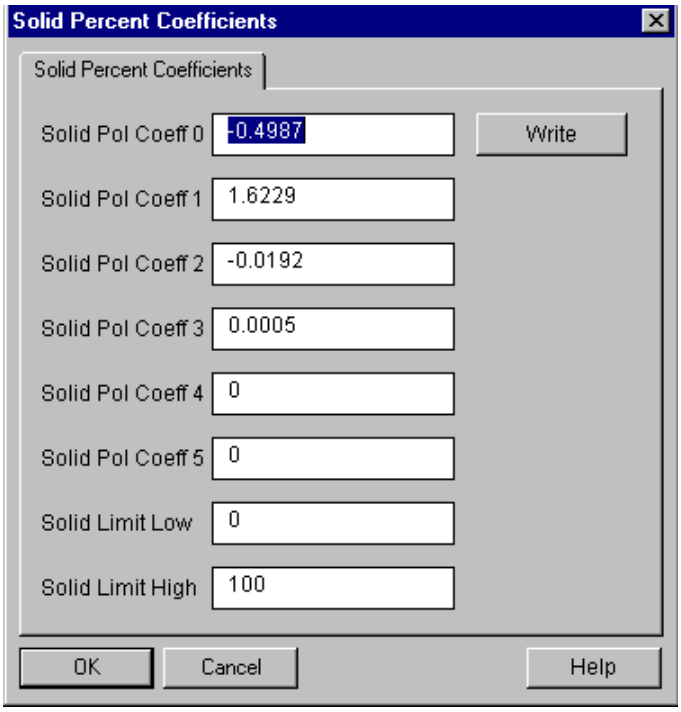
$$f(a,d,t) = a_0 + a_1 d + a_2 d^2 + a_3 d^3 + a\, d^4 + a_5 d^5 + a_6 d\, t + a_7 d^2 t + a_8 d^3 t + a_9 d\, t^2 + a_{10} d\, t^3 + a_{11} d^2 t^2 + a_{12} d^3 t^3 + a_{13} t + a_{14} t^2 + a_{15} t^3 + a_{16} t^4 + a_{17} t^5$$

This function is applied to a higher number of applications. It relates three measurements: density, temperature, and concentration.

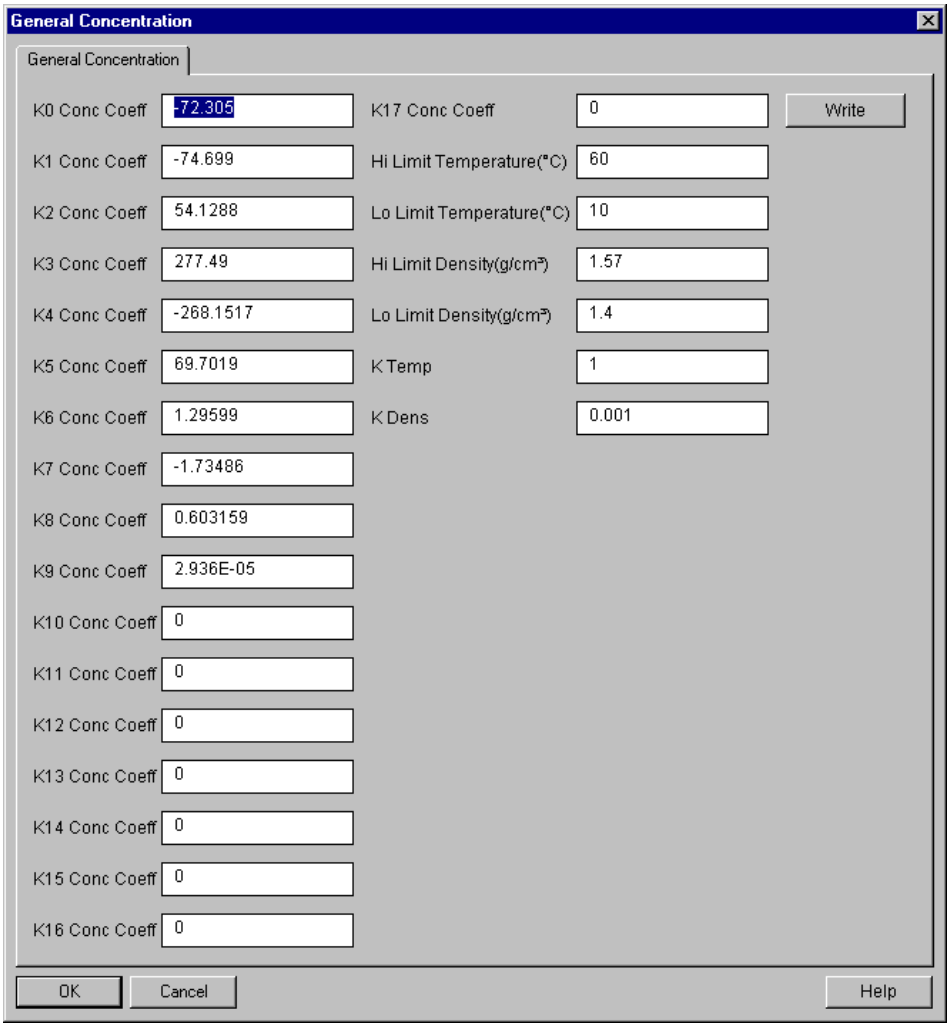
Clicking in “Constants”, the user will get the following screen:



Clicking in “Solid Percent Coefficients”, the user will get the following screw:



Clicking in “General Concentration”, the user will get the following screen:



Configuration via Local Adjustment

For configuration via local adjustment is necessary the Standard Parameters Descriptions, Specific Parameters and Parameter Attribute Table of the Transducer Block in the DT303 Operation, Maintenance and Instructions Manual and the Function Block Instruction Manual.

Tranducer Block Configuration

a.1) Calibration of Lower and Upper density/concentration:
To configure this option, the user should configure two parameters of the Transducer Block:
- **CAL_POINT_LO (relative index equal to 12);**
- **CAL_POINT_HI (relative index equal to 11);**

Using the local adjustment configuration procedure, configure the CAL_POINT_LO parameter as:
CONF: Select a **LCD**, for example **LCD2**;
BLOCK: Select **TRD**;
PRMT: Configure the value **12** (CAL_POINT_LO – Lower Value Calibration) according to Standard Parameters Descriptions, Specific Parameters and Parameter Attribute Table of the Transducer Block in the DT303 Operation, Maintenance, and Instructions Manual;
ITEM: The **CAL_POINT_LO** – Lower Value Calibration is a simple parameter and is not necessary to configure the element.

After these configurations, in "**UPDT**" option, insert the magnetic tool in the *Span* hole to update the local adjustment tree.

Using the local adjustment configuration procedure, configure the CAL_POINT_HI parameter as:
CONF: Select a **LCD**, for example **LCD2**;
BLOCK: Select **TRD**;
PRMT: Configure the value **11** (CAL_POINT_HI – Upper Value Calibration) according to Standard Parameters Descriptions, Specific Parameters and Parameter Attribute Table of the Transducer Block in the DT303 Operation, Maintenance, and Instructions Manual;
ITEM: The **CAL_POINT_HI** – Upper Value Calibration is a simple parameter is not necessary to configure the element.

a.2) Primary Unit Value:
The user must configure the following parameters using the local adjustment procedure:

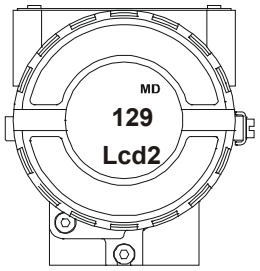
CONF: Select a **LCD**, for example **LCD2**;
BLOCK: Select **TRD**;
PRMT: Select the value **18** (PRIMARY_VALUE – Primary Unit Value), according to Standard Parameters Descriptions, Specific Parameters and Parameter Attribute Table of the Transducer Block in the DT303 Operation, Maintenance, and Instructions Manual;
ITEM: The **PRIMARY_VALUE** – Primary Unit Value is a parameter necessary to configure the element:
1 = Status;
2 = Value.

After these configurations, in "**UPDT**" option, insert the magnetic tool in the *Span* hole to update the local adjustment tree.

a.3) Primary Unit Type:
The user must configure the following parameters using the local adjustment procedure:

CONF: Select a **LCD**, for example, **LCD2**;
BLOCK: Select **TRD;**
PRMT: Select the value **20** (PRIMARY_VALUE_TYPE – Primary Unit Type), according to Standard Parameters Descriptions, Specific Parameters and Parameter Attribute Table of the Transducer Block in the DT303 Operation, Maintenance, and Instructions Manual;
ITEM: The **PRIMARY_VALUE_TYPE** - Configure the Transducer type according to application:
129 = Density / concentration.

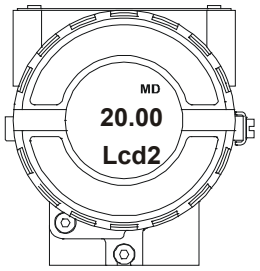
After this configuration, in "**UPDT**" option, insert the magnetic tool in the *Span* hole to update the local adjustment tree.



a.4) Secondary Unit Value:
The user must configure the following parameters using the local adjustment procedure:

CONF: Select a **LCD**, for example **LCD2**;
BLOCK: Select **TRD**;
PRMT: Select the value **31** (SECONDARY_VALUE – Secondary Unit Value), according to Standard Parameters Descriptions, Specific Parameters and Parameter Attribute Table of the Transducer Block in the DT303 Operation, Maintenance, and Instructions Manual;
ITEM: The **SECONDARY_VALUE** – Secondary Unit Value is a parameter necessary to configure the element:
1 = Status;
2 = Value.

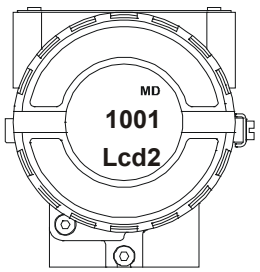
After this configuration in "**UPDT**" option insert the magnetic tool in the *Span* hole to update the local adjustment tree.



a.5) Secondary Variable Unit:
The user must configure the following parameters using the local adjustment procedure:

CONF: Select a **LCD**, for example **LCD2**;
BLOCK: Select **TRD**;
PRMT: Select the value **32** (SECONDARY_VALUE_UNIT – Secondary Variable Unit), according to Standard Parameters Descriptions, Specific Parameters and Parameter Attribute Table of the Transducer Block in the DT303 Operation, Maintenance, and Instructions Manual;
ITEM: The **SECONDARY_VALUE_UNIT** – Secondary Variable Unit is a parameter necessary to configure the element:
1000 = Temperature in Kelvin;
1001 = Temperature in °Celsius;
1002 = Temperature in ° Fahrenheit

After these configurations, in "**UPDT**" option, insert the magnetic tool in the *Span* hole to update the local adjustment tree.

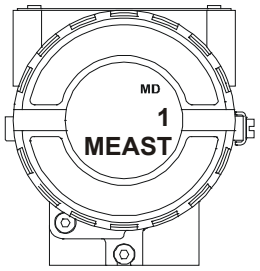


a.6) Measurement Type:
The user must configure the following parameters using the local adjustment procedure:

CONF: Select a **LCD**, for example, **LCD2**;
BLOCK: Select **TRD**;
PRMT: Select the value **90** (MEASURED_TYPE – Measurement Type), according to Standard Parameters Descriptions, Specific Parameters and Parameter Attribute Table of the Transducer Block in the DT303 Operation, Maintenance, and Instructions Manual;
ITEM: The **MEASURED_TYPE** - Configure the measurement type according to unit:

VALUE	MEASUREMENT TYPE
0	Density (g/cm3)
1	Density (Kg/m3)
2	Relative Density to 20°C
3	Relative Density to 4°C
4	Baumé Degree
5	Brix Degree
6	Plato Degree
7	INPM Degree
8	GL Degree
9	Solids Percentage
10	Density (lb/ft3)

After this configuration in "**UPDT**" option insert the magnetic tool in the *Span* hole to update the local adjustment tree.



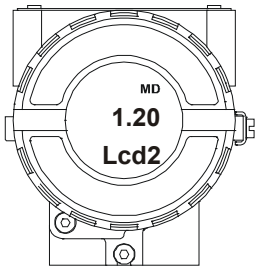
a.7) Self Calibration Air and Water:
To configure this option of calibration the user must configure 3 parameters of the Transducer Block:
- **AUTO_CAL_POINT_LO (Air – relative index equal to 95);**
- **AUTO_CAL_POINT_HI (Water – relative index equal to 96);**
- **MEASURED_TYPE (relative index equal to 90).**

NOTE
The unit for output is selected using the type of measurement (see Unit Code for DT303).

Using the local adjustment configuration procedure, configure the parameter MEASURED_TYPE and AUTO_CAL_POINT_LO as:

CONF: Select a **LCD**, for example **LCD2**;
BLOCK: Select **TRD**;
PRMT: Configure the value 90 (MEASURED_TYPE – Measurement Type) for Density (Kg/m3) value equal to 1.
PRMT: Configure the value **95** (AUTO_CAL_POINT_LO – Self Calibration of the Lower Value) according to Standard Parameters Descriptions, Specific Parameters and Parameter Attribute Table of the Transducer Block in the DT303 Operation, Maintenance, and Instructions Manual;
ITEM: The **AUTO_CAL_POINT_LO** – Lower Value Calibration is a simple parameter and is not necessary to configure the element.

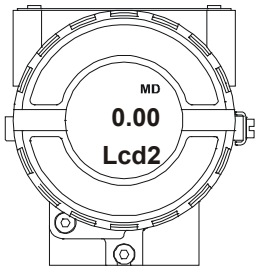
After these configurations, in "**UPDT**" option, insert the magnetic tool in the *Span* hole to update the local adjustment tree.



Using the local adjustment configuration procedure, configure the parameter MEASURED_TYPE and AUTO_CAL_POINT_HI as:

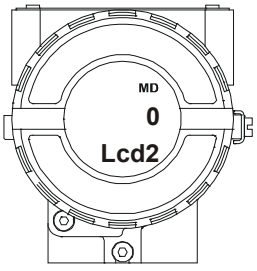
CONF: Select a **LCD**, for example **LCD2**;
BLOCK: Select **TRD**;
PRMT: Configure the value **90** (MEASURED_TYPE – Measurement Type) for Brix Degree value equal to 5.
PRMT: Configure the value **96** (AUTO_CAL_POINT_HI – Self Calibration of the Upper Value) according to Standard Parameters Descriptions, Specific Parameters and Parameter Attribute Table of the Transducer Block in the DT303 Operation, Maintenance, and Instructions Manual;
ITEM: The **AUTO_CAL_POINT_HI** – Lower Value Calibration is a simple parameter and is not necessary to configure the element.

After this configuration, in "**UPDT**" option, insert the magnetic tool in the *Span* hole to update the local adjustment tree.



a.8) Mounting Position:
The user must configure the following parameters using the local adjustment procedure:

CONF: Select a **LCD**, for example, **LCD2**;
BLOCK: Select **TRD;**
PRMT: Select the value **137** (MOUNTING_POSITION – Mounting Position), according to Standard Parameters Descriptions, Specific Parameters and Parameter Attribute Table of the Transducer Block in the DT303 Operation, Maintenance, and Instructions Manual;
ITEM: The **MOUNTING_POSITION** – Select "ITEM" as 2 to show in the display the value referent to mounting position:
0 = Direct;
1 = Reverse.
After this configuration, in "**UPDT**" option, insert the magnetic tool in the *Span* hole to update the local adjustment tree.



See below the configuration screens of the Transducer Block using the ProfibusView.

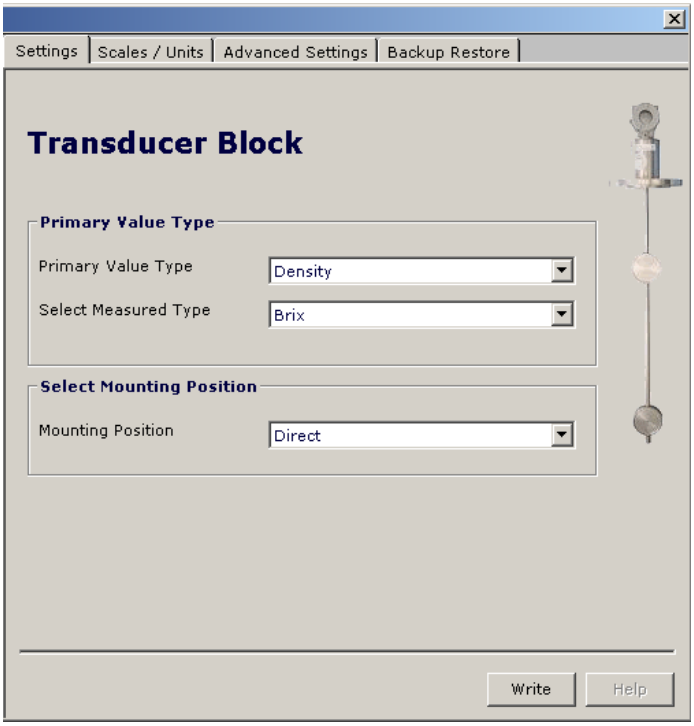


Figure 3.6 - Transducer Block and Function – ProfibusView

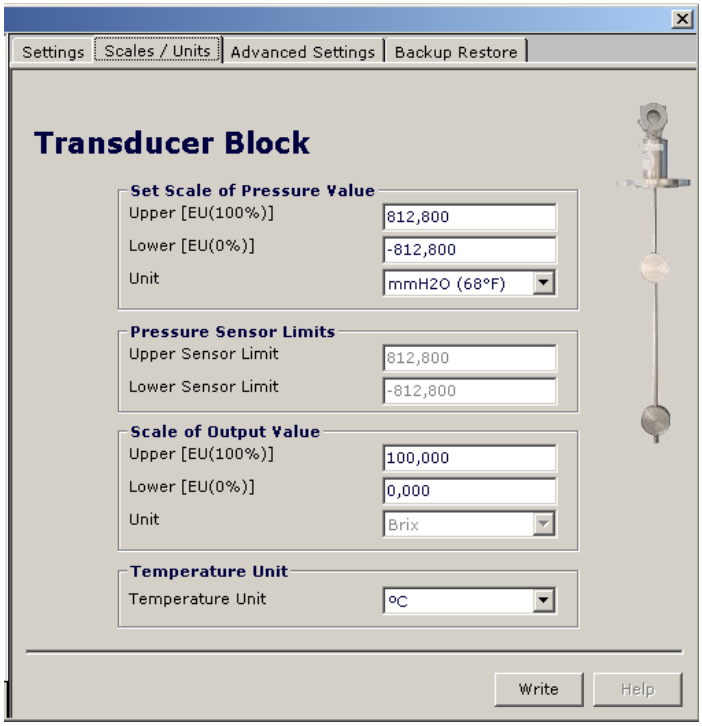


Figure 3.7 - Scale Units – ProfibusView

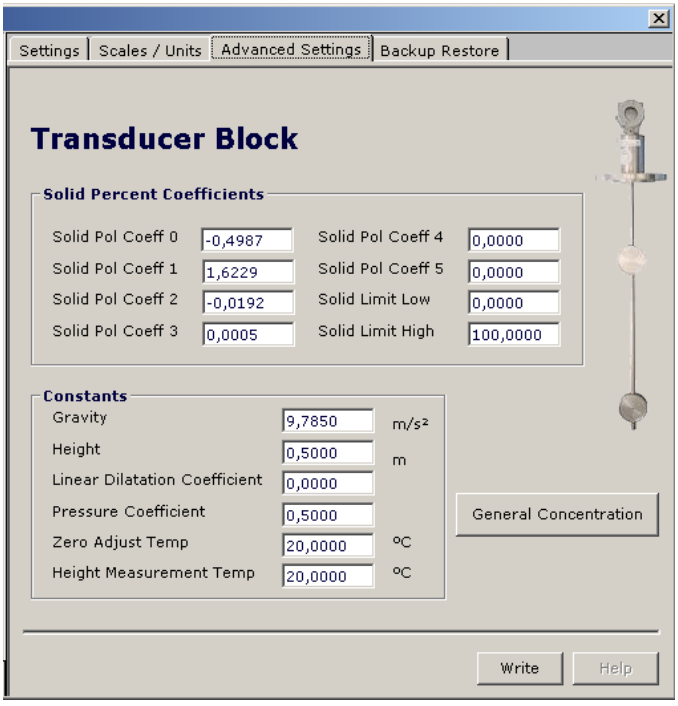


Figure 3.8 - Advanced Settings – ProfibusView

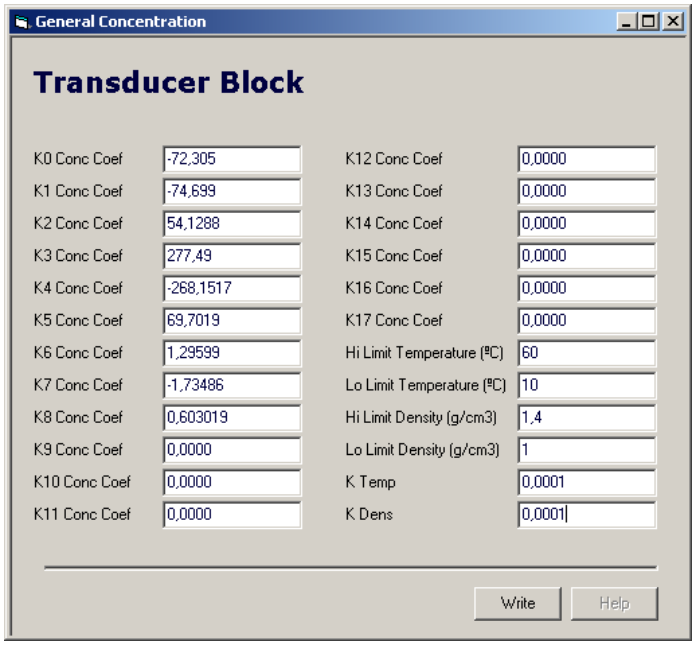


Figure 3.9 - Concentration General Units – ProfibusView

How to Configure the Analog Input Function Blocks

The Analog Input function blocks take the input data from the Transducer block, selected by channel number, and make it available to other function blocks at its output. The transducer block provides the input unit of the Analog Input, and when the unit is changed in the transducer, the PV_SCALE unit is changed too.

