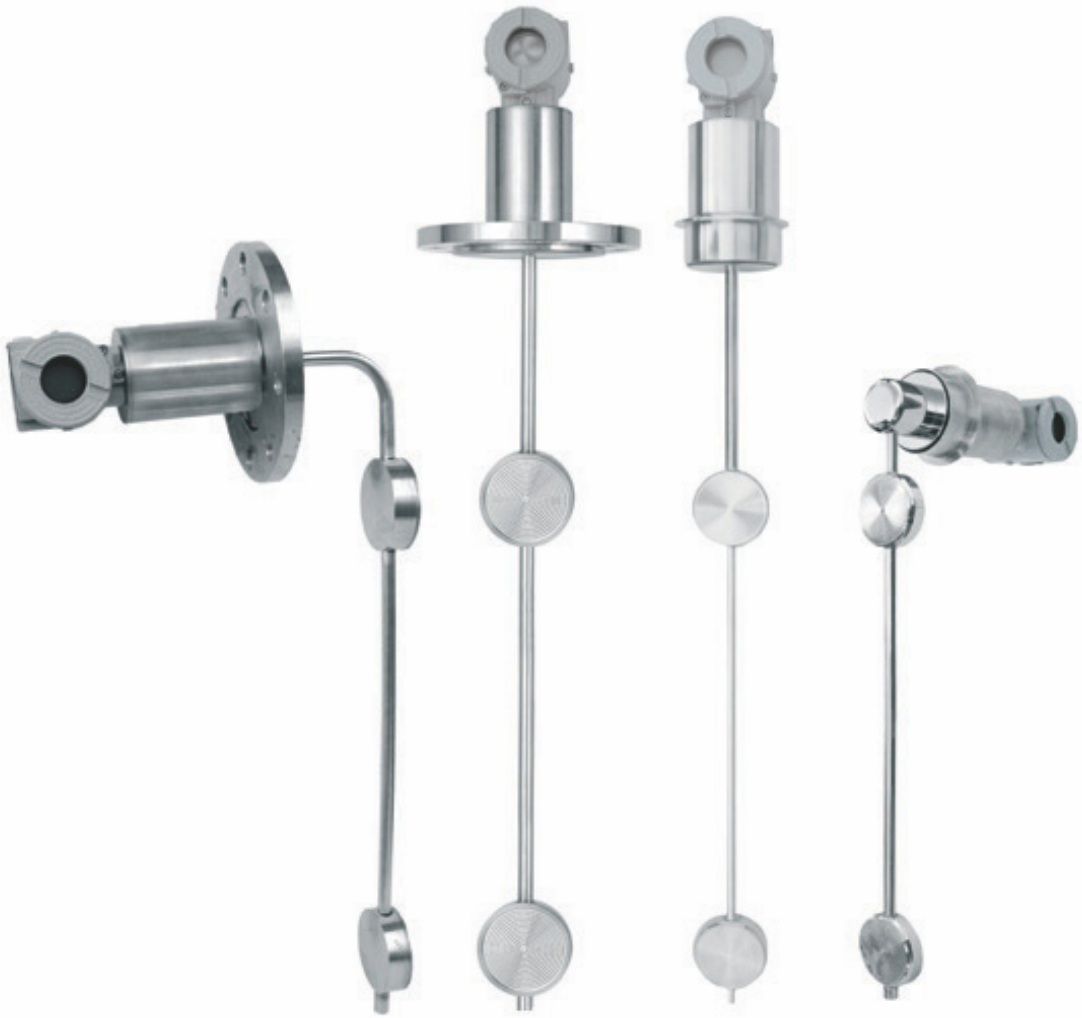
DT303

smar

OPERATION, MAINTENANCE
AND INSTRUCTIONS MANUAL

PROFIBUS PA CONCENTRATION DENSITY TRANSMITTER



MAY / 16
DT 303
VERSION 3

PROFIBUS®

DT303ME

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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.**

ATTENTION
In case of using Simatic PDM as the configuration and parameterization tool, Smar recommends that the user does not apply the option "Download to Device". This function can improperly configure the field device. Smar recommends that user make the use of the option "Download to PG / PC" and then selecting the Device Menu, use the menus of the transducer, function and display blocks acting specifically, according to each menu and method for reading and writing.

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

Waiver of responsibility

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

Warning

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

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

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

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

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

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

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

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

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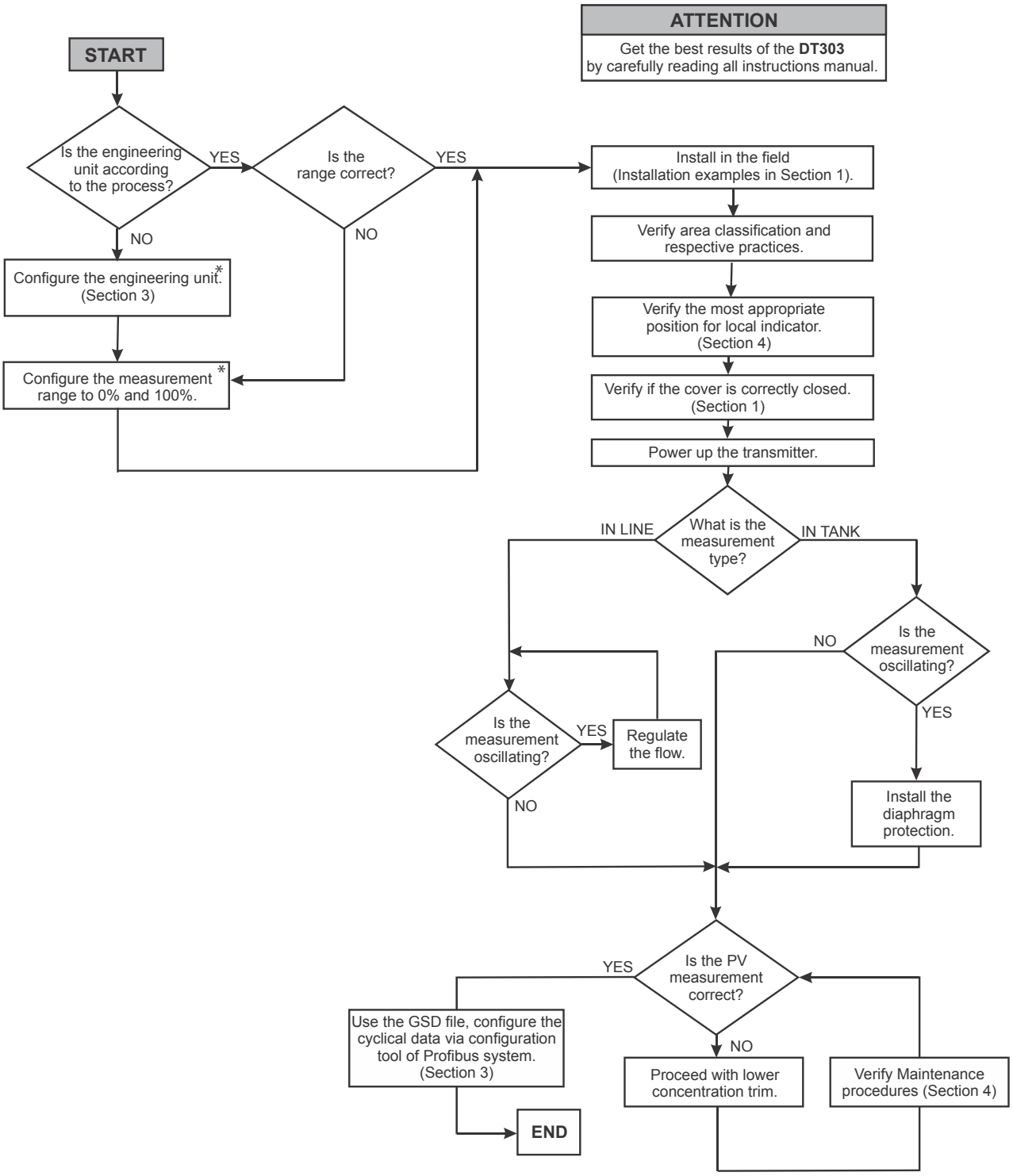
Installation Flowchart



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

Section 1

INSTALLATION

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.

General

The **DT303** has a built-in temperature sensor to compensate for 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 0.4m/sec, 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.

The industrial model uses flanged connection according to the standard ANSI 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.

Fixation

We have two types of fixation:

* Top installation (**DT303**: straight type)
* Lateral installation (**DT303**: curved type)

The dimensions of both types for industrial and sanitary models can be seen in the following figures.

The installation can be made in open or pressurized tanks or through an external sampler device from the process.

Some examples are shown in the following figures.

Choose a place with free access and free mechanical shock to install the device.

A - Industrial Model Top Mounting - Between Centre of the Sensors 250 mm

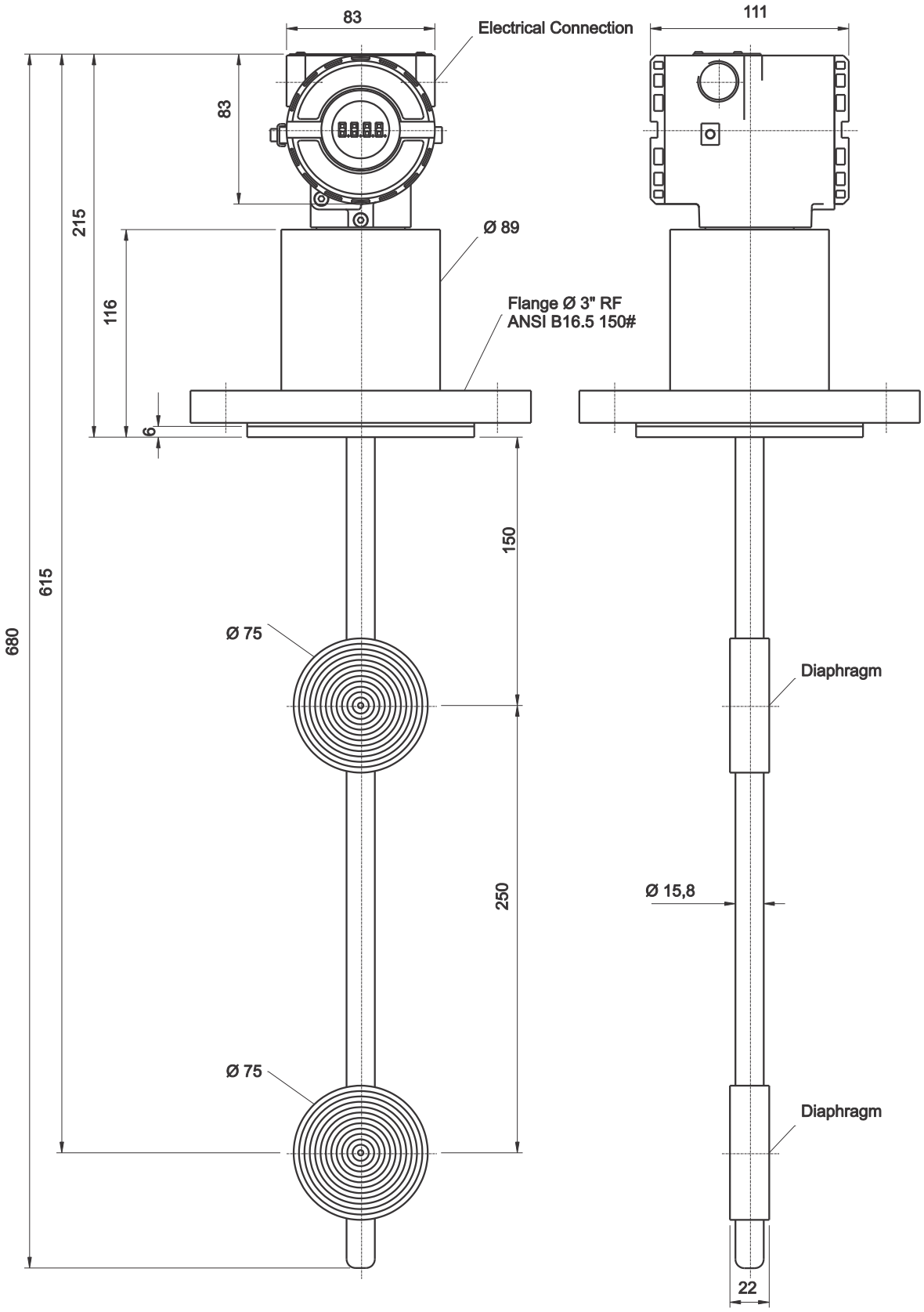


Figure 1.1 – DT303 Dimensional (A)

B – Industrial Model Side Mounting

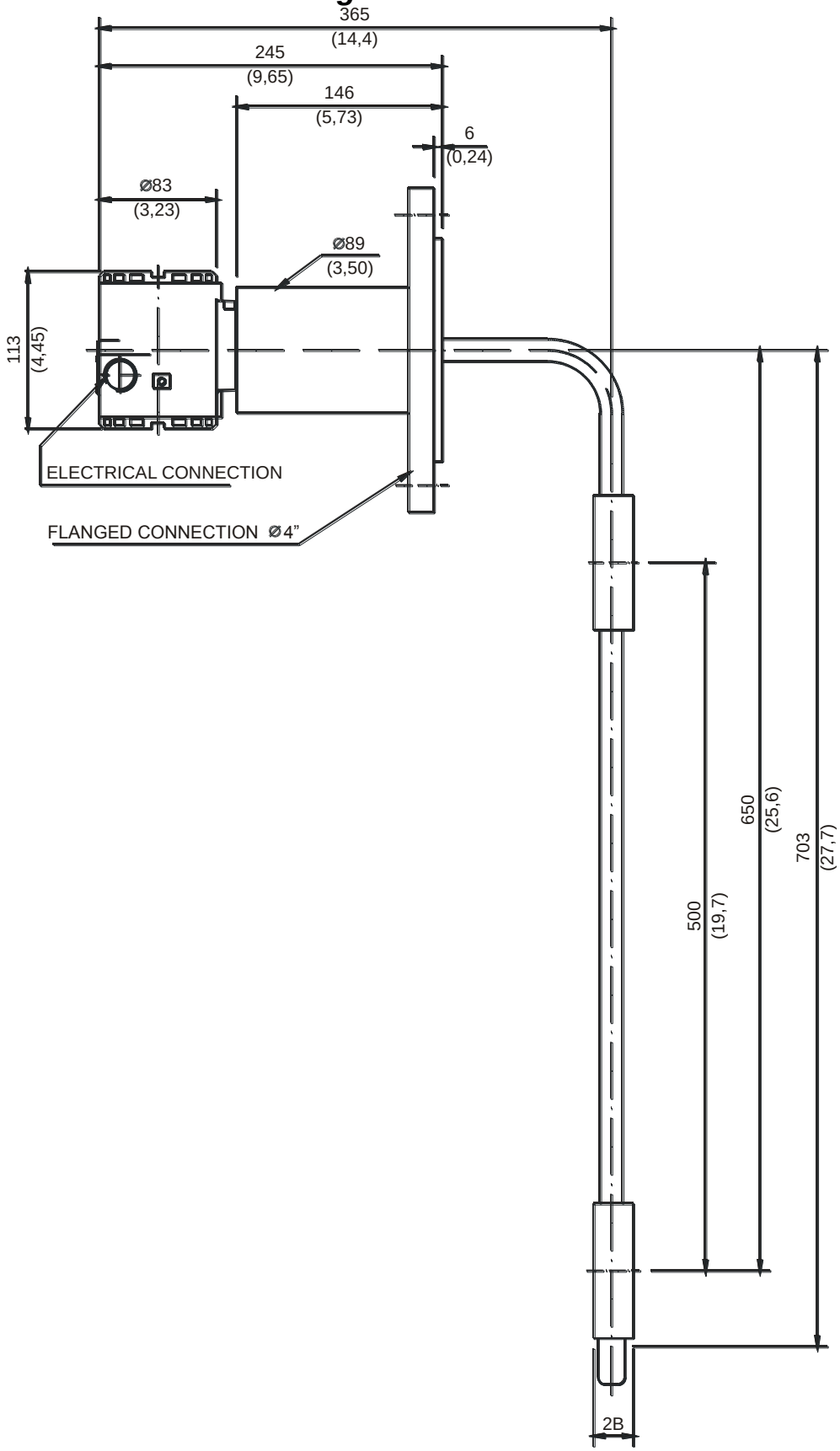


Figure 1.1 – DT303 Dimensional (B)

C – Sanitary Model Top Mounting - Between Centre of the Sensors 500 mm

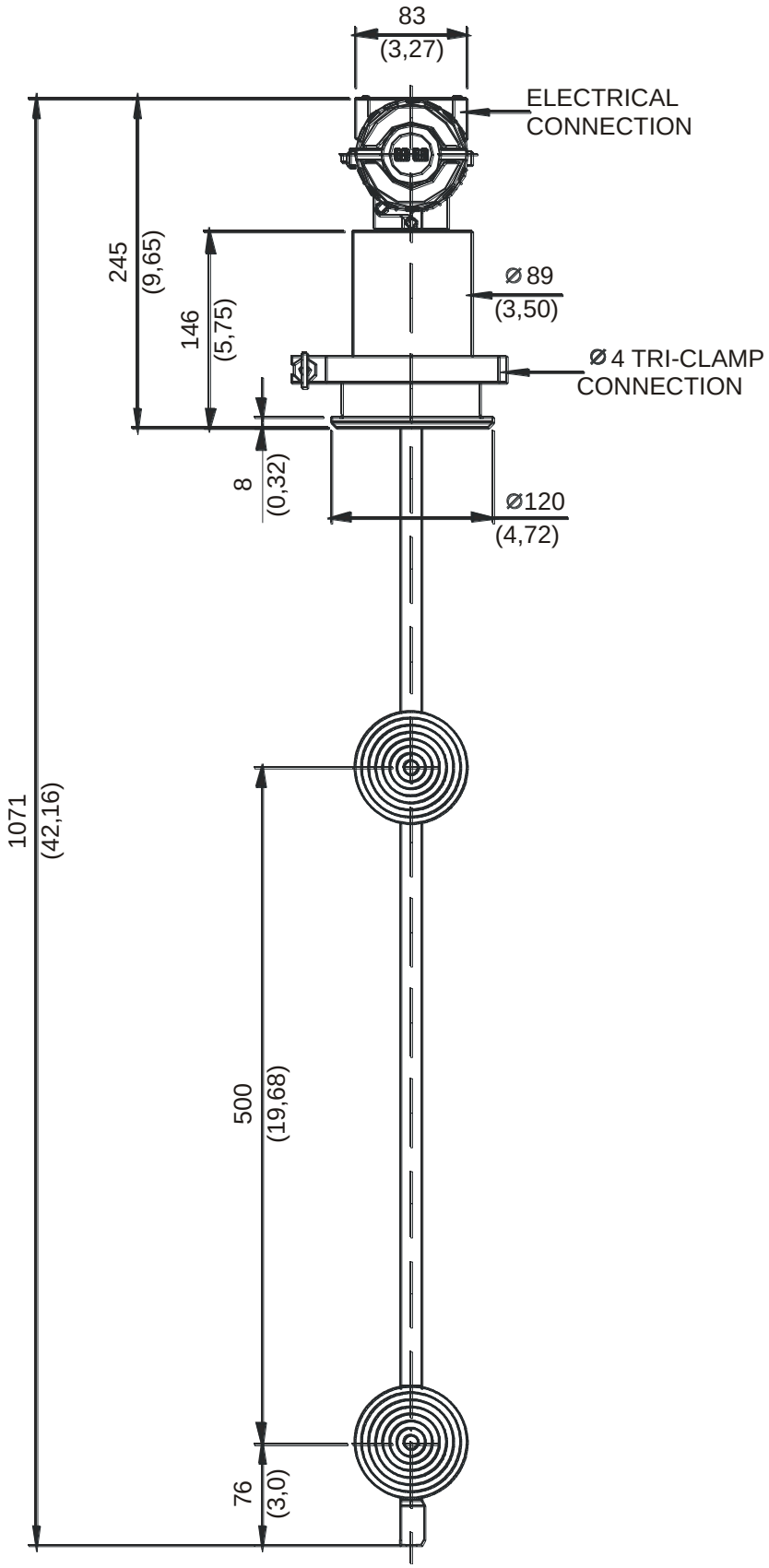


Figure 1.1 – DT303 Dimensional (C)

D – Sanitary Model Side Mounting

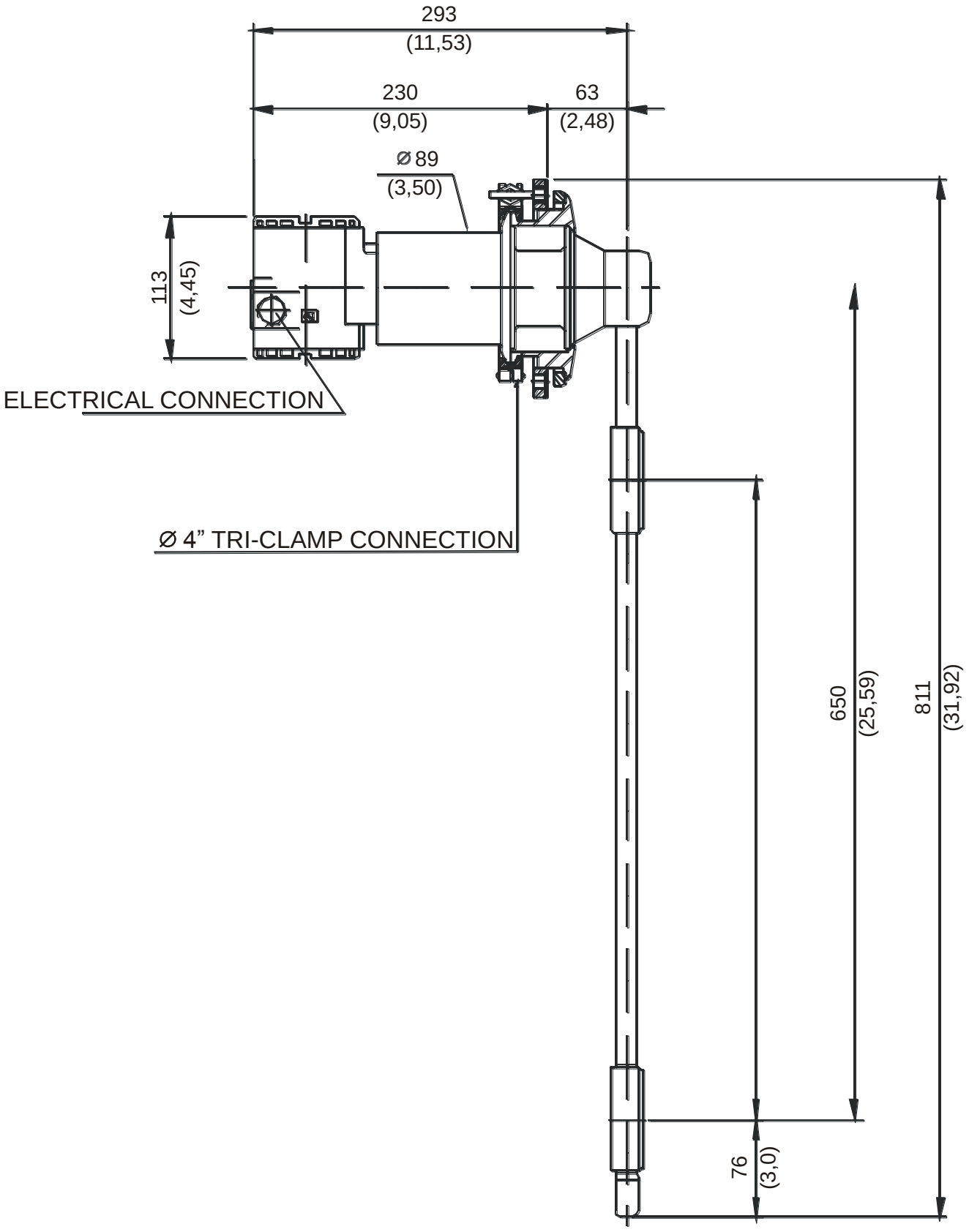


Figure 1.1 – DT303 Dimensional (D)

E – Industrial Model Top Mounting

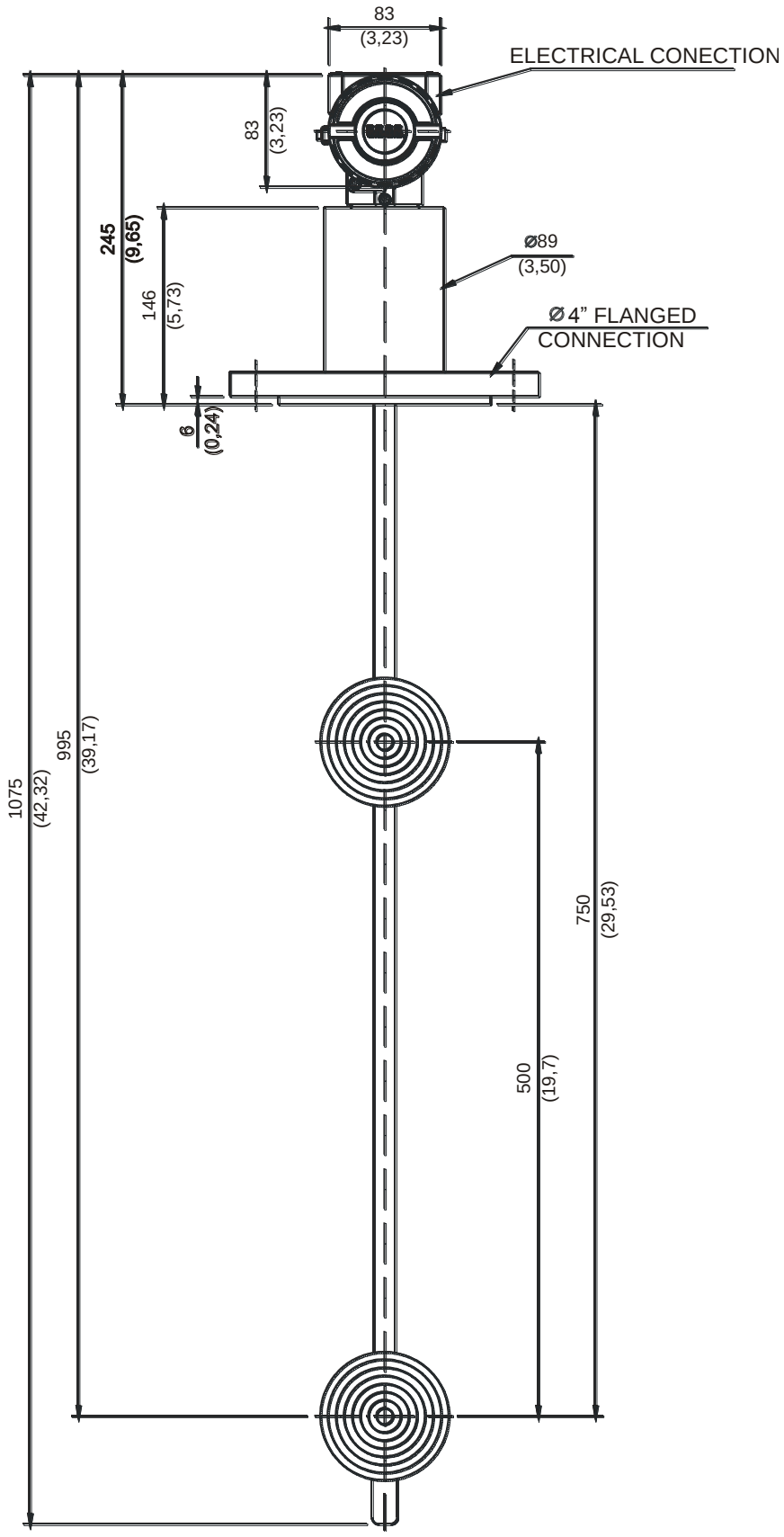


Figure 1.1 – DT303 Dimensional (E)

F - Sanitary Model Top Mounting - Between Centre of the Sensors 800 mm

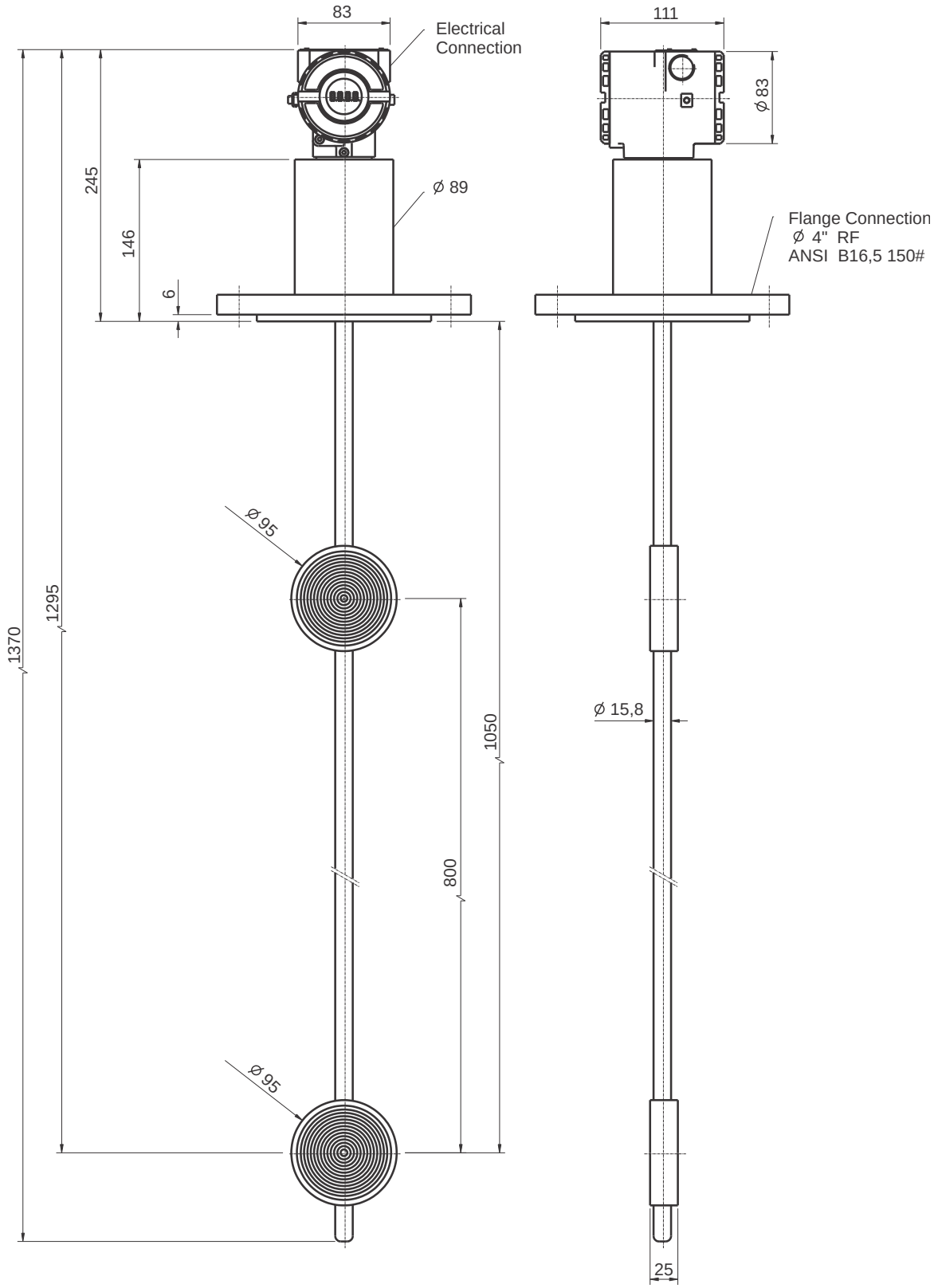


Figure 1.1 – DT303 Dimensional (F)