Optionally, a filter may be applied in the process value signal, whose time constant is PV_FTIME. Considering a step change to the input, this is the time in seconds to the PV reaches 63,2% of the final value. If the PV_FTIME value is zero, the filter is disabled. For more details, please, see the Function Blocks Specifications.

To configure the Analog Input Block, please, go to window “Analog Input Block” in the main menu. Using this window, the user can configure the block mode operation, selects the channel, scales and unit for input and output value and the damping.

The DT303 has three AI blocks. These blocks can be configured as:
1° AI Block: for concentration unit configuration;
2° AI Block: for density unit configuration;
3° AI Block: for temperature unit configuration.

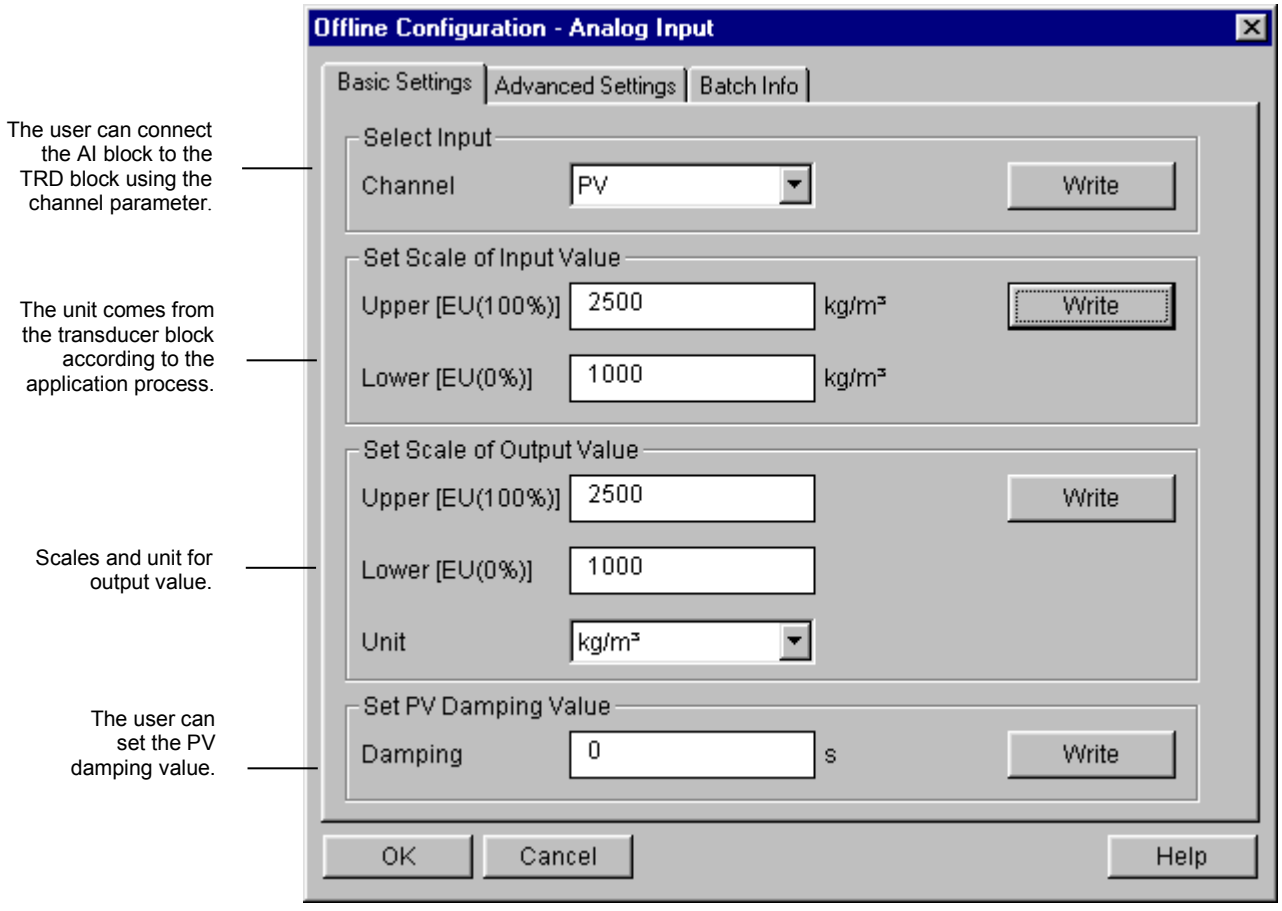


Figure 3.10 – Basic Settings for Analog Input Block

Selecting the tab "Advanced Settings", the user can configure the conditions for alarms and warnings, as well the fail safe condition. Please, see the window:

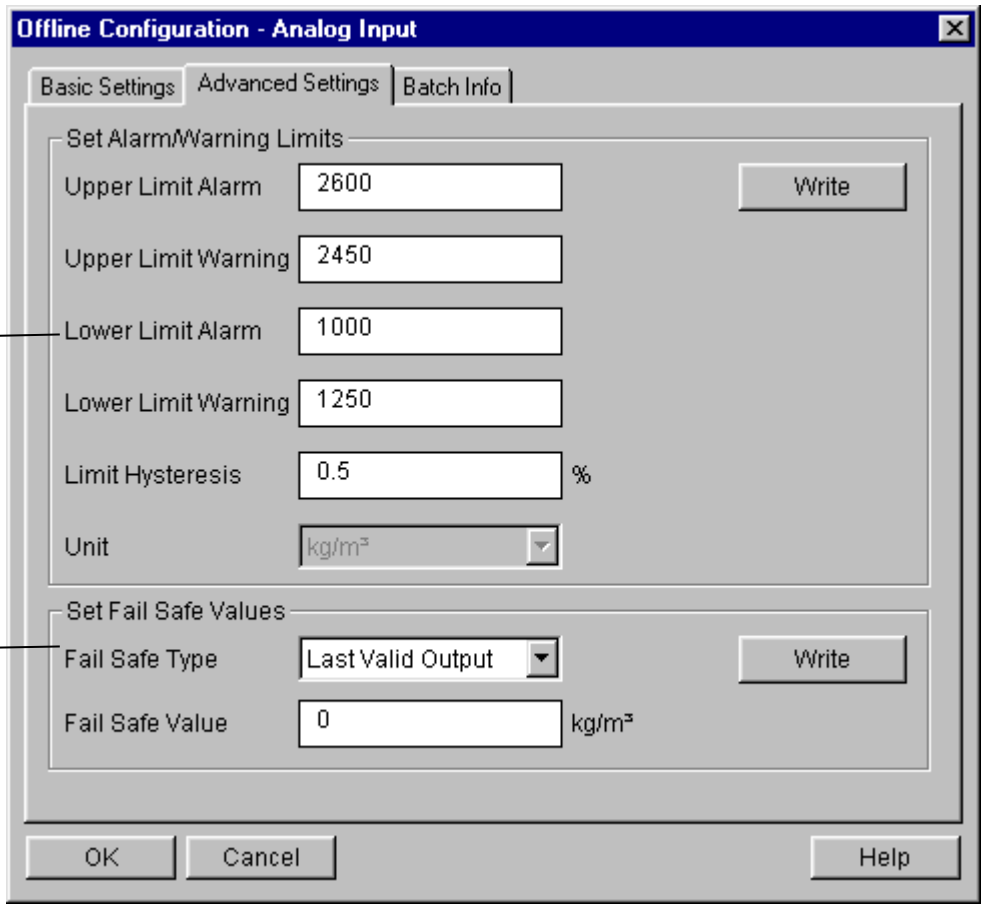


Figure 3.11 – Advanced Settings for Analog Input Block

In online configuration for the Analog Input Block, please, go to the main menu and select "Device - Online Configuration - Analog Input - Block Mode":

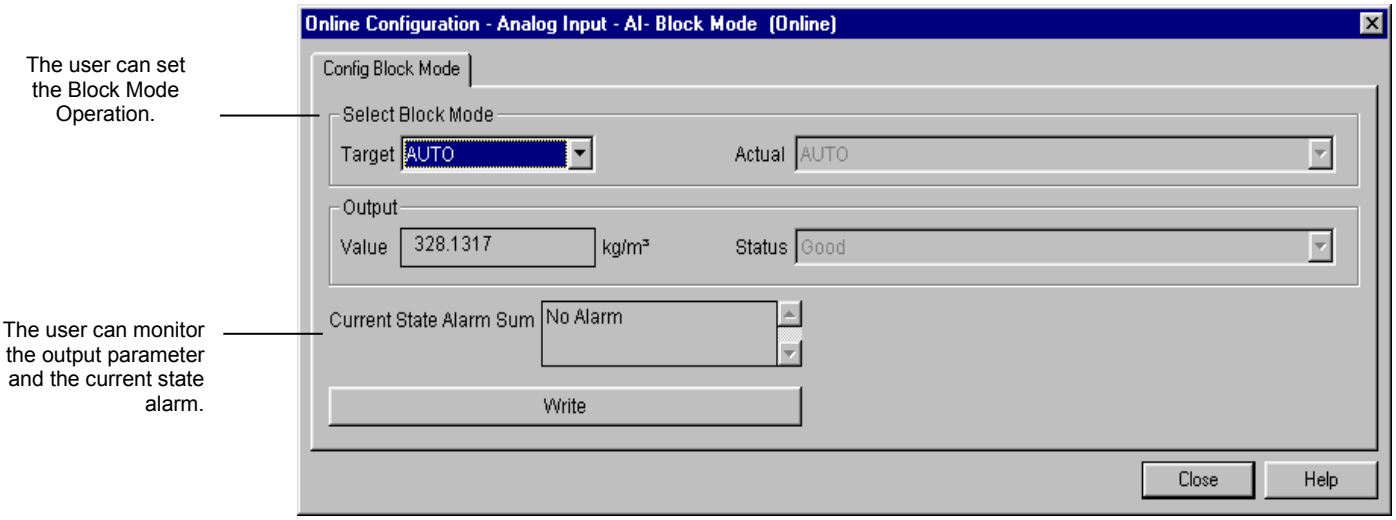


Figure 3.12 – Online Configuration for Analog Input Block

See below the configuration windows of the Analog Input Block using the ProfibusView.

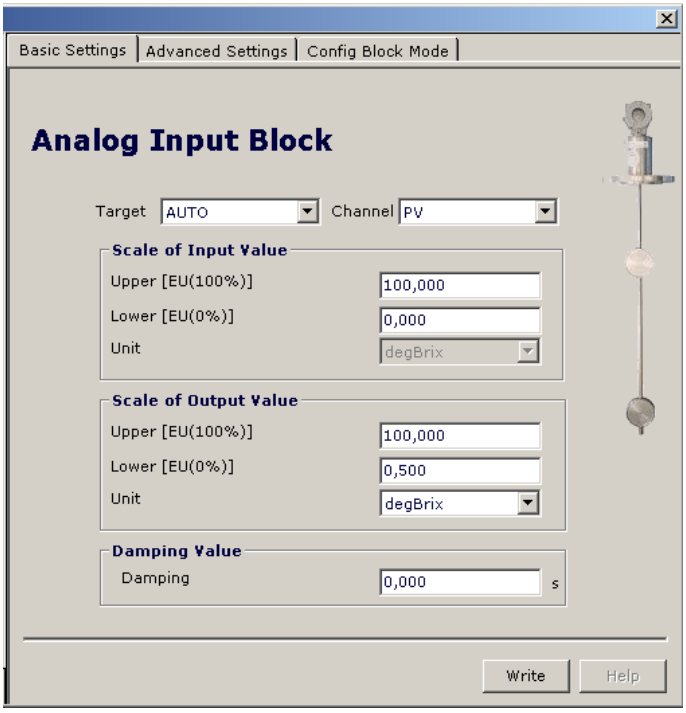


Figure 3.13 – Basic Settings – AI Block

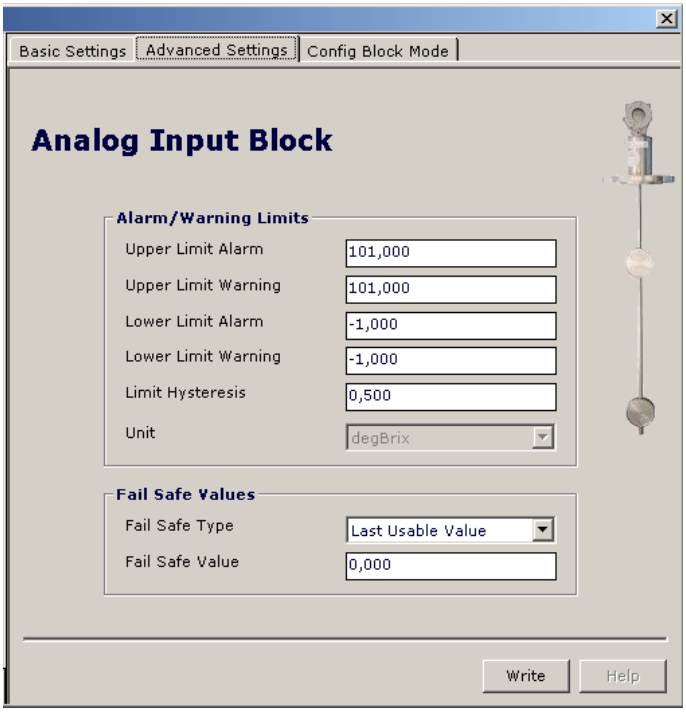


Figure 3.14 – Advanced Settings – AI Block

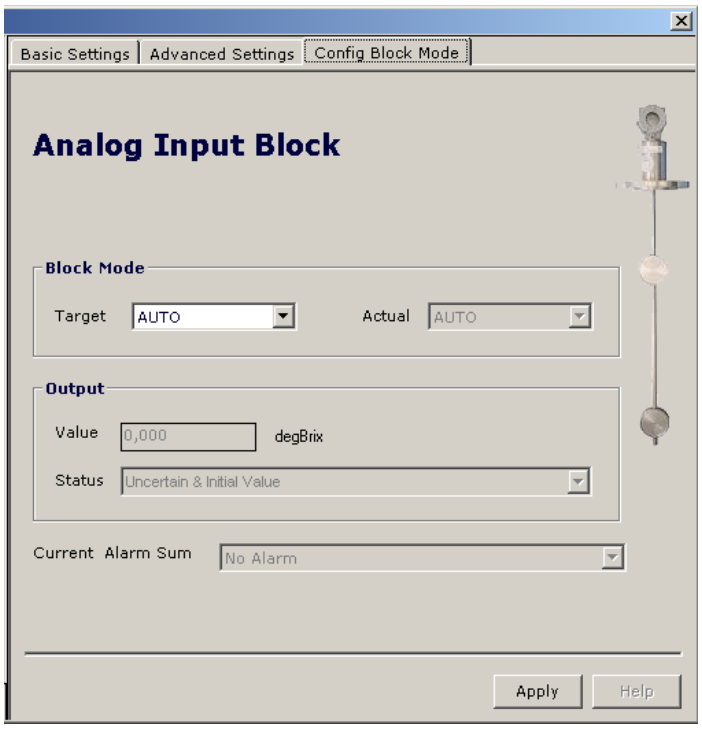


Figure 3.15 – Online Configuration – AI Block

Lower and Upper Concentration / Density Calibration

NOTE
The calibration windows of concentration / density lower and upper values of the ProfibusView are similar to Simatic PDM screens.

Each sensor has a characteristic curve that establishes a relation between the applied pressure, the sensor signal, and the measured concentration/density. This curve is determined for each sensor and it is stored in a memory together with the sensor. When the sensor is connected to the transmitter circuit, the content of its memory is made available to the microprocessor.

Sometimes the value on the transmitter display and transducer block reading may not match the applied pressure.

The reasons may be:

- The transmitter mounting position.
- The user's pressure standard differs from the factory standard.
- The transmitter had its original characterization shifted by over pressurization, over heating or by long term drift.

The calibration is used to match the reading with the correct concentration/density.

Please, make sure that the **DT303** is measuring concentration/density. Using ProfibusView or Simatic PDM, in the Transducer Block option, select the primary value type to “Density”.

The Primary Value Type indicates the density measurement.

The user can select the Measured Type selecting:
- Density (g/cm³),
- Density (Kg/m³),
- Relative Density @ 20°C
- Relative Density @ 4°C
- Baume,
- Brix,
- Plato Degree,
- INPM,
- Relative Density Alcohol
- Solid Percent,
- Density (lb/ft³)
- API – degree API

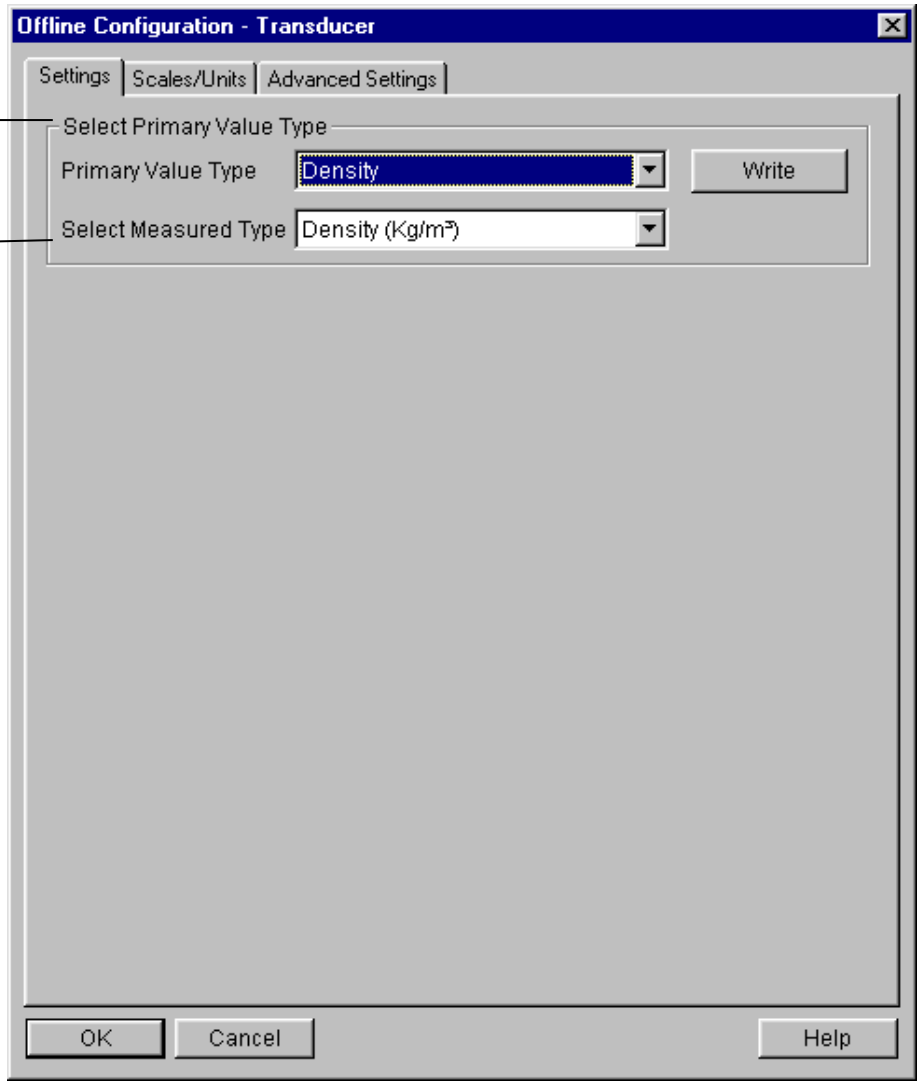


Figure 3.16 – Primary Value Type Selection

If is required an adjustment of unit, please just select the desired unit using the Measured Type parameter according to the application:

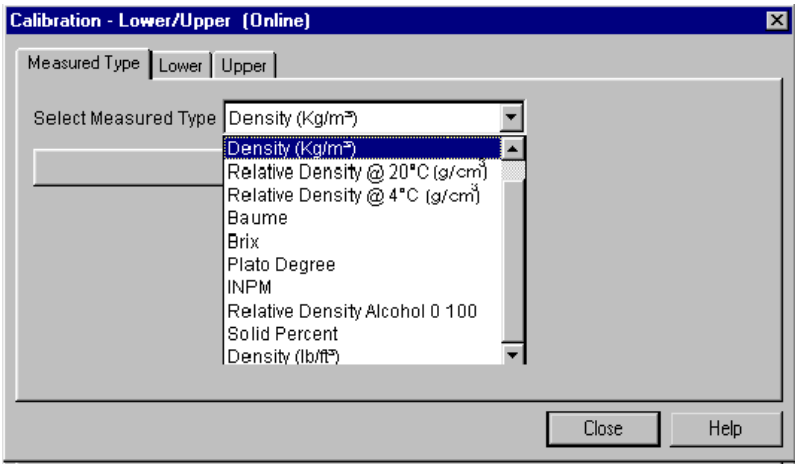


Figure 3.17 – Measured Type Selection

If the adjust requires a changing of measured values, please, calibrate the device with reference, according to these steps:
- Wait the process stabilizes and collect a sample;
- Determine in laboratory the value of density/concentration of stabilized process.

Using the ProfibusView or the Simatic PDM, in the Calibration option, the user can select the measured type and the lower and upper calibration procedure.

If the user selects Lower or Upper tab, the following window is shown and the user can see the actual calibrated point, the Primary Value and Status and the result of calibration procedure:

The user can see the actual concentration/ Density lower calibrated point and the matched pressure value.

The user can see the Primary Value, the Pressure Value, the Temperature value and the result according to the calibration process.

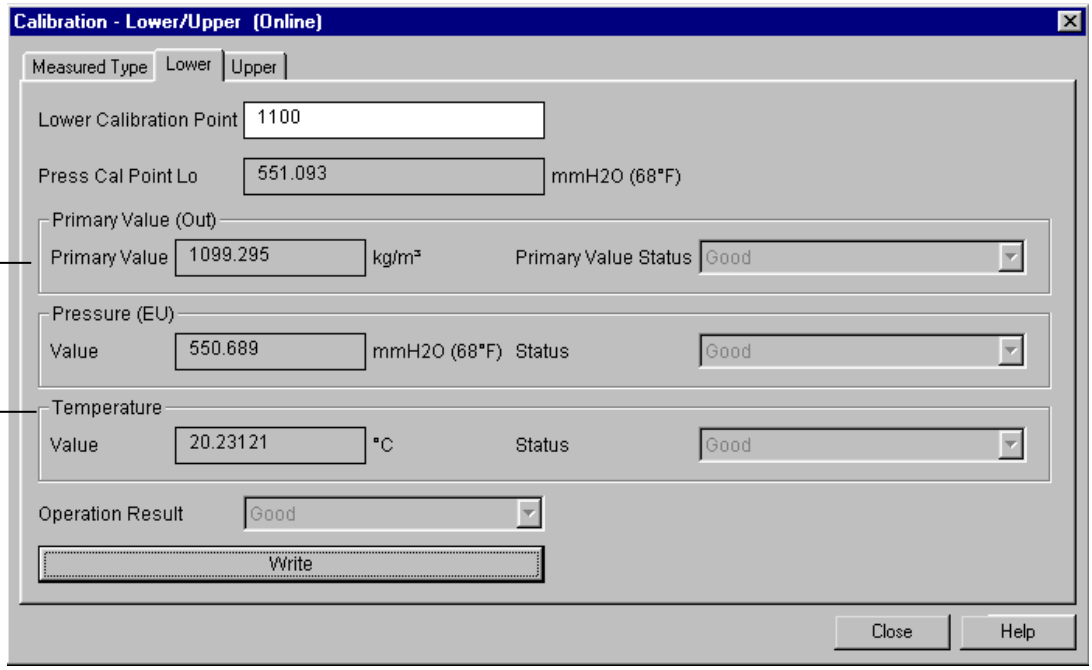


Figure 3.18 – DT303 Concentration/ Density Calibration

The calibrated point must be inside of the sensor range limits allowed for each type of concentration/ density measuring.

Lower and Upper Concentration/ Density Self-Calibration

NOTE
The self-calibration windows of lower and upper concentration / density of the ProfibusView are similar to Simatic PDM ones.

Using the **ProfibusView or Simatic PDM**, in the "Self-Calibration" option, the user can select the Measured Type and the lower and upper calibration procedure.

If the user selects Lower tab, the following window is shown and the user can see the actual calibrated point, the Primary Value and Status and the result of calibration procedure.

First Step – Air Self-Calibration

Place the **DT303** in work position (vertical) and facing the air, wait approximately **5** minutes for stabilization, choose **Kg/m³** for measurement unit and then click to the "Write" button. After this method, please return the Measured Type to the previous selection.

The user can see the actual concentration / density lower calibrated point.

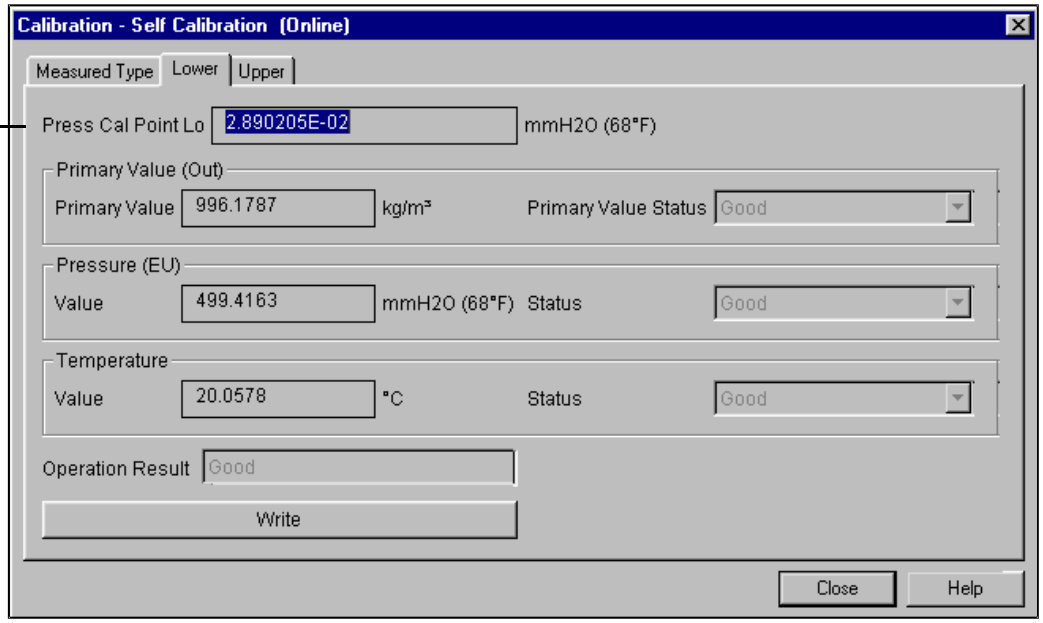


Figure 3.19 – DT303 Lower Concentration / Density Self-Calibration

If the user selects Upper tab, the following window is shown and the user can see the actual calibrated point, the Primary Value and Status and the result of calibration procedure.

Second Step – Water Self-Calibration

After air calibration, place the **DT303** in work position (vertical) and in water, immersing both diaphragms, wait approximately **5** minutes for stabilization and change the measurement unit for **Brix** and then click to the "Write" button. After this method, please return the Measured Type to the previous selection.

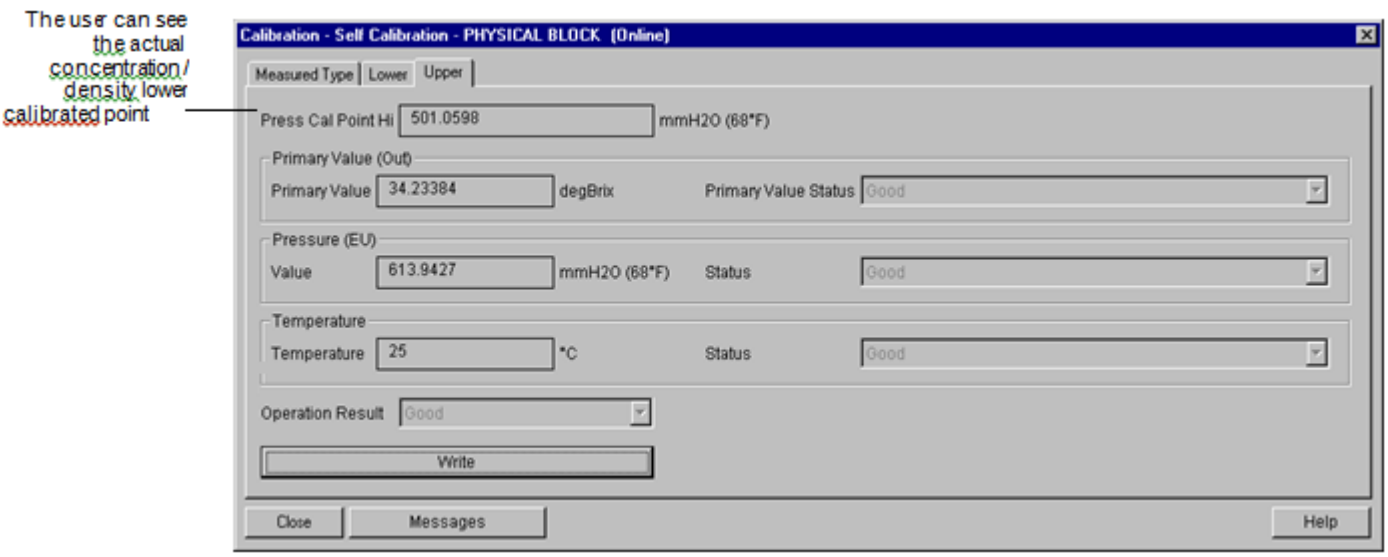


Figure 3.20 – DT303 Upper Concentration / Density Self-Calibration

WARNING
It is recommendable, for every new calibration, to save existing trim data, by means of parameter BACKUP_RESTORE, using option "Last Cal Backup".

Via Local Adjustment

Concentration/Density Calibration

The calibration process is always with reference, it means that the user must apply to the transmitter the measuring conditions. To calibrate, firstly follow the steps:

- Wait the process stabilizes and collect a sample;
- Determine in laboratory the value of density/concentration of stabilized process.
- To enter the local adjustment mode, place the magnetic tool in the orifice “Z” until flag “MD” lights up in the display. Remove the magnetic tool from “Z” and place it in the orifice “S”.

Remove and reinsert the magnetic tool in “S” until the message “LOC ADJ” is displayed. The message will be displayed during approximately 5 seconds after removing the magnetic tool from “S”. Insert the magnetic tool in “Z” and browse up to the PTYPE parameter to select the Primary Value Type to “Density”. Then, browse up to the LOWER or UPPER to make the calibration process, informing the determined value for the collected sample, for example, if the density is 1000 Kg/m^3, then with the magnetic tool in the orifice “S”, write for example, in UPPER parameter this value and remove the magnetic tool. After returning to monitoring, the Primary Value will indicate the calibrated value for this stabilized condition.

The calibration process procedure for LOWER and UPPER is identical. It is only necessary to inform the concentration/density for the collected sample.

Limit Conditions for Concentration/Density Calibration

For every writing operation in the transducer blocks there is an indication for the operation associate with the writing method. These codes appear in parameter XD_ERROR. Every time a calibration is performed. Code 16, for example, indicates a successfully performed operation.

Concentration/Density Values for scale of AI XD_SCALE					
Measured Type	Range 1		Range 2		AI Unit
	Lower	Upper	Lower	Upper	
Density (g/cm³)	0	3	0	10	g/cm³
Density (Kg/m³)	0	3000	0	10000	Kg/m³
Density (lb/ft³)	0	187,28	0	624,28	lb/ft³
Relative Density @ 20°C	0	3	0	10	-
Relative Density @ 4°C	0	3	0	10	-
Baume	-5	55	-5	55	degBaum
Brix	-10	110	-10	110	degBrix
Plato Degree	-10	110	-10	110	%Plato
INPM	-10	110	-10	110	INPM
GL	-10	110	-10	110	GL
Solid Percent	-10	110	-10	110	%Soli/wt
API	-10	110	-10	110	API

Notes: 1. Reference value @ 20°C
2. Over range limits +/- 10%

NOTE
Calibration mode exit via local adjustment occurs automatically should the magnetic tool not be used during some seconds. Keep in that even when parameters LOWER or UPPER already present the desired value, they must be actuated so that calibration is performed.

Limit Conditions for Calibration
For every writing operation in the transducer blocks there is an indication for the operation associate with the writing method. These codes appear in parameter XD_ERROR. Every time a calibration is performed. Code 16, for example, indicates a successfully performed operation.

Upper:
SENSOR_RANGE_EUO < NEW_UPPER < SENSOR_HI_LIMIT * 1.25
Otherwise, Invalid Calibration Request

(NEW_UPPER - TRIMMED_VALUE) < SENSOR_HI_LIMIT * 0.1
Otherwise, Excessive Correction.
(NEW_UPPER - CAL_POINT_LO) >CAL_MIN_SPAN * 0.75
Otherwise, Invalid Calibration Request.

Lower:
SENSOR_RANGE.EU0 < NEW_LOWER < SENSOR_HI_LIMIT * 1.25
Otherwise, Invalid Calibration Request
SENSOR_LO_LIMIT < TRIMMED _VALUE < SENSOR_HI_LIMIT * 1.25
Otherwise, Out of Range.
| NEW_LOWER - TRIMMED _VALUE | < SENSOR_HI_LIMIT * 0.1
Otherwise, Excessive Correction.
| CAL_POINT_HI - NEW_LOWER | > CAL_MIN_SPAN * 0.75
Otherwise, Invalid Calibration Request.

If all limit conditions are according to these rules, we get successful in the performed operation.

NOTE
Codes for XD_ERROR: 16: Default Value Set 22: Out of Range 26: Invalid Calibration Request 27: Excessive Correction

Self-Calibration
To make the self-calibration using the local adjustment, firstly is necessary to configure the AUTO_CAL_POINT_LO (LO) and AUTO_CAL_POINT_HI (HI) into the local adjustment tree (See section 4).

Please, see the resumed table for the transducer parameters involved in the calibration process:

Parameter (Name)	Parameter (Relative Index)	Item (Element)	Mnemonic
PRIMARY_VAL_TYPE	20	--	PVTY
MEASURED_TYPE	90	--	MEAST
AUTO_CAL_POINT_LO	95	--	LO
AUTO_CAL_POINT_HI	96	--	HI

To execute the Lower calibration, firstly the user should select the Measured Type as 1 (Density (Kg/m^3)). Then the user should apply air to the sensors and using the magnetic tool browses up to LO parameter and only writes a value. Any value written will calibrate internally the transmitter in 0.00 mmH_2O. To finalize, the Measured Type should be return to previous selection.

To execute the Upper calibration, firstly the user should select the Measured Type as 5 (Brix). Then the user should insert the sensors in water and using the magnetic tool browses up to HI parameter and only writes a value. In this situation, the applied pressure will be according to the distance between the sensors and the local gravity (approximately 500.0 mmH2O). To finalize, the Measured Type should be return to previous selection.

Sensor Information

The main information about the transmitter can be accessed selecting the Transducer block folder option as shown on the next figure. The sensor information will be displayed as shown below.

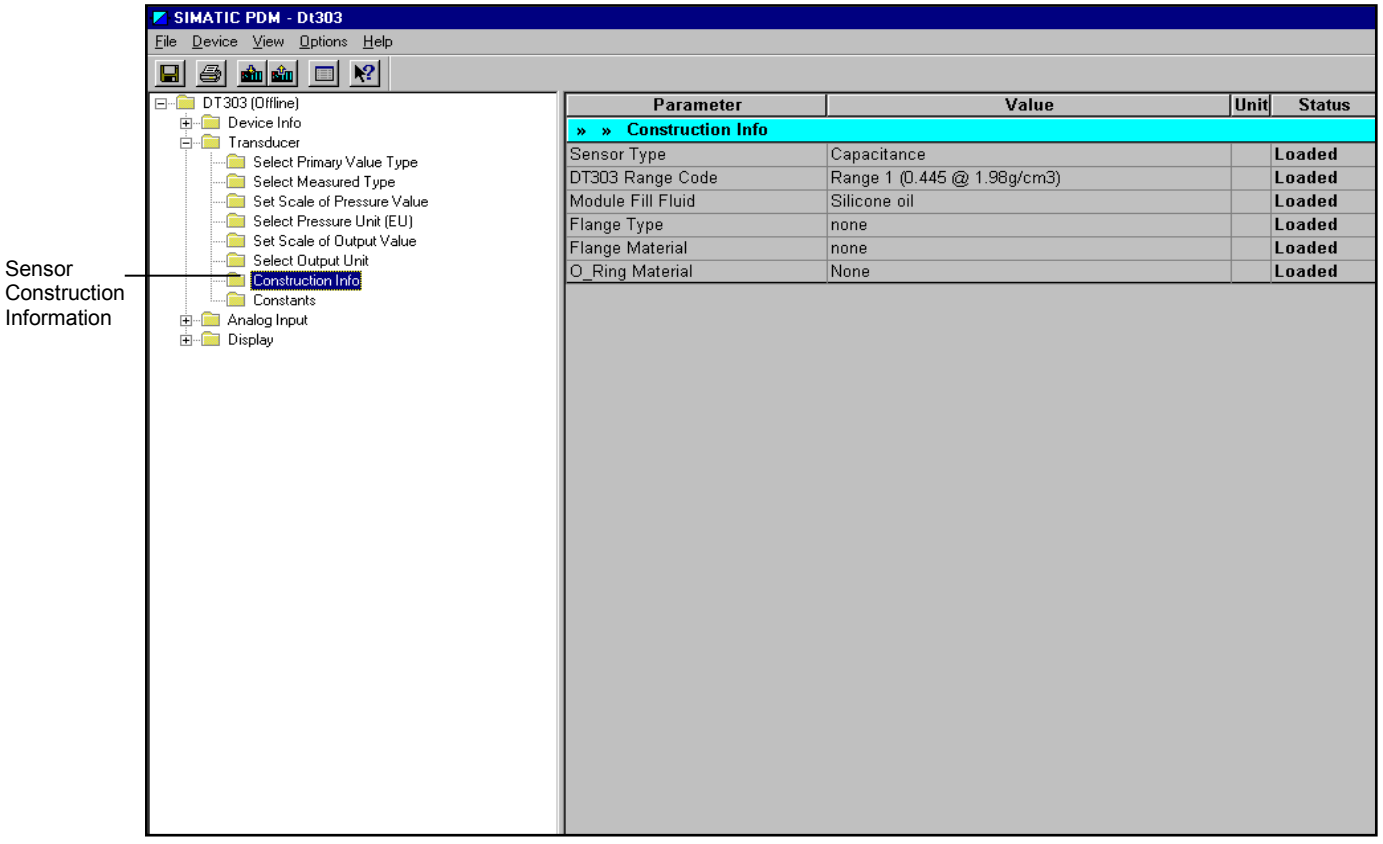


Figure 3.21 – Simatic PDM Transducer Block – Sensor Information

Some parameters are only factory configured (e.g. Sensor Type, Module Fill Fluid, etc.).

Temperature Calibration

NOTE
The temperature calibration windows of the ProfibusView are similar to Simatic PDM screens.

Write in parameter CAL_TEMPERATURE the right temperature value. After that, check the calibration performance using parameter TEMPERATURE. The user can select the unit using the parameter TEMPERATURE_UNIT. Normally, its operation is done by a method in the factory.

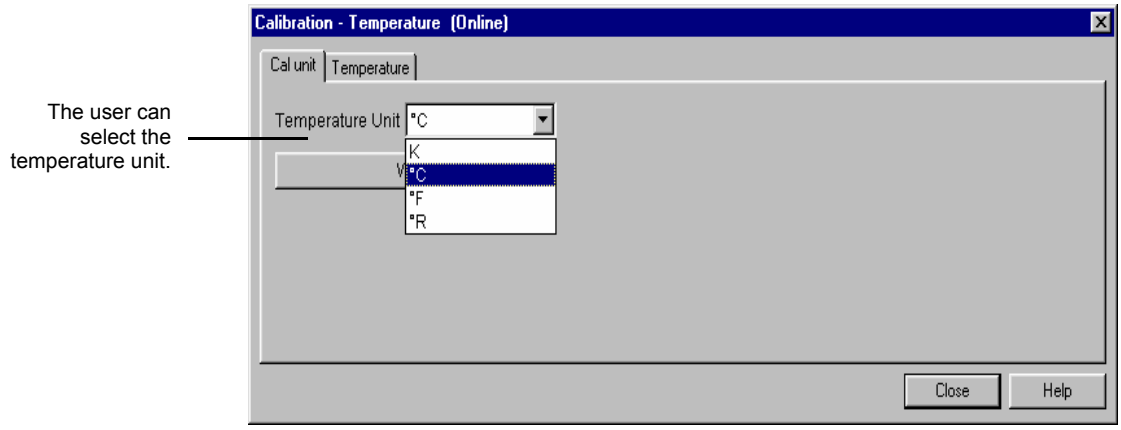


Figure 3.22 –Temperature Calibration Option

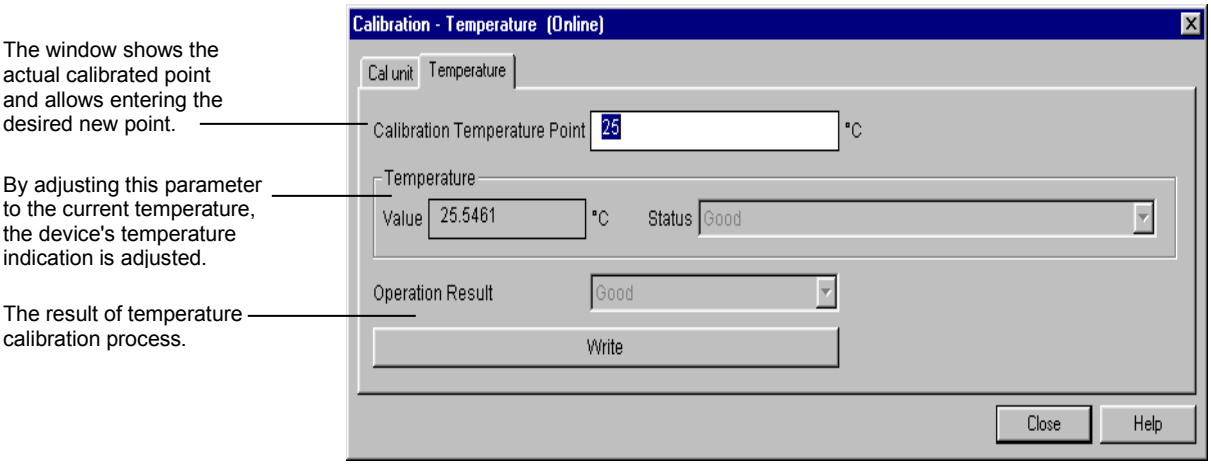


Figure 3.23 –Temperature Calibration Configuration Screen

Sensor Data Reading

NOTE
The sensor board located in the probe and the main electronic board located in the housing are compatible and matched during factory procedure. Due to this reason, it is not allowed to do the replacement of one of them in the field. If necessary, please return the device to Smar according to Section 4.

Always when **DT303** is on, is verified if the serial number of the sensor in the sensor board is the same that the saved serial number in EEPROM in the main board. When these numbers are different (a swap of sensor set or main board was carried through) the data stored in the EEPROM of sensor board is copied to the EEPROM of the main board.

Through the parameter BACKUP_RESTORE, also this reading can be made, choosing the option "Sensor Data Restore". The operation, in this case, is done independent of the sensor serial number. Through the option "Sensor Data Backup", the sensor data stored in the main board EEPROM memory can be saved in the EEPROM of the sensor board. (This operation is done at factory).