A – Typical Installation For Low Flow Tank (Industrial Model)

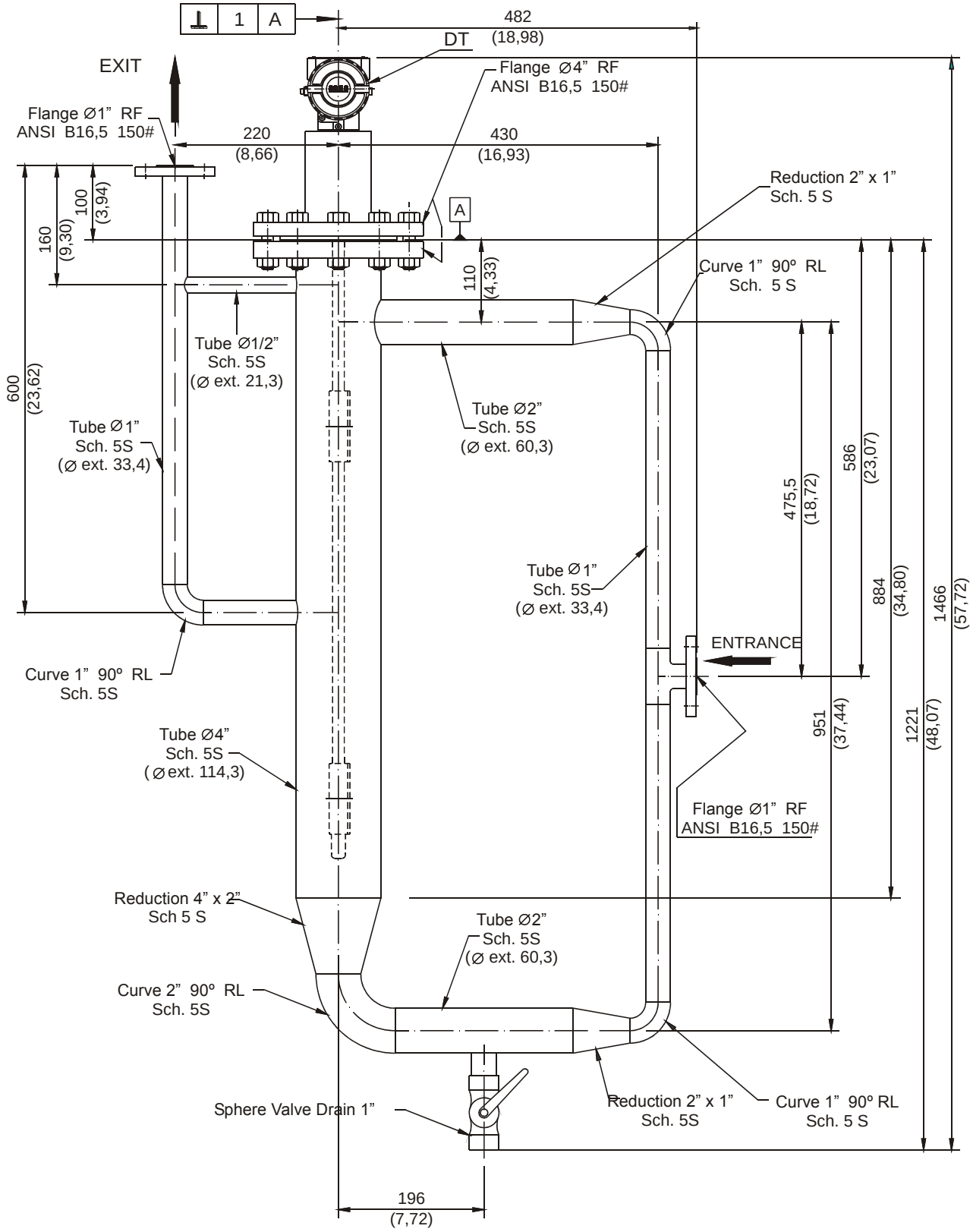


Figure 1.2 – Typical Installation for DT303 (A)

B – Typical Installation For Flow Tank (Sanitary Model)

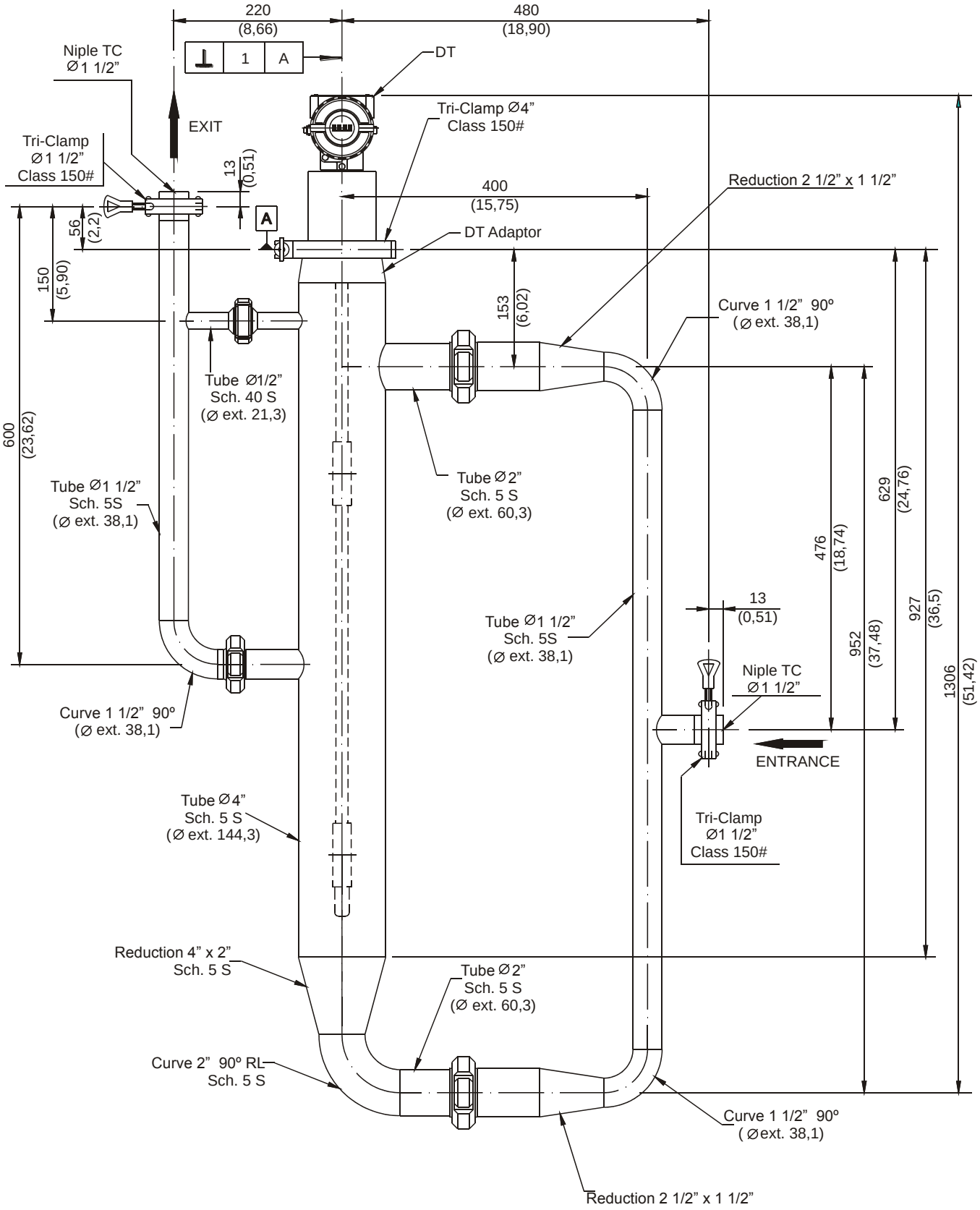


Figure 1.2 – Typical Installation for DT303 (B)

C – Typical Installation For High Flow Tank (Industrial Model)

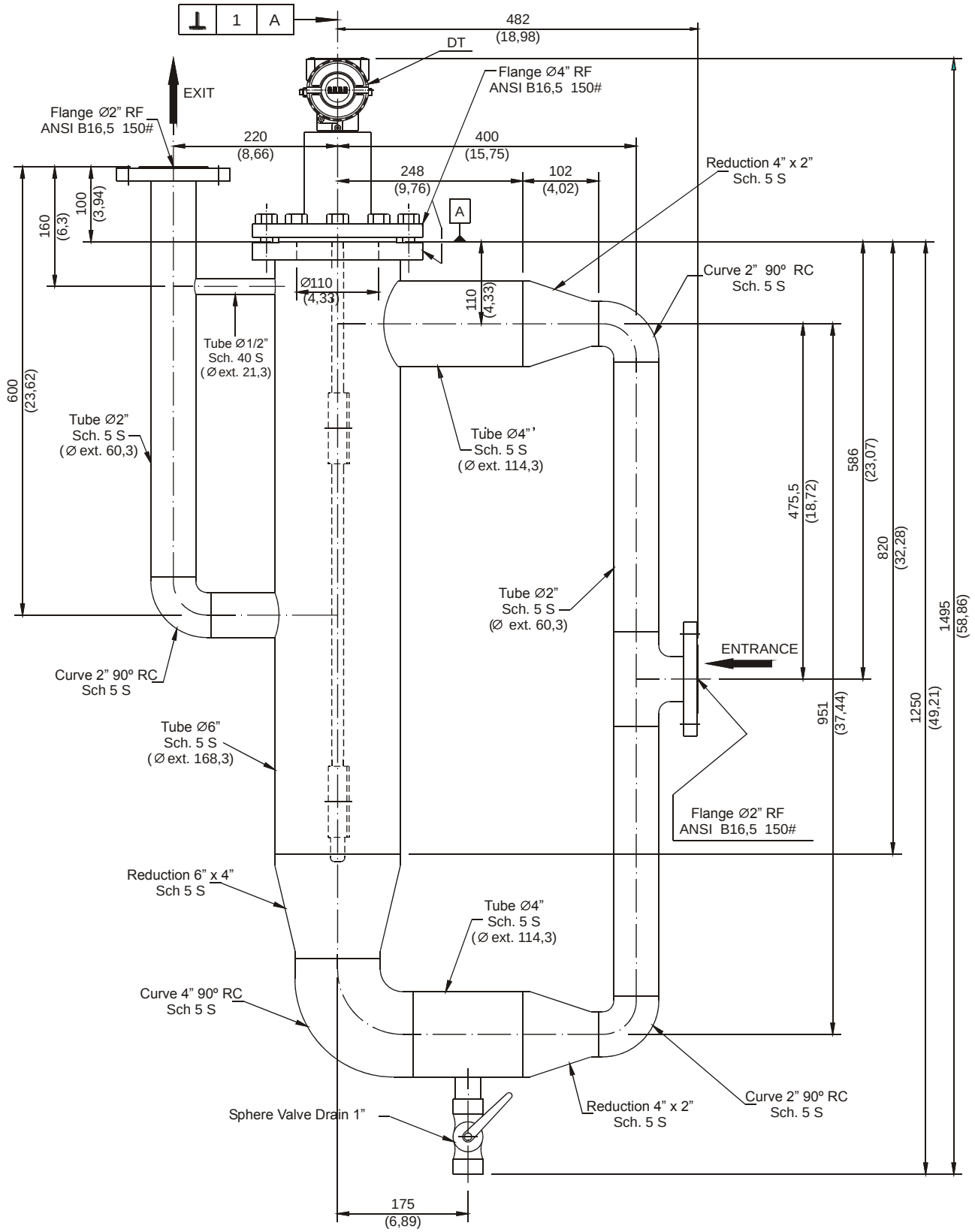


Figure 1.2 – Typical Installation for DT303 (C)

D – Typical Installation In Overflow Tanks

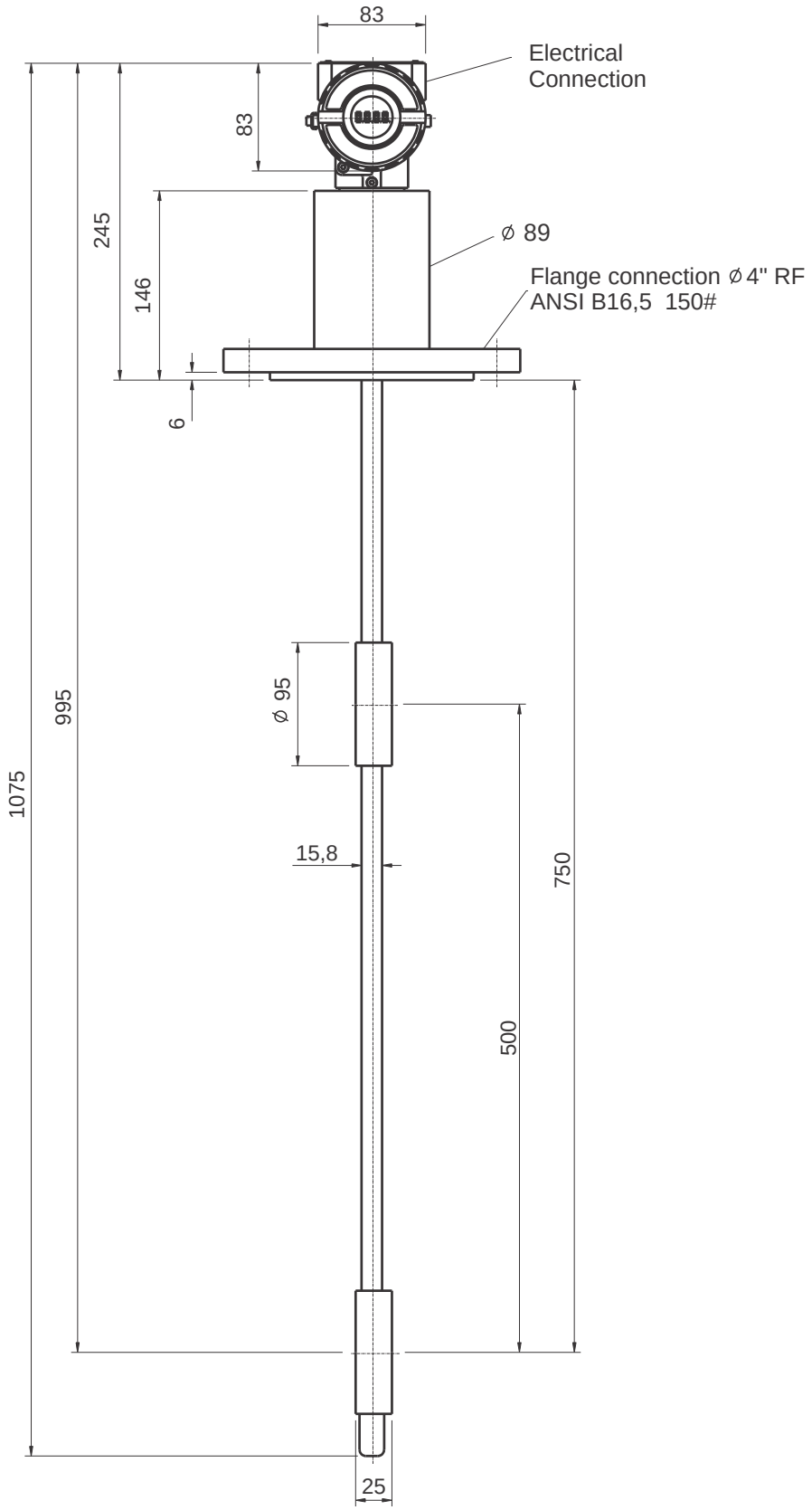


Figure 1.2 – Typical Installation for DT303 (D)

E – Typical Installation In Tank (Industrial Model)

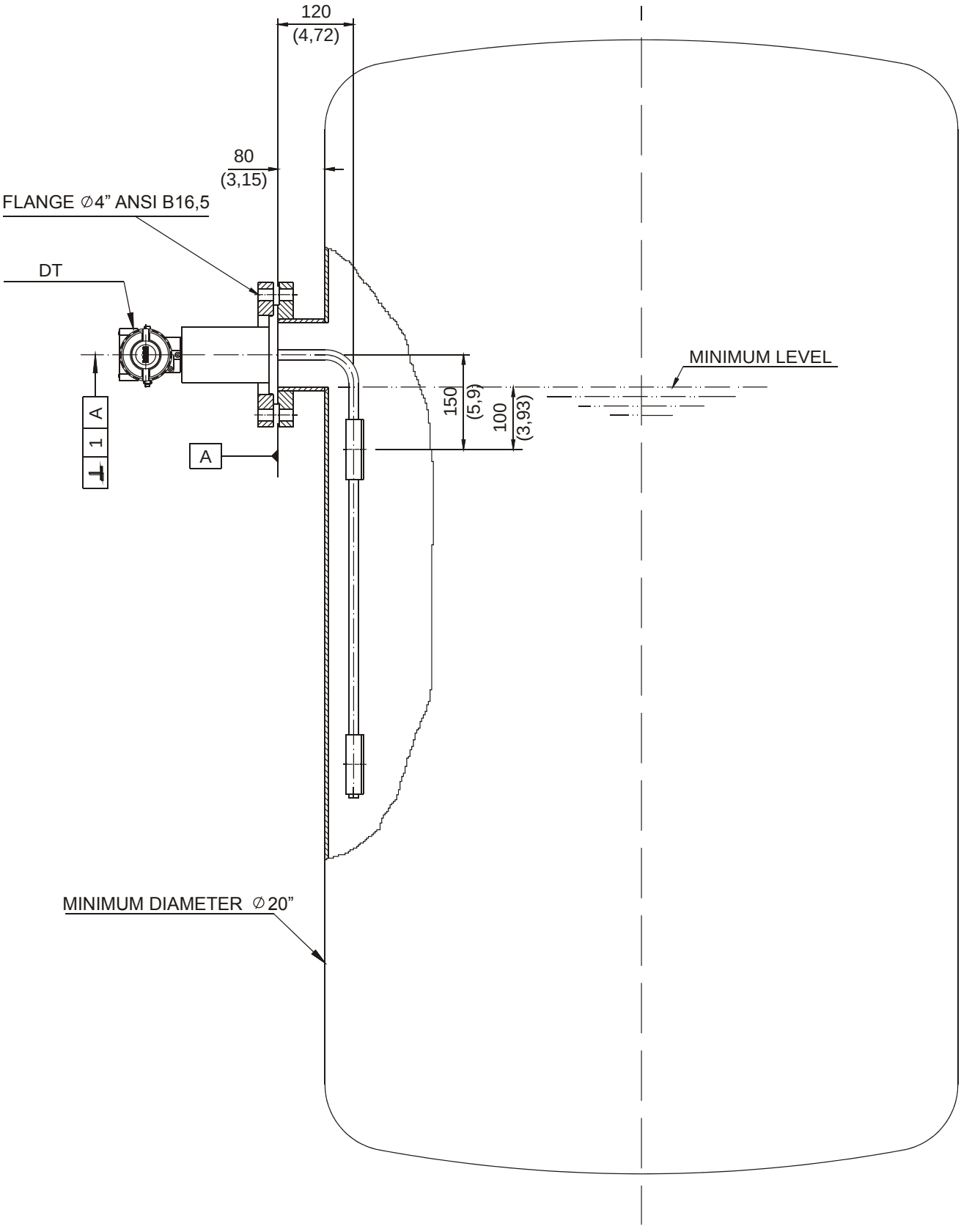


Figure 1.2 – Typical Installation for DT303 (E)

F – Typical Installation In Tank (Sanitary Model)

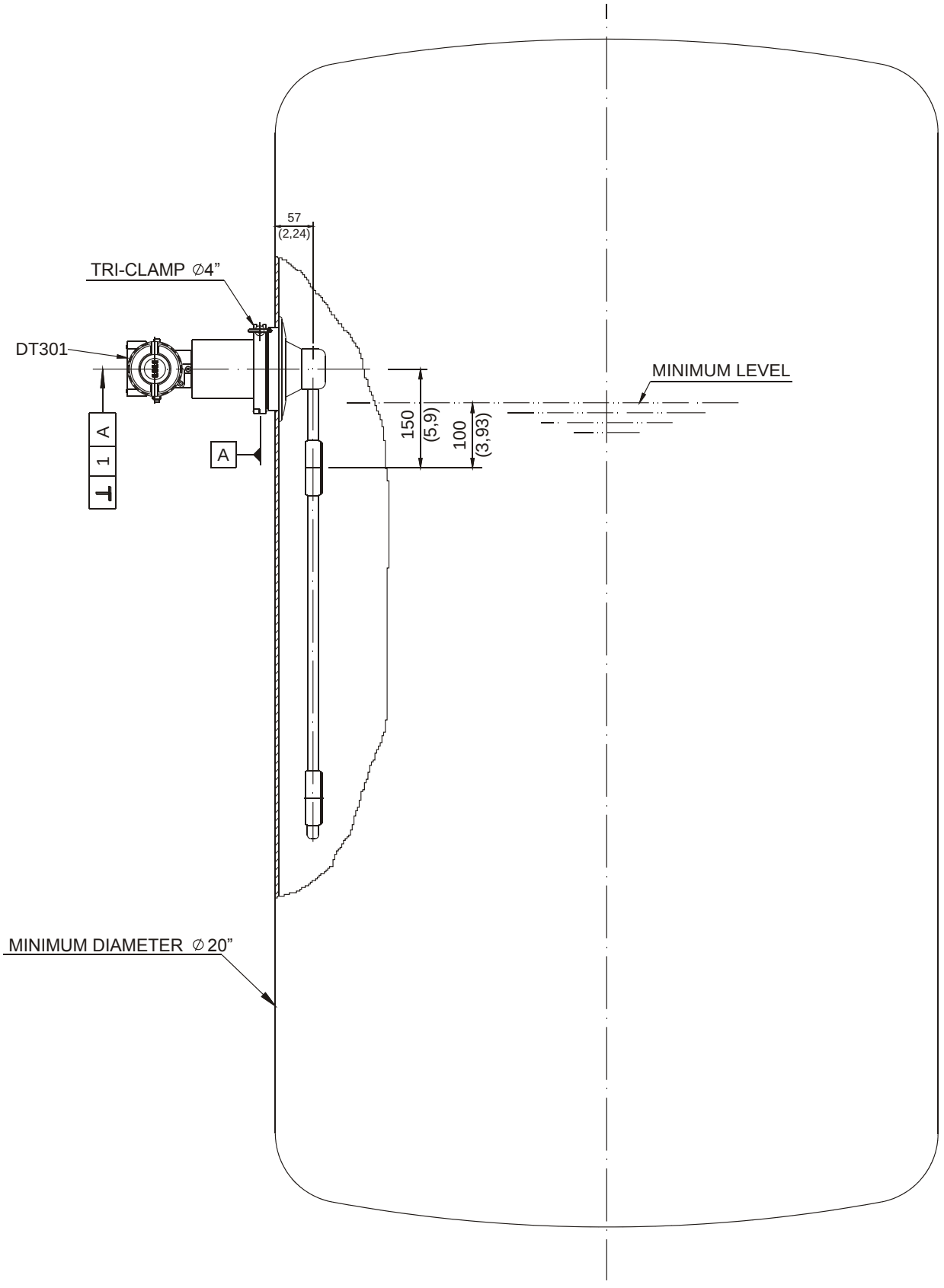


Figure 1.2 – Typical Installation for DT303 (F)

G - Typical Installation In Tank (Industrial Model)

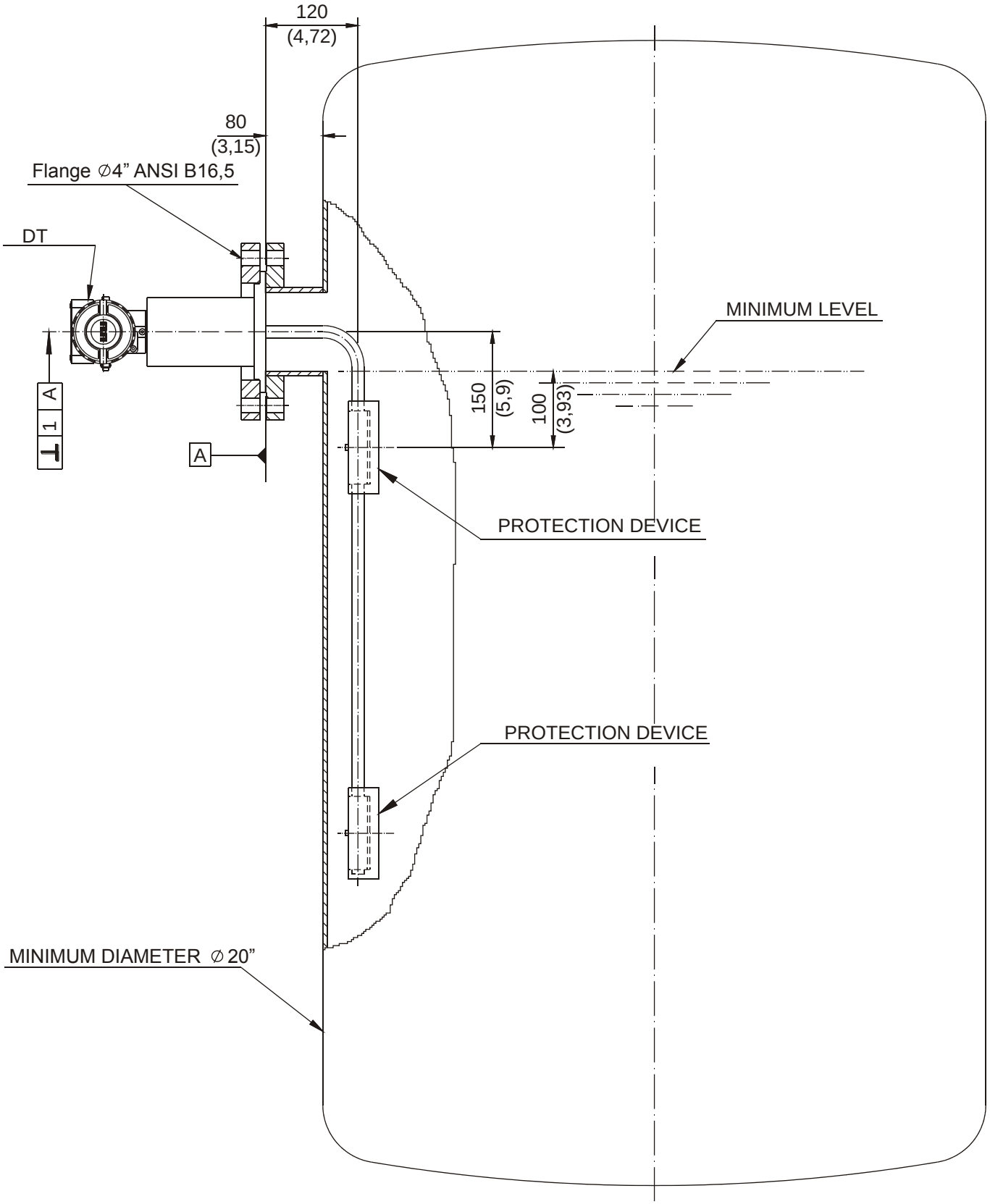


Figure 1.2 – Typical Installation for DT303 (G)