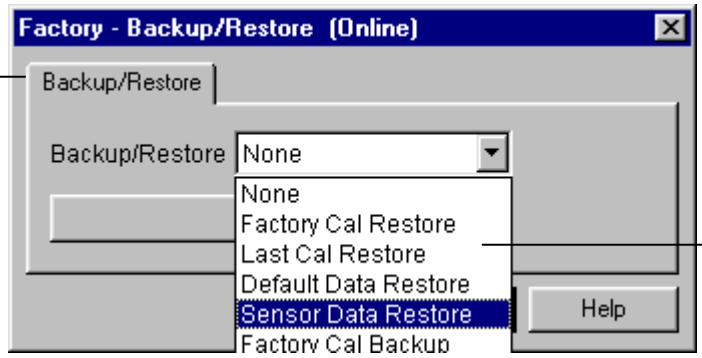
Through this parameter, we can recover default data from factory about sensor and last saved calibration settings, as well as making the rescue of calibrations. We have the following options:

Factory Cal Restore:	Recover last calibration settings performed at factory;
Last Cal Restore:	Recover last calibration settings performed by user and saved as backup;
Default Data Restore:	Restore all data as default;
Sensor Data Restore:	Restore sensor data saved in the sensor board and copy them to main board EEPROM memory;
Factory Cal Backup:	Copy the actual calibration settings to the factory ones;
Last Cal Backup:	Copy the actual calibration settings to the backup ones;
Sensor Data Backup:	Copy the sensor data at main board EEPROM memory to the EEPROM memory located at the sensor board;
None:	Default value, no action is done.

NOTE
The backup setting window of the ProfibusView is similar to Simatic PDM screen.

On the main menu of the Simatic PDM, selecting "Device Factory - Backup/Restore", the user can select backup and restore operations:

This parameter is used to save or restore the default, factory or user configuration stored at the sensor module.



By selecting the options contained in the list box, operations of backup and restore data in the sensor module can be selected.

Figure 3.24 – Transducer Block – Backup/Restore

Transducer Display – Configuration

NOTE
The display configuration windows of the ProfibusView are similar to Simatic PDM screens.

Using the ProfibusView or Simatic PDM 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 any configuration tool. It means, this block has some parameters, and those ones can be configured according to customer's needs.

The customer can choose up to six 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. The seventh parameter is used to access the physical device address. The user can change this address according to his application. To access and configure the Display Block, please, go to the main menu; select the screen “Display Block":

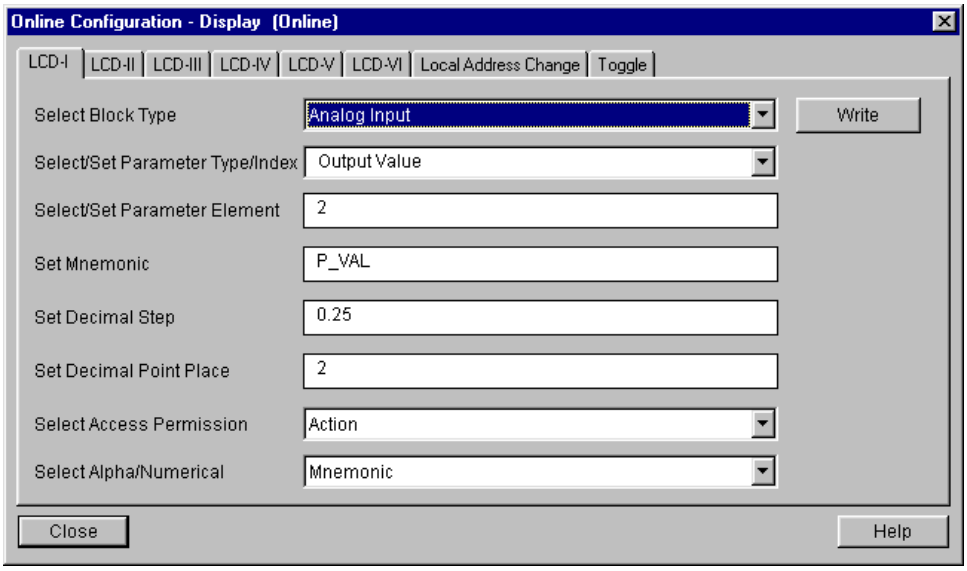


Figure 3.25 – Display Block

Display Transducer Block

The DT303 is completely configured by ProfibusView or Simatic PDM. It means, the user can select the best options to fit the application. From factory, it is configured with the options to set the Upper and Lower trim, for monitoring the input transducer output and check the Tag.

The local adjustment with the LCD (display) allows an easy and fast action on certain parameters, since it does not rely on communication and network wiring connections. Among the possibilities by Local Adjustment, the following options can be emphasized: Mode block, Outputs monitoring, Tag visualization and Tuning Parameters setting.

The interface with the user is described at the "Programming Using Local Adjustment" topic. The transducer block resources of all Smar 303 series field equipment have the same treatment methodology for local adjustment. Thus, if the user learns it once, can handle all types of Smar field equipment.

All function blocks and transducers defined according Profibus PA have a description of their features written, by the Device Description Language. This feature allows that third party configuration tools enabled by Device Description (DD) technology can interpret these features and make them accessible to configure. The Function Blocks and Transducers of 303 Series have been defined rigorously according the Profibus PA specifications to be interoperable to other parties.

To able the local adjustment using the magnetic tool, it is necessary to previously prepare the parameters related with this operation via system configuration.

There are six groups of parameters, which may be pre-configured by the user to able 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 select "None" in the parameter, "Select Block Type". Doing this, the device will not take the parameters related (indexed) to its block as a valid parameter.

Definition of Parameters and Values

Below are the definitions of the display transducer block configuration options. Refer to figure 3.27 to locate them.

Select Block Type
This is the type of the block where the parameter is located. The user can choose: Transducer Block, Analog Input Block, Totalizer Block, Physical Block or None.

Select/Set Parameter Type/Index
This is the index related to the parameter to be actuated or viewed (0, 1, 2…). For each block there

are some predefined indexes. Refer to the Function Blocks Manual to know the desired indexes and then just enter the desired index.

Select/Set Parameter Element
This is the element when the parameter is a structure.

Set Mnemonic
This is the mnemonic for the parameter identification (it accepts a maximum of 16 characters in the alphanumeric field of the display). Choose the mnemonic, preferably with no more than 5 characters because, this way, it will not be necessary to rotate it on the display.

Set Decimal Step
It is the increment and decrement in decimal units when the parameter is Float or Float Status value, or integer, when the parameter is in whole units.

Set Decimal Point Place
This is the number of digits after the decimal point (0 to 3 decimal digits).

Set Access Permission
The access allows the user to read, in the case of the “Monitoring” option, and to write when "Action" option is selected, then the display will show the increment and decrement arrows.

Set Alpha Numerical
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. It is useful when we are showing totalization at the LCD interface. In mnemonic option, the display may show the data in the numeric field and the mnemonic in the alphanumeric field.

Toggle
This parameter allows switching up to 6 parameters on the LCD during the monitoring.

In case the user wants to visualize a certain tag, opt for the index relative equal to "tag". To configure other parameters just select "LCD-II" up to "LCD-VI" windows:

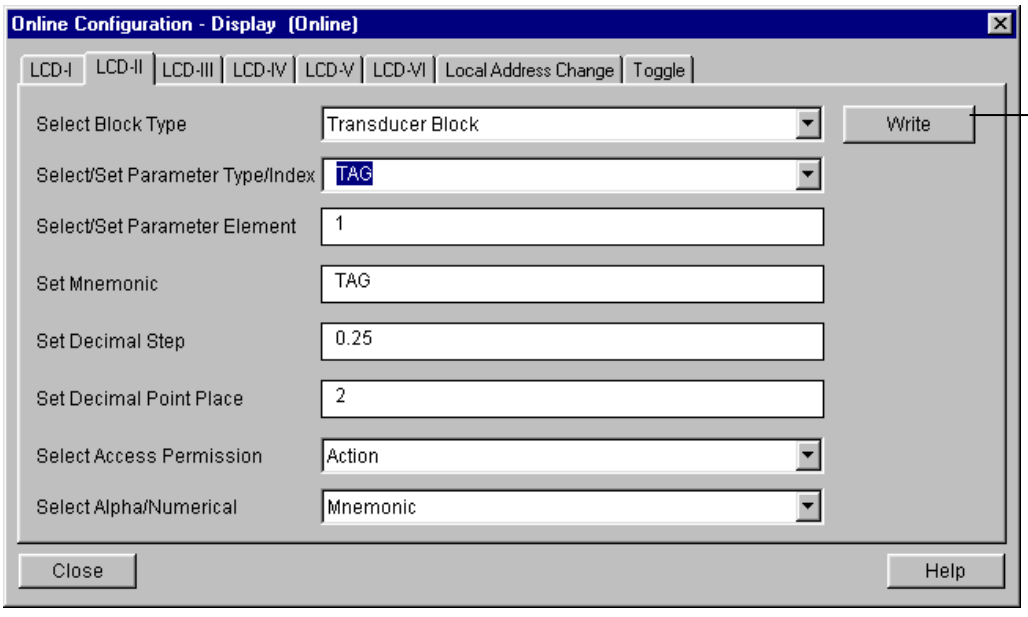


Figure 3.26 – Parameters for Local Adjustment Configuration

The tab "Local Address Change" allows the user "enable/disable" the access to changing the physical device address.

When the option “enable” is selected, the user can change the physical device by the local adjustment address.

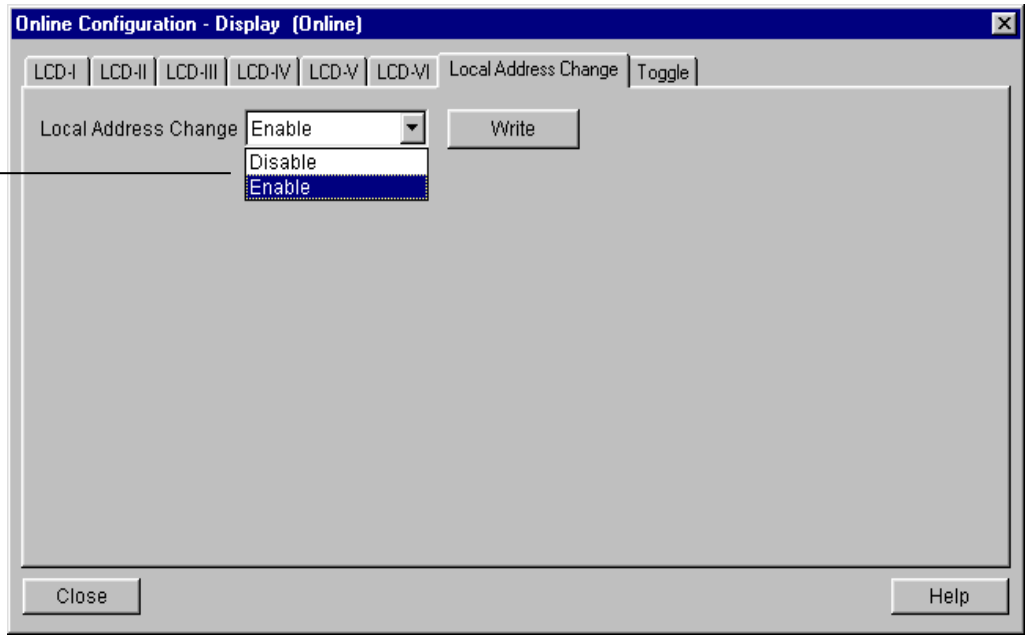


Figure 3.27 – Parameters for Local Adjustment Configuration

When the user enters into the local adjustment and rotate the parameters using the magnetic tool, after escaping to normal operation, e.g., the monitoring, if the parameter when the magnetic tool is removed has "Access Permission equal to Monitoring", then this last parameter will be shown at the LCD if the toggle parameter is equal to 1.

On the LCD interface always will be shown parameters according to toggle selection. If the user does not want to show any parameter, is only necessary to opt for "none" when configure the LCD tabs.

Selecting “None”, for example, the LCD-II will not be shown on the LCD display

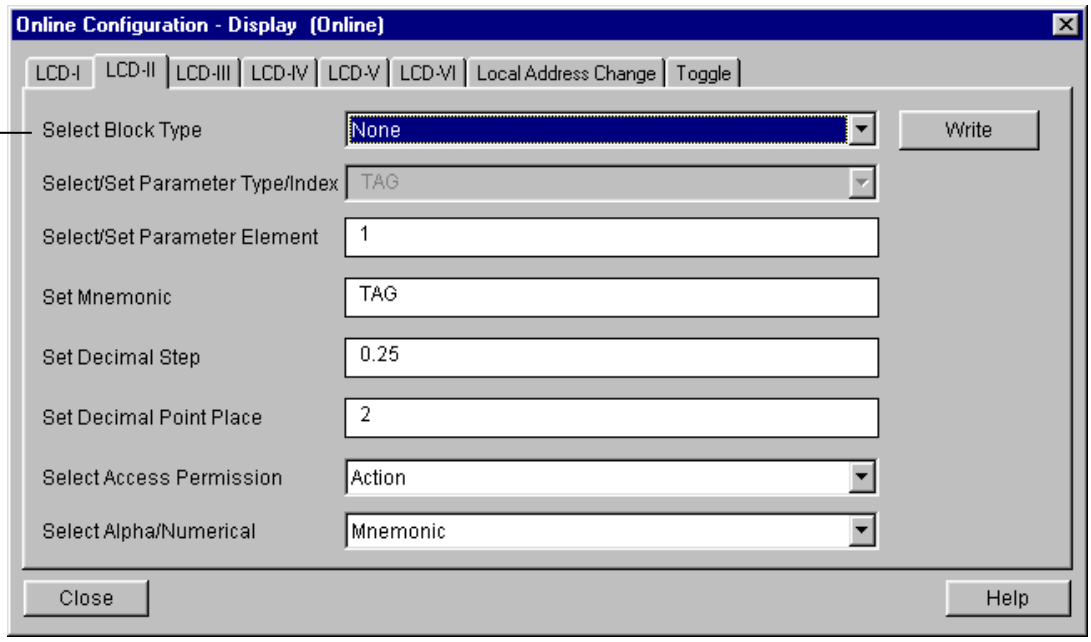


Figure 3.28 - Parameters for Local Adjustment Configuration

The user can select the "Mode Block" parameter at the LCD. In this case is necessary to select the index equal to "Mode Block":

With this option, the Mode Block parameter is shown at the LCD.

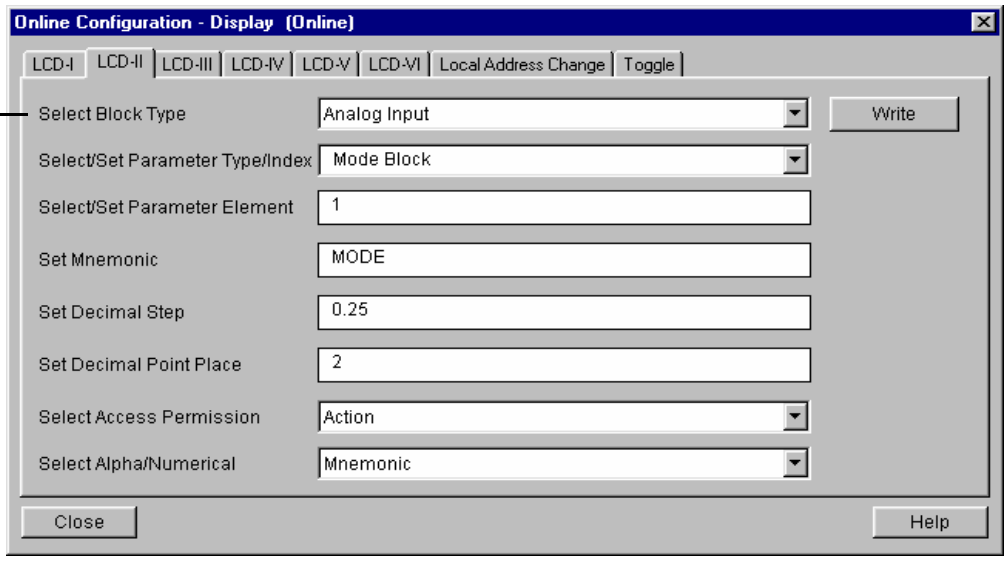
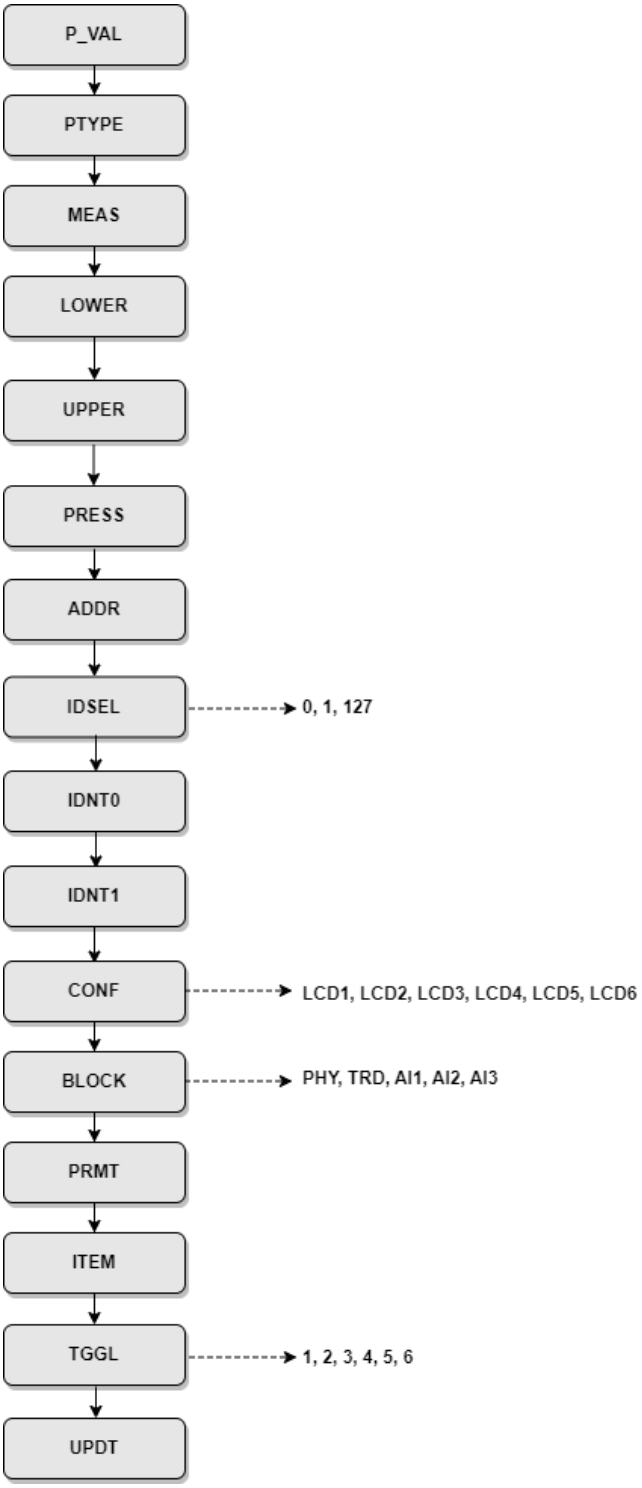


Figure 3.29 – Parameters for Local Adjustment Configuration

Local Adjustment Tree



How to access the local adjustment tree

- Place the magnetic tool in hole Z, wait for the MD icon to appear on the display;
- Place the magnetic tool in hole S, wait 2 seconds, remove it from S, wait 2 seconds, place it in S again and wait for LOC ADJ to appear on the display.

How to search and select menu options

- Hold the magnetic tool in Z to move through the local adjustment tree.
- Enter in S to select the desired option.

How to configure a block parameter in one of the local adjustment tree options

- Navigate to the CONF option and select the desired LCD;
- Return the switch to hole Z, navigate to the next option, BLOCK, and select the block to be configured, placing the magnetic tool in hole S;
- Return the switch to hole Z, navigate to the next option, PRMT, and select the parameter to be configured, placing the magnetic tool in hole S;
- Then, in the ITEM option, configure the subindex, if applicable;
- Navigate to the UPDT option and insert the magnetic tool in S;
- Enter local adjustment again and look for the configured parameter in the chosen LCD. After all these steps the parameter can be changed;
- Repeat the above steps for all parameters that will be configured. Use views 2 to 6 (LCD-II to LCD_VI) to avoid corrupting the main view of normal equipment operation (LCD-I).

Programming Using Local Adjustment

The DT303 is completely configured by ProfibusView or Simatic PDM. The user can select the best options to fit to the application. From factory, it is configured with the options to set the Upper and Lower trim, for monitoring the input transducer, output and check the Tag. Normally, the transmitter is configured by configuration tool, 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 by Local Adjustment, the following options can be emphasized: Mode block, Outputs monitoring, Tag visualization and Tuning Parameters setting.

The transmitter has two holes for magnetic switches, located under the identification plate. These magnetic switches are activated by one magnetic tool. This magnetic tool enables adjustment of the most important parameters of the blocks. Without display, the local adjustment is not possible.

To enter the local adjustment mode, place the magnetic tool in hole **Z** until flag **MD** lights up in the display. Removes magnetic tool from **Z** and place it in hole **S**. Remove and reinsert the magnetic tool in **S** until the message **LOC ADJ** is displayed. The message will be displayed during approximately 5 seconds after the user removes the magnetic tool from **S**. By placing the magnetic tool in **Z** the user will be able to access the local adjustment tree.

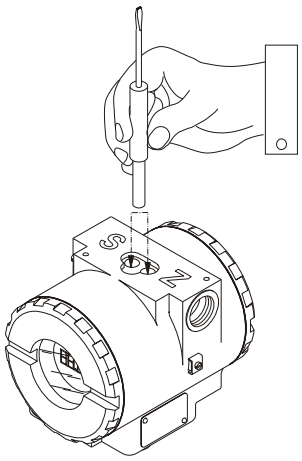


Figure 3.30 - Local Adjustment Holes

Table shows the actions on the **Z** and **S** holes on the **DT303** when Local Adjustment is enabled.

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

Table 3.5 - Purpose of the holes on the Housing

J1 Jumper Connections

If J1 is connected to ON, then simulation mode in the AI block is enabled.

W1 Jumper Connections

If W1 is connected to ON, the local adjustment programming tree is enabled, and then important block parameters can be adjusted, and communication can be pre-configured via local adjustment.

See next figure.

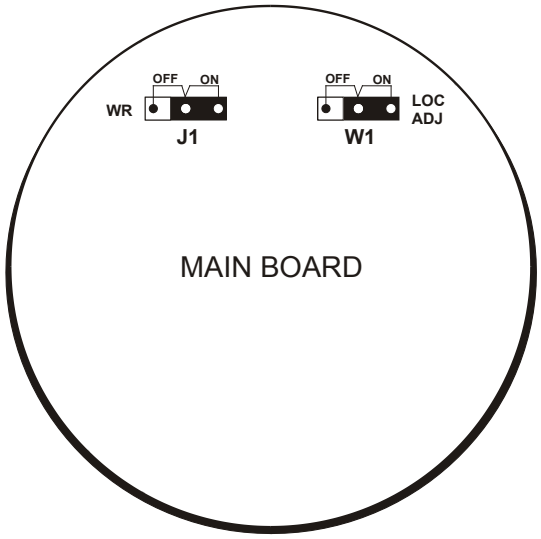
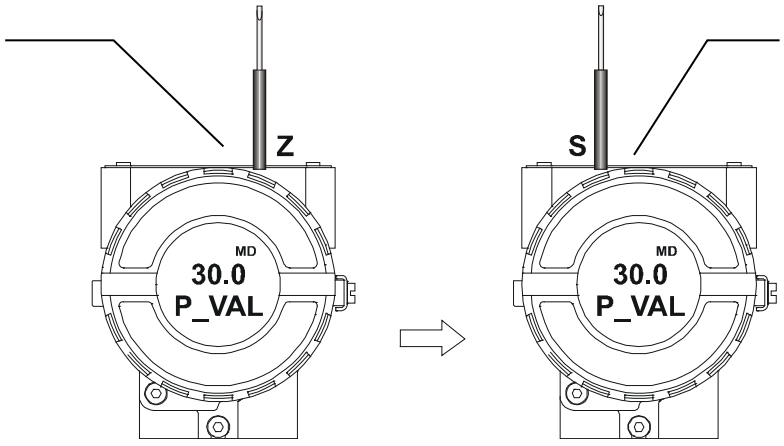


Figure 3.31 - J1 and W1 Jumpers

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 for 5 seconds.

Figure 3.32 – Step 1 – DT303

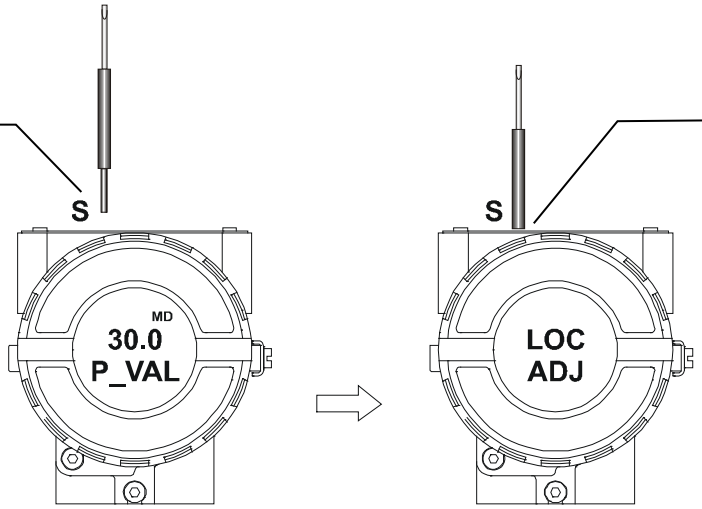


Figure 3.33 – Step 2 – DT303

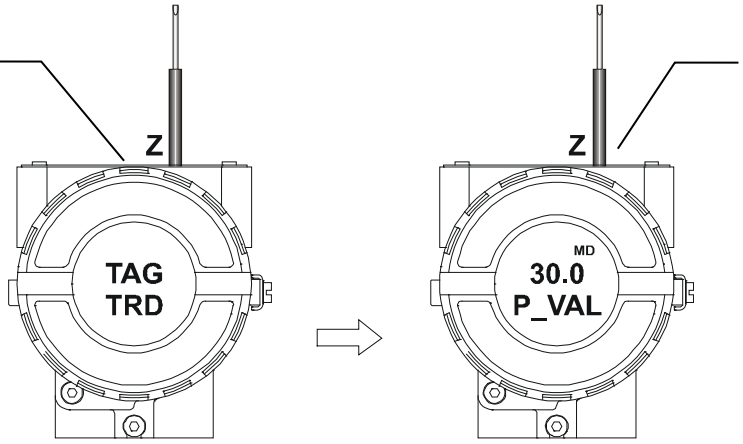


Figure 3.34 – Step 3 – DT303

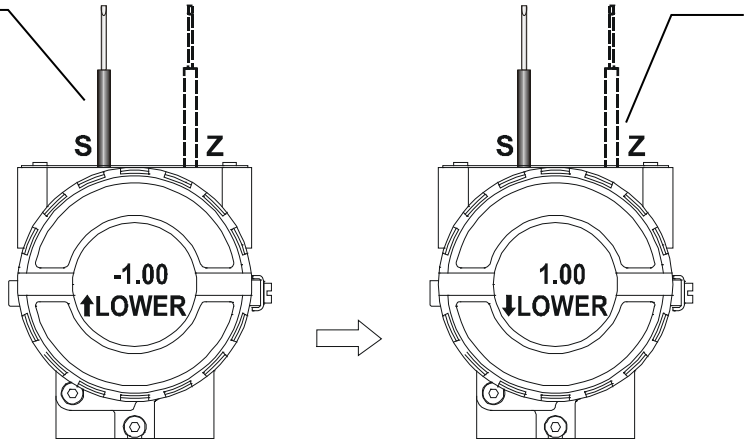
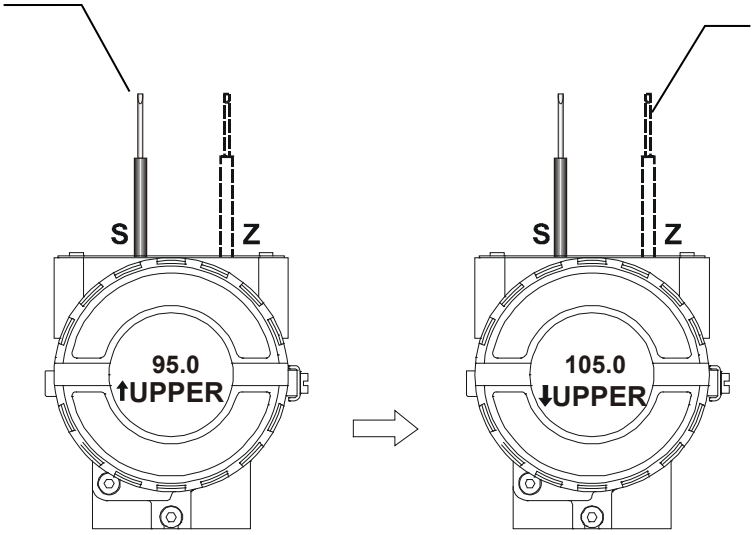


Figure 3.35 – Step 4 – DT303

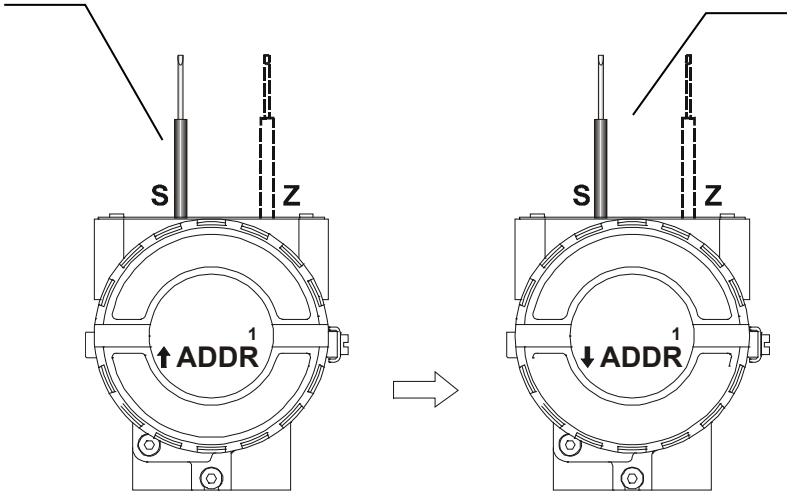
To range the upper value (UPPER), simply insert the magnetic tool in orifice S as soon as upper is shown on the display. An arrow pointing upward (↑) increments the value and an arrow pointing downward (↓) decrements the value. To increment the value, keep the tool insert in S up to set the value desired.



In order to decrement the upper value, place the magnetic tool in orifice Z to shift the arrow to the downward position an then; by insetting and keeping the tool in orifice S, it is possible to decrement the upper value.

Figure 3.36 – Step 5 – DT303

To change the address value, simply take off the magnetic tool from orifice Z as soon as ADDR is shown on the display. An arrow pointing upward (↑) increments the address and an arrow pointing downward (↓) decrements the address. To increment the address, insert the tool in S up to set the value desired.



To decrement the address value, place the magnetic tool in orifice Z to shift the arrow to the downward position and then, by inserting and keeping the tool in orifice S, it is possible to decrement the address value.

Figure 3.37 – Step 6 – DT303

This option configures the DT303 address on the PROFIBUS PA network. Acceptable values range from 3 to 126.

Since the local adjustment is configurable, the previous steps are only examples.

The local adjustment tree has other configuration options. See below:

IDSEL
There are three possible values for this parameter, resulting in three operating modes:
(0) PROFILE SPECIFIC – Equipment complies with a generic GSD, and this must be used when there is a perspective of exchanging equipment between manufacturers.
(1) MANUFACTURER SPECIFIC – (DEFAULT) Equipment complies with the manufacturer's GSD with its characteristics.
(127) AUTOMATIC_IDENT_NUMBER – Equipment will respond with the IDENT_NUMBER configured in the IDNT0 and IDNT1 parameters. For more details see note.

IDENT0
After changing the IDSEL parameter to 127, the equipment's IDENT_NUMBER value must be converted from hexadecimal to decimal, found inside the GSD file used to include it in the configuration, and the first part of the converted number must be written in IDNT0.

IDENT1
In IDENT1 write the second part of the equipment's IDENT_NUMBER value in decimal.

Examples:
0X06CA => IDNT0 = 6 and IDNT1 = 202
0X8079 => IDNT0 =128 and IDNT1 = 121

CONF
This option allows selecting the LCD to configure it, that is, which item will be shown on the DT303 display and the local adjustment tree. Six options are available – from LCD1 to LCD6.

BLOCK
In this option, the user can select the function block to be configured.

PRMT
It is the number corresponding to the relative index of the parameter to be configured within the function block chosen in the BLOCK option.

ITEM
This option must be configured if the parameter selected in PRMT has sub-items. For example, the OUT_SCALE parameter is composed of EU at 100%, EU at 0%, Unit Index and Decimal Point.

TGGL
This option allows choosing how many configured parameters will be alternately shown on the display during normal operation. For example, if TGGL equals two, the display will alternate between LCD1 and LCD2.

UPDT
The configuration is finished by activating UPDT after choosing the options for the local adjustment.

NOTE

AUTOMATIC_IDENT_NUMBER is a feature available from DT303 firmware version 4.11 onwards. This procedure can be used to replace a device from another manufacturer with a SMAR device without changing the configuration of the PROFIBUS master in operation.

This action is recommended when there is an urgent need to replace the equipment or there is no possibility of maintaining the configuration.

In this case, the IDENT_NUMBER of the SMAR equipment must be changed to reflect the same code as the equipment it will replace. This can only be done by comparing the GSD files of both and ensuring module compatibility.

For example, if there is a PROFIBUS PA device from another manufacturer in your network and that, according to its GSD file, has IDENT_NUMBER = 0x0639 and it is necessary to replace it with a Smar device, without downloading the configuration in the PROFIBUS master, the user must proceed as follows:

1) Change the address of the SMAR device to the same address as the device to be replaced.

2) Check in the configuration in operation on the client, which is the model and IDENT_NUMBER of the equipment via GSD file. Take a note of this number, for example 0x0639 is the IDENT_NUMBER used by one of the equipment models from another manufacturer.

3) On the Smar equipment, using the magnetic tool, go to the IDENT parameter and set the value to 127. This value means that the equipment will work in AUTOMATIC_IDENT_NUMBER.

4) After changing the IDENT parameter to 127, convert the GSD value to decimal and write the values in items IDNT0 and IDNT1:

   0x0639 => IDNT0 = 6 | IDNT1 = 57

5) Restart the equipment.

This Smar equipment can be added in place of another manufacturer's equipment without changing the configuration. Parameterizations (SETUP, Kp, Tr, scales) must be performed locally or with ProfibusView and PBI.

In case of FACT_INIT on the instrument, it will return to the default mode (1) MANUFACTURER SPECIFIC with the original IDENT_NUMBER Smar.

Monitoring View

Using the ProfibusView or Simatic PDM, in the Monitoring window, is possible to monitor the dynamics variables of the Transducer and the Analog Input block:

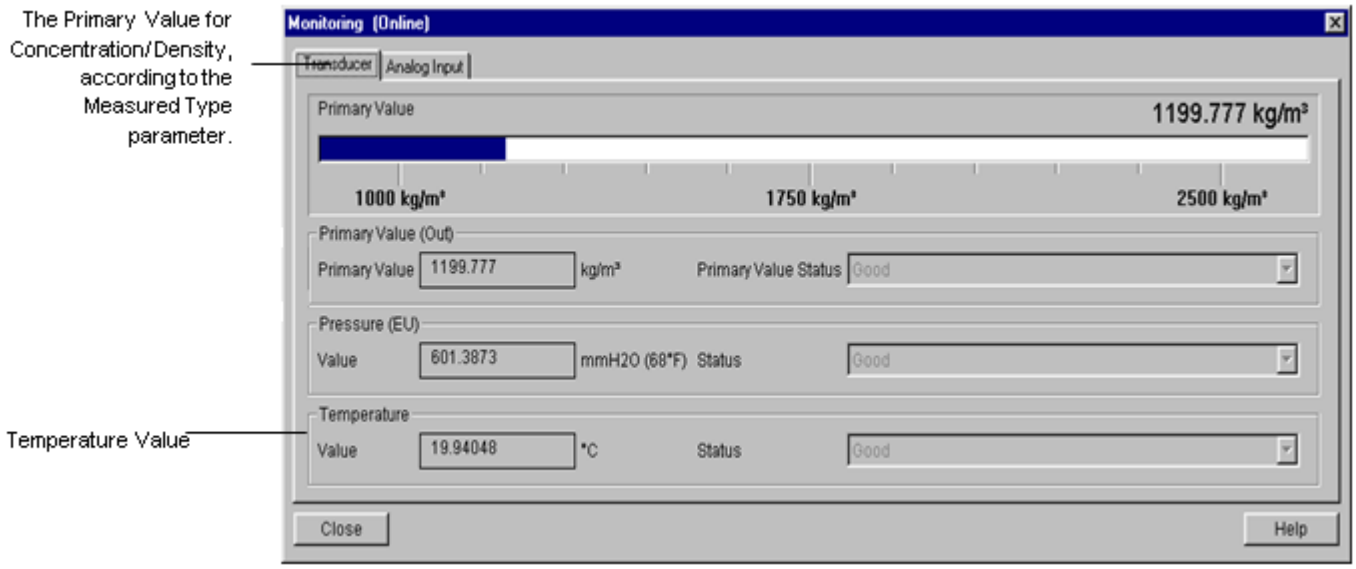


Figure 3.38 – Transducer Block Monitoring View – Simatic PDM

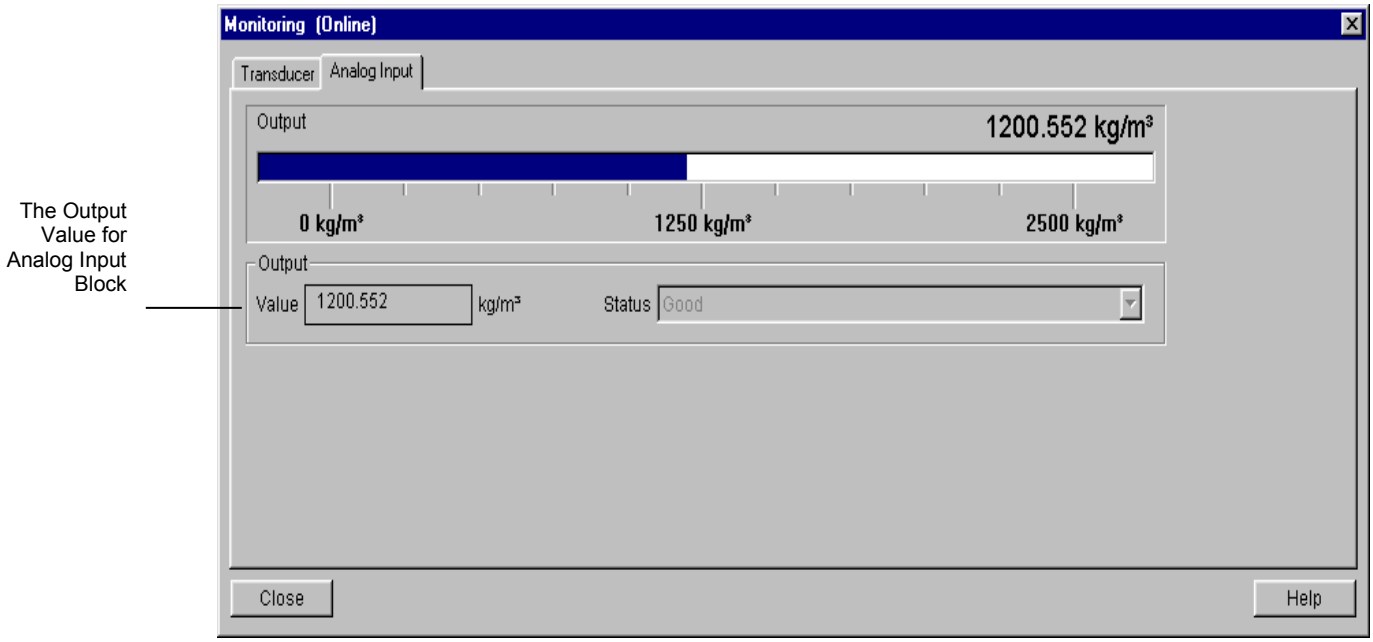


Figure 3.39 – Analog Input Block Monitoring View – Simatic PDM

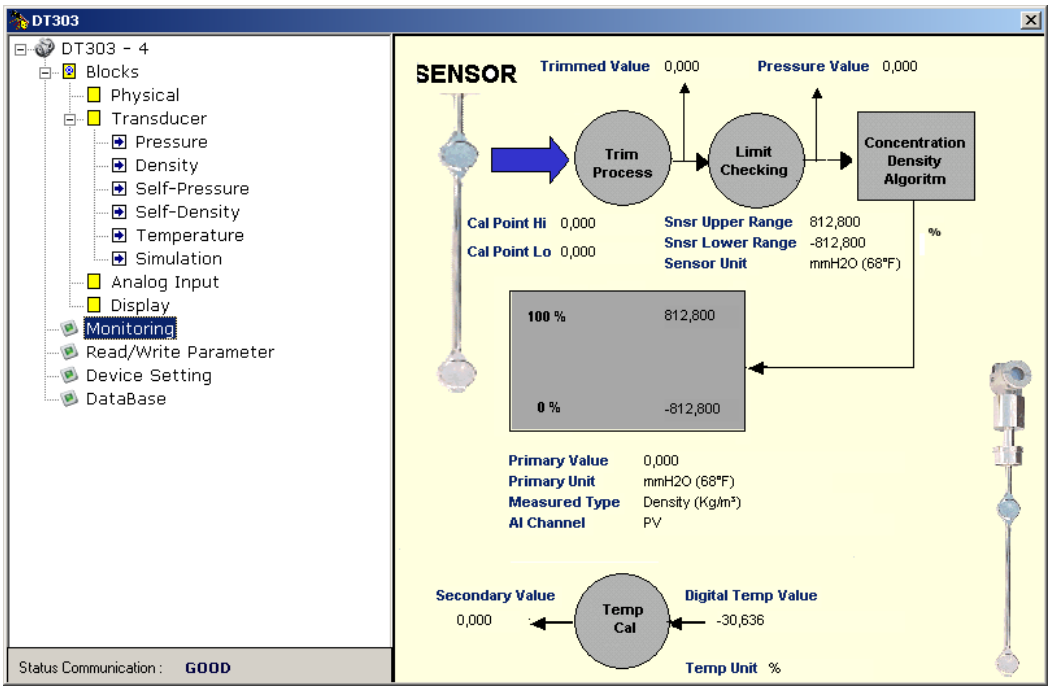


Figure 3.40 – Monitoring View – ProfibusView

Simulating Values

For simulation proposal the user can use the Simulated TRD option.