H - Typical Installation For Low Flow Tank With

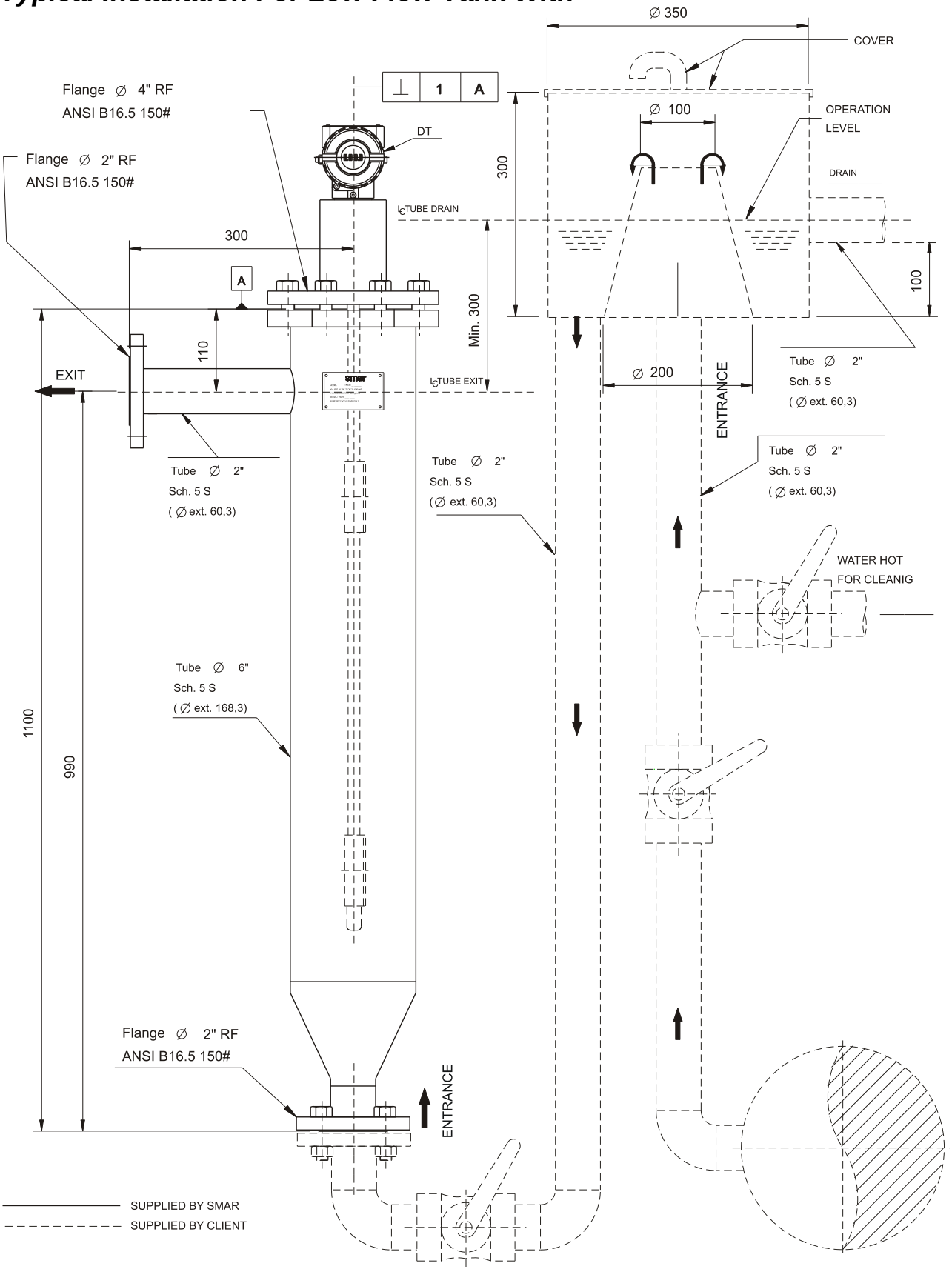


Figure 1.2 – Typical Installation for DT303 (H)

I - Typical Installation In Tank For Interface Level (Industrial Model)

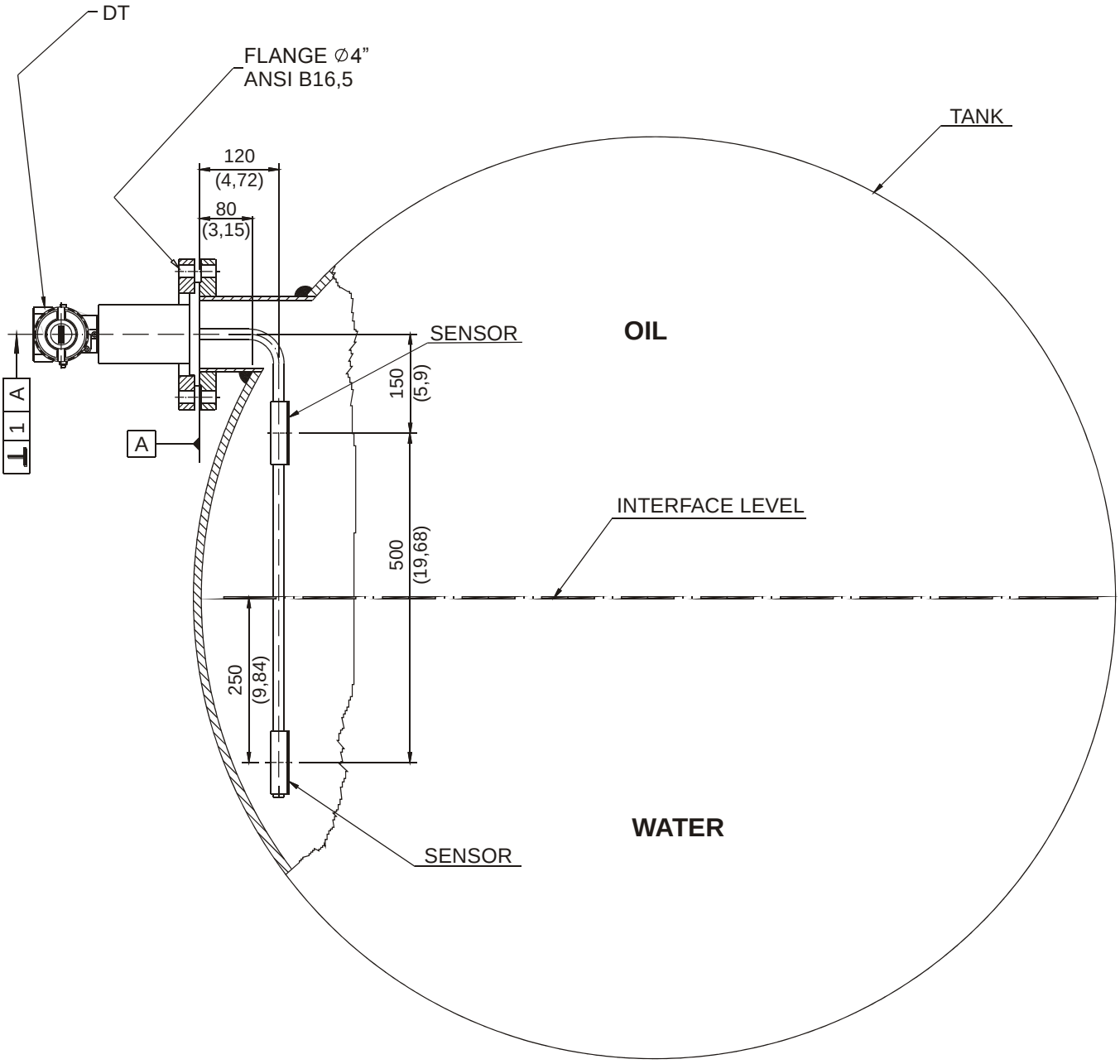


Figure 1.2 – Typical Installation for DT303 (I)

J - Typical Installation In Tank For Stand Pipe Interface Level (Industrial Model)

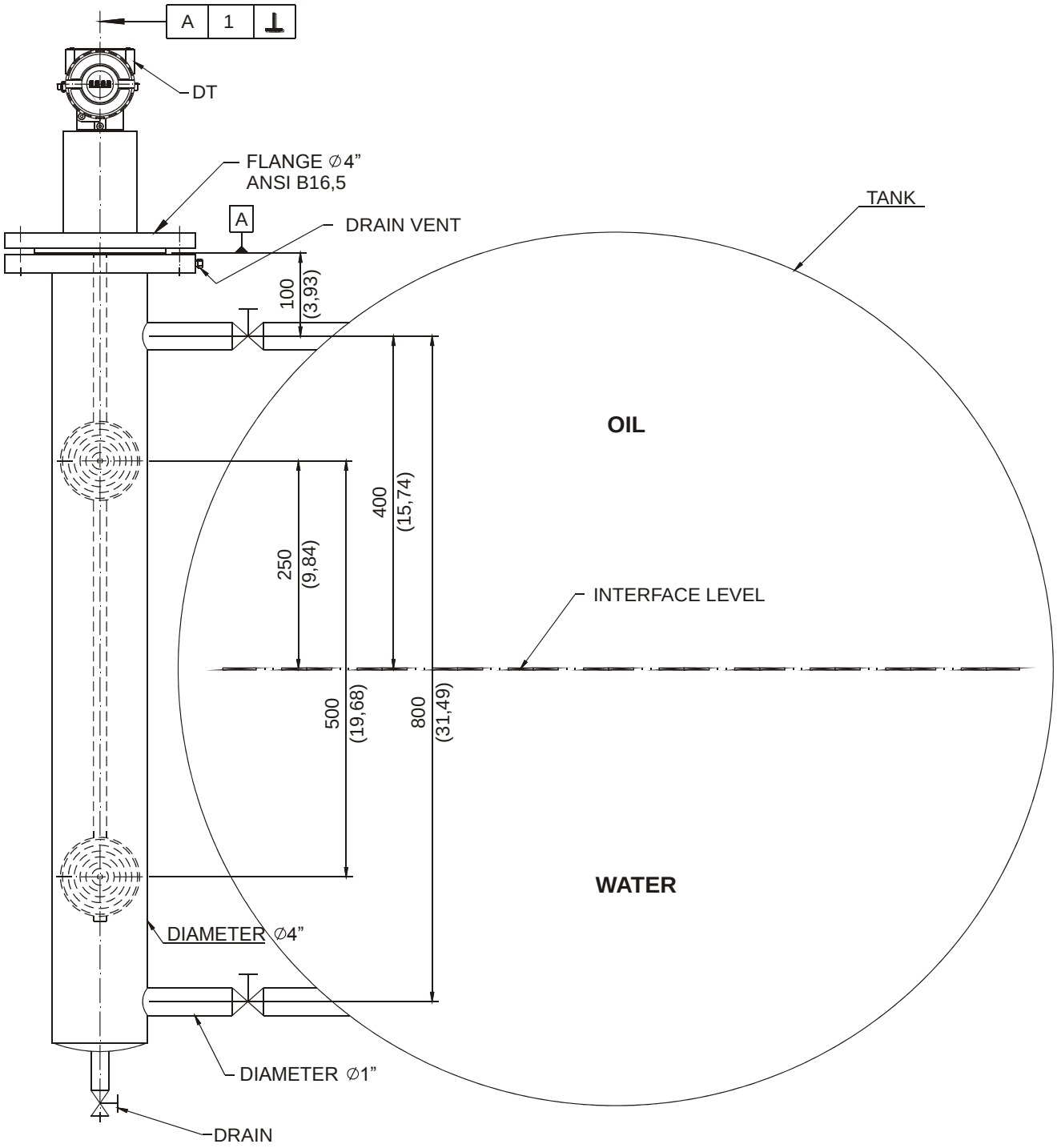


Figure 1.2 – Typical Installation for DT303 (J)

Housing Rotation

The housing can be rotated in order to get the digital display in better position. To rotate it, releases the housing rotation set screw. See figure 1.3.

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

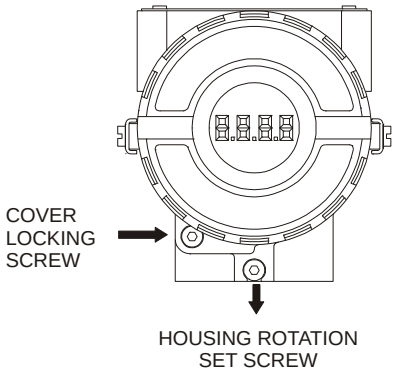


Figure 1.3 - Housing Rotation Set Screw

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

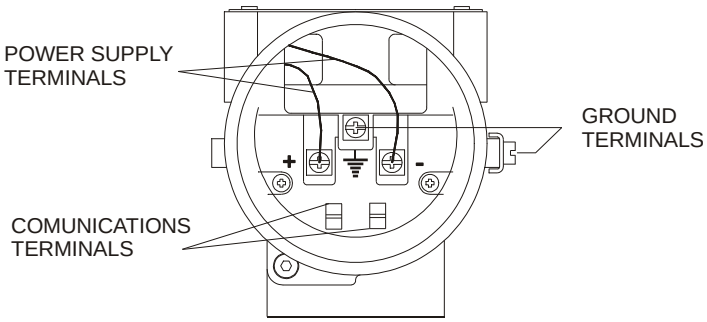


Figure 1.4 - Terminal Block

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.

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 particular implementation.

Bus topology (see figure 1.5) and tree topology (see figure 1.6) 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 connection of couplers should be kept less than 15 per 250m. In following figures the DP/PA link depends on the application needs.

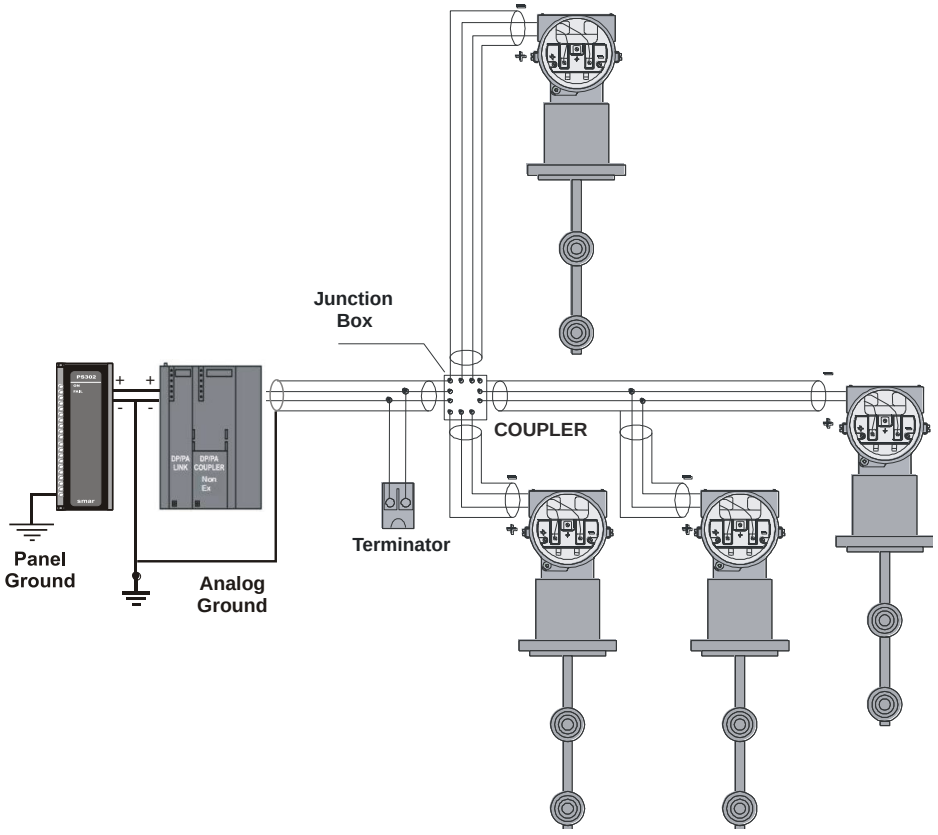


Figure 1.5 - Bus Topology

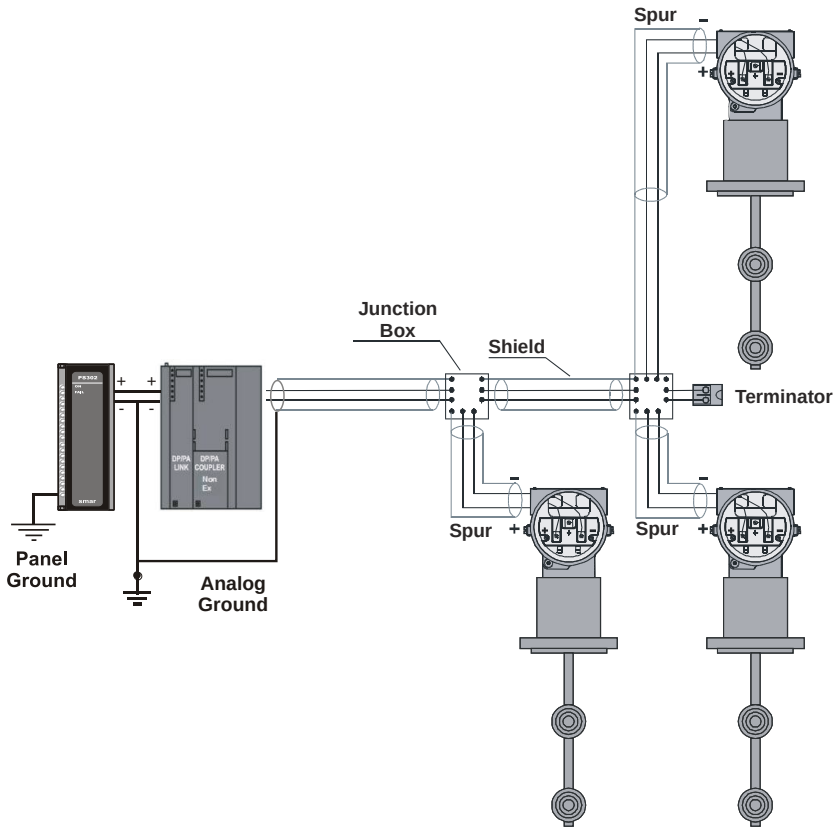


Figure 1.6 - Tree Topology

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 SB312LP, DF47-12 or DF47-17 is recommended.

Jumper Configuration

In order 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

WARNING

Explosions could result in death or serious injury, besides financial damage. Installation of this transmitter in explosive areas must be carried out in accordance with the local standards and the protection type adopted .Before continuing the installation make sure the certificate parameters are in accordance with the classified area where the equipment will be installed.

The instrument modification or parts replacement supplied by other than authorized representative of Smar is prohibited and will void the certification.

The transmitters are marked with options of the protection type. The certification is valid only when the protection type is indicated by the user. Once a particular type of protection is selected, any other type of protection can not be used.

The electronic housing and the sensor installed in hazardous areas must have a minimum of 6 fully engaged threads. Lock the housing using the locking screw (Figure 1.3).

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

Consult the Appendix A for further information about certification.

Explosion/Flame Proof

WARNING

The electric connection's entries must be connected or closed using the appropriate Ex-d metal cable gland and/or metal blanking plug with certified IP66 rating.

As the transmitter is non-ignition capable under normal conditions, the statement "Seal not Required" could be applied for Explosion Proof Version. (CSA Certification).

The standard plugs provided by Smar are certified according to the standards at FM, CSA and CEPEL. If the plug needs to be replaced, a certified plug must be used.

In the electrical connection with NPT thread, for waterproofing installation, use a non-hardening silicone sealant.

Do not remove the transmitter covers when power is ON.

Intrinsically Safe

WARNING

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

To protect the application the transmitter **must be connected to a barrier**. Match the parameters between barrier and the equipment (Consider the cable parameters). Associated apparatus ground bus shall be insulated from panels and mounting enclosures. Shield is optional. If used, 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 not recommended to remove the transmitter cover when the power is ON.

OPERATION

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

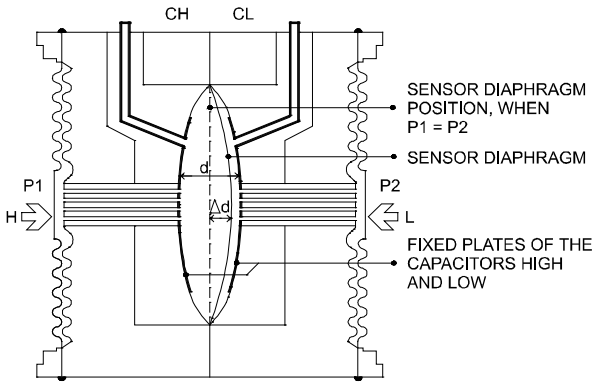


Figure 2.1 - Capacitive Cell

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 applied differential pressure.

Functional Description – Electronics

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

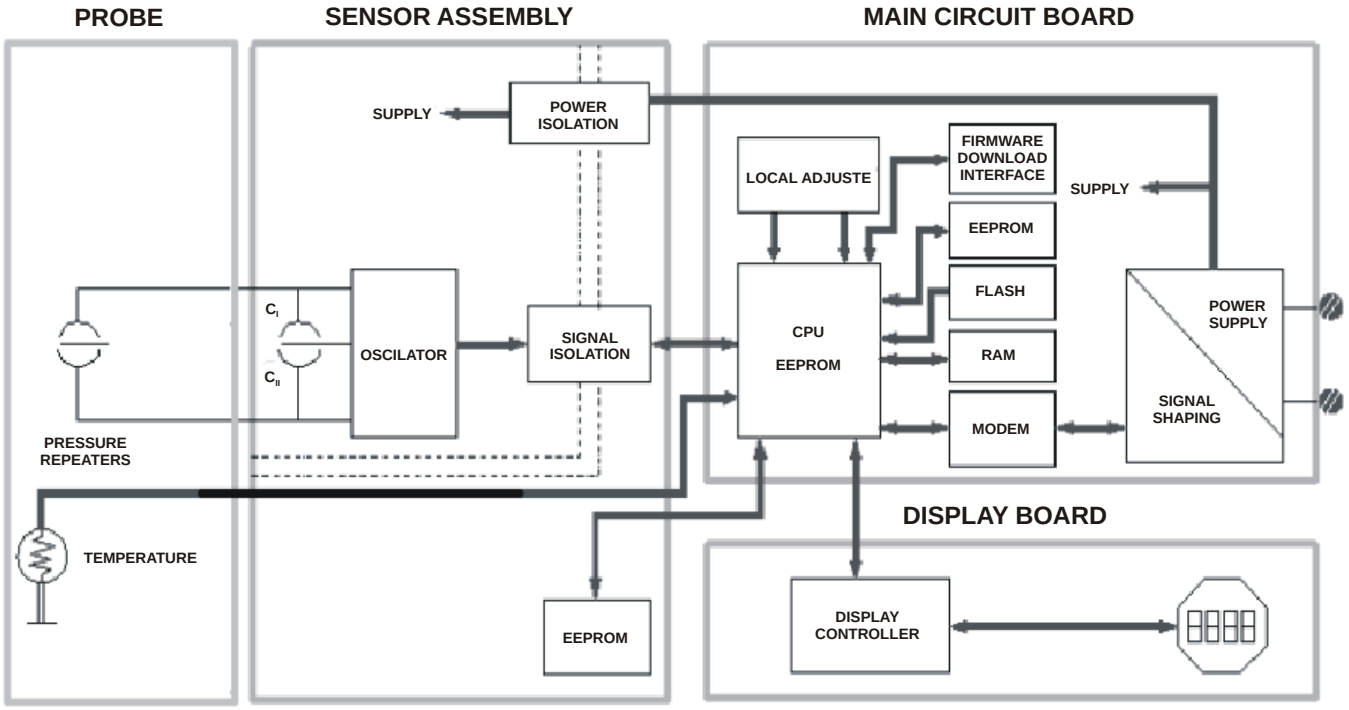


Figure 2.2 - DT303 Block Diagram Hardware

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.

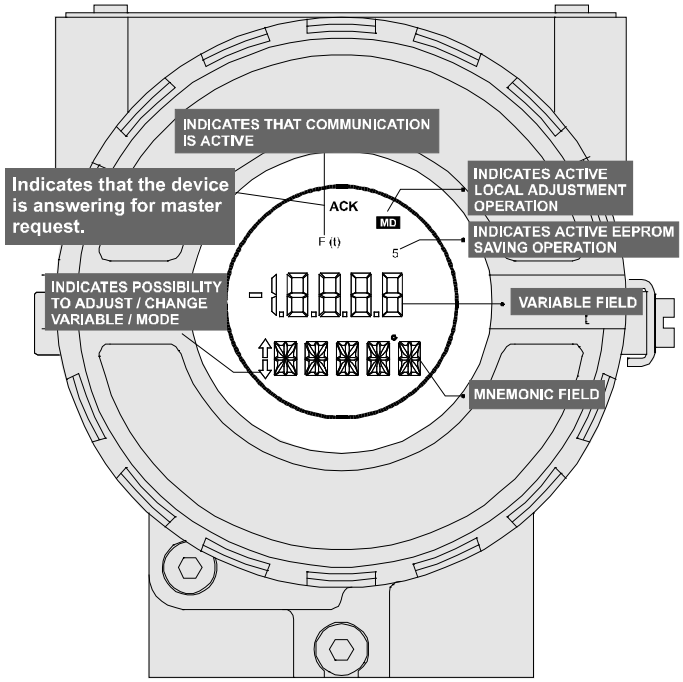


Figure 2.3 - LCD Indicator

CONFIGURATION

This section describes the characteristics of the blocks in the **DT303**. They follow the Profibus PA specifications, but for transducer blocks, the input transducer block and display, they have some special features on top of this.

The 303 Smar families are integrated in Profibus View 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 Profibus View and Simatic PDM.

In order 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 advisable 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 equipments (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 activate, 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

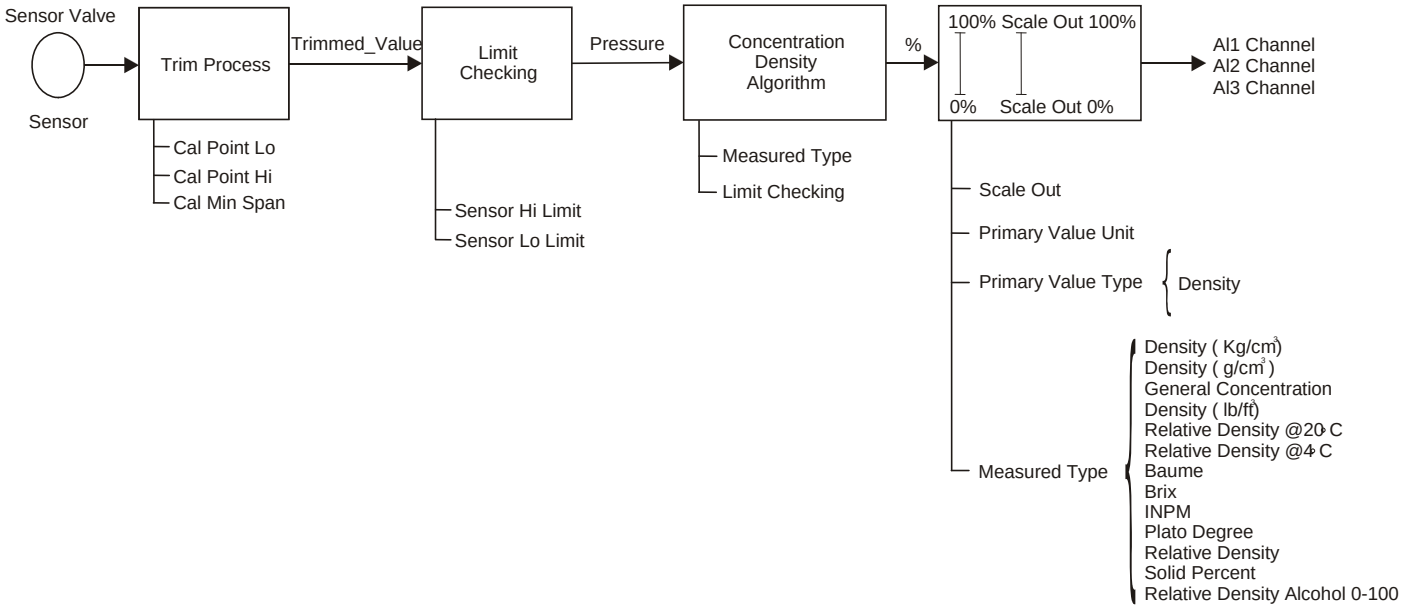


Figure 3.1 – Transducer Block Diagram

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.

Parameter	Description
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: • 0 - Range 1 (0.5 @ 1.8 g/cm^3), • 1 - Range 2 (1.0 @ 2.50 g/cm^3), • 2 - Range 3 (2.0 @ 5.00 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/s^2.
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/cm^3.
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/cm^3.
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.
MEASURED_TYPE	When the Primary Value Type is density, it allows to measure: • Density (g/cm^3), • Density (Kg/m^3), • Relative Density @ 20°C (g/cm^3), • Relative Density @ 4°C (g/cm^3), • Baume, • Brix, • Plato Degree, • INPM, • GL, • Solid Percent, • Density (lb/ft^3), • 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.

Parameter	Description
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.
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

Index	Parameter Mnemonic	Object Type	Data Type	Store	Size	Access	Parameter usage/ Type of transport	Default – value
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	-
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

Index	Parameter Mnemonic	Object Type	Data Type	Store	Size	Access	Parameter usage/ Type of transport	Default – value
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				

Relative Index	Parameter Mnemonic	View_1	View_2	View_3	View_4
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				
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				

Relative Index	Parameter Mnemonic	View_1	View_2	View_3	View_4
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 Profibus View or Simatic PDM

The transducer block has an algorithm, a set of contained parameters and a channel connecting it to a function block.

The algorithm describes the behavior of the transducer as a data transfer function between the I/O hardware and other function block. The set of contained parameters, 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 guide line 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 Profibus View 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.

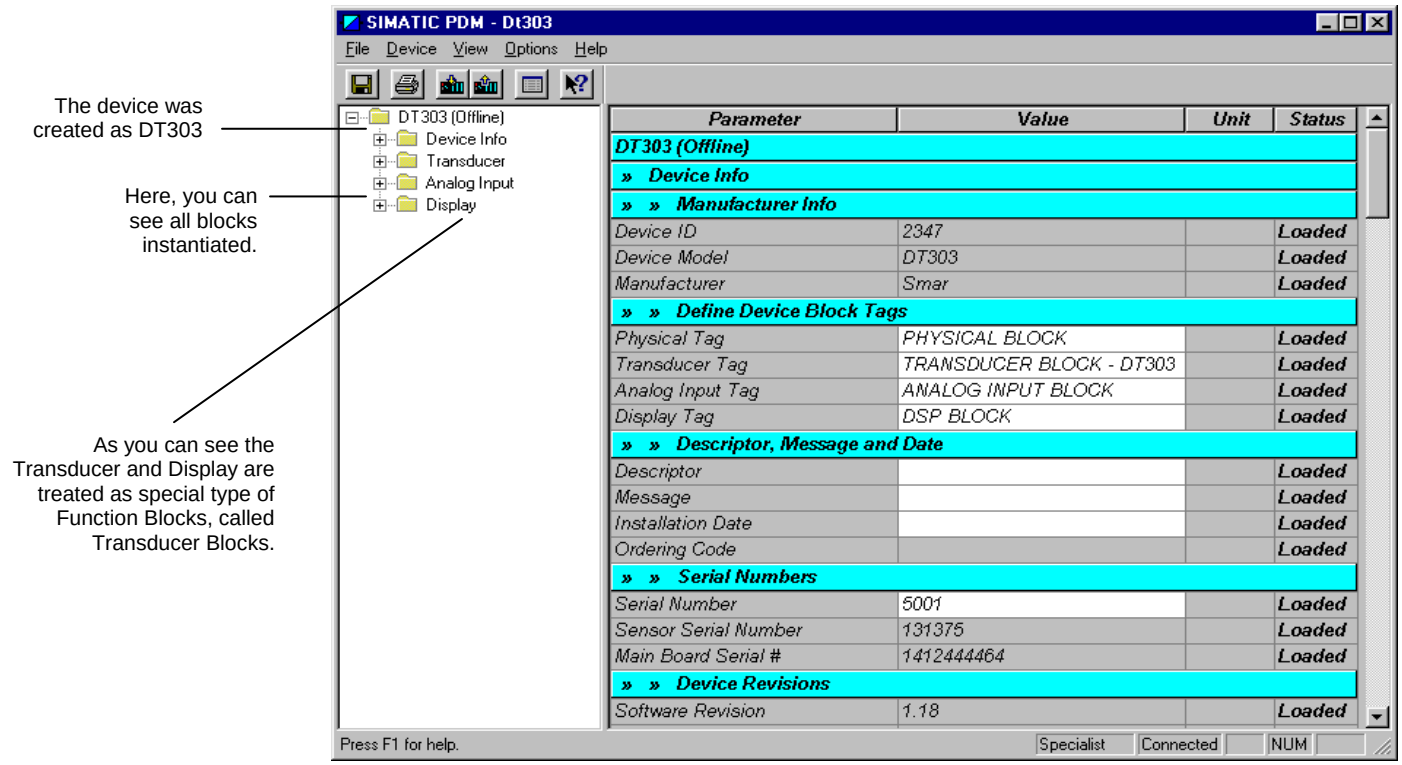


Figure 3.2 – Function and Transducer Block – Simatic PDM

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

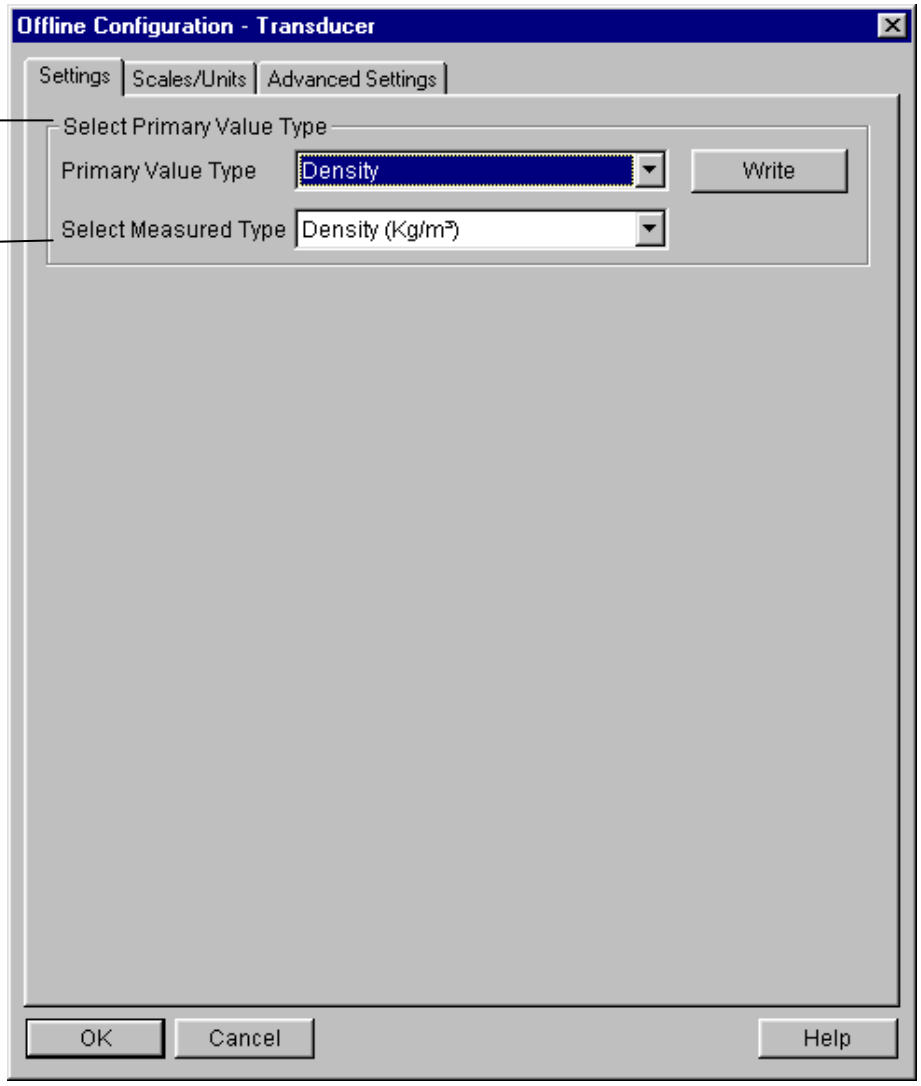


Figure 3.3 – Offline Configuration – Transducer

Using this window, the user can set the Primary Value Type according to his 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:

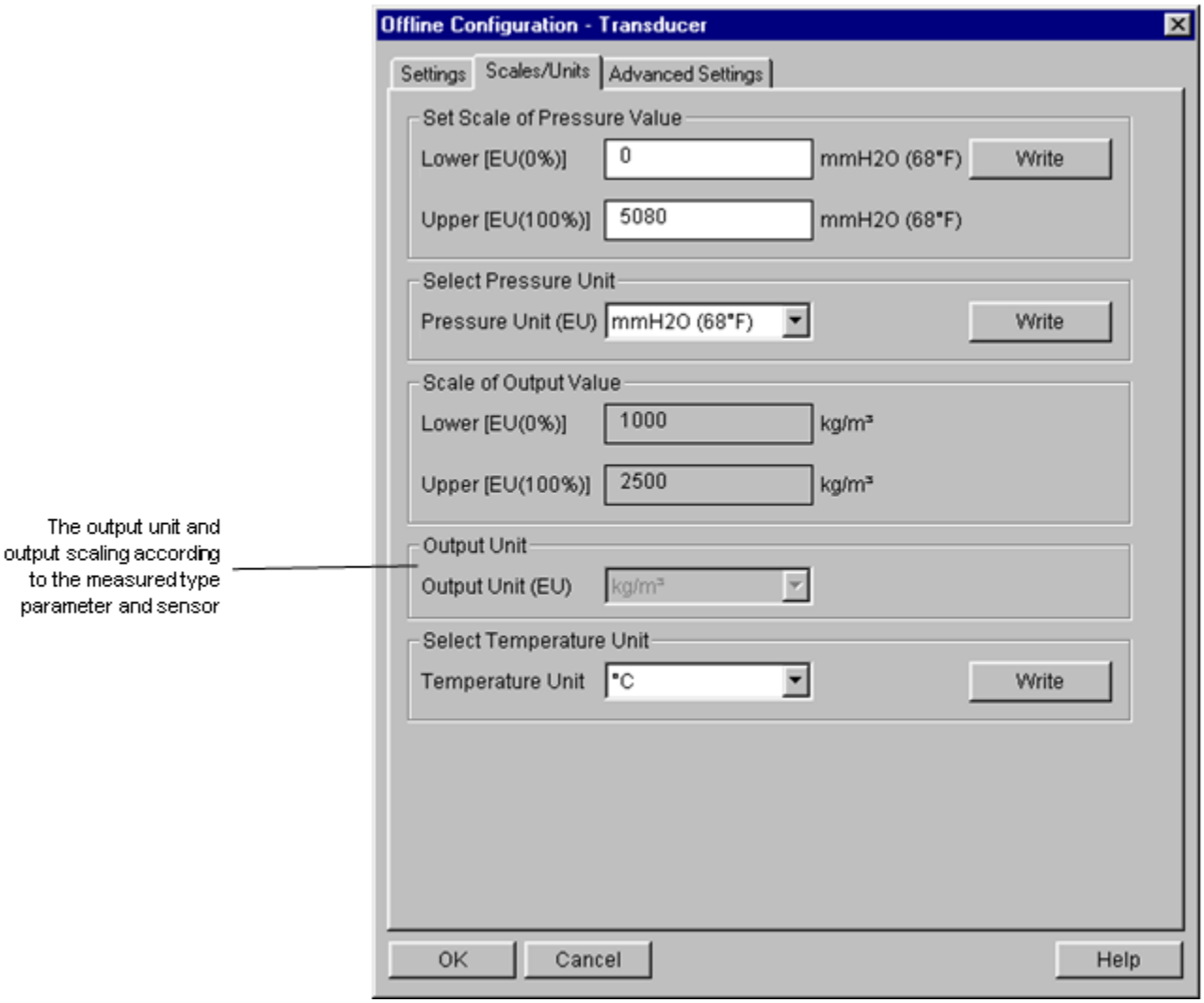


Figure 3.4 – Scale Units for Transducer Block

Advanced Settings

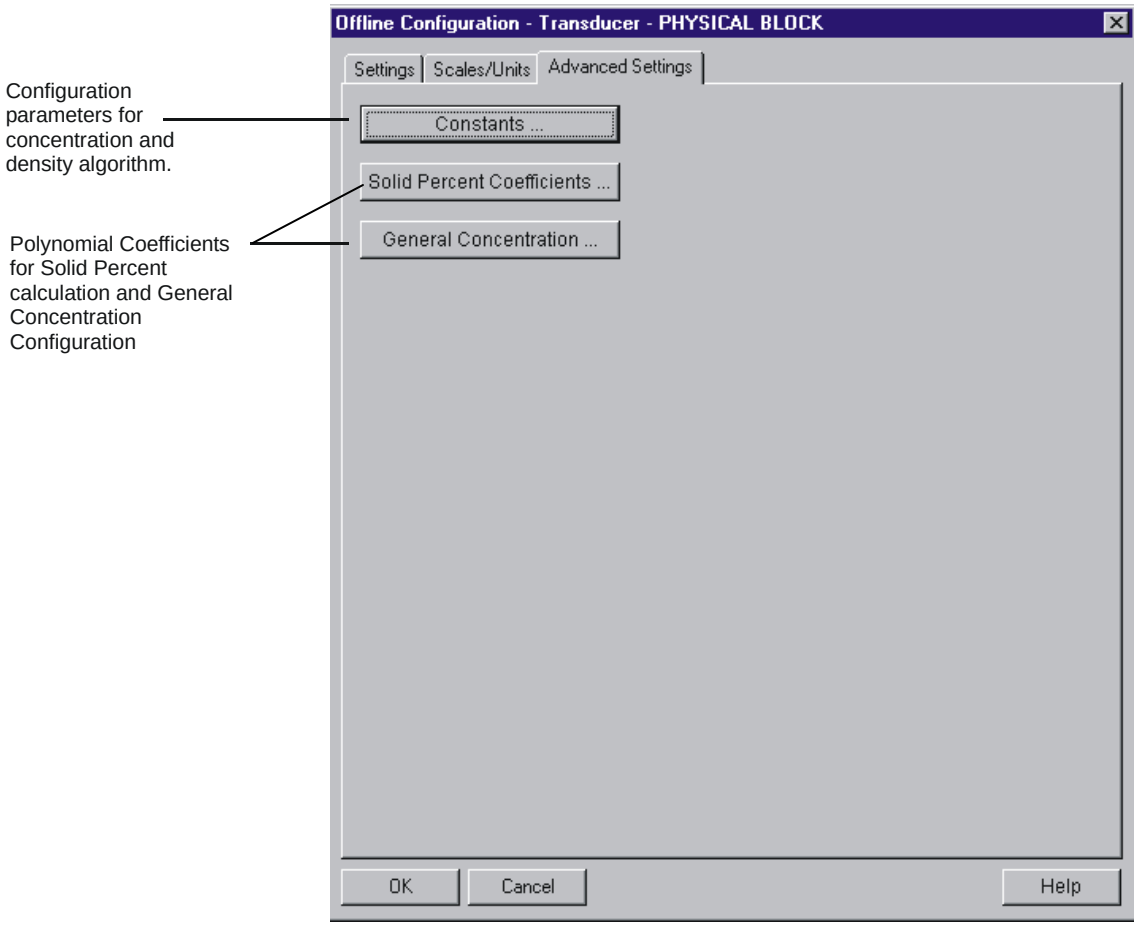


Figure 3.5 – Transducer Offline – Advanced Settings

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.

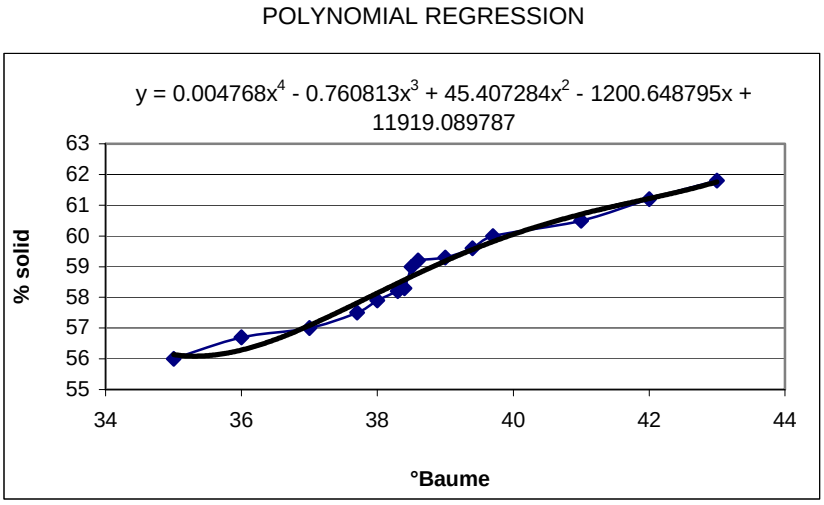
The general equation to determine the solid percent is:

%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



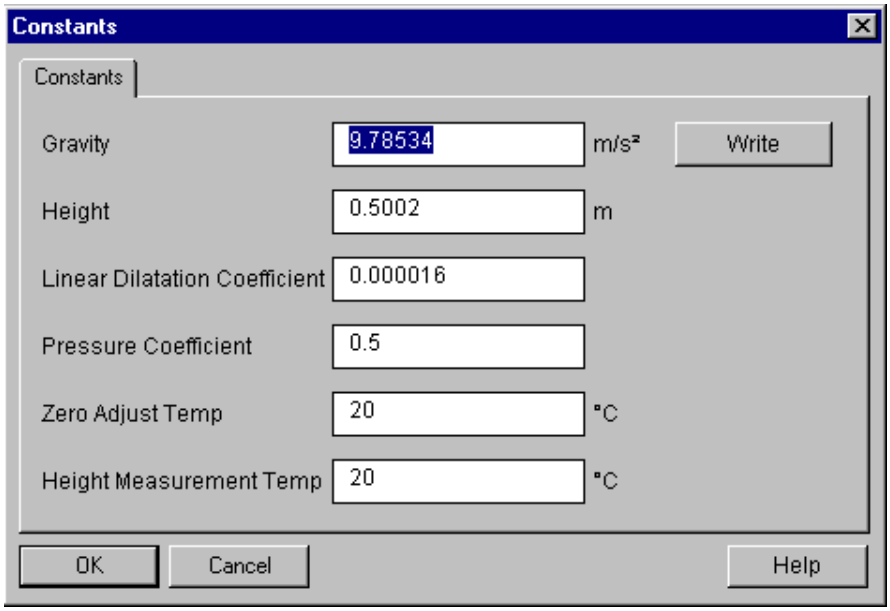
Concentration Percentage (% conc)
For applications that demand other relation among measures, the polynomial used is:

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

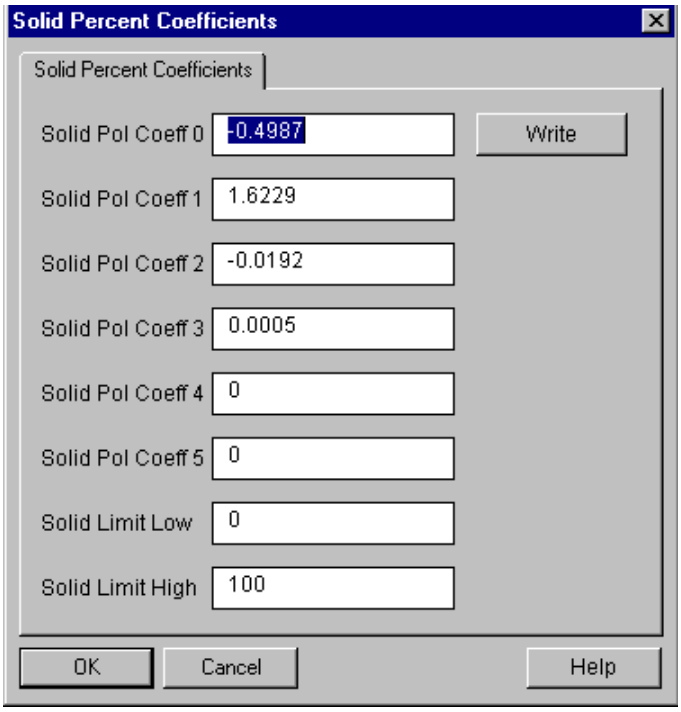
This function is applied to a higher number of applications. It relates three measurements: density, temperature and concentration.

As the digital display used in DT301 is of 4 ½ digits, the maximum indicated value would be 19999. When selecting the unit, be certified that in your application the value won't surpass 19999.

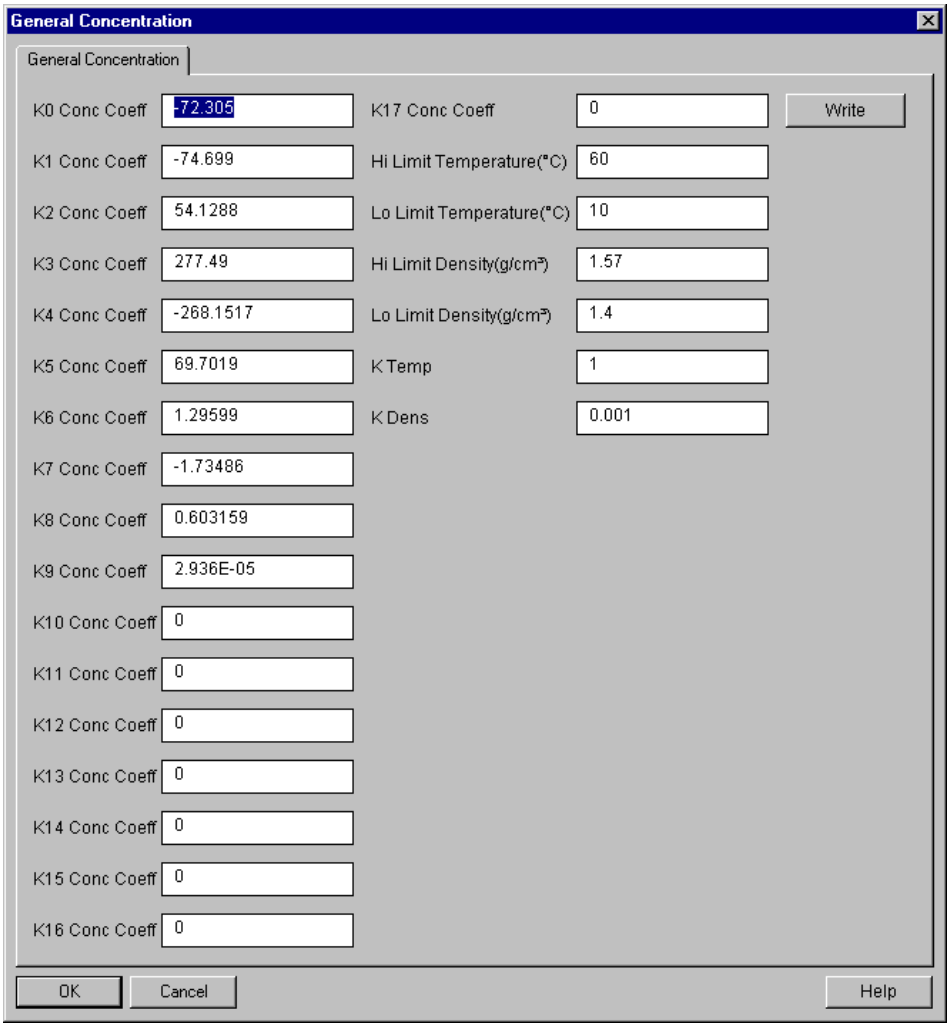
Clicking in “Constants”, the user will get the following screen:



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) Density / Inferior and Superior concentration calibration:
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 – Inferior 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** – Inferior Value Calibration is a simple parameter and is not necessary to configure the element.

After this 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 – Superior 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** – Superior 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:

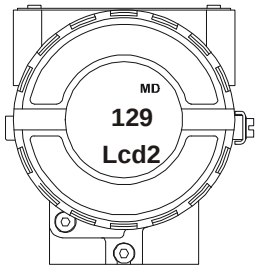
CONF: Select a **LCD**, for example **LCD2**;
BLOCK: Select **TRD**;
PRMT: Select the value **18** (PRIMARY_VALUE – Primary Unit Value), according to Standard Parameters Descriptions, Specific Parameters and Parameter Attribute Table of the Transducer Block in the DT303 Operation, Maintenance and Instructions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

After this 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.

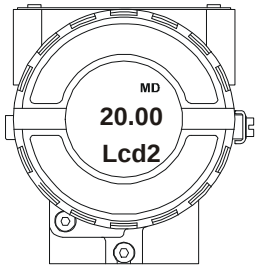
After this configuration in "**UPDT**" option insert the magnetic tool in the *Span* hole to update the local adjustment tree.



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.

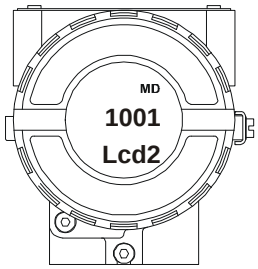
After this configuration in "**UPDT**" option insert the magnetic tool in the *Span* hole to update the local adjustment tree.



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 ° Farenheit

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

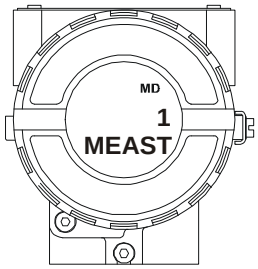


a.6) Measurement Type:
The user must configure the following parameters using the local adjustment procedure:

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.



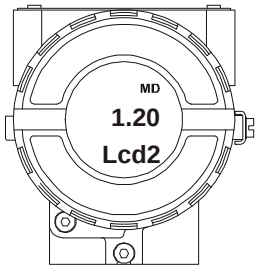
a.7) Self Calibration Air and Water:
To configure this option of calibration the user must configure 3 parameters of the Transducer Block:
- **AUTO_CAL_POINT_LO (Air – relative index equal to 95);**
- **AUTO_CAL_POINT_HI (Water – relative index equal to 96);**
- **MEASURED_TYPE (relative index equal 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 Inferior 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** – Inferior Value Calibration is a simple parameter and is not necessary to configure the element.

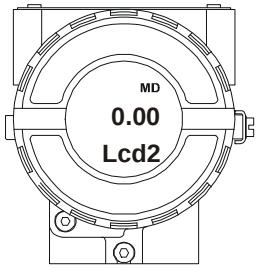
After this configuration in "**UPDT**" option insert the magnetic tool in the *Span* hole to update the local adjustment tree.



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

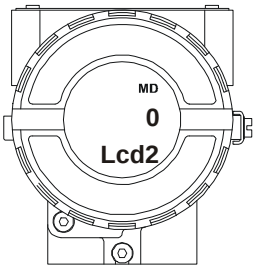
CONF: Select a **LCD**, for example **LCD2**;
BLOCK: Select **TRD**;
PRMT: Configure the value **90** (MEASURED_TYPE – Measurement Type) for Brix Degree value equal to 5.
PRMT: Configure the value **96** (AUTO_CAL_POINT_HI – Self Calibration of the Superior Value) according to Standard Parameters Descriptions,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

After this configuration in "**UPDT**" 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 Profibus View.

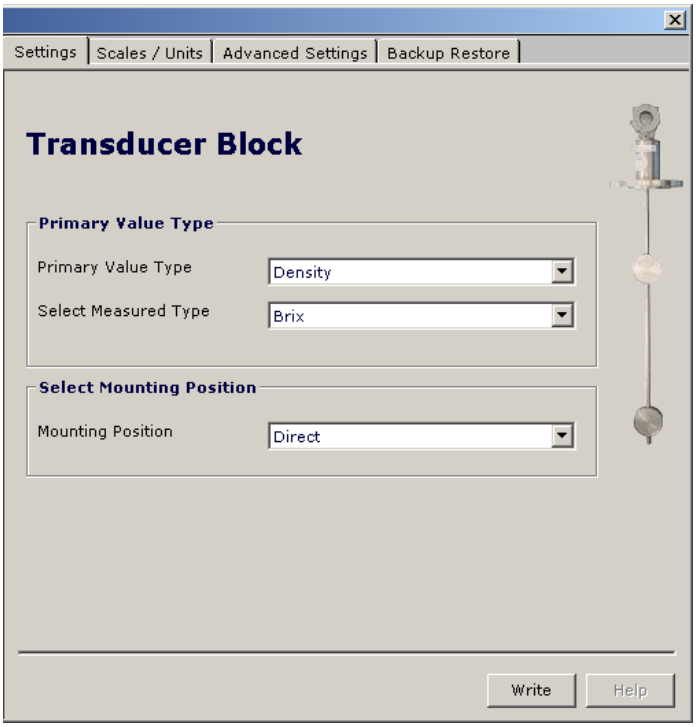


Figure 3.6 - Transducer Block and Function – Profibus View

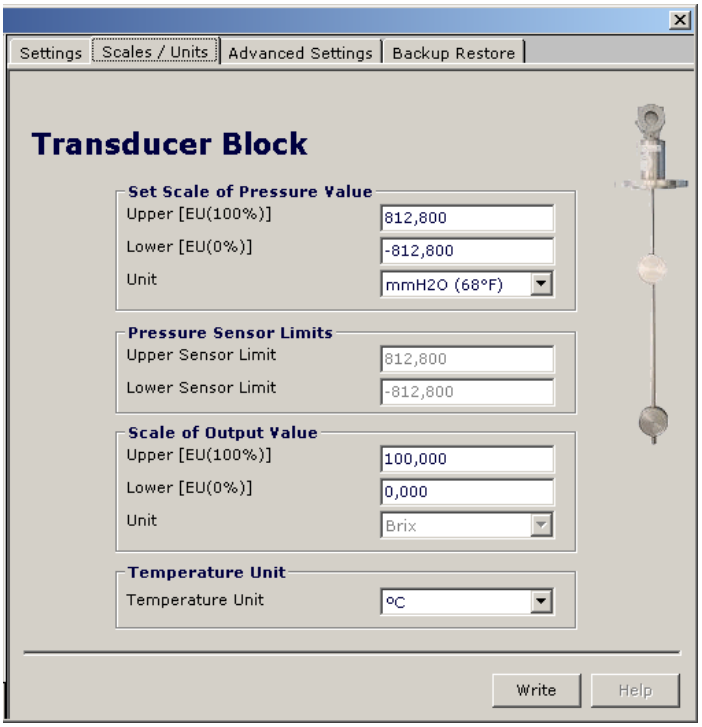


Figure 3.7 - Scale Units – Profibus View

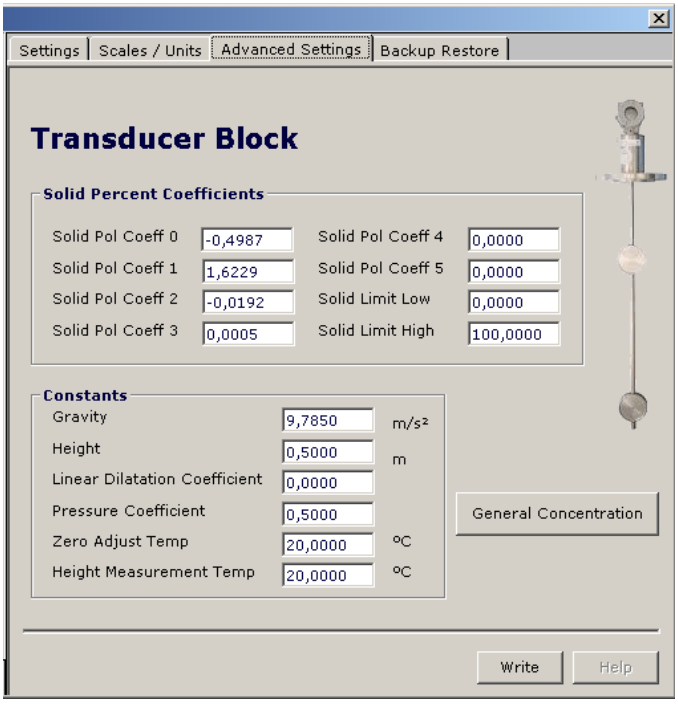


Figure 3.8 - Advanced Settings – Profibus View

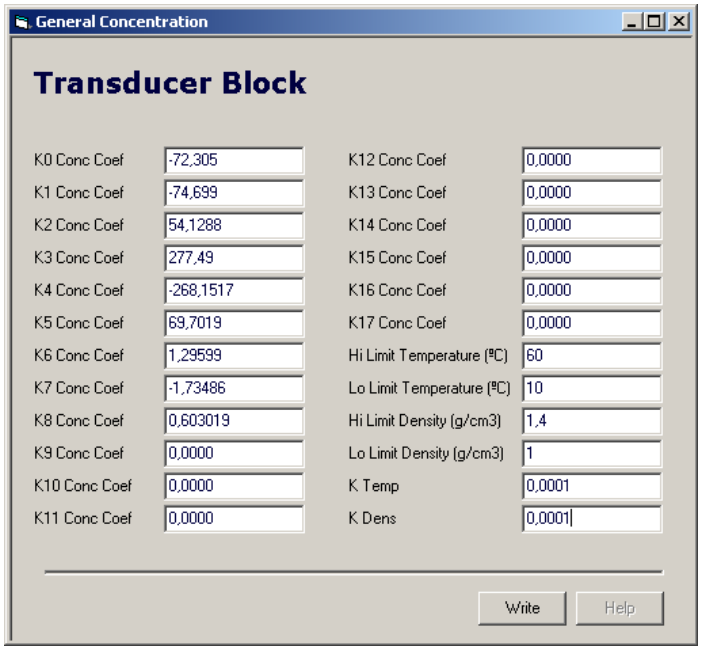


Figure 3.9 - Concentration General Units – Profibus View

How to Configure the Analog Input Blocks

The Analog Input 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 screen “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.