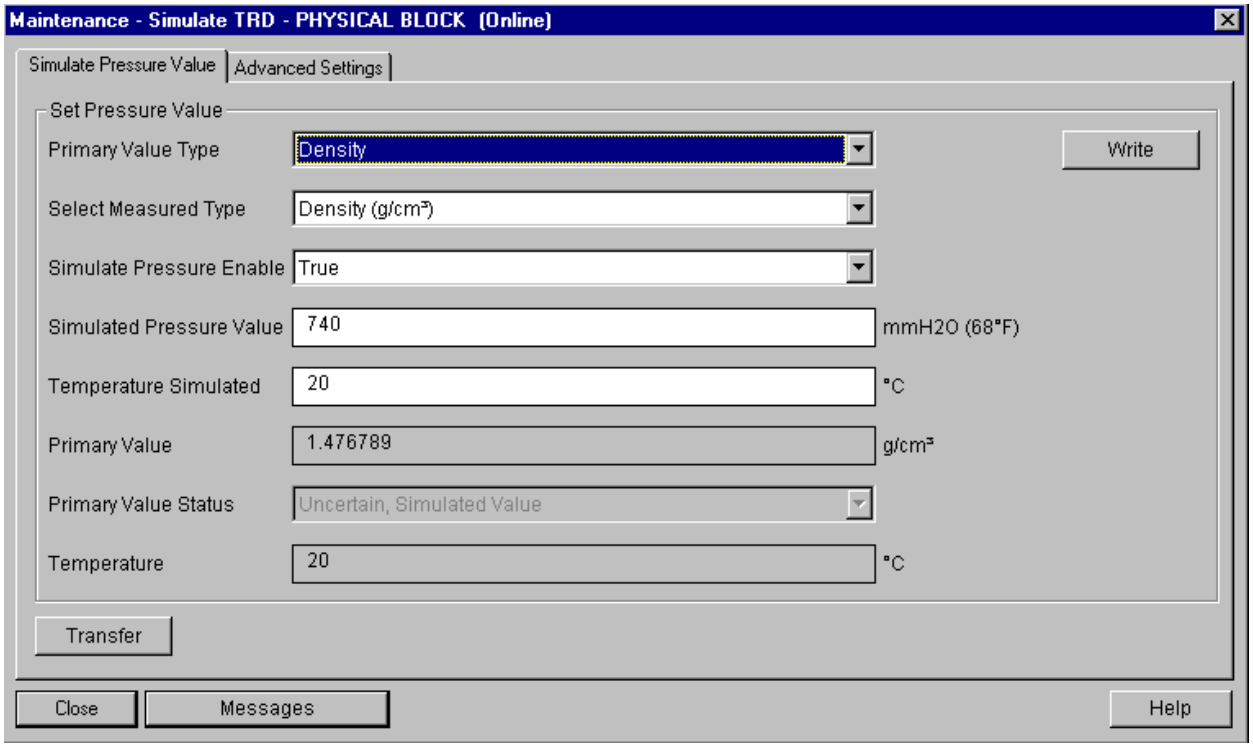


Figure 3.41 – Simulate TRD Screen

Note that the user needs to enable the simulation through the simulation pressure enable parameter and the status of primary value parameter will indicate this situation when it is activated.

Cyclical Diagnosis

Via cyclic communication is possible to verify diagnostics from the **DT303** using the Profibus Master Class 1 or even via acyclic communication via Master Class 2. The Profibus-PA devices provide up to 4 standard diagnoses bytes via Physcial Block (see figure 3.42 and 3.43) and when the most significant bit of the fourth Byte is "1", the diagnose will extend the information in more 6 bytes. These Diagnosis bytes can also be monitored via cyclic tools.

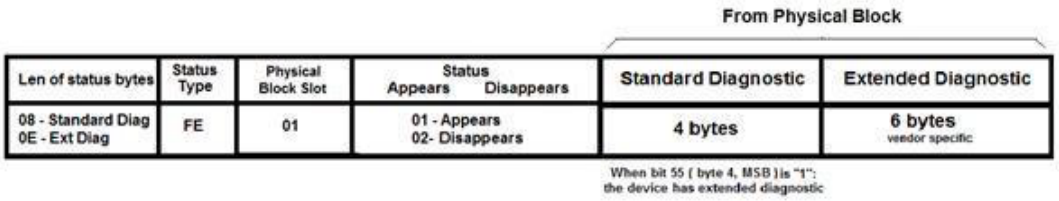


Figure 3.42 – Cyclical Diagnosis

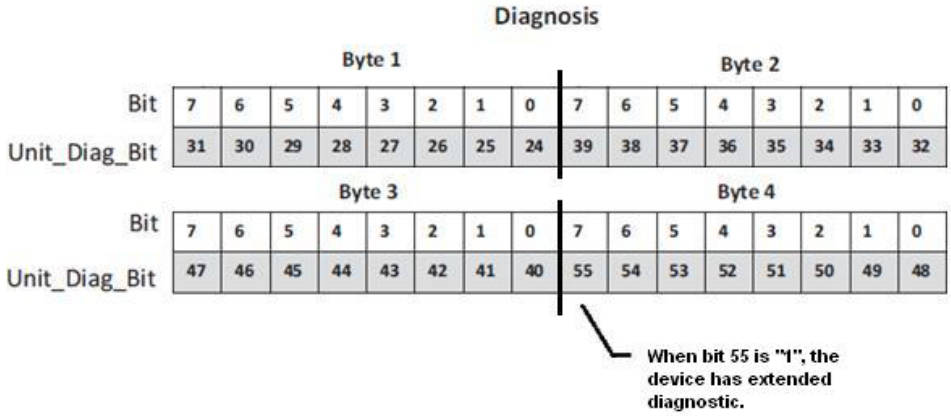


Figure 3.43 – Cyclic Diagnosis mapping for 4 bytes of Physical Block.

Unit_Diag_bit is described in the GSD file Profibus-PA device.

See below a description part of a GSD file for the 4 bytes and more detail:

```
;---------- Description of device related diagnosis: ---------------------
;



Unit_Diag_Bit(16)   = "Error appears"
Unit_Diag_Bit(17)   = "Error disappears"
;
;Byte 01
Unit_Diag_Bit(24)   = "Hardware failure electronics"
Unit_Diag_Bit(25)   = "Hardware failure mechanics"
Unit_Diag_Bit(26)   = "Not used 26"
Unit_Diag_Bit(27)   = "Electronic temperature alarm"
Unit_Diag_Bit(28)   = "Memory error"
Unit_Diag_Bit(29)   = "Measurement failure"
Unit_Diag_Bit(30)   = "Device not initialized"
Unit_Diag_Bit(31)   = "Device initialization failed"

;Byte 02
Unit_Diag_Bit(32)   = "Not used 32"
Unit_Diag_Bit(33)   = "Not used 33"
Unit_Diag_Bit(34)   = "Configuration invalid"
```

```
Unit_Diag_Bit(35)   = "Restart"
Unit_Diag_Bit(36)   = "Coldstart"
Unit_Diag_Bit(37)   = "Maintenance required"
Unit_Diag_Bit(38)   = "Not used 38"
Unit_Diag_Bit(39)   = "Ident_Number violation"


;Byte 03
Unit_Diag_Bit(40)   = "Not used 40"
Unit_Diag_Bit(41)   = "Not used 41"
Unit_Diag_Bit(42)   = "Not used 42"
Unit_Diag_Bit(43)   = "Not used 43"
Unit_Diag_Bit(44)   = "Not used 44"
Unit_Diag_Bit(45)   = "Not used 45"
Unit_Diag_Bit(46)   = "Not used 46"
Unit_Diag_Bit(47)   = "Not used 47"


;byte 04
Unit_Diag_Bit(48)   = "Not used 48"
Unit_Diag_Bit(49)   = "Not used 49"
Unit_Diag_Bit(50)   = "Not used 50"
Unit_Diag_Bit(51)   = "Not used 51"
Unit_Diag_Bit(52)   = "Not used 52"
Unit_Diag_Bit(53)   = "Not used 53"
Unit_Diag_Bit(54)   = "Not used 54"
Unit_Diag_Bit(55)   = "Extension Available"

;Byte 05 TRD Block & PHY Block
Unit_Diag_Bit(56)   = "Sensor failure"
Unit_Diag_Bit(57)   = "Temperature Out of work range"
Unit_Diag_Bit(58)   = "Process Measurement Out of High limit"
Unit_Diag_Bit(59)   = "Process Measurement Out of Low limit"
Unit_Diag_Bit(60)   = "Calibration Error - Check XD_ERROR parameter"
Unit_Diag_Bit(61)   = "Simulation Active in TRD Block"
Unit_Diag_Bit(62)   = "No valid polynomial version"
Unit_Diag_Bit(63)   = "Device is writing lock"

;byte 06 AI_1 Block
Unit_Diag_Bit(64)   = "Simulation Active in AI 1 Block"
Unit_Diag_Bit(65)   = "Fail Safe Active in AI 1 Block"
Unit_Diag_Bit(66)   = "AI 1 Block in Out of Service"
Unit_Diag_Bit(67)   = "AI 1 Block Output out of High limit"
Unit_Diag_Bit(68)   = "AI 1 Block Output out of Low limit"
Unit_Diag_Bit(69)   = "Not used 69"
Unit_Diag_Bit(70)   = "Not used 70"
Unit_Diag_Bit(71)   = "Not used 71"

;byte 07 AI_2 Block
Unit_Diag_Bit(72)   = "Simulation Active in AI 2 Block"
Unit_Diag_Bit(73)   = "Fail Safe Active in AI 2 Block"
Unit_Diag_Bit(74)   = "AI 2 Block in Out of Service"
Unit_Diag_Bit(75)   = "AI 2 Block Output out of High limit"
Unit_Diag_Bit(76)   = "AI 2 Block Output out of Low limit"
Unit_Diag_Bit(77)   = "Not used 77"
Unit_Diag_Bit(78)   = "Not used 78"
Unit_Diag_Bit(79)   = "Not used 79"

;byte 08 AI_3 Block
Unit_Diag_Bit(80)   = "Simulation Active in AI 3 Block"
Unit_Diag_Bit(81)   = "Fail Safe Active in AI 3 Block"
Unit_Diag_Bit(82)   = "AI 3 Block in Out of Service"
Unit_Diag_Bit(83)   = "AI 3 Block Output out of High limit"
Unit_Diag_Bit(84)   = "AI 3 Block Output out of Low limit"
Unit_Diag_Bit(85)   = "Not used 85"
Unit_Diag_Bit(86)   = "Not used 86"
Unit_Diag_Bit(87)   = "Not used 87"
```

;byte 09 TRD Block
Unit_Diag_Bit(88) = "Primary Value type is not density"
Unit_Diag_Bit(89) = "Not used 89"
Unit_Diag_Bit(90) = "Not used 90"
Unit_Diag_Bit(91) = "Not used 91"
Unit_Diag_Bit(92) = "Not used 92"
Unit_Diag_Bit(93) = "Not used 93"
Unit_Diag_Bit(94) = "Not used 94"
Unit_Diag_Bit(95) = "Not used 95"

;byte 10
Unit_Diag_Bit(96) = "Not used 96"
Unit_Diag_Bit(97) = "Not used 97"
Unit_Diag_Bit(98) = "Not used 98"
Unit_Diag_Bit(99) = "Not used 99"
Unit_Diag_Bit(100) = "Not used 100"
Unit_Diag_Bit(101) = "Not used 101"
Unit_Diag_Bit(102) = "Not used 102"
Unit_Diag_Bit(103) = "Not used 103"

NOTE

If the FIX flag is active on LCD, the **DT303** is configured to "Profile Specific" mode. When in "Manufacturer Specific" mode, the Identifier Number is 0x0905. Once the Identifier_Number_Selector is changed from "Profile Specific" to "Manufacturer Specific" or vice-versa, one must wait 5 seconds while is saved. Then, turn the **DT303** off and turn it on again. So, the Identifier Number is updated to the communication level. If the equipment is in "Profile Specific" and using the GSD file Identifier Number equals 0x0905, the acyclic communication will work with the tools based on EDDL, FDT/DTM, but no cyclic communication with the Profibus-DP master.

Section 4

MAINTENANCE PROCEDURES

General

Smar **DT303** Concentration/Density 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 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.

DT303 has been designed to operate for many years without malfunctions. The process application can require periodic cleaning of the repeater diaphragms, and then the flanges may be easily removed and reinstalled. The transmitter eventually can require maintenance, and then it may be changed in the field. In this case, the possibly damaged sensor should be returned to Smar for evaluation and, if necessary, repair. Refer to the item "Returning Materials" at the end of this Section. Table 4.1 shows the symptoms and the probable source of problem.

SYMPTOM	PROBABLE SOURCE OF PROBLEM
NO COMMUNICATION	**Transmitter Connections** Check wiring polarity and continuity. Check for short circuit 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 **DT303** 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 application. 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 terminators are OK and correctly positioned. Check that the coupler connections 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 that device address is configured correctly.
	Electronic Circuit Failure Check the main board for defect by replacing it with a spare one.
INCORRECT READING	**Transmitter Connections** Check for intermittent short circuits, open circuits, and grounding problems. Check if the sensor is correctly connected to the **DT303** terminal block.
	Noise, Oscillation Adjust damping. Check grounding of the transmitters housing. Check that the shielding of the wires between 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 **DT303** has been configured. Check if process is within the range of the sensor and the **DT303**.

Table 4.1 - Symptoms and Probable Source of Problem

If the problem is not presented in the previous table, 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 configurations done on the equipment, with the exception of the physical address of the equipment and the gsd identifier number selector parameter. Once completed, all settings relevant to the application must be done again. Two magnetic tools should be used to this effect. On the equipment, withdraw the nut that fixes the identification tag on the top of the housing, so that access is gained to the "**S**" and "**Z**" holes.

The operations to follow are:
1) Switch off the equipment, insert the magnetic tools and keep them in the holes (the magnetic end in the holes).
2) Power on 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, otherwise the information will not be saved.

This procedure makes effective the entire factory configuration and will eliminate eventual problems with the function blocks or with the equipment communication.

ATTENTION

In general, in every change that needs to be persisted, such as after a download, the information is saved in FRAM. During this operation, the "5" symbol appears on the display and you must not turn off the transmitter, otherwise the information will not be persisted (saved).

Procedure to change the DT303 Main Board

- Replace the main board
- Read from sensor (Backup menu – parameter: Sensor Data Restore).
- Trim the temperature with two temperatures 30°C apart.
- This procedure must be done, when the temperature is stable, a temperature standard must be used as a reference to adjust the DT temperature.
- After the temperature trim, make the self-calibration according to the Section 3.

Disassembly Procedure

WARNING

Do not disassemble with power on.

Figures 4.3 and 4.4 show transmitter's exploded view and will help you to understand the text below. The numbers between parentheses are relating to the enumeration of the items of the related drawing.

Group of the Probe

To have access to the probe for cleaning, it is necessary to remove it from the process. Remove the transmitter loosening the against-flange.

Cleaning should be done carefully to avoid damaging of the delicate isolating diaphragms. The use of a soft cloth and a nonacid solution is recommended.

To remove the sensor from the electronic housing, the electrical connections (in the field terminal side) and the main board connector must be disconnected.

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

WARNING
To avoid damage do not rotate the electronic housing more than 270º starting from the fully threaded without disconnecting the electronic circuit from the sensor and from the power supply. See Figure 4.1.

Figure 4.1 – Safe Housing Rotation

Electronic Circuit

To remove the circuit board **(3)**, loosen the two screws that anchor the board.

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

Pull the main board out of the housing and disconnect the power supply and the sensor connectors.

Reassemble Procedure

WARNING
Do not assemble the main board with power on.

Group of the Probe

The bolts, nuts, flanges, and other parts should be inspected for corrosion or other eventual damage. Damaged parts should be replaced.

The fitting of the sensor must be done with the main board out of the electronic housing. Mount the sensor to the housing turning clockwise until it stops. Then turn it counterclockwise until it faces the protective cover **(1)** parallel to the process flange. Tighten the hex screw **(5)** to lock the housing to the sensor. Only after install the main board.

Electronic Circuit

Plug sensor connector and power supply connector to main board.

Attach the display to the main board. Observe the four possible mounting positions. The Smar mark indicates up position.

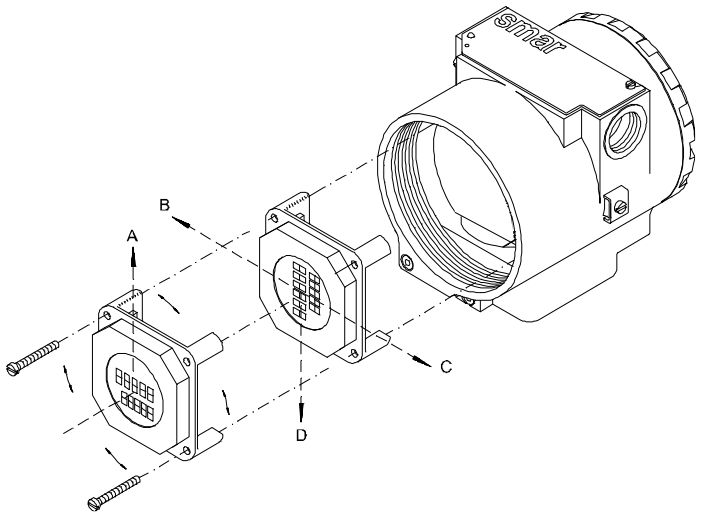


Figure 4.2 - Four Possible Positions for the Display

Anchor the main board and display with their screws.

After tightening the protective cover **(1)**, mounting procedure is complete. The transmitter is ready to be energized and tested.

Interchangeability

To obtain an accurate and better temperature compensated response, each sensor is submitted to a factory characterization process and the specific data is stored in an EEPROM located in the sensor body.

Every time the power is turned on, the main circuit reads the sensor serial number, should it differ from the number stored in the memory. The circuit understands that there is a new sensor, and the following information is transferred from the sensor to the main circuit:

- Temperature compensation coefficients.
- Sensor's trim including 5-point characterization curve.
- Sensor characteristics: type, range, diaphragm material and fill fluid.

The other transmitter characteristics are stored in the main circuit memory and are not affected by sensor change. Data transfer from the sensor to the main circuit can also be forced by parameter BACKUP_RESTORE previously explained. In case of changing of the main board, the information of the sensor, as described above are up-to-date.

Upgrading DT301 to DT303

The sensor and casing of the DT301 is the same as the **DT303**. By changing the circuit board of the DT301 it becomes a **DT303**.

To remove the circuit board **(3)**, loosen the two screws that anchor the board. Caution with the circuit boards must be taken as mentioned above.

Pull the DT301 main board out of the housing and disconnect the power supply and the sensor connectors.

Put in the **DT303** main board reversing the procedure for removing the DT301 circuit.

Returning Materials

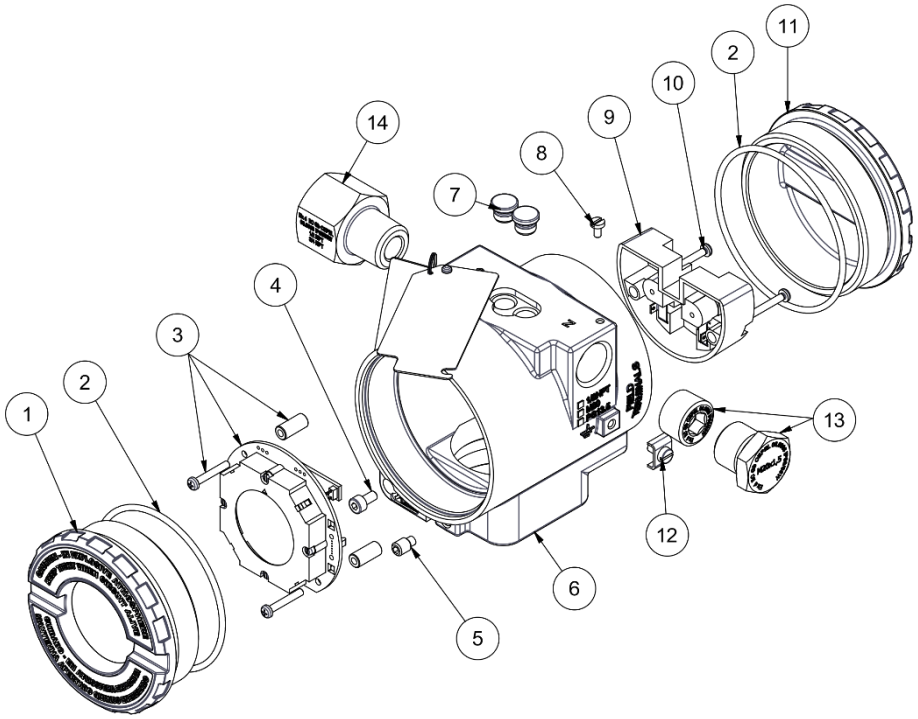
If it becomes necessary to return the transmitter and/or configurator to Smar, simply contact our office, informing the defective instrument's serial number, and return it to our factory. To speed up

analysis and solution of the problem, the defective item should be returned with the Service Request Form (SRF – Appendix B) properly filled with a description of the failure observed and with as much details as possible. Other information concerning to the instrument operation, such as service and process conditions, is also helpful.

Accessories

ACCESSORIES	
ORDERING CODE	**DESCRIPTION**
SD1	Magnetic Tool for Local Adjustment
PS302	Power Supply
FDI302	Field Device Interface
BT302	Terminator
DF47-12 or DF47-17	Intrinsic Safety Barrier
SB302	Isolated Intrinsic Safety Barrier

Exploded View



SPARE PARTS LIST		
DESCRIPTION	**POSITION**	**CODE**
COVER WITH WINDOW FOR INDICATION	1	400-1307-1xx
COVER O-RING	2	204-0122
MAIN ELECTRONIC CIRCUIT BOARD	3	400-1357 (NOTE)
COVER LOCKING SCREW	4	204-0120
SENSOR LOCKING SCREW	5	400-1121
HOUSING	6	400-1314-6xx
LOCAL ADJUSTMENT PROTECTION COVER	7	204-0114
IDENTIFICATION PLATE FIXING SCREW	8	204-0116
TERMINAL BLOCK	9	400-0059
TERMINAL HOLDING SCREW	10	204-0119
COVER WITHOUT WINDOW	11	400-1307-0xx
EXTERNAL GROUND SCREW	12	204-0124
M20 X 1.5 External Socket Plug in 316 SST BR-EX D PG13.5 External Socket Plug in 316 SST 1/2" NPT BR-Ex-d Internal Socket Set Plug in 316 SST 3/4 NPT Adapter in 316 SST BR-EX D	13 13 13 14	400-0810 400-0811 400-1484 400-0812

NOTE ITEM 3
Access https://www.smar.com.br/en/support, in General Support, look for Compatibility Note and consult the document.

NOTE ITEM 13
The spare part 400-1484, Internal Hexagonal Plug 1/2" NPT 316SST BR-Ex-d, was standardized in 316SST material and will be used in all line of housings (aluminum, copper free aluminum or 316SST). With or without CEPEL certificate.