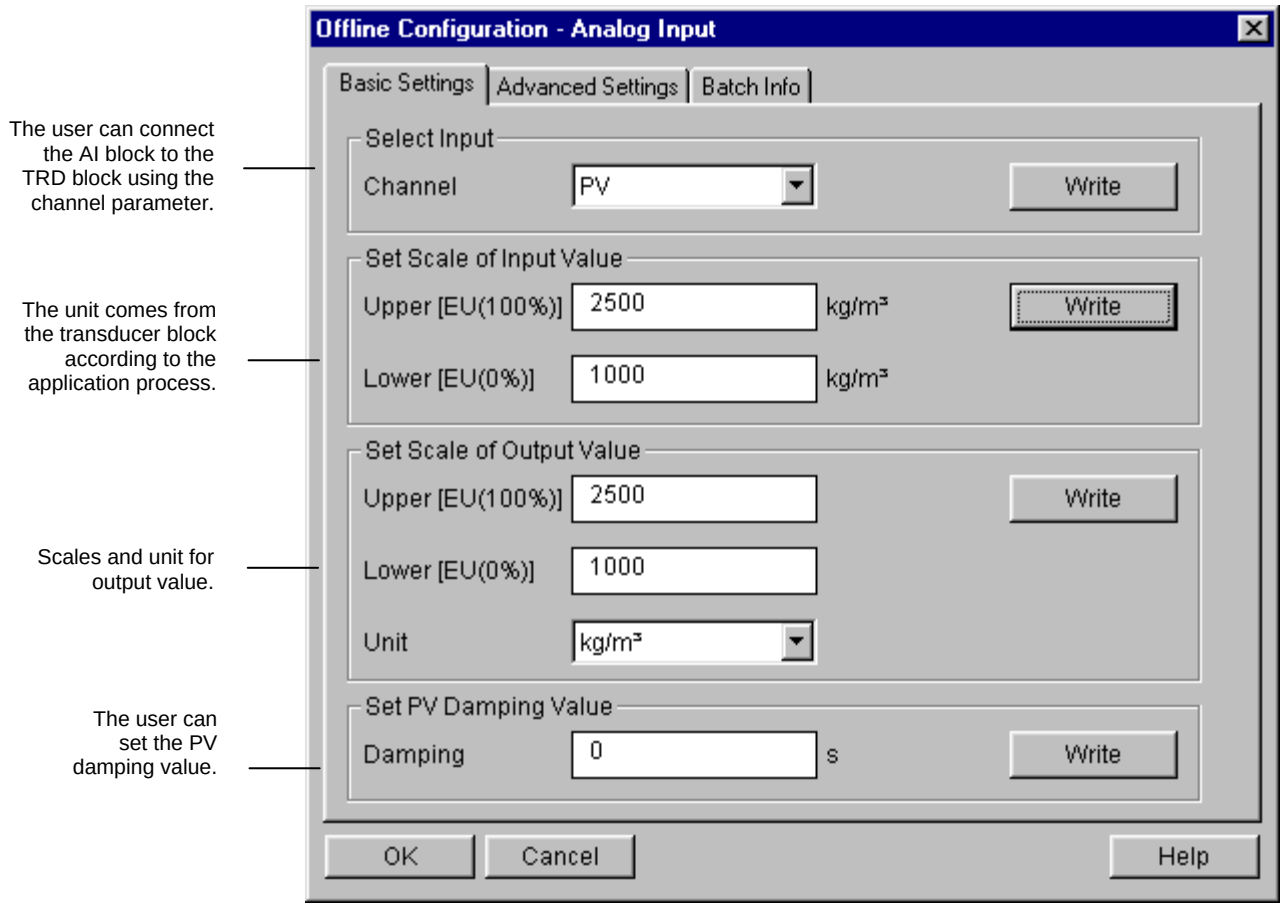


Figure 3.10 – Basic Settings for Analog Input Block

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

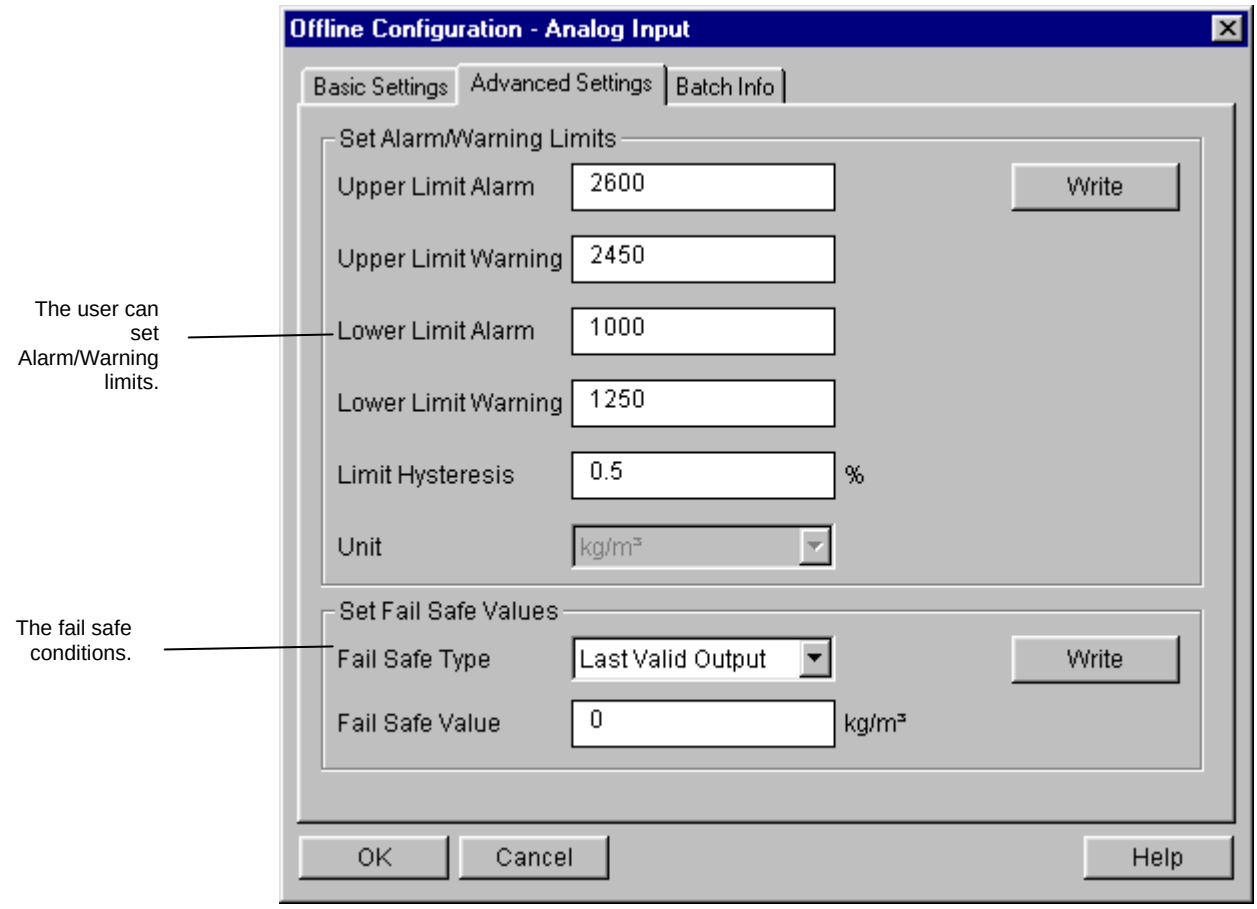


Figure 3.11 – Advanced Settings for Analog Input Block

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

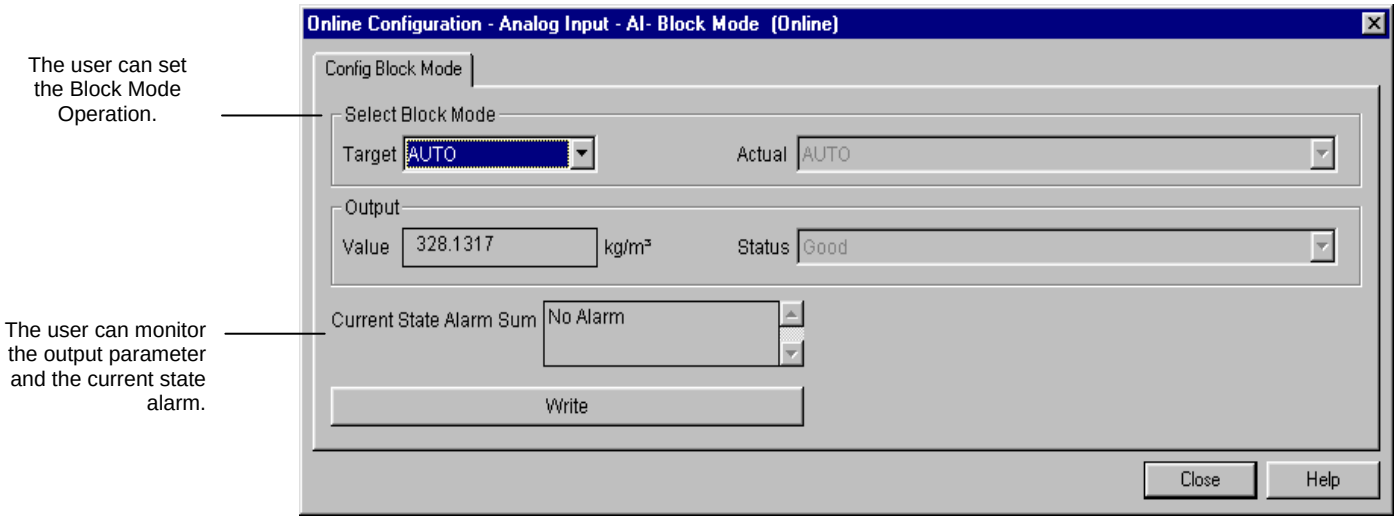


Figure 3.12 – Online Configuration for Analog Input Block

See below the configuration screens of the Analog Input Block using the Profibus View.

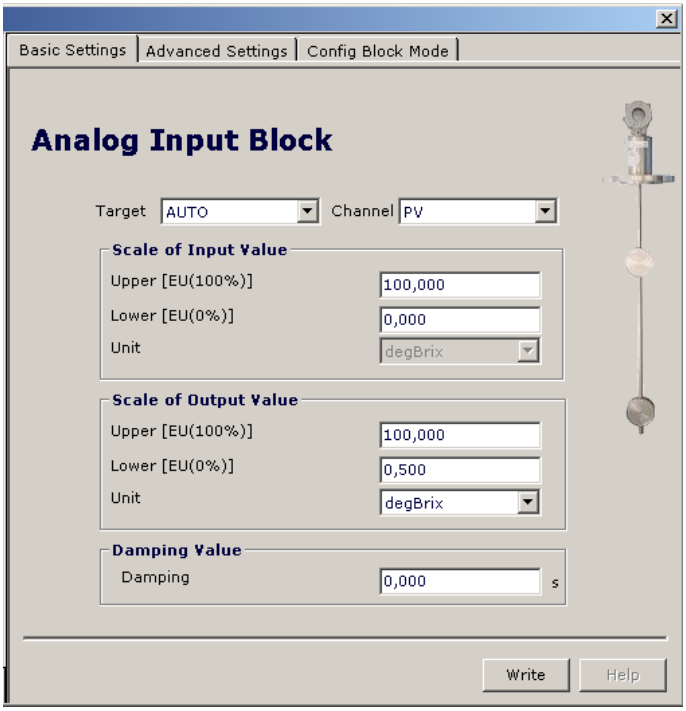


Figure 3.13 – Basic Settings – AI Block

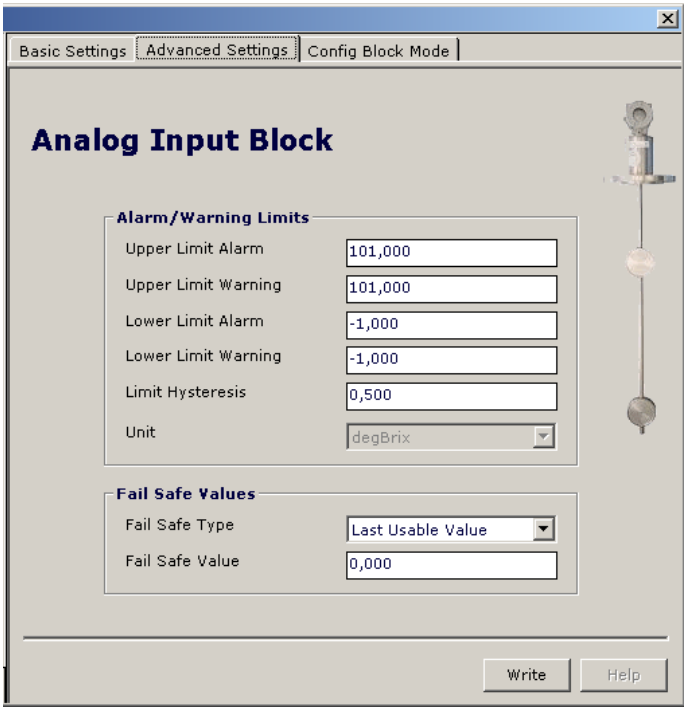


Figure 3.14 – Advanced Settings – AI Block

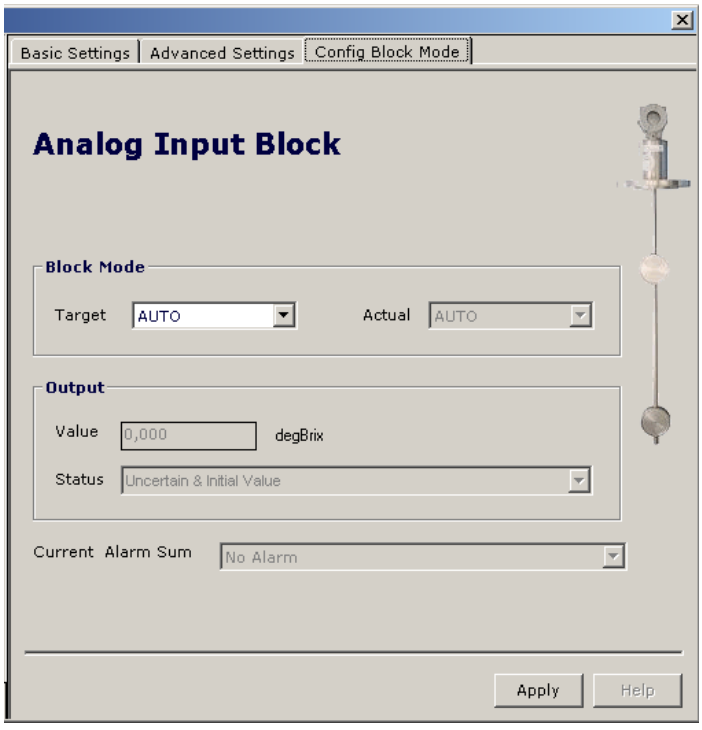


Figure 3.15 – Online Configuration – AI Block

Lower and Upper Concentration / Density Calibration

NOTE
The calibration screens of concentration / density inferior and superior value of the Profibus View 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, sure that the **DT303** is measuring concentration/density. Using Profibus View or Simatic PDM, in the Transducer Block screen, 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
- 0 - 100,
- Solid Percent, Density (lb/ft³)
- API – degree API

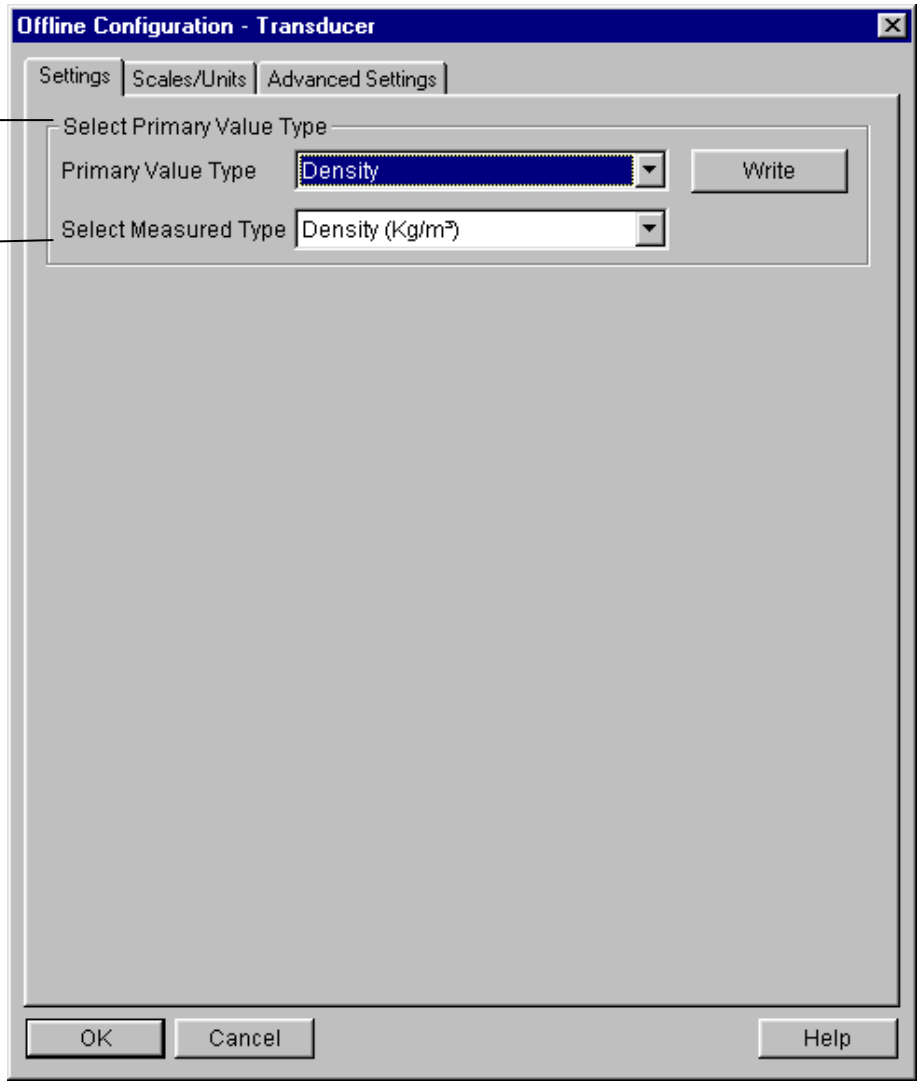


Figure 3.16 – Primary Value Type Selection

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

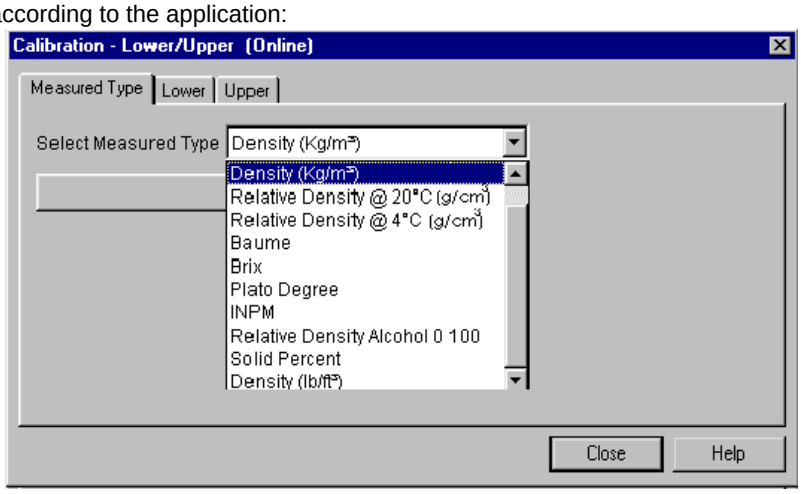


Figure 3.17 – Measured Type Selection

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 Profibus View or the Simatic PDM, in the Calibration screen, the user can select the measured type and the lower and upper calibration procedure.

If the user selects Lower or Upper page, 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.

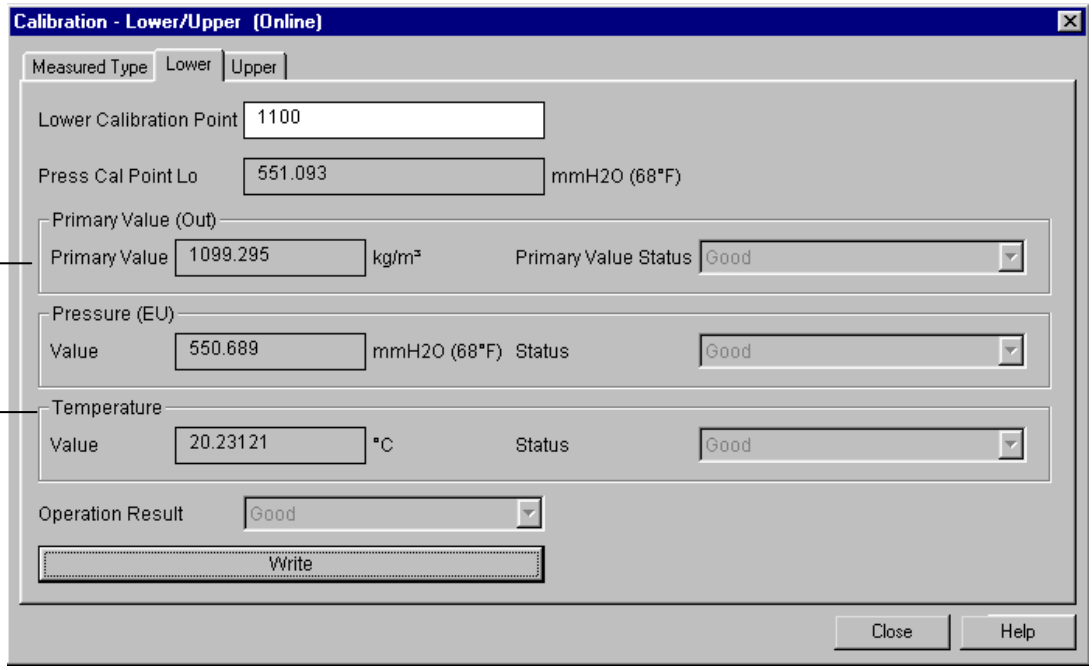


Figure 3.18 – DT303 Concentration/ Density Calibration

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 screens of inferior and superior concentration / density of the Profibus View are similar to Simatic PDM screens.

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

If the user selects Lower page, 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.

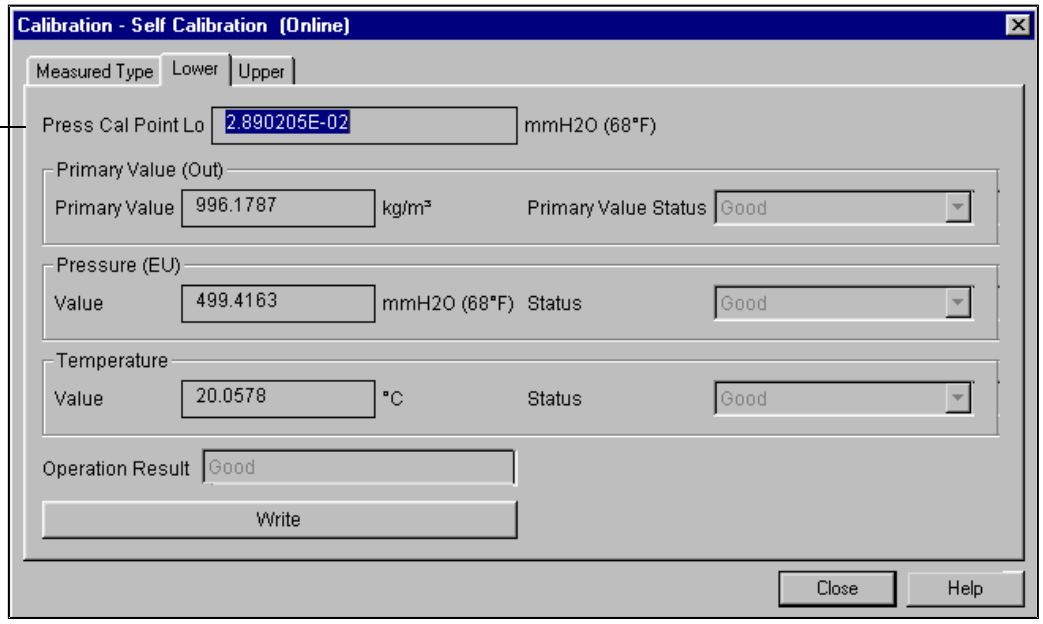


Figure 3.19 – DT303 Lower Concentration / Density Self-Calibration

If the user selects Upper page, 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.

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

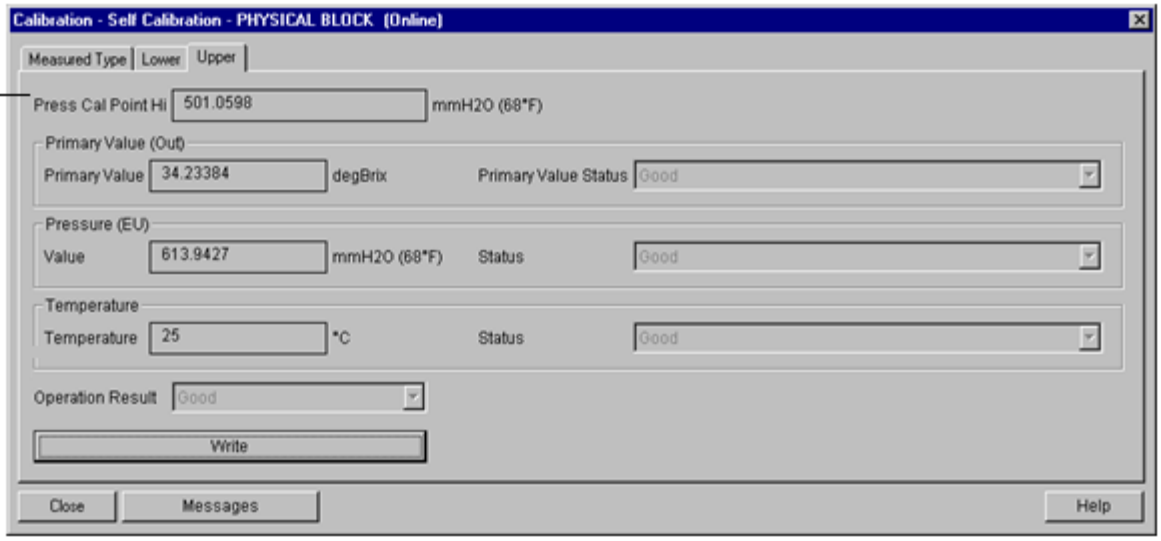


Figure 3.20 – DT303 Upper Concentration / Density Self-Calibration

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. In order 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.

- In order 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.

Limits for Concentration/Density Calibration						
Measured Type	Range 1		Range 2		Range 3	
	Lower	Upper	Lower	Upper	Lower	Upper
Density (g/cm^3)	0.445	1.98	0.9	2.75	2.25	5.5
Density (Kg/m^3)	445.0	1980.0	900.0	2750.0	2250.0	5500.0
Density (lb/ft^3)	27.9	124.3	55.8	171.6	140.4	343.2
Relative Density @ 20°C	0.445	1.98	0.9	2.75	2.25	5.5
Relative Density @ 4°C	0.445	1.98	0.0	2.75	2.25	5.5
Baume	-5.2	57.2				
Brix	-10.0	110.0				
Plato Degree	-10.0	110.0				
INPM	-10.0	110.0				
Relative Density Alcohol 0 - 100	-10.0	110.0				
Solid Percent	-10.0	55.0				
API	0.0	90.0				

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
In order 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.

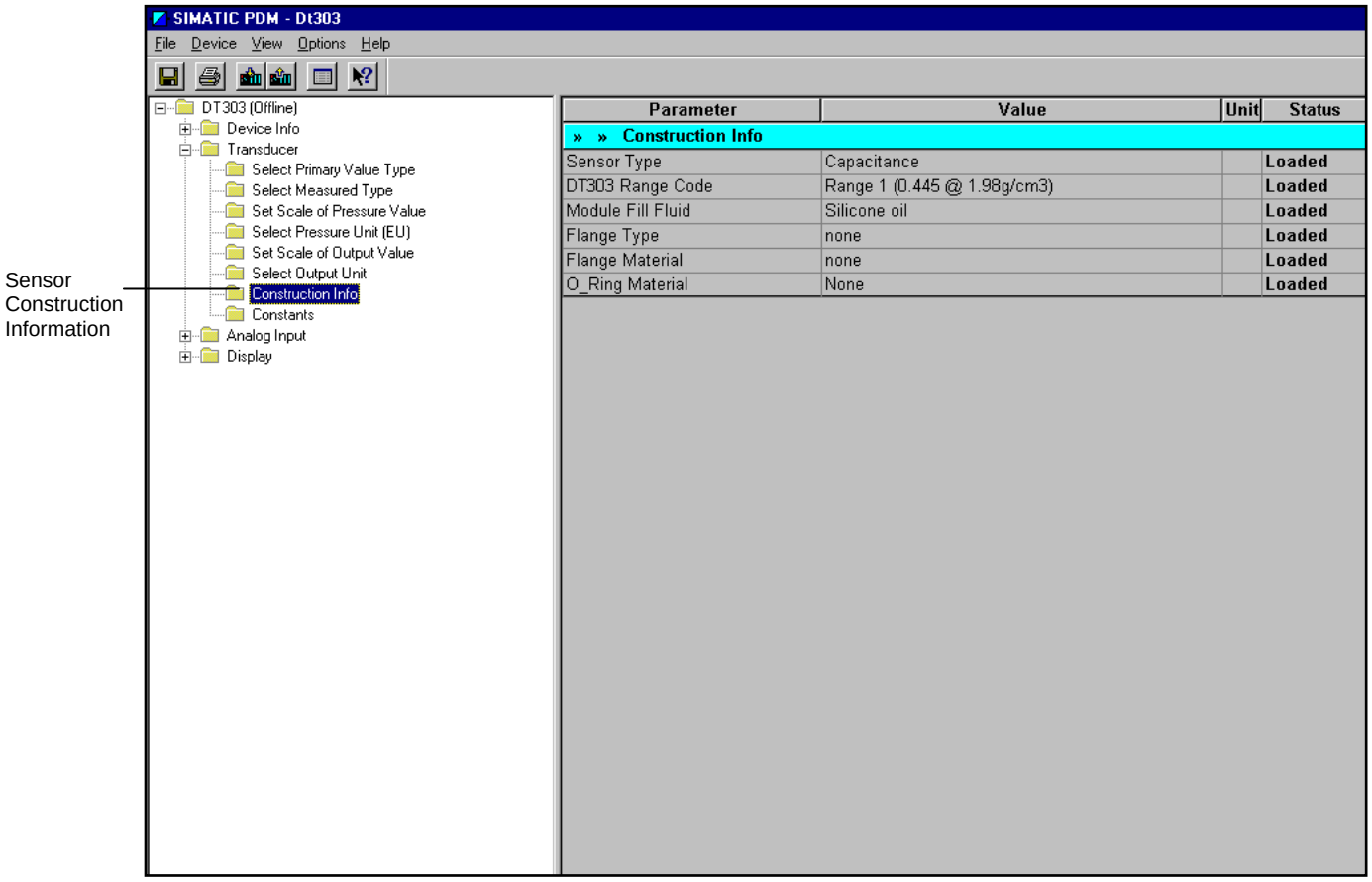


Figure 3.21 – Simatic PDM Transducer Block – Sensor Information

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

Temperature Calibration

NOTE
The temperature calibration screens of the Profibus View 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.

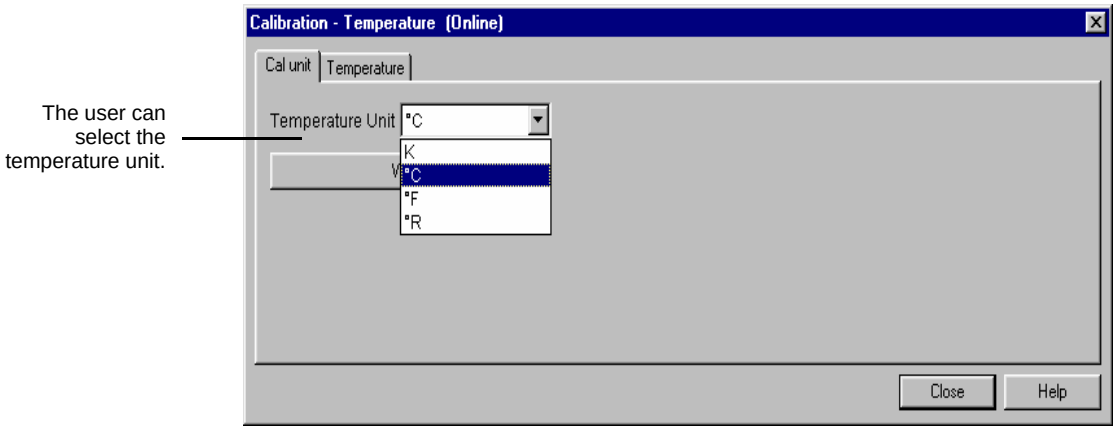


Figure 3.22 –Temperature Screen

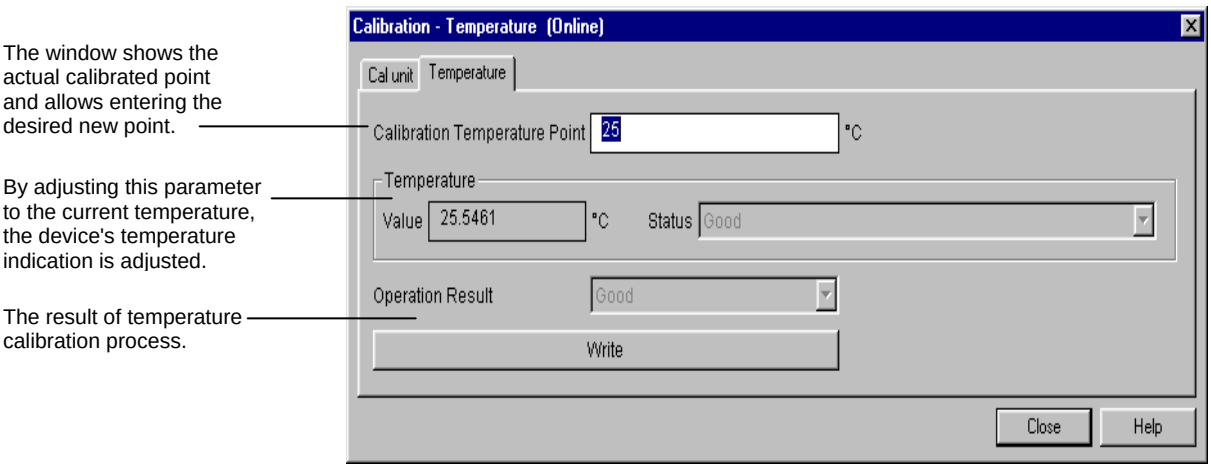


Figure 3.23 –Temperature Calibration Configuration Screen

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 made 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).

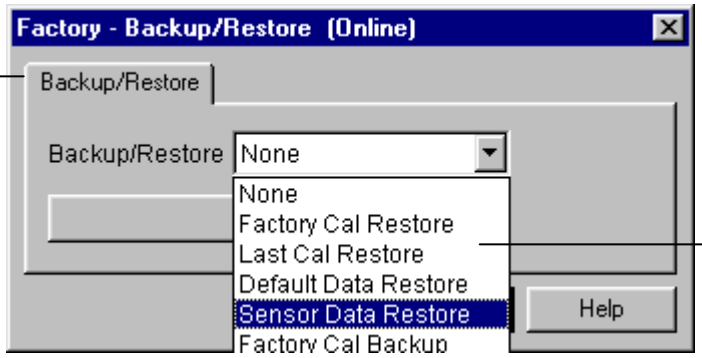
Through this parameter, we can recover default data from factory about sensor and last saved calibration settings, as well as making the rescue of calibrations. We have the following options:

Factory Cal Restore:	Recover last calibration settings made at factory;
Last Cal Restore:	Recover last calibration settings made 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 screen of the Profibus View 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 screens of the Profibus View are similar to Simatic PDM screens.

Using the Profibus View 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":

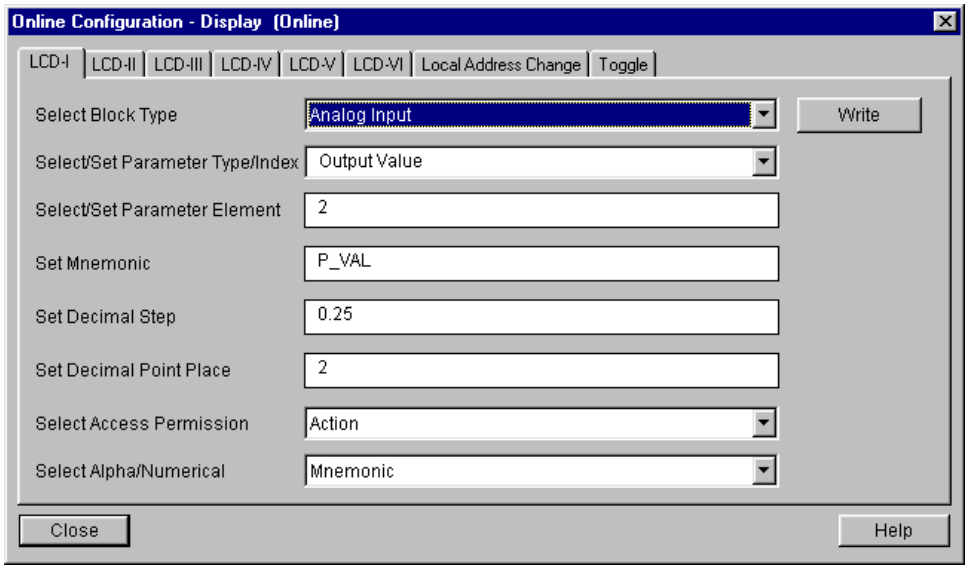


Figure 3.25 – Display Block

Display Transducer Block

The local adjustment is completely configured by Profibus View or Simatic PDM. It means, the user can select the best options to fit his 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 much better configured by Profibus View or by Simatic PDM, but the local functionality of the LCD permits 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 this manual in the chapter "Programming Using Local Adjustment". It is significantly the resources on this transducer display, also all the Series 303 field devices from Smar has the same methodology to handle with it. So, since the user has learned once, he is capable to handle all kind of field devices from Smar.

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

In order 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 in order 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

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 option mnemonic, 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 you wish 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:

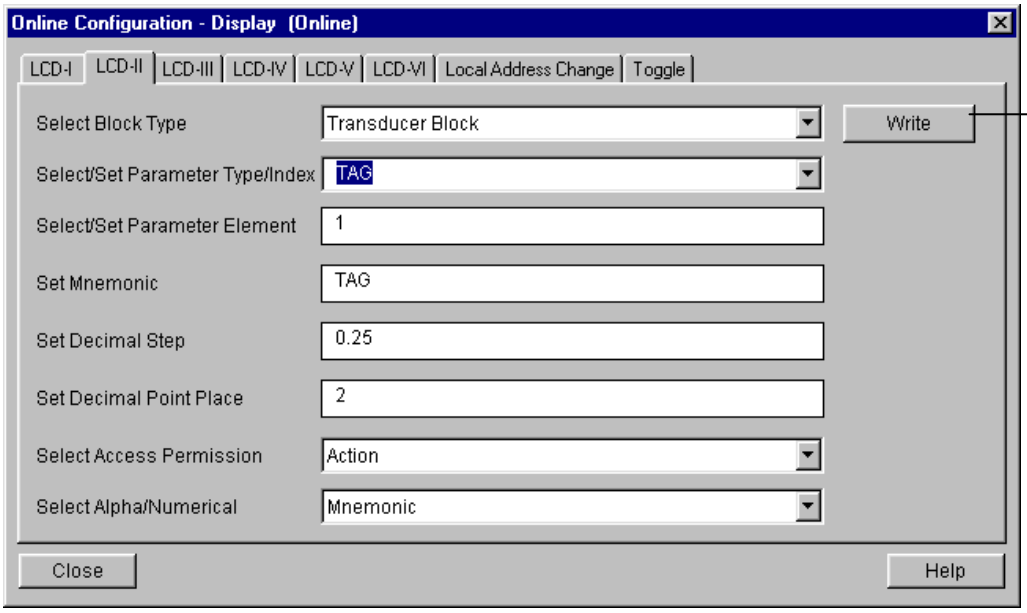


Figure 3.26 – Parameters for Local Adjustment Configuration

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

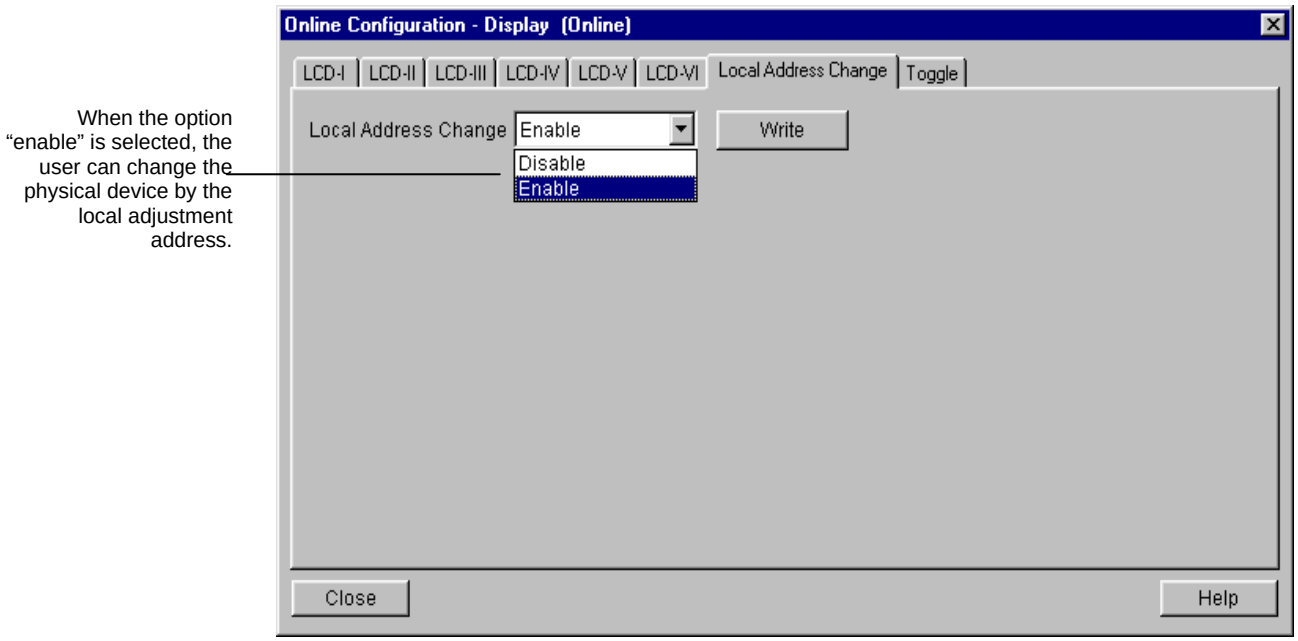


Figure 3.27 – Parameters for Local Adjustment Configuration

When the user enter 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 pages:

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

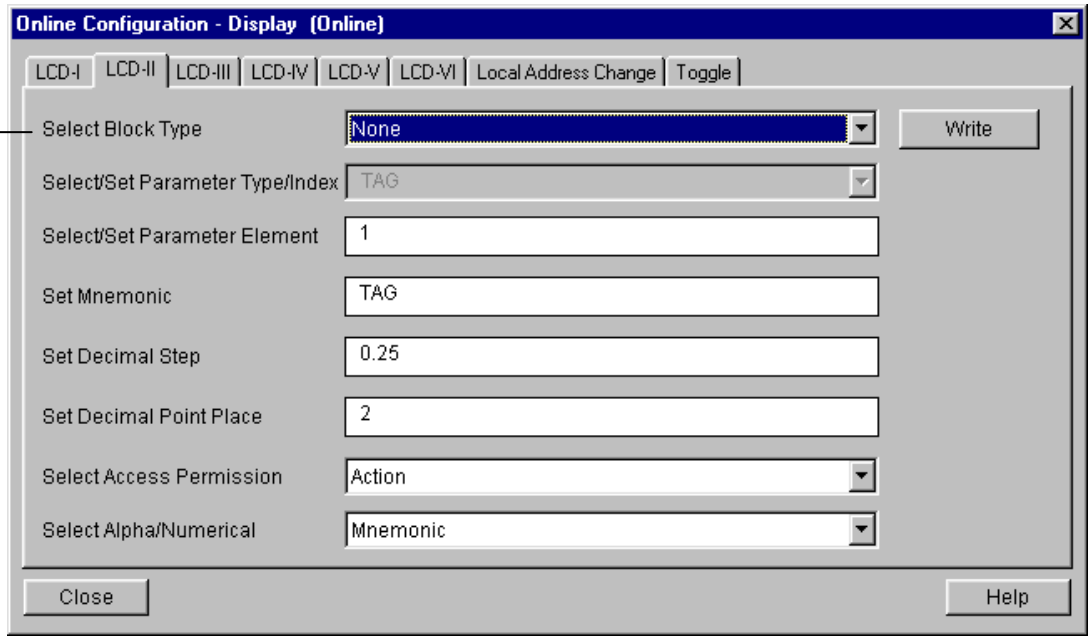


Figure 3.28 - Parameters for Local Adjustment Configuration

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.

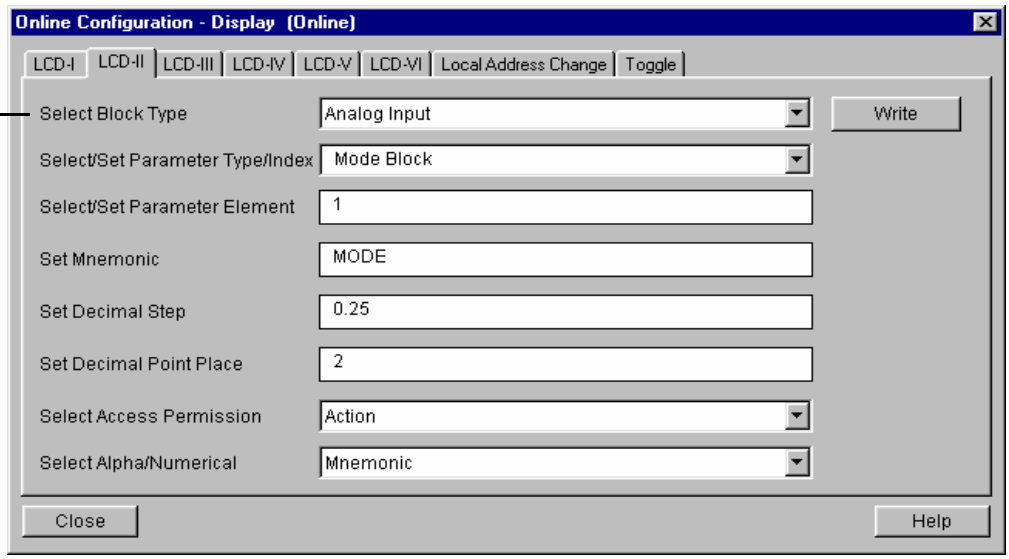


Figure 3.29 – Parameters for Local Adjustment Configuration

Local Adjustment tree – Quick Guide

1) HOW TO ACCESS LOCAL ADJUSTMENT TREE

Follow Steps:
1) Insert magnetic screw driver in zero hole;
2) Wait 3 seconds;
3) Insert magnetics screw driver in span hole;
4) Wait 3 seconds, then MD will appear on display.

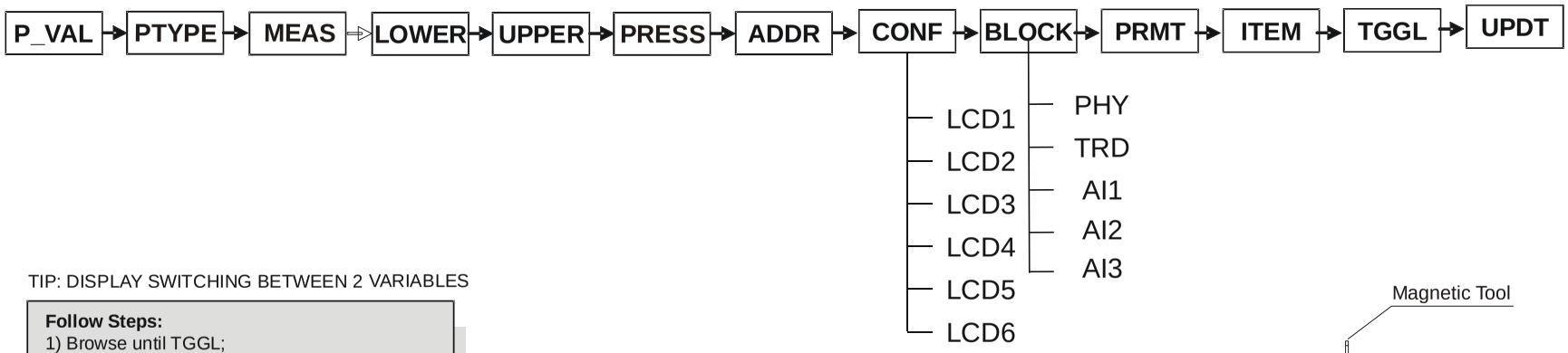
2) HOW TO BROWSE AND SELECT MENU OPTIONS

Browse: Insert magnetic screw driver in zero hole and hold.

Select: Insert magnetic screw driver in span hole and hold.

3) HOW TO CONFIGURE A BLOCK PARAMETER

1) Browse until CONF option, select LCD2;
2) Browse until BLOCK select the block that will be configured;
3) Browse until PRMT and set the relative index of the parameter;
4) Browse until ITEM and set the sub index (if applicable);
5) Browse until UPDT, insert magnetic screw driver in Zero Hole;
6) Reenter in Local Adjustment, browse until LCD2, now the parameter is available to change;
7) Repeat above steps for all the parameters to be configured.

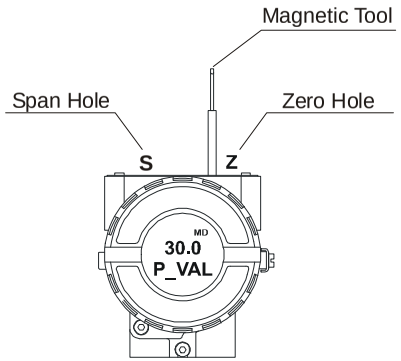


TIP: DISPLAY SWITCHING BETWEEN 2 VARIABLES

Follow Steps:
1) Browse until TGGL;
2) Select 2;
3) Configure LCD 2 with the desired parameter.

With TOGGLE 6

LCD1	LCD2	LCD3	LCD4	LCD5	LCD6
PVAL	SEC2	LOWER	UPPER	SEC1	SEC2
18	31	12	11	29	31



- CONF: option where it is possible to select the LCD to configure. Six options are available: from LCD1 up to LCD6;
- BLOCK: option where the user must select the function block that he desires to configure;
- PRMT: number correspondent to the relative index of the desired parameter into the chosen function block;
- ITEM: configure this option when a selected parameter has sub items to be configured, for example, the OUT_SCALE parameter is compounded by “EU at 100%”, “EU at 0%”, “Unit Index” and “Decimal Point”;
- TGGL (Toggle): switches from 1 up to 6 configured parameters on the display. If TGGL is equal to 2, for example, the display will switch between LCD1 and LCD2;
- UPDT: refreshes the display when one of the LCDs are configured. Finalize display configuration by setting "UPDT", after choosing the configuration for the local adjustment.

Programming Using Local Adjustment

The local adjustment is completely configured by Profibus View or Simatic PDM. It means, the user can select the best options to fit his 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 much better configured by configuration tool, but the local functionality of the LCD permits 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 for the user is at this manual in the section related to "Programming Using Local Adjustment". It is significantly the resources on this transducer display, also all the Series 303 field devices from Smar has the same methodology to handle with it. So, since the user has learned once, he is capable to handle all kind of field devices from Smar. This Local adjustment configuration is a suggestion only. The user may choose his preferred configuration via configuration tool, simply configuring the display block).

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. It also enables pre-configuration of the communication. The jumper W1 on top of the main circuit board must be in place and the positioner must be fitted with digital display for access to the local adjustment. Without display, the local adjustment is not possible.

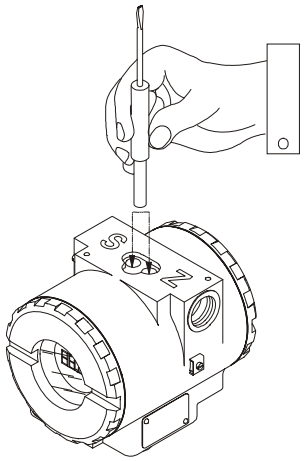


Figure 3.30 - Local Adjustment Holes

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 AO 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.

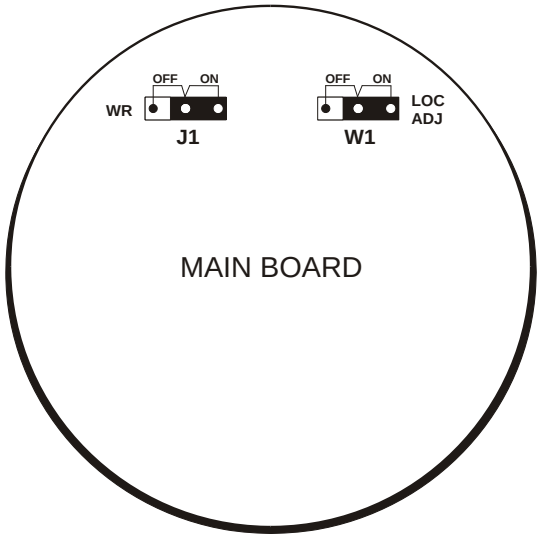


Figure 3.31 - J1 and W1 Jumpers

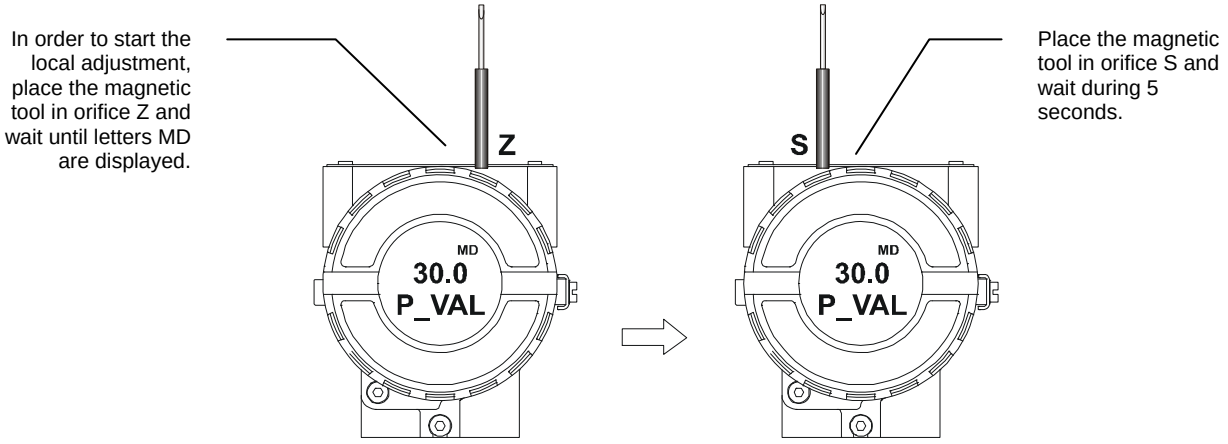


Figure 3.32 – Step 1 – DT303

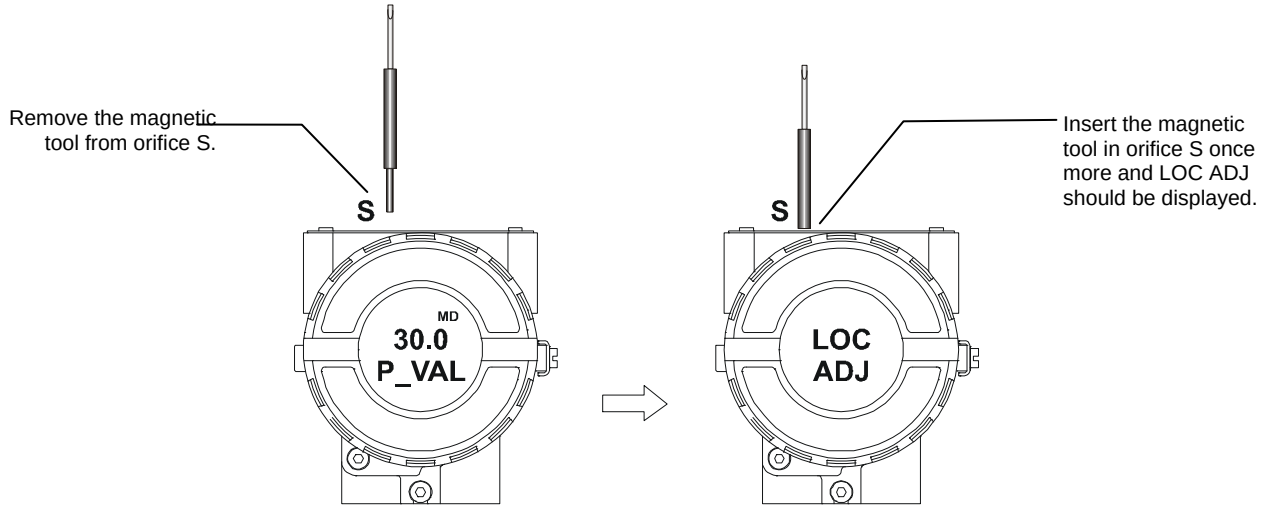
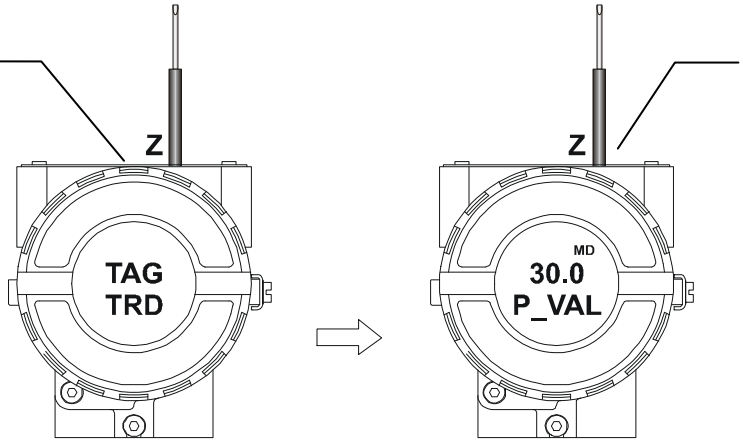


Figure 3.33 – Step 2 – DT303

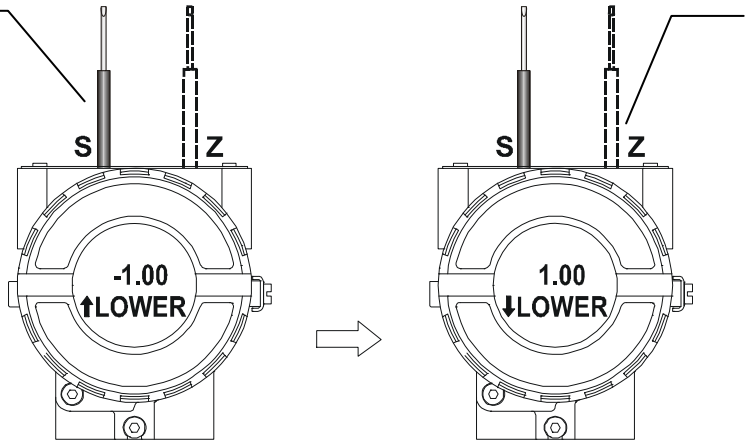
Place the magnetic tool in orifice Z. In case this is the first configuration, the option shown on the display is the TAG with its corresponding mnemonic configured by the SYSCON. Otherwise, the option shown on the display will be the one configured in the prior operation. By keeping the tool inserted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



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

Figure 3.34 – Step 3 – DT303

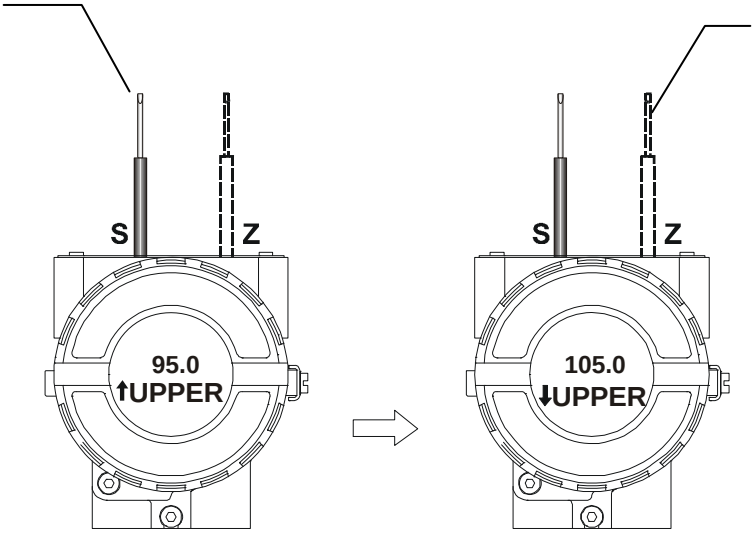
In order to range the lower value (lower), simply insert the magnetic tool in orifice S as soon as LOWER is shown on the display. An arrow pointing upward (↑) increments the valve and an arrow pointing downward (↓) decrements the value. In order to increment the value, keep the tool insert in S up to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



In order to decrement the lower value, 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 lower value.