400-1314-6	HOUSING

COD.	Communication Protocol
P	Profibus PA

COD.	Electrical Connection
0	½ NPT
A	M20x1.5
B	PG13.5

COD.	Material
H0	Aluminum (IP/Type)
H1	Stainless steel (IP/Type
H2	Aluminum for saline atmosphere (IPW/Type X)
H4	Aluminum Copper Free (IPW/Type X)

COD.	Painting
P0	Gray Munsell N6.5
P8	Without painting
P9	Safety Blue Epoxy – Electrostatic painting

400-1314-6	P	0	H0	P0	TYPICAL MODEL

400-1307	Cover

COD.	Type
0	With window
1	Without window

COD.	Material
H0	Aluminum (IP/Type)
H1	Stainless steel (IP/Type)

COD.	Painting
P0	Gray Munsell N6.5
P8	Without painting
P9	Safety Blue Epoxy – Electrostatic painting

400-1307	1	H0	P0	TYPICAL MODEL

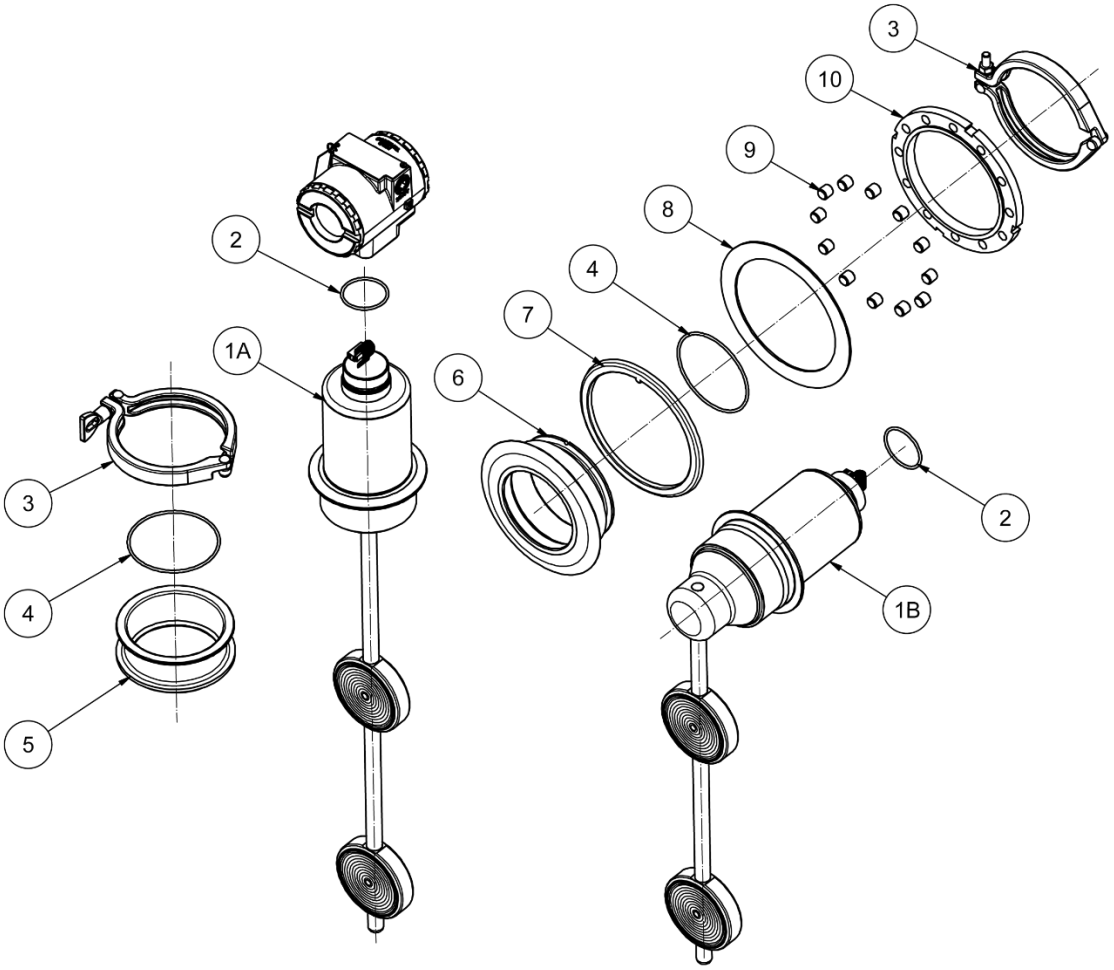


Figure 4.3 - DT303 Exploded View - Sanitary Model

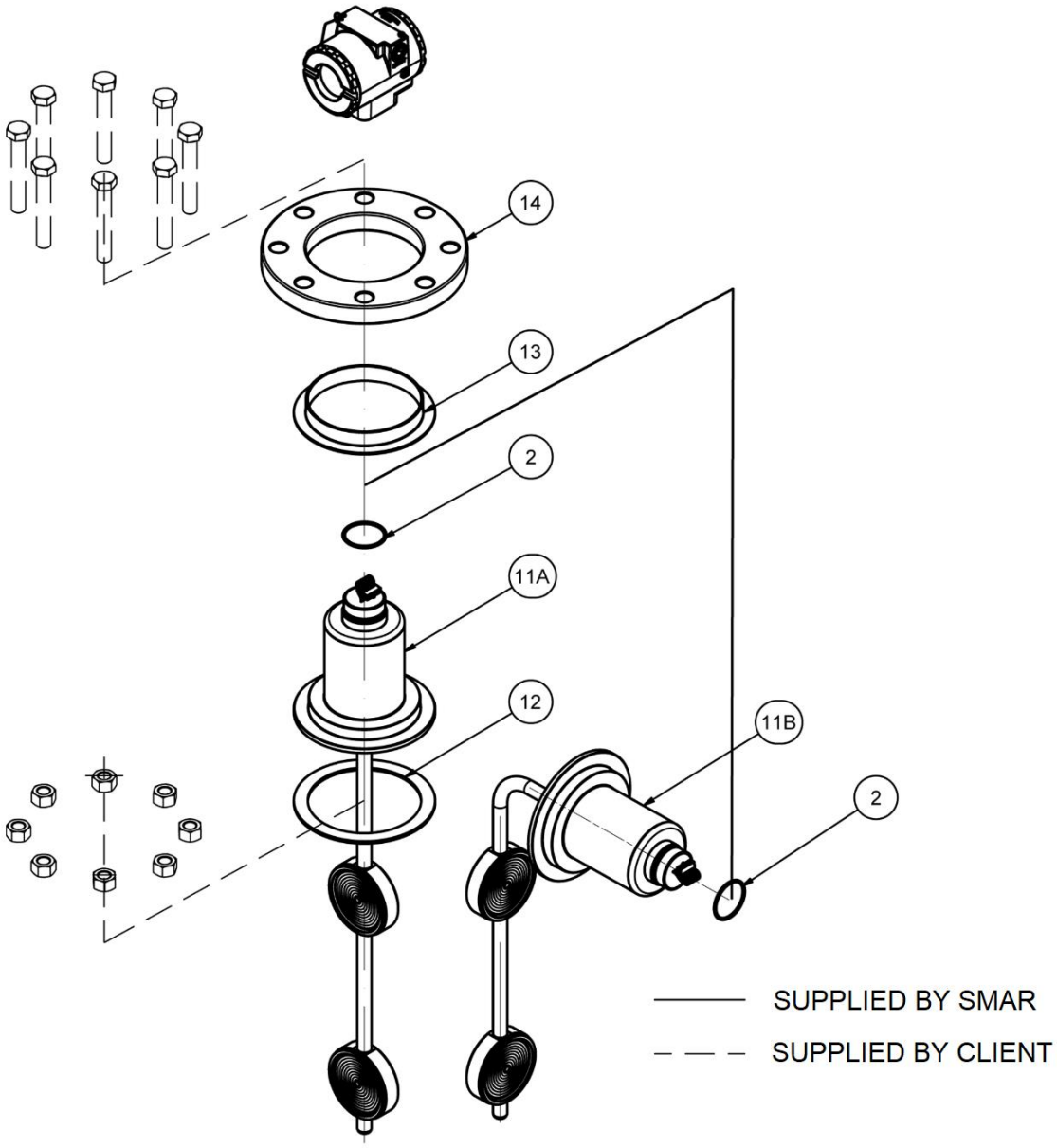


Figure 4.4 – DT303 Exploded View – Industrial Model

Spare parts

SPARE PARTS LIST			
DESCRIPTION OF PARTS	**POSITION**	**CODE**	**CATEGORY (NOTE 1)**
O-RINGS (NOTE 4)			
Neck, Buna-N	2	204-0113	B
Process connection, Buna-N (**Sanitary Model**)	4	400-0815	B
PROCESS CONNECTION – INDUSTRIAL MODEL			
Flange 4" – 150# ASME B-16.5, 316L SST	14	400-0237	
Flange 4" – 300# ASME B-16.5, 316L SST	14	400-0238	
Flange 4" – 600# ASME B-16.5, 316L SST	14	400-0239	
Flange DN 100, PN 25 / 40, DIN 2526 – Form D, 316L SST	14	400-0240	
Teflon Gasket	12	400-0720	
Teflon Insulation Joint	13	400-0863	
PROCESS CONNECTION - SANITARY MODEL			
Tank Adapter for Straight Model 316L SST	5	400-0241	
Tri-Clamp de 4", 316L SST (Clamp 304/ Nut 316L)	3	400-0242	
Tank Adapter for Curve Model 316L SST	6	400-0721	
Silicon O'Ring	7	400-0722	
Protection Flange	8	400-0723	
Tightening Flange	10	400-0724	
Tightening Flange Screw	9	400-0725	
PROBE			
Industrial Probe	11A or 11B	(NOTE 5)	B
Sanitary Probe	1A or 1B	(NOTE 5)	B

Table 4.2 - Spare Parts List

NOTE 1: For category A, it is recommended to keep, in stock, 25 parts installed for each set, and for category B, 50.
NOTE 2: Includes terminal block, bolts, caps, and identification plate without certification.
NOTE 3: The main board of **DT303** and probe are items.
NOTE 4: O-rings are packaged in packs of 12 units.
NOTE 5: To specify sensors, use the following tables.

400-0243-S	Sanitary Model Probe

COD.	RANGE
1	0 to 3 g/cm^3 (1)
2	0 to 10 g/cm^3

COD.	Diaphragm Material
I	316L SST
U	Hastelloy C276

COD.	Fill Fluid
N	Propylene Glycol – Neobee M2O – Food Grade

COD.	Mounting
1	Straight
2	Curved

400-0243-S	1	I	N	1

Note 1: Values referring to the 250 mm probe between centers. For a 500 mm probe, range 1 ranges from 0 to 2 g/cm^3.

400-0243-I	Industrial Model Probe

CODE	RANGE
1	0 to 3 g/cm^3 (1)
2	0 to 10 g/cm^3 (2)

CODE	Diaphragm Material / Probe
H	Hastelloy C276 / Hastelloy C276
I	316L SST / 316L SST
L	316L SST HALLAR Plated/ 316L SST HALLAR Plated
U	Hastelloy C276 / 316L SST
Z	Others - Specify

CODE	Fill Fluid
N	Propylene Glycol – Neobee M2O
S	DC 200/20 - Silicone Oil

CODE	Mounting
1	Straight
2	Curved

400-0243-I	1	H	S	1

Note 1: Values referring to the 250 mm probe between centers. For a 500 mm probe, range 1 ranges from 0 to 2 g/cm^3 and 800 mm probe, varies from 0 to 1.8 g/cm^3.

Note 2: Values referring to probes of 250 and 500 mm between centers. For 800 mm probe, range 2 ranges from 0 to 7 g/cm^3.

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).

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 analyzed.

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 CHARACTERISTICS

Filling Fluids

The filling fluid selection shall consider its physical properties in what concerns to pressure temperature limits and chemical compatibility with the process fluid. This consideration is important if there is a leak and the filling fluid comes into contact with the process fluid.

The table 5.1 presents the filling fluids, which are available for the **DT303**, together with some physical properties and applications.

FILLING FLUID	VISCOSITY (cSt) at 25ºC	DENSITY (g/cm³) at 25ºC	THERMAL EXPANSION COEFFICIENT (1/ºC)	APPLICATIONS
Silicone DC 200 / 20	20	0.95	0.00107	General purpose – Standard
Propylene Glycol Neobee M20 (Food Grade)	9.8	0.90	0.001	Beverage and pharmaceutical food grade

Table 5.1 - Properties of Filling Fluids

Functional Specifications

Output Signal
Profibus PA, Digital only, complies with IEC 1158-2 (H1): 31.25 kbit/s voltage mode with bus power.

Power Supply
Bus power 9 - 32 VDC.
Quiescent current consumption 12 mA.

Indicator
Optional 4½-digit numerical and 5-character alphanumerical LCD indicator.

Hazardous Area Certifications
See Appendix A.

Temperature Limits

Ambient:	-40	to	85º C	(-40	to	185º F)
Process:	-20	to	150º C	(-04	to	302º F)
Storage:	-40	to	100º C	(-40	to	212º F)
Digital Display:	-10	to	60º C	(14	to	140º F)

Turn-on Time
Approximately 5 seconds.

Configuration
Basic configuration may be done using local adjustment magnetic tool if device is fitted with display. Complete configuration is possible using remote configurator (Eg: ProfibusView and Simatic PDM).

Volumetric Displacement
Less than 0.15 cm^3 (0.01 in^3)

Static Pressure Limits
70 kgf/cm^2 (7 MPa) (1015 PSI)

Humidity Limits
0 to 100% RH

Performance Specifications

Reference conditions: range starting at zero, temperature 25ºC (77ºF), atmospheric pressure, power supply of 24 Vdc, silicone oil fill fluid, isolating diaphragms in 316L SS and digital trim equal to lower and upper range values.

RANGE	ACCURACY (1)	ENVIROMENT	STABILITY (For 3 Months)	ZERO (2) STATIC PRESSURE (per 1 kgf/cm^2)
1	±0.0004 g/cm^3 (±0.1 ^{0}Bx)	0.003 Kg/m^3	0.021 Kg/m^3	0.001 Kg/m^3
2	±0.0007 g/cm^3 (±0.1 ^{0}Bx)	0.013 Kg/m^3	0.083 Kg/m^3	0.004 Kg/m^3

(1) Linearity, hysteresis and repeatability effects are included.
(2) This is systematic error that can be eliminated by calibrating at the operating static pressure.

Table 5.2 - Performance Specifications

Power Supply Effect
±0.005% of calibrated span per volt.

Electromagnetic Interference Effect
Designed to comply with IEC 61326-1:2006, IEC 61326-2-3:2006, IEC 61000-6-4:2006 and IEC 61000-6-2:2005.

Physical Specifications

Electrical Connection
½ -14 NPT, Pg 13.5 or M20 x 1.5.

Process Connection
Industrial model: AISI316L Stainless Steel Flange, in accordance with ASME B16.5 or EN1092-1 (Former DIN2526).
Sanitary model: AISI316L Stainless Steel Triclamp (Clamp 304/ Nut 316L).

Wetted Parts
Isolating diaphragms: 316L SST or Hastelloy C276
Probe material: 316 SST, Hastelloy C276 or 316L SST with Halar
O-ring for sanitary model: Buna-N, Viton™ or Teflon™

Non-wetted Parts
Electronic Housing: injected low copper aluminum with polyester painting or 316 SST housing, with Buna-N O-rings on cover (NEMA 4X, IP67).
Fill fluid: Silicone (DC200/20), Neobee M20 Propylene Glycol.
Identification plate: 316 SST.

Mounting
Side or top mounting.

Weight
Sanitary model: 9 kg (20 lb)
Industrial model: 12 kg (26 lb).

Ordering Code

MODEL	SANITARY CONCENTRATION/DENSITY TRANSMITTER				
CODE	**Range**			**Minimum Span**	
1	0	to	3 kg/cm³	0.025 g/cm³	**Note**: These measurement ranges are provided for our standard Density Transmitter, 250 mm of distance between diaphragms (centers) on the probe and are valid for straight and curved devices. For instruments with distance between centers of 500 mm, please see table 5.1 .
2	0	to	10 kg/cm³	0.025 g/cm³	

CODE	Diaphragm / Probe Material
I	316L SST/ 316L SST
U	Hastelloy C276 / 316L SST

CODE	Fill Fluid
N	Neobee - M20 Propylene Glycol – Food Grade
S	DC 200/20 - Silicone Oil

CODE	Local Indicator
0	Without Indicator
1	With Digital Indicator

CODE	Electrical Connection
0	½ - 14 NPT **(4)**
1	½ - 14 NPT x ¾ NPT (AI 316) – With Adapter **(5)**
2	½ - 14 NPT x ¾ BSP (AI 316) – With Adapter **(6)**
3	½ - 14 NPT x ½ BSP (AI 316) – With Adapter **(6)**
A	M20 X1.5 **(4)**
B	PG 13.5 DIN **(6)**
Z	Others - Specify

CODE	Mounting
1	Straight – distance between centers 500 mm
2	Curved – distance between centers 500 mm
3	Straight – distance between centers 250 mm
4	Curved – distance between centers 250 mm

CODE	Process Connection
J	Tri-clamp – 4”
K	SMS thread diameter 89 RD120-4

CODE	O-Rings
B	Buna-N
V	Viton
T	Teflon

CODE	Tank Adapter
0	Without Tank Adapter (Supplied by Customer)
2	Curved DT30XS with adapter for D>4m tank
3	Curved DT30XS with adapter for 1.2m < D < 3.8m tank
4	Curved DT30XS with adapter for 0.5m < D < 1m tank
5	Straight DT30XS with adapter (welded)

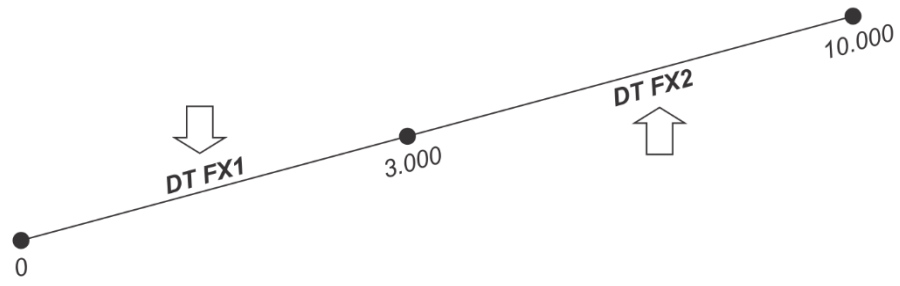
CODE	Tri-Clamp
0	Without Tri-clamp
1	With Tri-clamp in 304 SST

CODE	Continues next page

DT303S	1	I	N	1	0	2	J	B	0	1	*

⬅ **TYPICAL MODEL NUMBER**

* Leave it blank for no optional items.



MODEL	SANITARY CONCENTRATION/DENSITY TRANSMITTER (CONTINUATION)

COD	Identification Plate
I4	ATEX (EX-I, EX-D) GAS
I5	INMETRO (EX-D, EX-I) GAS
I6	WITHOUT CERTIFICATION
I7	ATEX (EX-I) MINING
IO	INMETRO DUST

COD	Housing Material (1) (2)
H0	Aluminum (IP/Type)
H1	316 SST (IP/Type)
H2	Aluminum for Saline Atmosphere (IPW/TypeX) **(3)**
H3	316 SST for Saline Atmosphere (IPW/TypeX) **(3)**
H4	Copper Free Aluminum (IPW/TypeX) **(3)**

COD	Special (See notes)
Z0	Not applicable
ZZ	See notes

COD	Tag Plate
J0	With Tag
J1	Blank
J2	User's Specification

COD	Painting
P0	Gray Munsell N 6,5
P2	Blue Safety – Atmospheric Zone – Petrobras N1021
P3	Black Polyester
P8	Without Painting
P9	Blue Safety Epoxy – Electrostatic Painting

COD	Manufacturing Standard
S0	Smar

DT303S	/	I6	H0	Z0	J0	P0	S0	TYPICAL MODEL

Notes

(1) IPX8 tested in 10 meters of water column for 24 hours.
(2) Ingress Protection:

Product	CEPEL	NEMKO / EXAM	FM	CSA	NEPSI
DT30X	IP66/68/W	IP66/68/W	Type 4X/6	Type 4X	IP67

(3) IPW / TypeX tested for 200 hours according to NBR 8094 / ASTM B 117 standard.
(4) Certification Ex-d for FM / ATEX / IECEx / INMETRO
(5) Certification Ex-d for INMETRO
(6) Options not certified for Explosive Atmosphere.

Table 5.1

Dimensions between diaphragms (centers)	Limit Values	
	Measuring range Fx1	Measuring range Fx2
mm	**Kg/m^3**	**Kg/m^3**
250	0-3000	0-10000
500	0-2000	0-10000

MODEL	INDUSTRIAL CONCENTRATION/DENSITY TRANSMITTER		
CODE	Range		Minimum Span
1	0 to 3 kg/cm³		0.025 g/cm³
2	0 to 10 kg/cm³		0.025 g/cm³

Note: These measurement ranges are provided for our standard Density Transmitter, 250 mm of distance between diaphragms (centers) on the probe and are valid for straight and curved devices. For instruments with distance between centers of 500 and 800mm, please see table 5.2.