Figure 3.35 – Step 4 – DT303

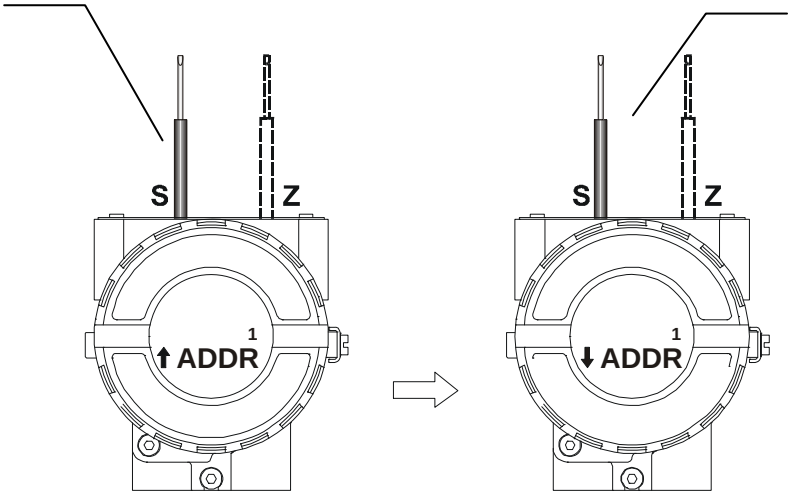
In order to range the upper value (UPPER), simply insert the magnetic tool in orifice S as soon as upper is shown on the display. An arrow pointing upward (↑) increments the valve and an arrow pointing downward (↓) decrements the value. In order to increment the value, keep the tool insert in S up to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



In order to decrement the 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

In order 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. In order to increment the address, insert the tool in S up to set the value desired.



In order 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

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

Monitoring View

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

The Primary Value for Concentration/Density, according to the Measured Type parameter.

Temperature Value

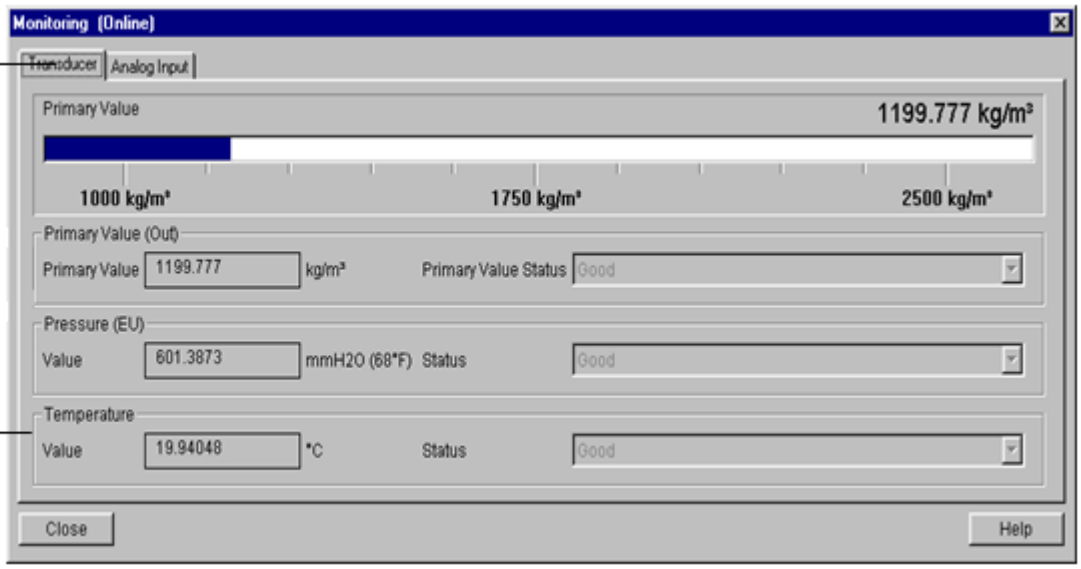


Figure 3.38 – Transducer Block Monitoring View – Simatic PDM

The Output Value for Analog Input Block

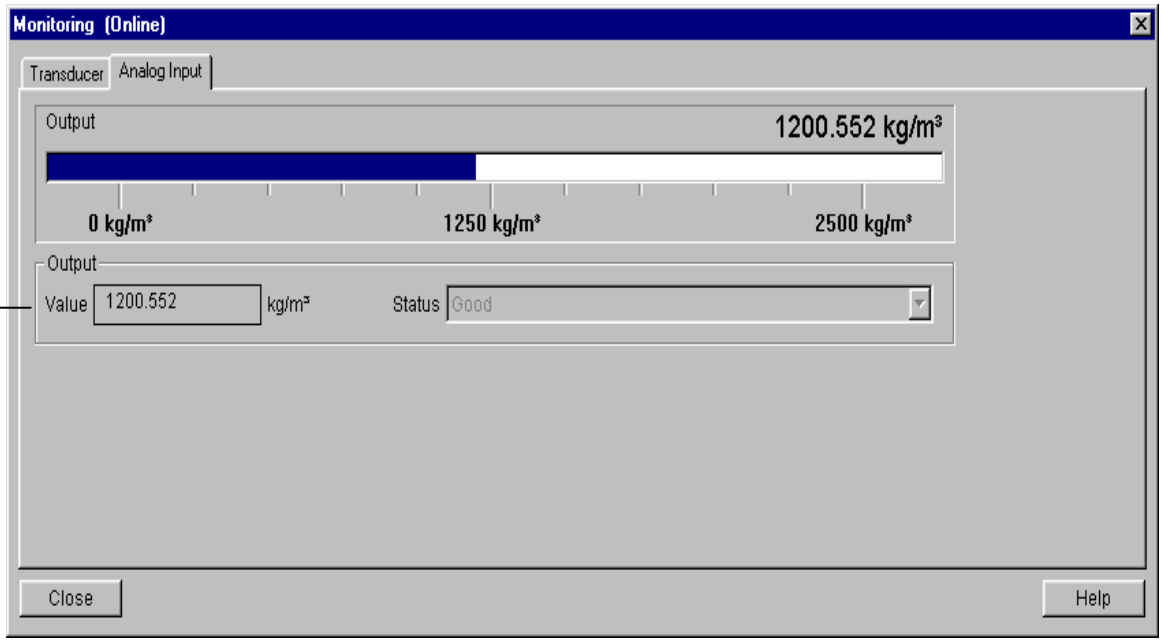


Figure 3.39 – Analog Input Block Monitoring View – Simatic PDM

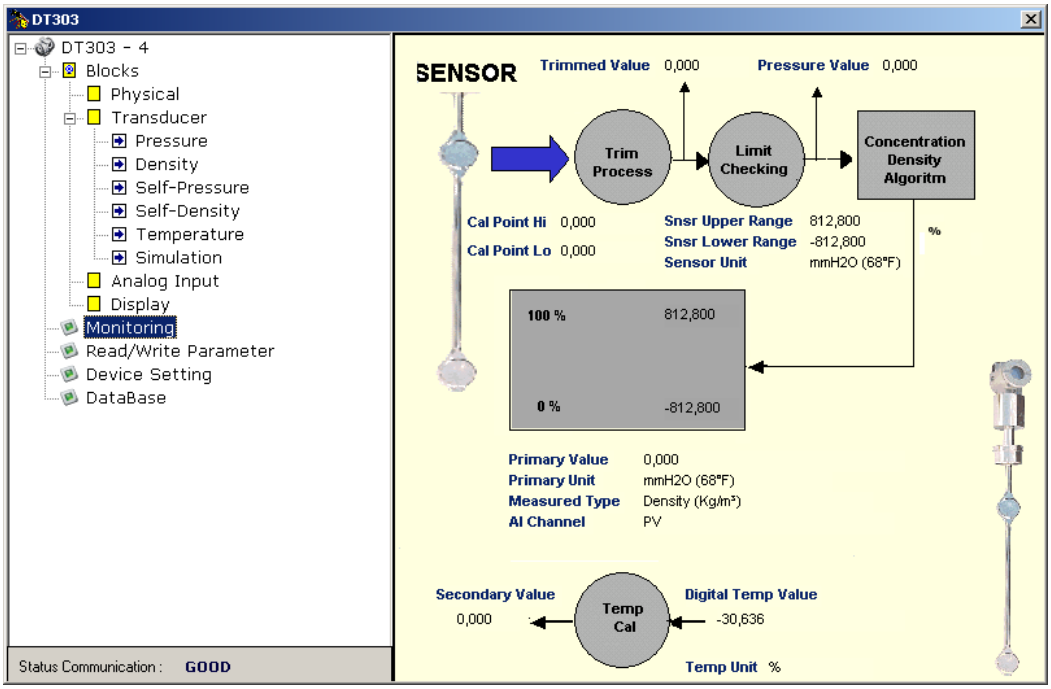


Figure 3.40 – Monitoring View – Profibus View

Simulating Values

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

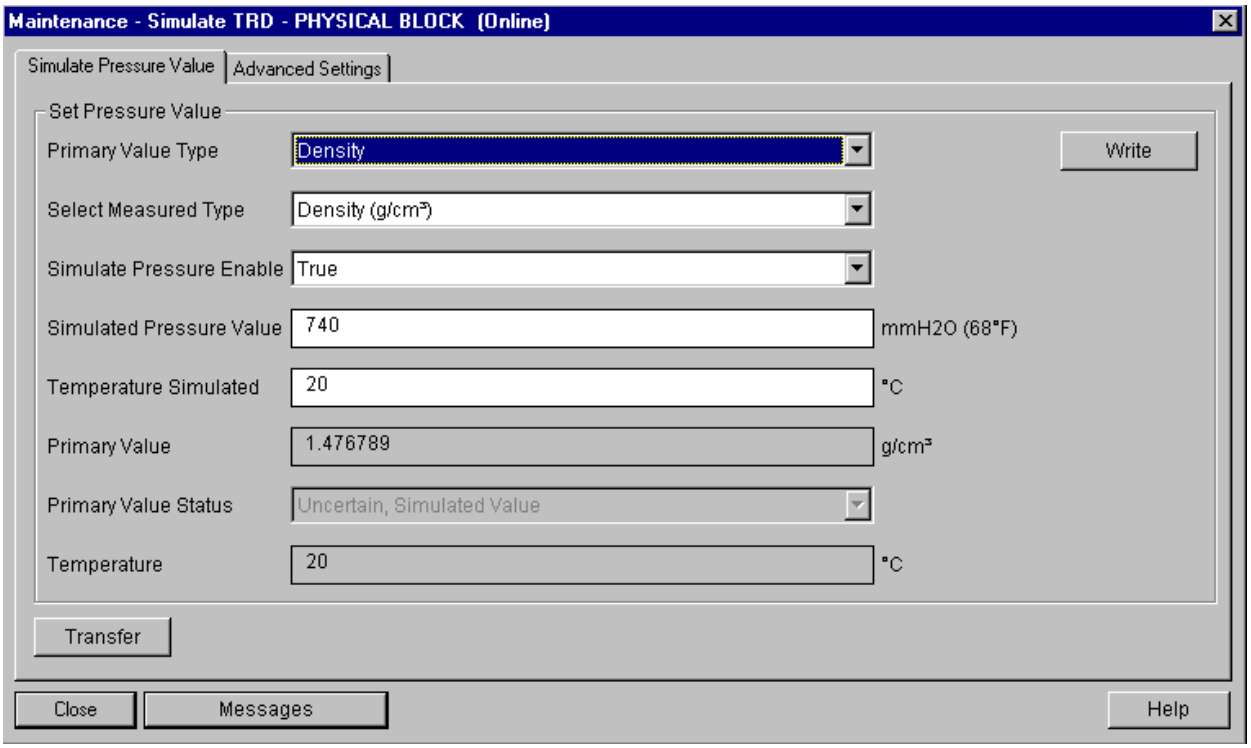


Figure 3.41 – Simulate TRD Screen

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.

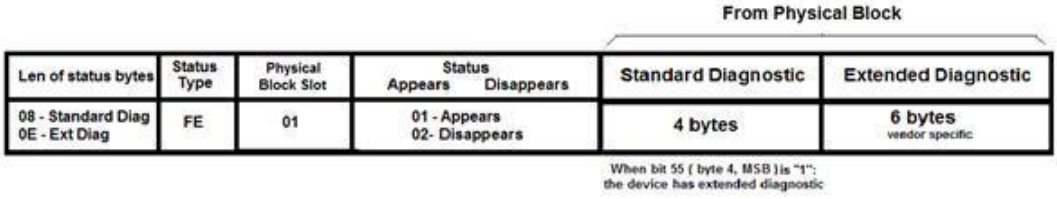


Figure 3.42 – Cyclical Diagnosis

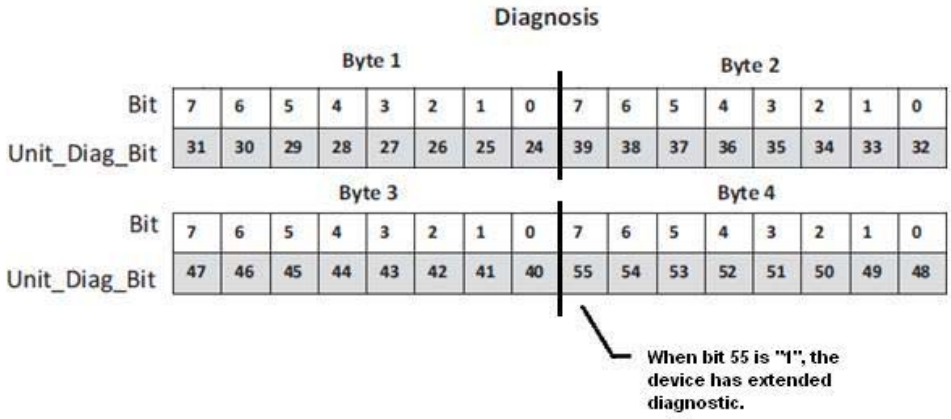


Figure 3.43 – Cyclic Diagnosis mapping for 4 bytes of Physical Block.

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 shorts or ground loops. Check if the power supply connector is connected to main board. Check if the shield is not used as a conductor. It should be grounded at one end only.
	Power Supply Check power supply output. The voltage must be between 9 - 32 VDC at the **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 two 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 to. Check if process is within the range of the sensor and the **DT303**.

Table 4.1 - Symptoms and Probable Source of Problem

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 steady, 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 (16A, 16B, 19A or 19B)

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 in order 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 **(5)**, loosen the two screws **(3)** 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 (16A, 16B, 19A or 19B)

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 **(6)** 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.

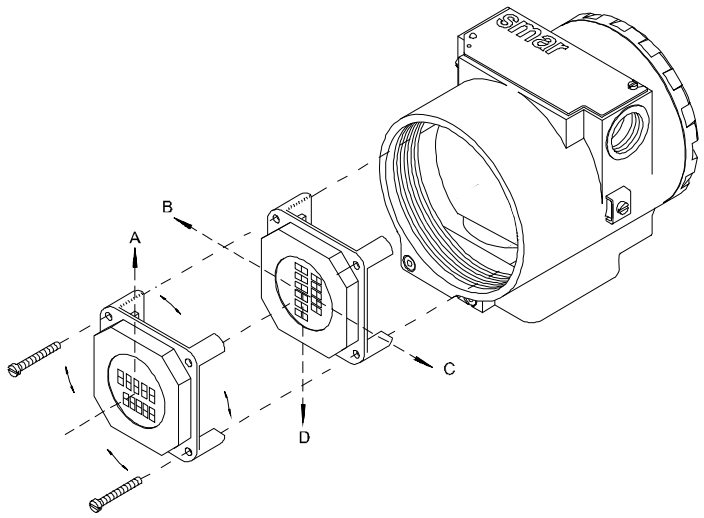


Figure 4.2 - Four Possible Positions for the Display

Anchor the main board and display with their screws **(3)**.

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

Interchangeability

In order 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 exactly the same as the **DT303**. By changing the circuit board of the DT301 it becomes a **DT303**.

Upgrading the DT301 to a **DT303** is therefore the same as the procedure for replacing the main board described above.

To remove the circuit board **(5)**, loosen the two screws **(3)** 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. In order to speed up analysis and solution of the problem, the defective item should be returned with the Service Request Form (SRF – Appendix B) properly filled with a description of the failure observed and with as much details as possible. Other information concerning to the instrument operation, such as service and process conditions, is also helpful.

ACCESSORIES	
ORDERING CODE	**DESCRIPTION**
SD1	Magnetic Tool for Local Adjustment
BC1	Fieldbus/RS232 Interface
PS302	Power Supply
FDI302	Field Device Interface
BT302	Terminator
DF47	Intrinsic Safety Barrier
DF48	Fieldbus Repeater
SB302	Isolated Intrinsic Safety Barrier

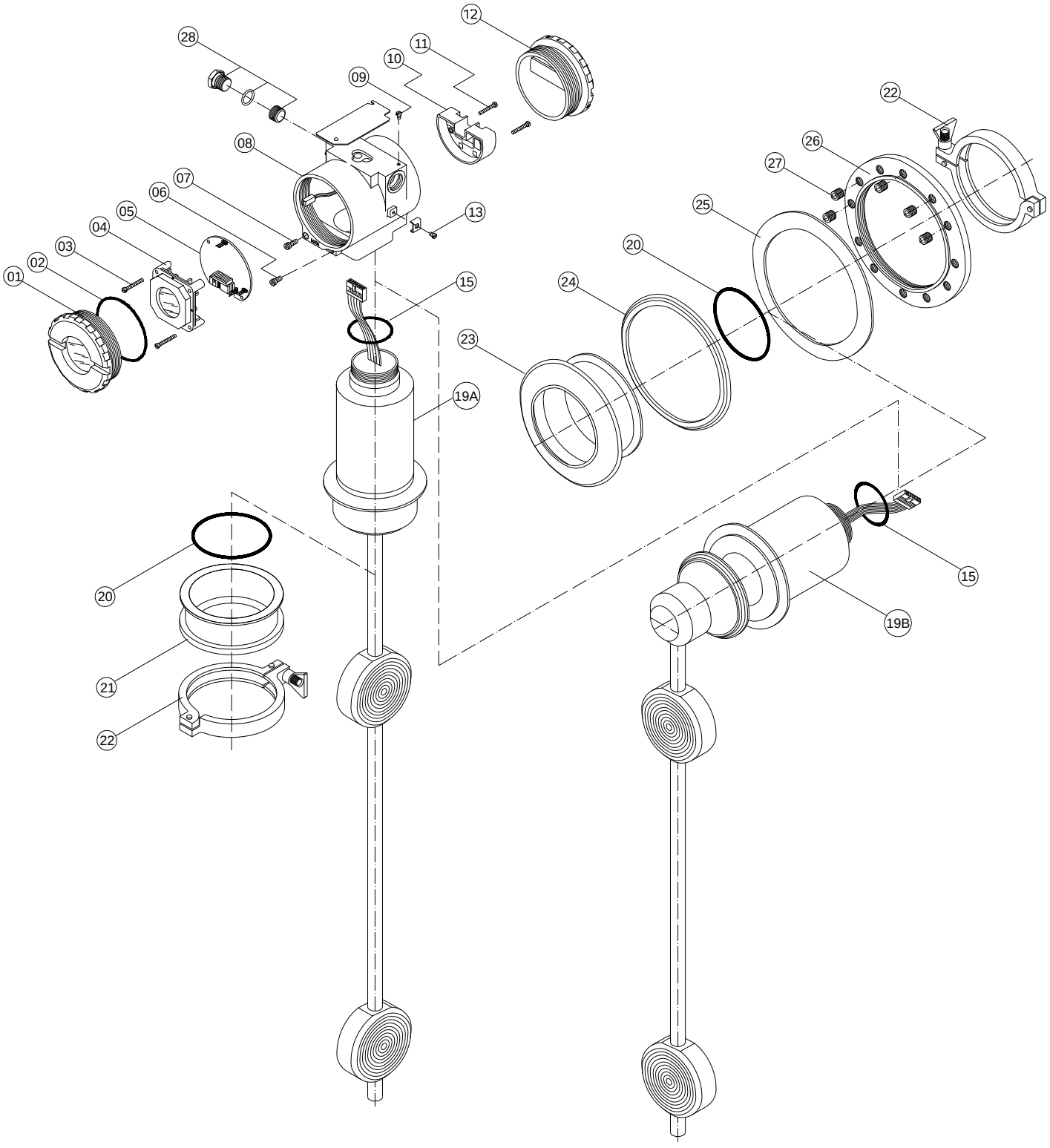


Figure 4.3 – Exploded View - Sanitary Model

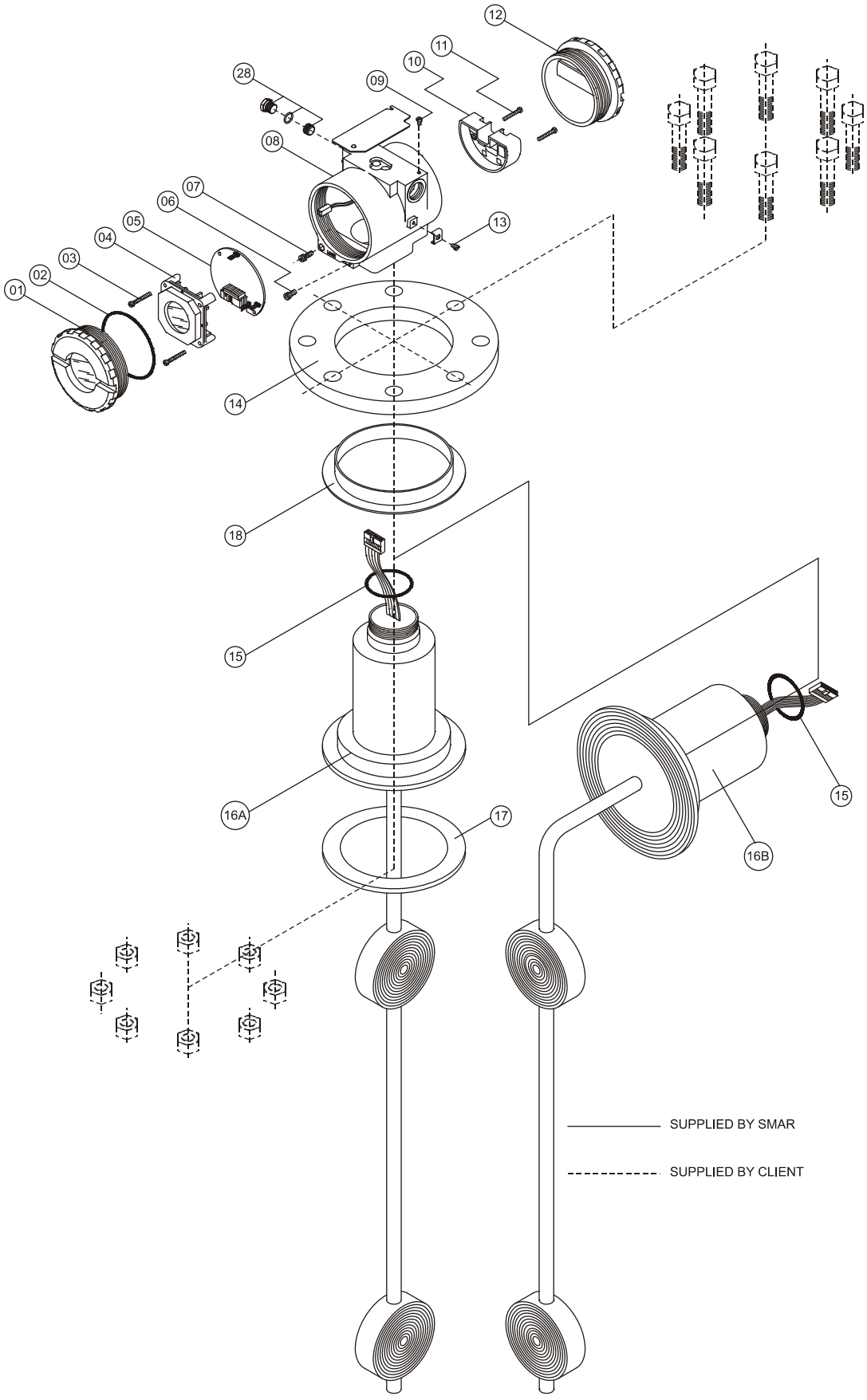


Figure 4.4 - Exploded View – Industrial Model

SPARE PARTS LIST			
DESCRIPTION OF PARTS	**POSITION**	**CODE**	**CATEGORY (NOTE 1)**
HOUSING, Aluminum (NOTE 2)			
½ - 14 NPT	8	400-0270	
M20 x 1.5	8	400-0271	
PG 13.5 DIN	8	400-0272	
HOUSING, 316 SST (NOTE 2)			
½ - 14 NPT	8	400-0273	
M20 x 1.5	8	400-0274	
PG 13.5 DIN	8	400-0275	
COVER (INCLUDES O-RING)			
Aluminum	1 and 12	204-0102	
316 SST	1 and 12	204-0105	
COVER WITH WINDOW FOR INDICATION (INCLUDES O-RING)			
Aluminum	1	204-0103	
316 SST	1	204-0106	
COVER LOCKING SCREW	7	204-0120	
SENSOR LOCKING SCREW			
Without head M6 screw	6	400-1121	
EXTERNAL GROUND SCREW	13	204-0124	
IDENTIFICATION PLATE FIXING SCREW	9	204-0116	
DIGITAL INDICATOR	4	214-0108	
TERMINAL INSULATOR	10	314-0123	
MAIN ELECTRONIC CIRCUIT BOARD (GLL 892) (NOTE 3)	5	400-0276	A
O-RINGS (NOTE 4)			
Cover, Buna-N	2	204-0122	B
Neck, Buna-N	15	204-0113	B
Process connection, Buna-N (**Sanitary Model**)	20	400-0236	B
Process connection, Viton (**Sanitary Model**)	20	400-0813	B
Process connection, Teflon (**Sanitary Model**)	20	400-0814	B
TERMINAL HOLDING SCREW			
Housing in Aluminum	11	304-0119	
Housing in 316 Stainless Steel	11	204-0119	
MAIN BOARD SCREW HOUSING IN ALUMINUM			
Units with indicator	3	304-0118	
Units without indicator	3	304-0117	
MAIN BOARD SCREW HOUSING IN 316 STAINLESS STEEL			
Units with indicator	3	204-0118	
Units without indicator	3	204-0117	
PROCESS CONECTION – INDUSTRIAL MODEL			
Flange 4” – 150# ANSI B-16.5, 316 SST	14	400-0237	
Flange 4” – 300# ANSI B-16.5, 316 SST	14	400-0238	
Flange 4” – 600# ANSI B-16.5, 316 SST	14	400-0239	
Flange DN 100, PN 25 / 40, DIN 2526 – Form D, 316 SST	14	400-0240	
Teflon Closing Junction	17	400-0720	
Teflon Insulation Junction	18	400-0863	
PROCESS CONNECTION - SANITARY MODEL			
Tank Adapter for Straight Model 316 SST	21	400-0241	
Tri-Clamp de 4”, 304 SST	22	400-0242	
Tank Adapter for Curve Model 316 SST	23	400-0721	
Silicon Closing Ring	24	400-0722	
Protection Flange	25	400-0723	
Tightening Flange	26	400-0724	
Tightening Flange Screw	27	400-0725	
1/2" NPT Internal Socket set Plug in Bichromatized Carbon Steel BR-EX D 1/2" NPT Internal Socket set Plug in 304 SST BR-EX D M20 X 1.5 External Socket set Plug in 316 SST BR-EX D PG13.5 External Socket set Plug in 316 SST BR-EX D 3/4 NPT Adapter in 316 SST BR-EX D	28 28 28 28 28	400-0808 400-0809 400-0810 400-0811 400-0812	
PROBE			
Industrial Probe	16A or 16B	**(NOTE 5)**	B
Sanitary Probe	19A or 19B	**(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.

400-0244 Sanitary Model Probe

COD.	RANGE			Minimum Span
1	0.5	to	1.8 g/cm3	0,025 g/cm^3
2	1.0	to	2.5 g/cm^3	0,025 g/cm^3
3	2.0	to	5.0 g/cm^3	0,025 g/cm^3

COD.	Diaphragm Material
H	Hastelloy C276
I	316L SST
T	Tantalum
Z	Others – Specify

COD.	Fill Fluid
S	DC 200/20 - Silicone Oil
D	DC 704 - Silicone Oil
G	Glycerin and water – Food Grade
N	Propylene Glycol – Neobee M2O – Food Grade
T	Syltherm 800
Z	Others – Specify

COD.	Mounting
1	Top
2	Side

400-0244 - 1 H - S 1

400-0243 Industrial Model Probe

COD.	RANGE			Minimum Span
1	0.5	to	1.8 g/cm^3	0,025 g/cm^3
2	1.0	to	2.5 g/cm^3	0,025 g/cm^3
3	2.0	to	5.0 g/cm^3	0,025 g/cm^3

CODE	Diaphragm Material / Probe
H	Hastelloy C276 / Hastelloy C276
I	316L SST / 316L SST
U	Hastelloy C276 / 316L SST
X	316L SST / 316L SST with plated TEFZEL (ETFE)
Z	Others - Specify

COD.	Fill Fluid
S	DC 200/20 - Silicone Oil
D	DC 704 - Silicone Oil
G	Glycerin and water– Food Grade
N	Propylene Glycol – Neobee M2O – Food Grade
T	Syltherm 800
Z	Others – Specify

COD.	Mounting
1	Top
2	Side

400-0243 - 1 H - S 1

Section 5

TECHNICAL CHARACTERISTICS

Filling Fluids

The filling fluid selection shall take into account its physical properties in what concerns to pressure temperature limits and chemical compatibility with the process fluid. The latter is an important consideration in case the filling fluid happens to come in contact with the process fluid, should a leakage occur.