CODE	Diaphragm Material / Probe
H	Hastelloy C276 / Hastelloy C276
I	316L SST / 316L SST
U	Hastelloy C276 / 316L SST
L	316L SST with Halar / 316L SST with Halar
Z	Others - Specify

CODE	Fill Fluid
N	Neobee - M20 Propylene Glycol – Food Grade
S	DC 200/20 - Silicone Oil

CODE	Local Indicator
0	Without Indicator
1	With Digital Indicator

CODE	Electrical Connection
0	½ - 14 NPT **(4)**
1	½ - 14 NPT x ¾ NPT (AI 316) – With Adapter **(5)**
2	½ - 14 NPT x ¾ BSP (AI 316) – With Adapter **(6)**
3	½ - 14 NPT x ½ BSP (AI 316) – With Adapter **(6)**
A	M20 X1.5 **(4)**
B	PG 13.5 DIN **(6)**
Z	Others - Specify

CODE	Mounting
1	Top – Between Centre of the Sensors 500 mm
2	Side - Between Centre of the Sensors 500 mm
3	Top – Between Centre of the Sensors 800 mm
4	Side - Between Centre of the Sensors 800 mm
5	Top – Between Centre of the Sensors 250 mm
6	Side - Between Centre of the Sensors 250 mm
7	Straight – distance between centers 250 mm with normalized tube
Z	Special – See notes

CODE	Process Connection
5	4” ASME B – 16.5
A	DN 100 EN 1092 – FORM D
Z	Others – Specify

CODE	Pressure Class
1	150# ASME B – 16.5
2	300# ASME B – 16.5
3	600# ASME B – 16.5
C	PN 25/40
Z	Others - Specify

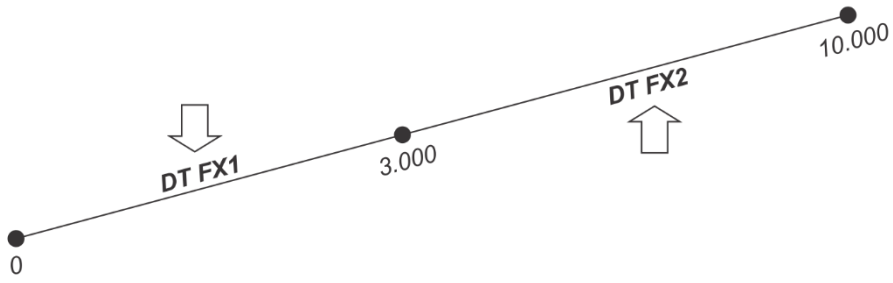
CODE	Flange Face
0	RF
2	RTJ

CODE	Continues next page

DT303I	1	I	S	1	0	1	5	1	*

TYPICAL MODEL NUMBER

* Leave it blank for no optional items.



MODEL	INDUSTRIAL CONCENTRATION/DENSITY TRANSMITTER (CONTINUATION)

COD	Identification Plate
I4	ATEX (EX-I, EX-D) GAS
I5	INMETRO (EX-D, EX-I) GAS
I6	WITHOUT CERTIFICATION
I7	ATEX (EX-I) MINING
IO	INMETRO DUST

COD	Housing Material (1) (2)
H0	Aluminum (IP/Type)
H1	316 SST (IP/Type)
H2	Aluminum for Saline Atmosphere (IPW/TypeX) **(3)**
H3	316 SST for Saline Atmosphere (IPW/TypeX) **(3)**
H4	Copper Free Aluminum (IPW/TypeX) **(3)**

COD	Special (See notes)
ZZ	See notes

COD	Tag Plate
J0	With Tag
J1	Blank
J2	User's Specification

COD	Painting
P0	Gray Munsell N 6,5
P2	Blue Safety – Atmospheric Zone – Petrobras N1021
P3	Black Polyester
P8	Without Painting
P9	Blue Safety Epoxy – Electrostatic Painting

COD	Manufacturing Standard
S0	Smar

COD	Optional Items
*	

DT303I	I6	H0	ZZ	J0	P0	S0	*

TYPICAL MODEL

* Leave it blank for no optional items.

Optional Items

Diaphragm Thickness	**N0** - Standard
Strengthening of the Probe	**R0 -** Standard **R1** – With strengthening of the probe
Mounting Position	**E0 -** Standard **E1** – Reverse position

Notes

(1) IPX8 tested in 10 meters of water column for 24 hours.
(2) Ingress Protection:

Product	CEPEL	NEMKO / EXAM	FM	CSA	NEPSI
DT30X	IP66/68/W	IP66/68/W	Type 4X/6	Type 4X	IP67

(3) IPW / TypeX tested for 200 hours according to NBR 8094 / ASTM B 117 standard.
(4) Certification Ex-d for FM / ATEX / IECEx / INMETRO.
(5) Certification Ex-d for INMETRO.
(6) Options not certified for Explosive Atmosphere.

Table 5.2

Dimensions between diaphragms (centers)	Limit Values	
	Measuring range Fx1	Measuring range Fx2
mm	**Kg/m³**	**Kg/m³**
250	0-3000	0-10000
500	0-2000	0-10000
800	Unavailable	350-7000

MODEL	SUBMERSIBLE CONCENTRATION/DENSITY TRANSMITTER				
COD.	Range			Minimum Span	
1	0	to	3 kg/cm^3	0.025 g/cm^3	**Note**: These measurement ranges are provided for our standard Density Transmitter, 250 mm of distance between diaphragms (centers) on the probe and are valid for straight and curved devices. For instruments with distance between centers of 500, please see table 5.3.
2	0	to	10 kg/cm^3	0.025 g/cm^3	

COD.	Diaphragm Material
H	Hastelloy C276/

COD.	Probe
I	316L SST

COD.	Distance Between Centers
1	250 mm
2	500 mm

COD.	Fill Fluid
S	DC 200/20 - Silicone Oil

COD.	Normalizer Tube
0	Without tube
1	With 304 SST tube

COD.	Probe Type
1	316 SST Tubular Rod
2	Flanged Hose

COD.	Probe Length
1	1 meter
2	2 meters
3	3 meters
4	4 meters
5	5 meters
6	6 meters
7	7 meters
8	8 meters

COD.	Power Supply Cable Length
1	10 meters
2	15 meters

DT303M	1	H	I	1	S	0	1	1	1

TYPICAL MODEL

MODEL	SUBMERSIBLE CONCENTRATION/DENSITY TRANSMITTER (CONTINUATION)

COD.	Identification Plate
I6	Without certification

COD.	Tag Plate
J0	With Tag
J1	Blank
J2	See notes

COD.	Centralizer
C0	Standard
C1	With centralizer

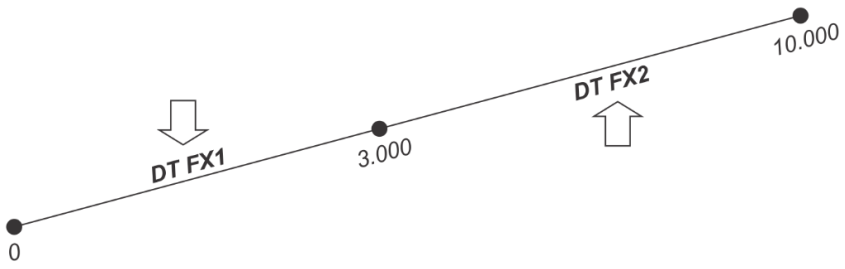
COD.	Probe Strengthening
R0	Standard

DT303M	I6	J0	C0	R0

TYPICAL MODEL

Table 5.3

Dimensions between diaphragms (centers) mm	Limit Values	
	Measuring range Fx1	Measuring range Fx2
mm	**Kg/m^3**	**Kg/m^3**
250	0-3000	0-10000
500	0-2000	0-10000


10.000
DT FX2
DT FX1
3.000
0

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"
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 UL International Demko AS (NB 0539).

LVD Directive 2014/35/EU – "Low Voltage"
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.

PED Directive 2014/68/EU - "Pressure Equipment"
This product is in compliance with Article 4 paragraph 3 of the Pressure Equipment Directive 2014/68/EU and was designed and manufactured in accordance with the sound engineering practice. This equipment cannot bear the CE marking related to PED compliance. However, the product bears the CE marking to indicate compliance with other applicable European Community Directives.

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"
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
In hazardous areas with intrinsic safety or 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 3015610
XP Class I Division 1, Groups A, B, C, D
DIP Class II, 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; Ta = -25°C < Ta < 60°C; Type 4, 4X, 6

Entity Parameters Fieldbus Power Supply Input (report 3015629):
Vmax = 24 V dc, Imax =250mA, Pi = 1.2 W, Ci = 5 nF, Li = 8 uH
Vmax=16 V dc, Imax=250 mA, Pi=2.0 W, Ci = 5 nF, Li = 8 µH
Overpressure Limits: 1015 psi (report 3011728)

Special conditions for safe use:
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.

Drawing 102A-0925, 102A-1202, 102A-1325

DNV
Explosion Proof (Nemko 03ATEX1375X)
II 2G Ex d IIC T6 Gb
Ambient Temperature: -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:
EN 60079-0:2012 General Requirements
EN 60079-1:2007 Flameproof Enclosures “d”

Drawing 102A-1387, 102A-1482

DEKRA
Intrinsic Safety (DMT 03 ATEX E 359)
I M1 Ex ia I Ma
II 1/2 G Ex ia IIC T4/T5/T6, EPL Ga/Gb

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 EN 60079-11:2012, replacing EN 60079-27: 2008.

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 60079-0:2009 + A11:2013 General Requirements
EN 60079-11:2012 Intrinsic Safety “i”
EN 60079-26:2015 Equipment with equipment protection level (EPL) Ga

Drawing 102A-1269, 102A-1484, 102A-1445, 102A-1501

INMETRO NCC
Segurança Intrínseca (NCC 24.0150X)
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 IP66W/68W

Prova de Explosão (NCC 24.0151)
Ex db IIC T6 Ga/Gb
Ex tb IIIC T85 ºC Da/Db
Tamb: -20 °C a +40 °C
IP66/68 ou IP66W/68W

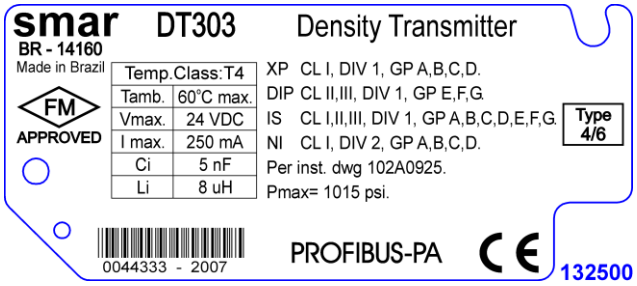
Observações:
O número do certificado é finalizado pela letra "X" para indicar que para a versão do Transmissor de Densidade, modelos DT302 e DT303 equipado com invólucro fabricado em liga de alumínio, somente pode ser instalado em localização que exigem o “EPL Ga”, se durante a instalação for excluído 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.

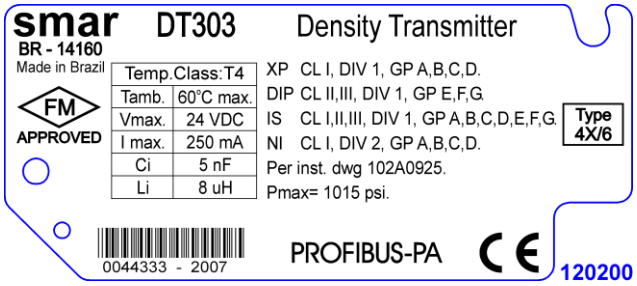
Normas Aplicáveis:
ABNT NBR IEC 60079-0:2020 Atmosferas explosivas - Parte 0: Equipamentos – Requisitos gerais
ABNT NBR IEC 60079-1:2016 Atmosferas explosivas - Parte 1: Proteção de equipamento por invólucro à prova de explosão “d”
ABNT NBR IEC 60079-11:2013 Atmosferas explosivas - Parte 11: Proteção 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 102A1360, 102A1227, 102A1998, 102A1997, 102A2079

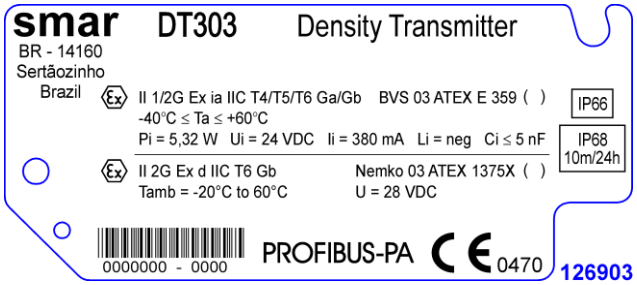
Identification Plate

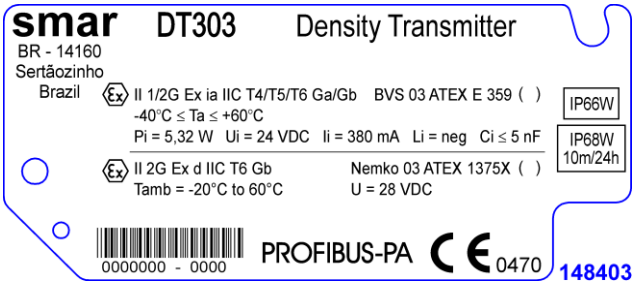
FM Approvals

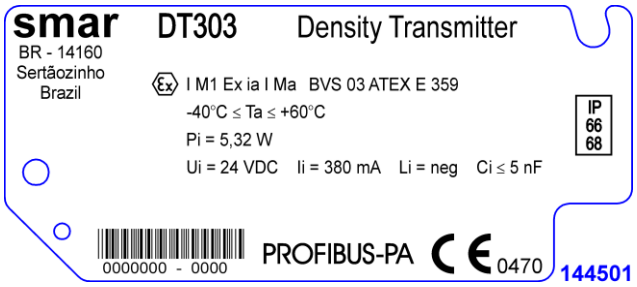


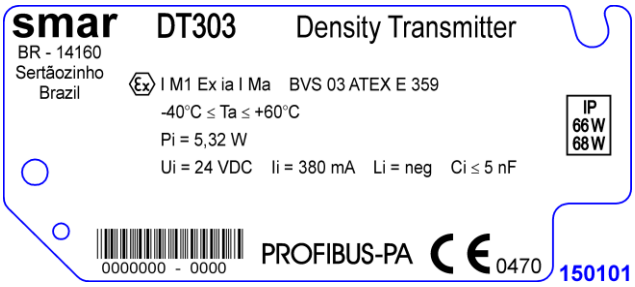


ATEX / IECEx

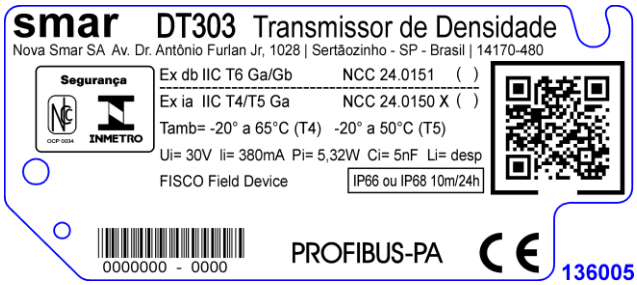


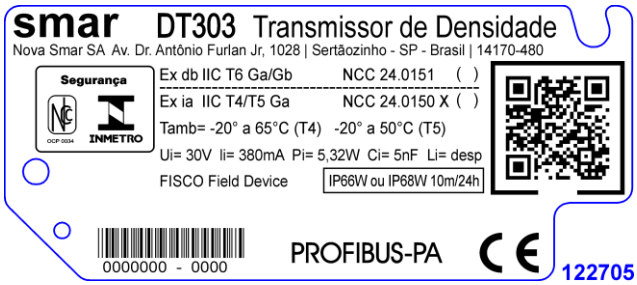


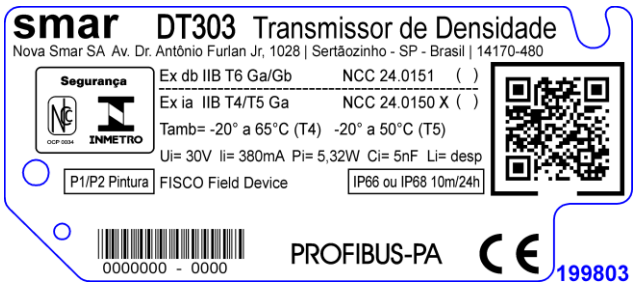


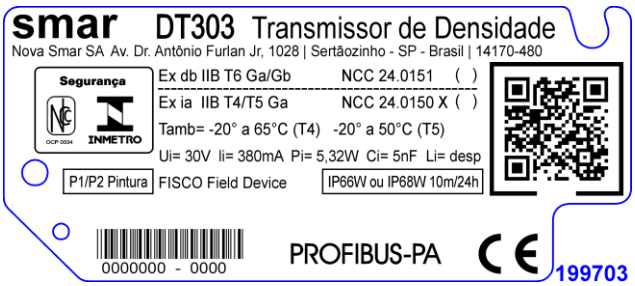


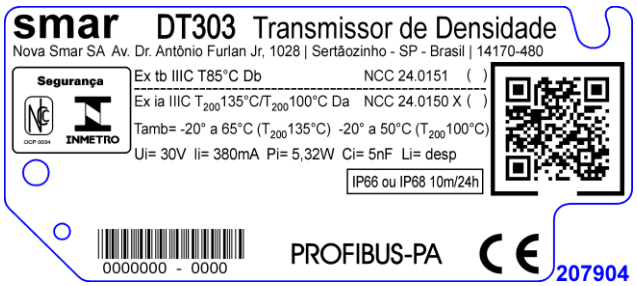
INMETRO NCC



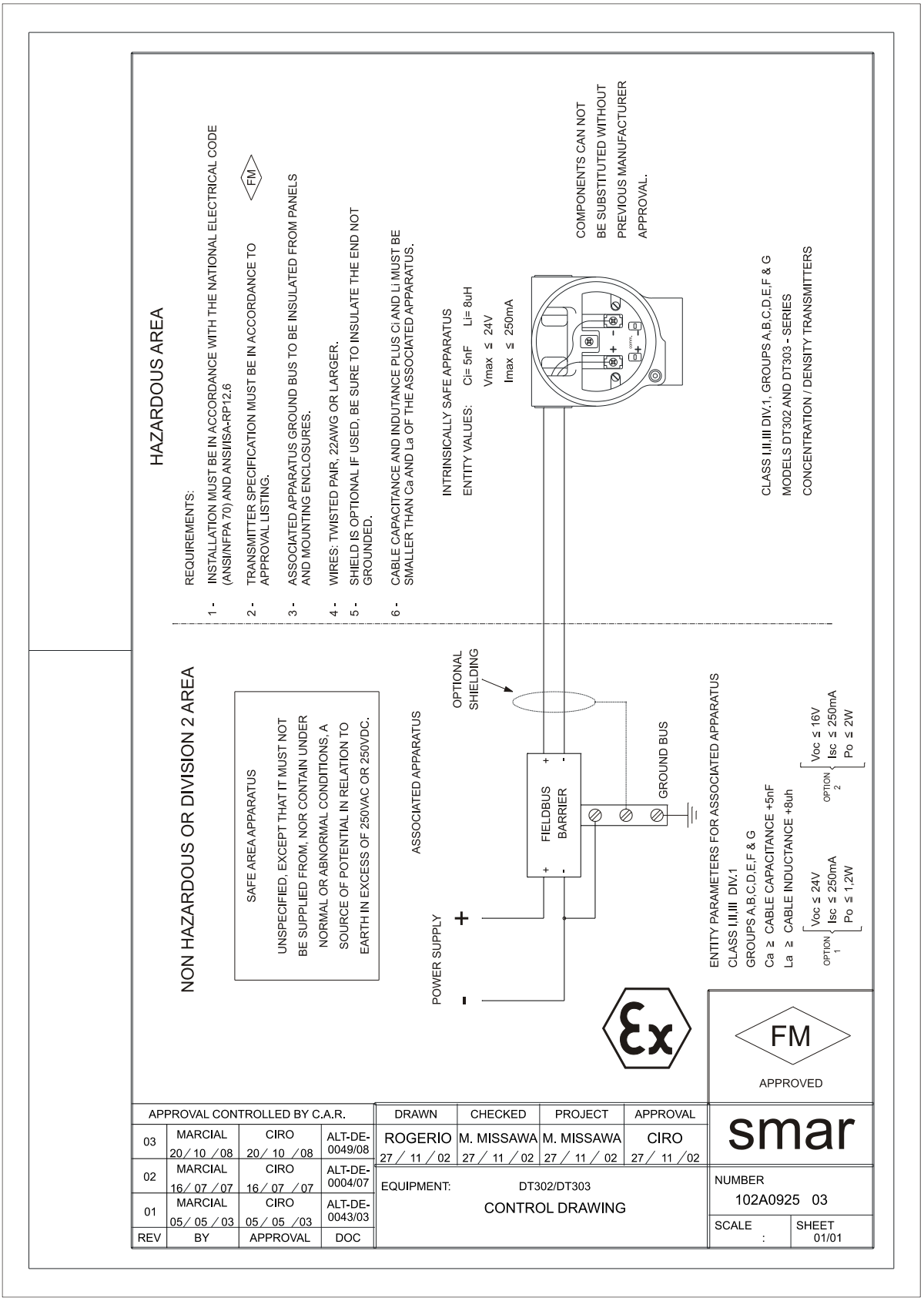







smar DT303 Transmissor de Densidade
Nova Smar SA Av. Dr. Antônio Furlan Jr, 1028 | Sertãozinho - SP - Brasil | 14170-480
Segurança
INMETRO
Ex tb IIIC T85°C Db NCC 24.0151 ( )
Ex ia IIIC T200135°C/T200100°C Da NCC 24.0150 X ( )
Tamb= -20° a 65°C (T200135°C) -20° a 50°C (T200100°C)
Ui= 30V Ii= 380mA Pi= 5,32W Ci= 5nF Li= desp
IP66 ou IP68 10m/24h
0000000 - 0000
PROFIBUS-PA
CE
207904

FM Approvals



Appendix B

smar	SRF – Service Request Form Density Transmitters	Proposal No.:

Company:	Unit:	Invoice:

COMMERCIAL CONTACT		TECHNICAL CONTACT	
Full Name:		Full Name:	
Function:		Function:	
Phone:	Extension:	Phone:	Extension:
Fax:		Fax:	
Email:		Email:	

EQUIPMENT DATA

Model:	Serial Number:	Sensor Number:
Technology: ( ) HART® ( ) FOUNDATION fieldbus ( ) PROFIBUS PA		Firmware Version:

PROCESS DATA

Process Fluid:

Calibration Range		Ambient Temperature (ºF)		Process Temperature (ºF)		Process Pressure	
Min.:	Max.:	Min.:	Max.:	Min.:	Max.:	Min.:	Max.:
Static Pressure		**Vacuum**		**Density**		**Concentration**	
Min.:	Max.:	Min.:	Max.:	Min.:	Max.:	Min.:	Max.:

Normal Operation Time:	Failure Date:

FAILURE DESCRIPTION

(Please, describe the failure. Can the error be reproduced? Is it repetitive?)

OBSERVATIONS

USER INFORMATION

Company:

Contact: Title: Section:

Phone: Extension: E-mail:

Date: Signature:

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