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
Silicone DC 704	39	1.07	0.000799	General purpose (high temperature and vacuum)
Syltherm 800	10	0.934	0.0009	General purpose (extreme temperatures, positive and negative)
Propylene Glycol Neobee M20 (Food Grade)	9.8	0.90	0.001	Beverage and pharmaceutical food grade
Glycerin and Water (Food Grade)	12.5	1.13	0.00034	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
Explosion proof, weather proof and intrinsically safe, CEPEL, Dekra/EXAM, FM and NEMKO.

Other Certification
3A standard.

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 5.0 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: Profibus View 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
3	±0.0016 g/cm^3 (±0.1 ^{0}Bx)	0.041 Kg/m^3	0.521 Kg/m^3	0.007 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: 316 SST flange ANSI B16.5, Flange DIN 2526 Form D, DN100 PN 25/40.
Sanitary model: 304 SST Tri-clamp.

Wetted Parts
Isolating diaphragms: 316L SST, Hastelloy C276 or 316L SST with plated TEFZEL (ETFE).
Probe material: 316L SST or Hastelloy C276
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, DC704), Syltherm 800, Glycerin and Water or Neobee M20 Propylene Glycol.
Identification plate: 316 SST.

Mounting
Side or top mounting.

Weight
Sanitary model: 9 kg (20 lb) - Industrial model: 14 kg (31 lb).

Ordering Code

MODEL	SANITARY CONCENTRATION/DENSITY TRANSMITTER

CODE	Range			Minimum Span
1	0.5	to	1.8 g/cm^3	0.025 g/cm^3
2	1.0	to	2.5 g/cm^3	0.025 g/cm^3
3	2.0	to	5.0 g/cm^3	0.025 g/cm^3

Note: For the concentration units: °Brix, °Plato, °INPM, °GL and °Baumé, specify code1.

CODE	Wetted Parts Material
H	Hastelloy C276
I	316L SST
U	Probe in 316 SST and Diaphragms in Hastelloy C276
Z	Others – Specify

CODE	Fill Fluid
N	Neobee - M20 Propylene Glycol – Food Grade **(8)**
D	DC 704 - Silicone Oil
S	DC 200/20 - Silicone Oil
G	Glycerin and Water – Food Grade
T	Syltherm 800
Z	Others – Specify

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)**
4	½ - ½ NPTF (AI 316) - With Adapter
5	½ - ¾ NPTF (AI 316) - With Adapter
A	M20 X1.5 **(4)**
B	PG 13.5 DIN **(7)**
Z	Others - Specify

CODE	Mounting
1	Top
2	Side

CODE	Process Connection
J	Tri-clamp – 4" 300# **(8)**
Z	Others - Specify

CODE	Wetted O-Rings Material
B	Buna-N **(8)**
V	Viton **(8)**
T	Teflon **(8)**
Z	Others - Specify

CODE	Tank Adapter
0	Without Tank Adapter (Supplied by Customer)
1	With Tank Adapter 316 SST

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	1	1	*

⬅ **TYPICAL MODEL NUMBER**

* Leave it blank for no optional items.

MODEL	SANITARY CONCENTRATION/DENSITY TRANSMITTER (CONTINUATION)

CODE	Identification Plate
I1	FM: XP, IS, NI, DI
I4	EXAM (DMT): EX-IA; NEMKO: EX-D
I5	CEPEL: EX-D, EX-IA
I6	Without Certification
I7	EXAM (DMT) GRUPO I, M1 EX-IA
IE	NEPSI: EX-IA

CODE	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)**

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

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

DT303S	/	I6	H0	J0	P0

⬅ TYPICAL MODEL NUMBER

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) Certified for use in Explosive Atmosphere (CEPEL, FM, NEPSI, NEMKO, CSA and EXAM).
(5) Certified for use in Explosive Atmosphere (CEPEL and CSA).
(6) Options not certified for Explosive Atmosphere.
(7) Certified for use in Explosive Atmosphere (CEPEL, NEPSI, NEMKO and EXAM).
(8) Compliant with 3A-7403 standard for food and other applications where sanitary connections are required.
- Neobee M2O Fill Fluid
- Finishing wet Face: 0.8 µm Ra (32 µ" AA)
- Wet O-Ring: Viton, Teflon and Buna-N

MODEL — **INDUSTRIAL CONCENTRATION/DENSITY TRANSMITTER**

CODE	Range	Minimum Span
1	0.5 to 1.8 g/cm^3	0.025 g/cm^3
2	1.0 to 2.5 g/cm^3	0.025 g/cm^3
3	2.0 to 5.0 g/cm^3	0.025 g/cm^3

Note: For the concentration units: °Brix, °Plato, °INPM, °GL and °Baumé, specify code1.

CODE	Diaphragm Material / Probe
H	Hastelloy C276 / Hastelloy C276
I	316L SST / 316L SST
U	Hastelloy C276 / 316L SST
X	316L SST with plated TEFZEL (ETFE) / 316L SST with plated TEFZEL (ETFE)
Z	Others - Specify

CODE	Fill Fluid
N	Neobee - M20 Propylene Glycol – Food Grade
D	DC 704 - Silicone Oil
S	DC 200/20 - Silicone Oil
G	Glycerin and Water – Food Grade
T	Syltherm 800
Z	Others – Specify

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)**
4	½ - ½ NPTF (AI 316) - With Adapter
5	½ - ¾ NPTF (AI 316) - With Adapter
A	M20 X1.5 **(4)**
B	PG 13.5 DIN **(7)**
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

CODE	Process Connection
5	4” ANSI B – 16.5
9	DN 100 DIN 2526 – FORM D
A	DN 80 DIN 2526 – FORM D
Z	Others – Specify

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

CODE	Optional Items

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)

CODE	Identification Plate
I1	FM: XP, IS, NI, DI
I4	EXAM (DMT): EX-IA; NEMKO: EX-D
I5	CEPEL: EX-D, EX-IA
I6	Without Certification
I7	EXAM (DMT) GRUPO I, M1 EX-IA
IE	NEPSI: EX-IA

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

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

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

CODE	Optional Item (*)
ZZ	Special Options

DT303I	/	I6	H0	J0	P0	*

⬅ **TYPICAL MODEL NUMBER**

* Leave it blank for no optional items.

Optional Items

Diaphragm Thickness	**N0** - Standard
	N1 – 0.1 mm
Strengthening of the Probe	**R1** – With strengthening of the probe
Mounting Position	**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) Certified for use in Explosive Atmosphere (CEPEL, FM, NEPSI, NEMKO, CSA and EXAM).
(5) Certified for use in Explosive Atmosphere (CEPEL and CSA).
(6) Options not certified for Explosive Atmosphere.
(7) Certified for use in Explosive Atmosphere (CEPEL, NEPSI, NEMKO and EXAM).

Appendix A

CERTIFICATIONS INFORMATION

European Directive Information

Consult www.smar.com for the EC declarations of conformity for all applicable European directives and certificates.

ATEX Directive (94/9/EC) – "Electrical equipment and protective system intended for use in potential explosive atmospheres"
The EC-Type Examination Certificate had been released by Nemko AS (CE0470) and/or DEKRA EXAM GmbH (CE0158), according to European Standards.
The certification body for Production Quality Assurance Notification (QAN) and IECEx Quality Assessment Report (QAR) is Nemko AS (CE0470).

LVD Directive 2006/95/EC – "Electrical Equipment designed for use within certain voltage limits"
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 61010-1:2010 - Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements.

Hazardous Locations General Information

Ex Standards:
IEC 60079-0 General Requirements
IEC 60079-1 Flameproof Enclosures "d"
IEC 60079-11 Intrinsic Safety "i"
IEC 60079-26 Equipment with equipment protection level (EPL) Ga
IEC 60529 Classification of degrees of protection provided by enclosures (IP Code)

Customer responsibility:
IEC 60079-10 Classification of Hazardous Areas
IEC 60079-14 Electrical installation design, selection and erection
IEC 60079-17 Electrical Installations, Inspections and Maintenance

Warning:
Explosions could result in death or serious injury, besides financial damage.
Installation of this instrument in an explosive environment must be in accordance with the national standards and according to the local environmental protection method. Before proceeding with the installation match the certificate parameters according to the environmental classification.

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

Marking Label
Once a device labeled with multiple approval types is installed, do not reinstall it using any other approval types. Scratch off or mark unused approval types on the approval label.

For Ex-i protection application
- Connect the instrument to a proper intrinsically safe barrier.
- Check the intrinsically safe parameters involving the barrier, equipment including the cable and connections.
- Associated apparatus ground bus shall be insulated from panels and mounting enclosures.
- When using shielded cable, isolate the not grounded cable end.
- Cable capacitance and inductance plus C_i and L_i must be smaller than C_o and L_o of the Associated Apparatus.

For Ex-d protection application
- Only use Explosion Proof/Flameproof certified Plugs, Adapters and Cable glands.

- In an Explosion-Proof/Flame-Proof installation, do not remove the instrument housing covers when powered on.

- Electrical Connection

In Explosion-Proof installations the cable entries must be connected through conduit with sealed unit or closed using metal cable gland or closed using metal blanking plug, all with at least IP66 and Ex-d certification. For enclosure with saline environment protection (W) and ingress protection (IP) applications, all NPT thread parts must apply a proper water-proof sealant (a non-hardening silicone group sealant is recommended).

For Ex-d and Ex-i protection application

- The transmitter has a double protection. In this case the transmitter shall be fitted with appropriate certified cable entries Ex-d and the electric circuit supplied by a certified diode safety barrier as specified for the protection Ex-ia.

Environmental Protection

- Enclosure Types (Type X): Supplementary letter X meaning special condition defined as default by Smar the following: Saline Environment approved - salt spray exposed for 200 hours at 35ºC. (Ref: NEMA 250).
- Ingress protection (IP W): Supplementary letter W meaning special condition defined as default by Smar the following: Saline Environment approved - salt spray exposed for 200 hours at 35ºC. (Ref: IEC60529).
- Ingress protection (IP x8): Second numeral meaning continuous immersion in water under special condition defined as default by Smar the following: 1 Bar pressure during 24hours. (Ref: IEC60529).

Hazardous Locations Certifications

North American Certifications

FM Approvals (Factory Mutual)

Intrinsic Safety (FM 3015610)
IS Class I, Division 1, Groups A, B, C and D
IS Class II, Division 1, Groups E, F and G
IS Class III, Division 1

Explosion Proof (FM 3015610)
XP Class I, Division 1, Groups A, B, C and D

Dust Ignition Proof (FM 3015610)
DIP Class II, Division 1, Groups E, F and G
DIP Class III, Division 1

Non Incendive (FM 3015610)
NI Class I, Division 2, Groups A, B, C and D

Environmental Protection (FM 3015610)
Option: Type 4X/6 or Type 4/6

Special conditions for safe use:
Entity Parameters:Fieldbus Power Supply Input (report 3015629):
Vmax = 24 Vdc, Imax = 250 mA, Pi = 1.2 W, Ci = 5 nF, Li = 8 uH
Vmax = 16 Vdc, Imax = 250 mA, Pi = 2.0 W, Ci = 5 nF, Li = 8 uH
Temperature Class: T4
Maximum Ambient Temperature: 60ºC (-20 to 60 ºC)
Overpressure Limits: 1015 psi (report 3011728)

European Certifications

NEMKO Approval

Explosion Proof (Nemko 03ATEX1375X)
Group II, Category 2 G, Ex d, Group IIC, Temperature Class T6, EPL Gb
Ambient Temperature: -20 ºC to +60 ºC

Environmental Protection (Nemko 03ATEX1375X)
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”

EXAM Approval (BBG Prüf - und Zertifizier GmbH)

Intrinsic Safety (DMT 03 ATEX E 359)
Group I, Category M1, Ex ia, Group I, EPL MA
Group II, Category 1/2 G, Ex ia, Group IIC, Temperature Class T4/T5/T6, EPL Ga/Gb

FISCO Field Device
Supply circuit for the connection to an intrinsically safe 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

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

INMETRO Approvals

Intrinsic Safety (CEPEL 02.0125X)
Ex ia, Group IIC, Temperature Class T4/T5, EPL Ga

FISCO Field Device
Entity Parameters:
Pi = 5.32 W Ui = 30 V Ii = 380 mA Ci = 5.0 nF Li = Neg

Ambient Temperature: -20 to 65 ºC for T4
-20 to 50 ºC for T5

Explosion Proof (CEPEL 02.0126)
Ex d, Group IIC, Temperature Class T6, EPL Gb

Ambient Temperature: 40 ºC (-20 a 40 ºC)

Environmental Protection (CEPEL 02.0125X and CEPEL 02.0126)
Options: IP 66/68 W or IP 66/68

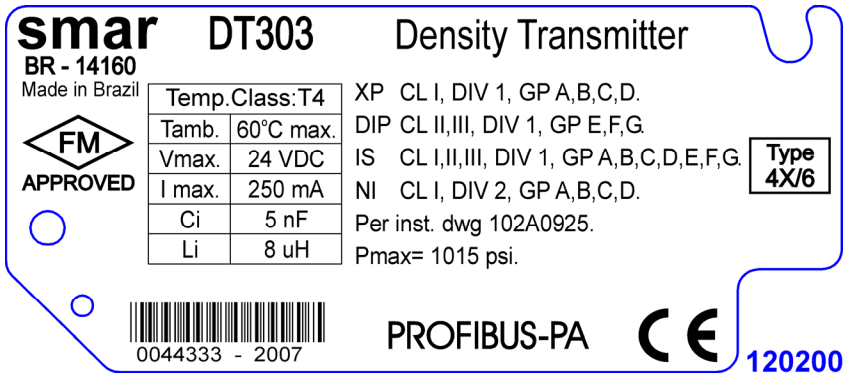
Special conditions for safe use:
The certificate number ends with the letter "X" to indicate that for the version of Density Transmitter model DT302 equipped with housing made of aluminum alloy, only can be installed in "Zone 0" if is excluded the risk of occurs impact or friction between the housing and iron/steel itens.

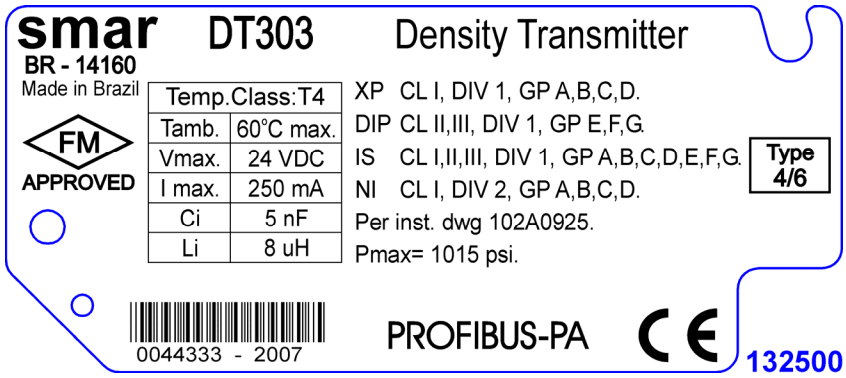
The Essential Health and Safety Requirements are assured by compliance with:
ABNT NBR IEC 60079-0:2008 General Requirements
ABNT NBR IEC 60079-1:2009 Flameproof Enclosures “d”
ABNT NBR IEC 60079-11:2009 Intrinsic Safety “i”
ABNT NBR IEC 60079-26:2008 Equipment with equipment protection level (EPL) Ga
IEC 60079-27:2008 Fieldbus intrinsically safe concept (FISCO)
ABNT NBR IEC 60529:2009 Classification of degrees of protection provided by enclosures (IP Code)

Identification Plate and Control Drawing

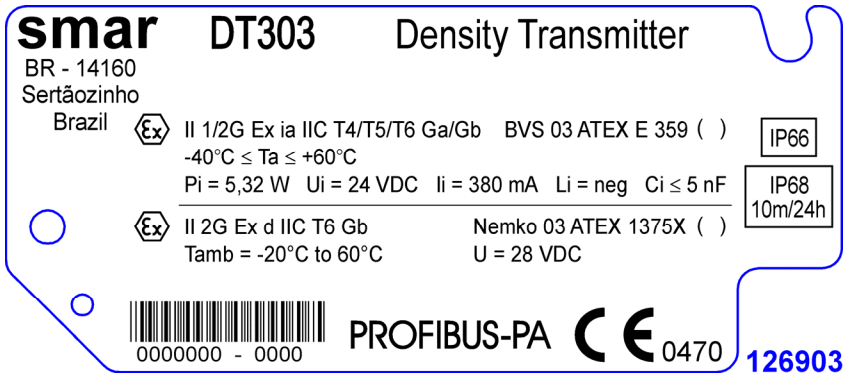
Identification Plate

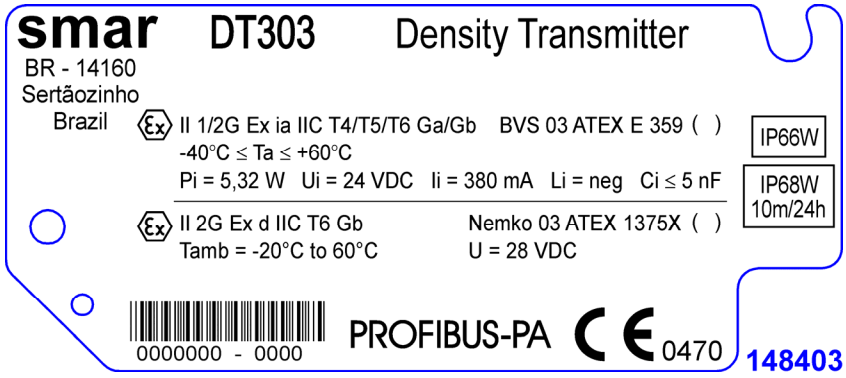
FM

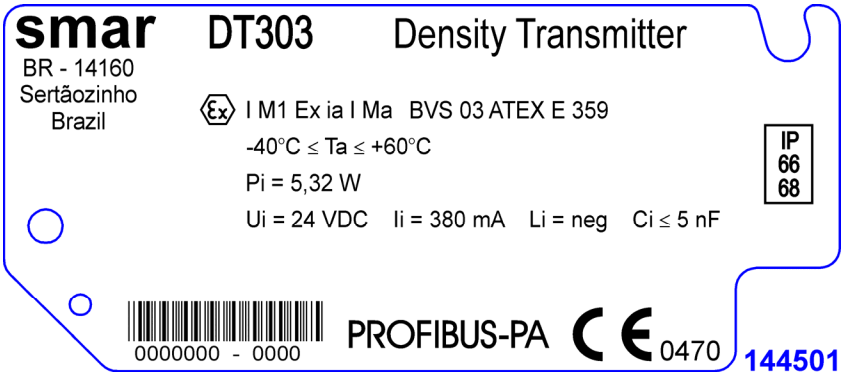




EXAM and NEMKO



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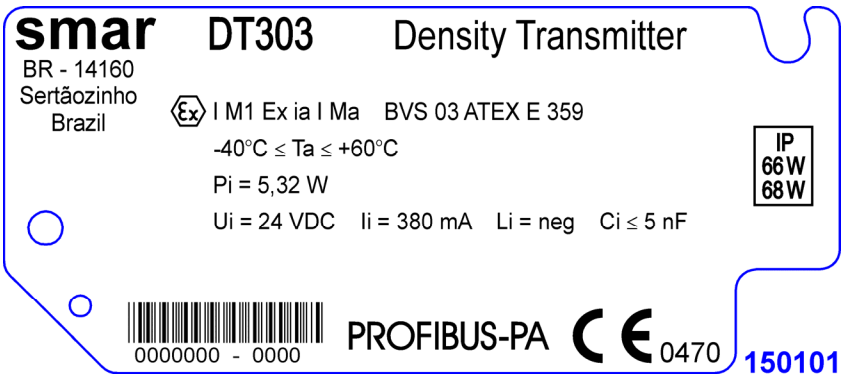
DT303 Density Transmitter
BR - 14160
Sertãozinho
Brazil
I M1 Ex ia I Ma BVS 03 ATEX E 359
-40°C ≤ Ta ≤ +60°C
Pi = 5,32 W
Ui = 24 VDC Ii = 380 mA Li = neg Ci ≤ 5 nF
IP
66
68
0000000 - 0000
PROFIBUS-PA
0470
144501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DT303 Density Transmitter
BR - 14160
Sertãozinho
Brazil
I M1 Ex ia I Ma BVS 03 ATEX E 359
-40°C ≤ Ta ≤ +60°C
Pi = 5,32 W
Ui = 24 VDC Ii = 380 mA Li = neg Ci ≤ 5 nF
IP
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68 W
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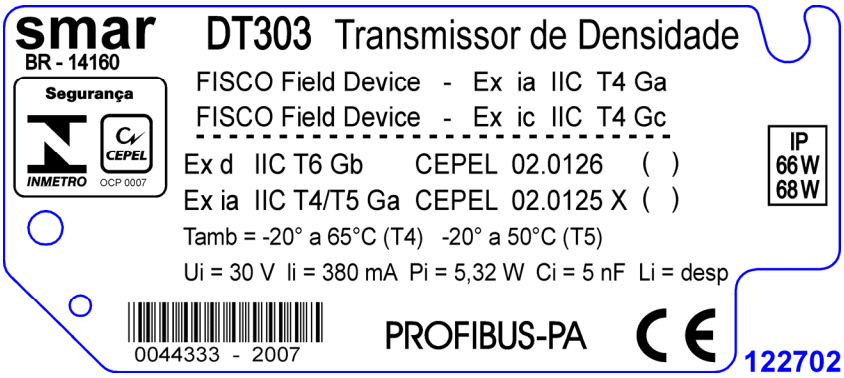
PROFIBUS-PA
0470
150101

CEPEL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DT303 Transmissor de Densidade
BR - 14160
Segurança
INMETRO
CEPEL
OCP 0007
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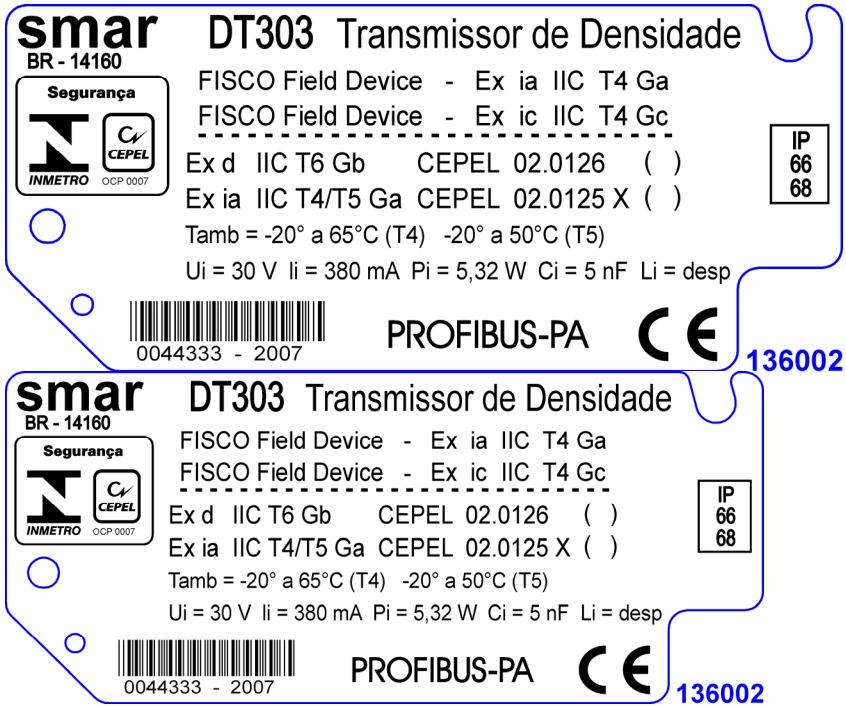
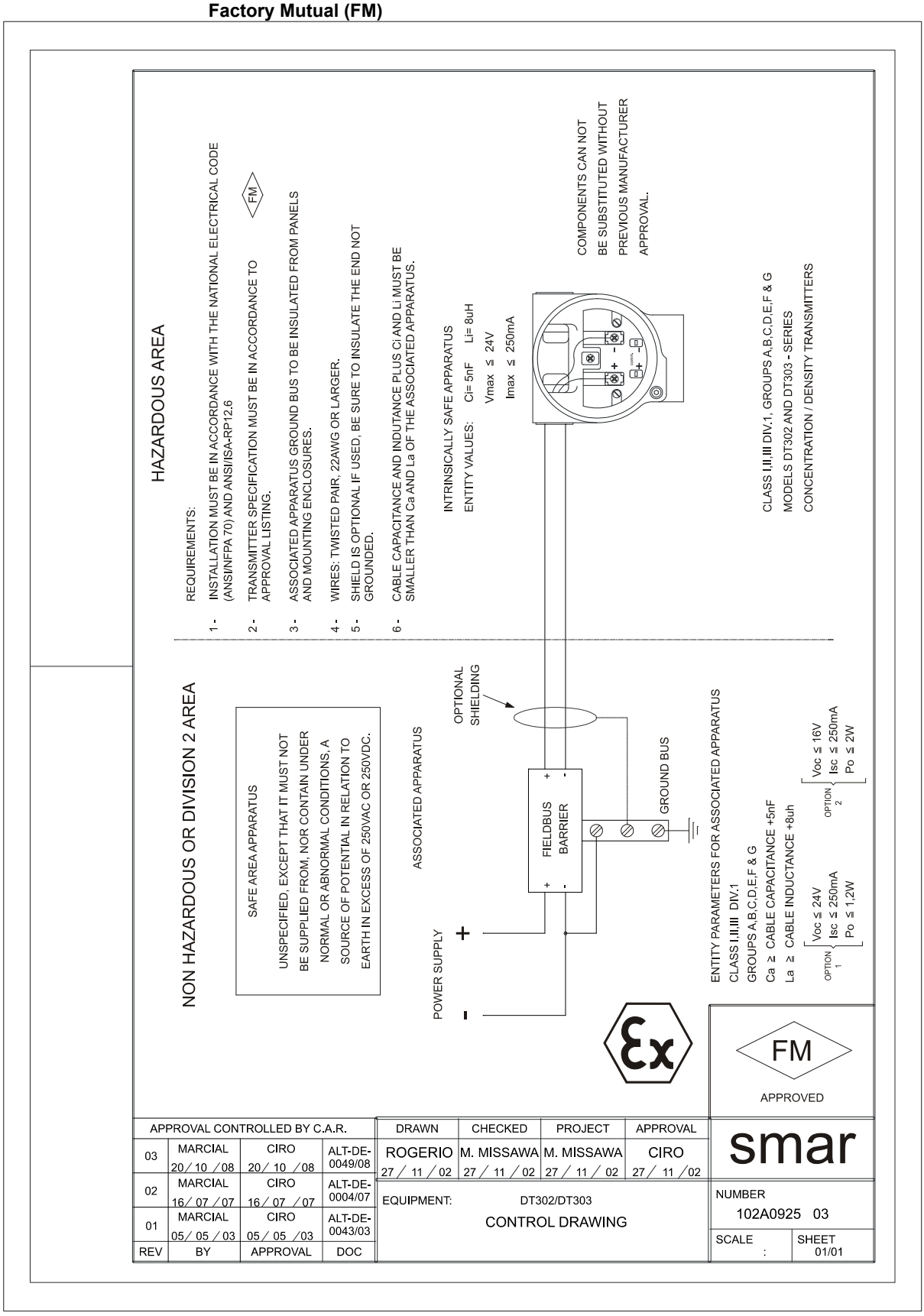
FISCO Field Device - Ex ic IIC T4 Gc
Ex d IIC T6 Gb CEPEL 02.0126 ( )
Ex ia IIC T4/T5 Ga CEPEL 02.0125 X ( )
Tamb = -20° a 65°C (T4) -20° a 50°C (T5)
Ui = 30 V Ii = 380 mA Pi = 5,32 W Ci = 5 nF Li = desp
IP
66 W
68 W
0044333 - 2007
PROFIBUS-PA
122702


smar
DT303 Transmissor de Densidade
BR - 14160
Segurança
INMETRO
CEPEL
OCP 0007
FISCO Field Device - Ex ia IIC T4 Ga
FISCO Field Device - Ex ic IIC T4 Gc
Ex d IIC T6 Gb CEPEL 02.0126 ( )
Ex ia IIC T4/T5 Ga CEPEL 02.0125 X ( )
Tamb = -20° a 65°C (T4) -20° a 50°C (T5)
Ui = 30 V Ii = 380 mA Pi = 5,32 W Ci = 5 nF Li = desp
IP 66 68
0044333 - 2007
PROFIBUS-PA
136002
smar
DT303 Transmissor de Densidade
BR - 14160
Segurança
INMETRO
CEPEL
OCP 0007
FISCO Field Device - Ex ia IIC T4 Ga
FISCO Field Device - Ex ic IIC T4 Gc
Ex d IIC T6 Gb CEPEL 02.0126 ( )
Ex ia IIC T4/T5 Ga CEPEL 02.0125 X ( )
Tamb = -20° a 65°C (T4) -20° a 50°C (T5)
Ui = 30 V Ii = 380 mA Pi = 5,32 W Ci = 5 nF Li = desp
IP 66 68
0044333 - 2007
PROFIBUS-PA
136002

Control Drawing

Factory Mutual (FM)



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 observed behavior, if it is repetitive, how it reproduces, etc.)

OBSERVATIONS

USER INFORMATION

Company:

Contact: Title: Section:

Phone: Extension: E-mail:

Date: Signature: