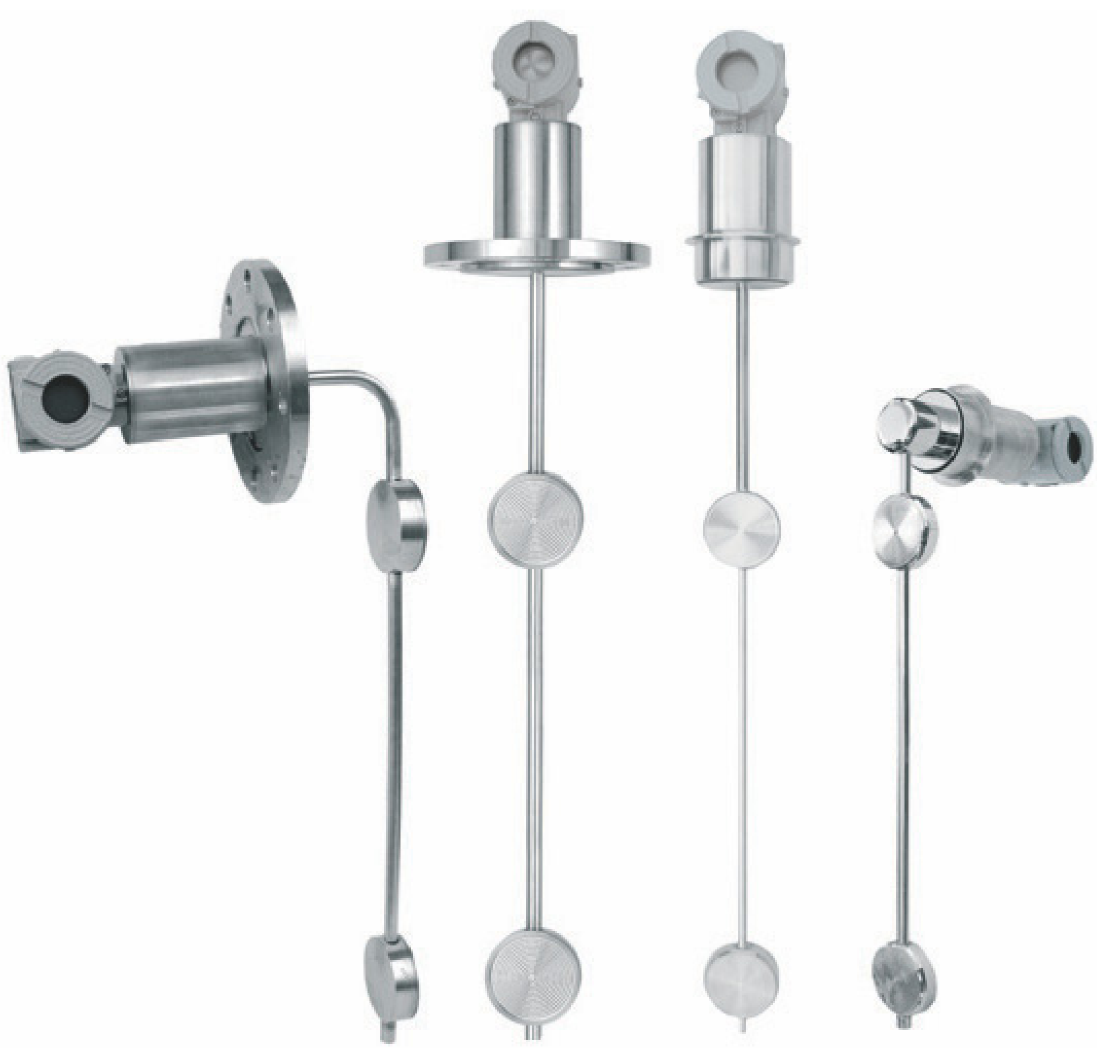
smar - DT302

OPERATION, MAINTENANCE
AND INSTRUCTIONS MANUAL

FIELDBUS CONCENTRATION DENSITY TRANSMITTER



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DT302

VERSION 3

FOUNDATION

DT302ME

INTRODUCTION

The **DT302** is from the first generation of Fieldbus Foundation devices. It is a transmitter for concentration and density measurements. It is based on a field-proven capacitive sensor that provides reliable operation and high performance. The digital technology used in the **DT302** 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 **DT302 (Touché)** is a device to measure in continuous mode the concentration and density of liquids, directly in industrial process.

The **DT302** is composed for 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 temperature variation of the process. 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 value of density in the process.

According to the industrial process, the measured concentration by means **DT302** can be expressed in Density, Relative Density, Brix Degree, Baumé Degree, INPM Degree, Plato Degree, Solid %, etc.

The **DT302** is part of Smar's complete 302 line of Fieldbus Foundation 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 Fieldbus technology, with its capability to interconnect several devices, very large control schemes can be constructed. In order too be user friendly the function block concept was introduced

The **DT302**, like the rest of the 302 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 302 line of Fieldbus Foundation 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 **DT302** 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 **DT302** uses the same hardware and housing for the **DT302**.

The **DT302**, 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 **DT302** by carefully reading these instructions. This product is protected by US patent numbers: **6,234,019; D439,855** and **5,827,963.**

NOTE
This Manual is compatible with version 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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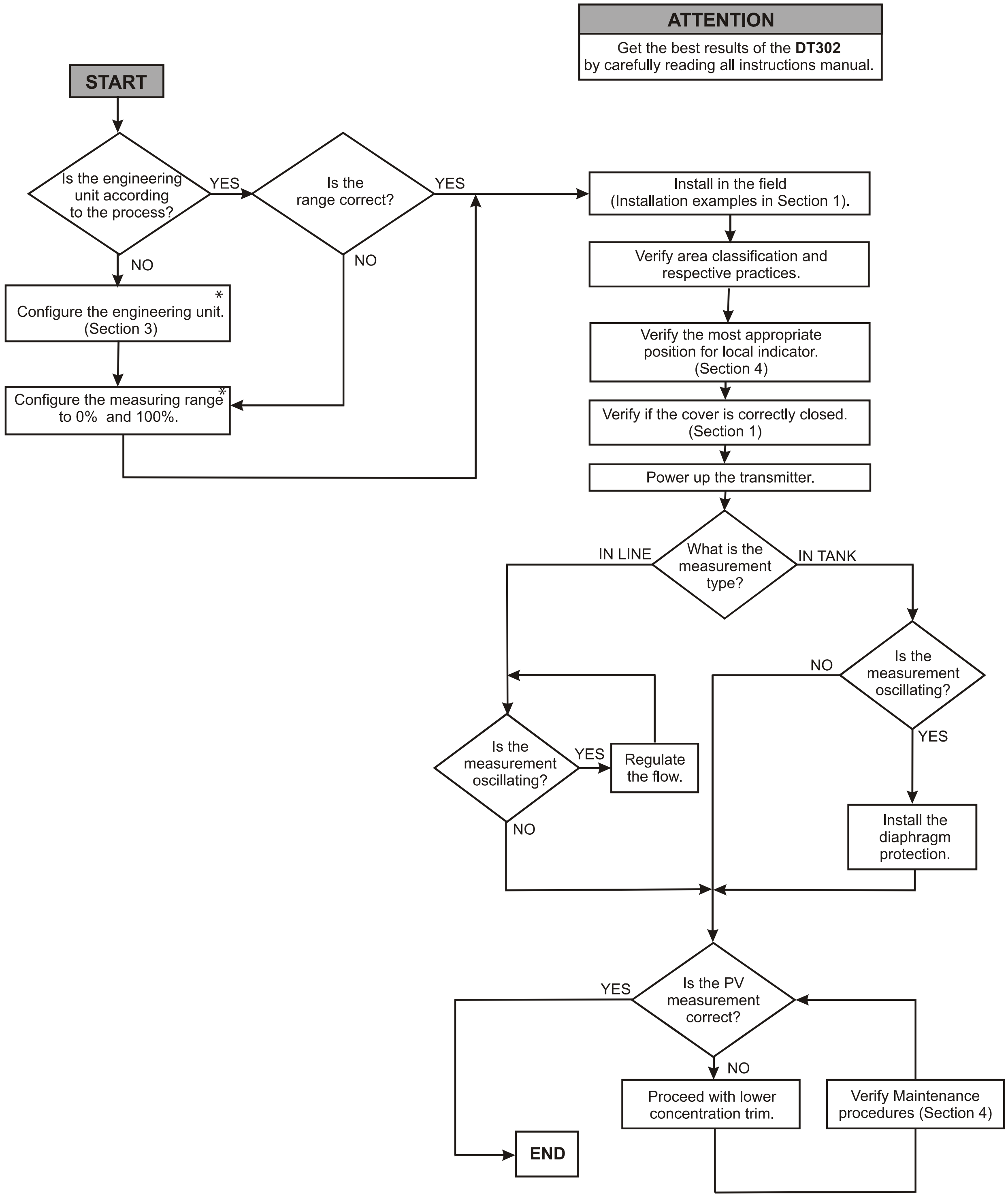
Installation Flowchart



* More information in Section 3 from DT302 Operation, Maintenance and Instructions Manual.

** Tip: The Brix of water is 0 (zero)/ or H_2O density = 998.2@20^{0}C.

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 **DT302** has a built-in temperature sensor to compensate for temperature variations. At the factory, each transmitter is submitted to a temperature cycle process, and 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 in using of DT302

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 a piping of ϕ 6”. This information is according to fluids which viscosity is close to that water. For fluids where the viscosity is very different to that 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 DT302

DT302I - Industrial Model, for general use.

DT302S- 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 (**DT302**: straight type).
Lateral installation (**DT302**: side 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 chock to install the device.

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

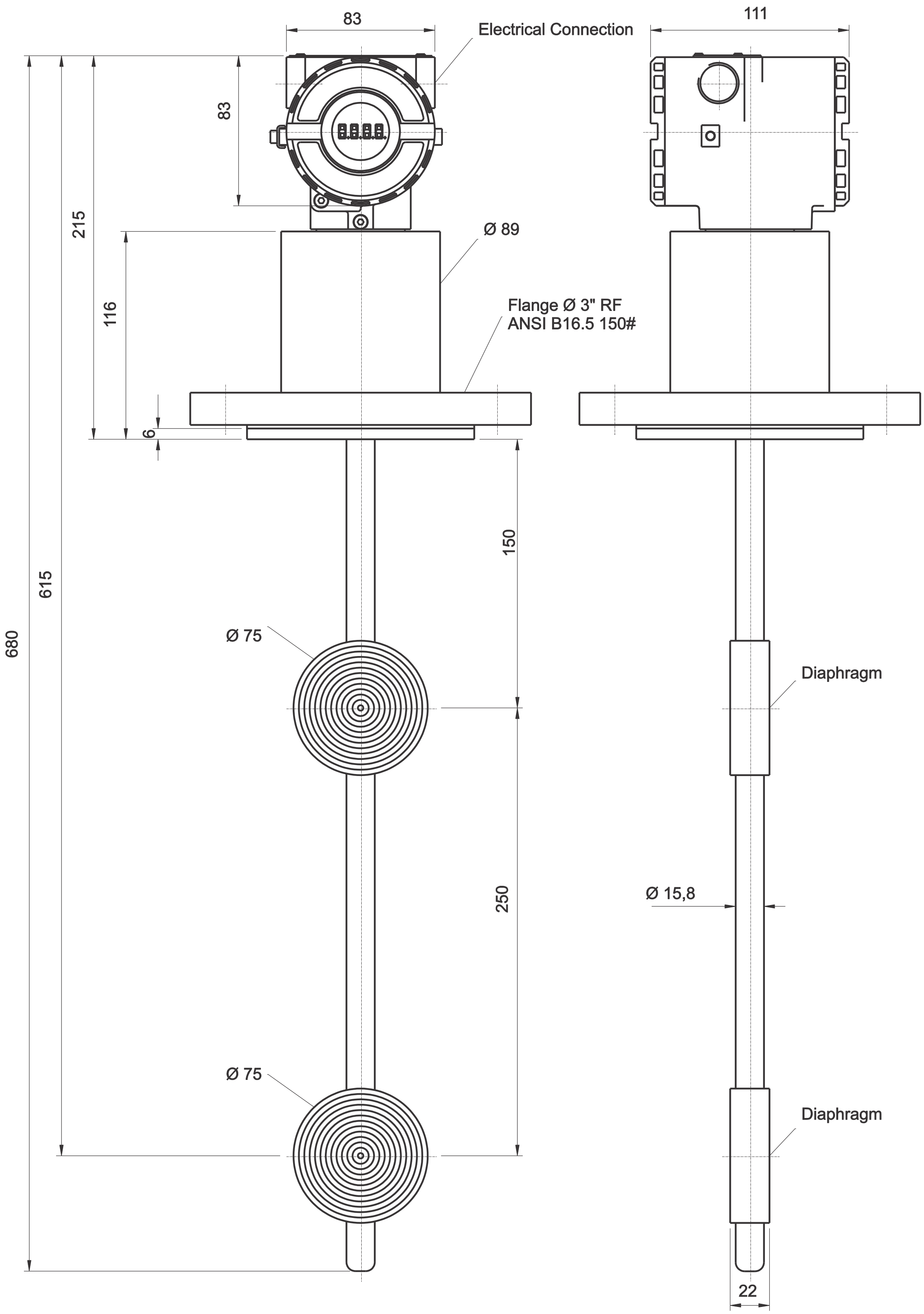


Figure 1.1 – DT302 Dimensional (A)

B – Industrial Model Side Mounting

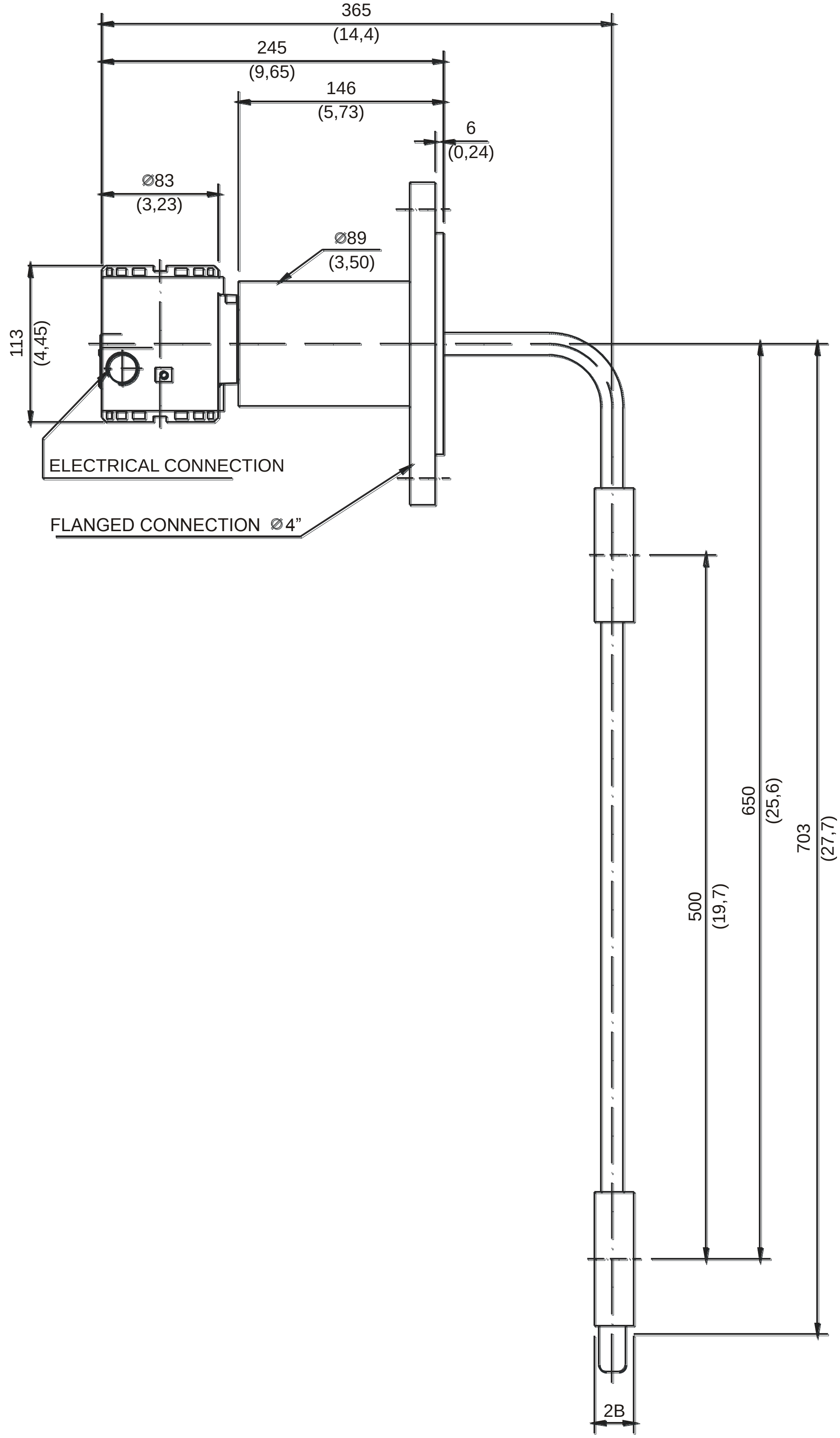


Figure 1.1 – DT302 Dimensional (B)

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

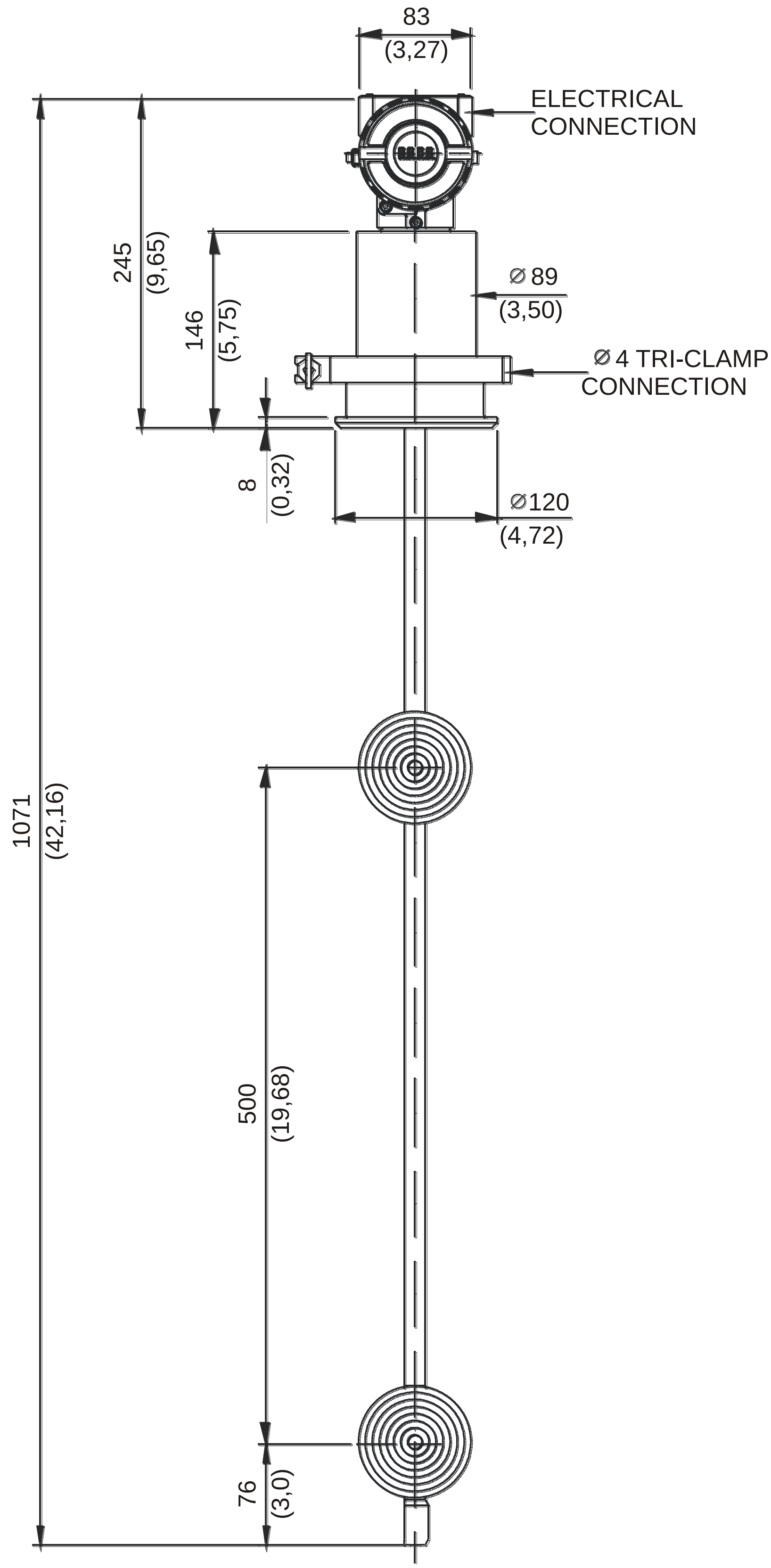


Figure 1.1 – DT302 Dimensional (C)

D – Sanitary Model Side Mounting

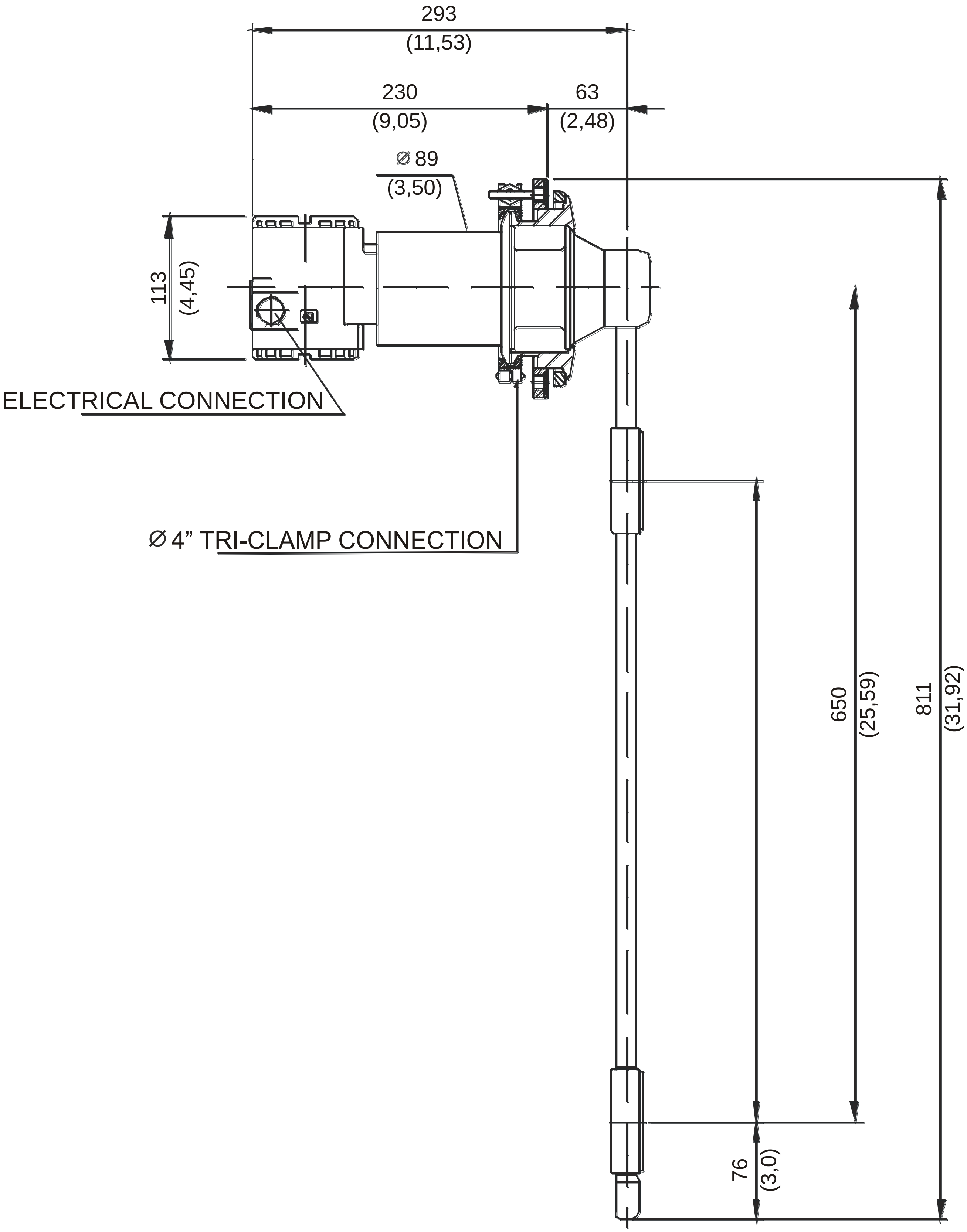


Figure 1.1 – DT302 Dimensional (D)

E – Industrial Model Top Mounting

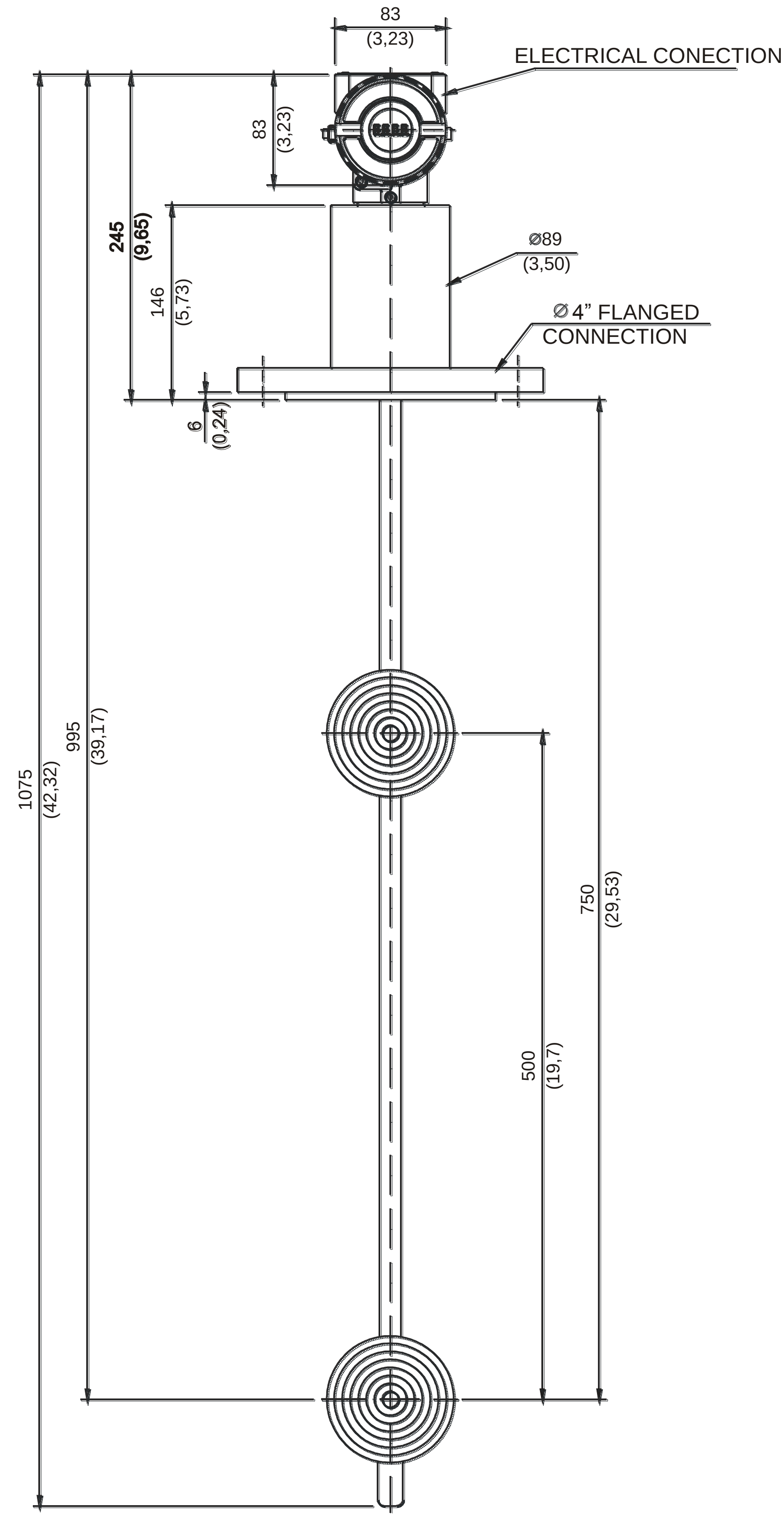


Figure 1.1 – DT302 Dimensional (E)

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

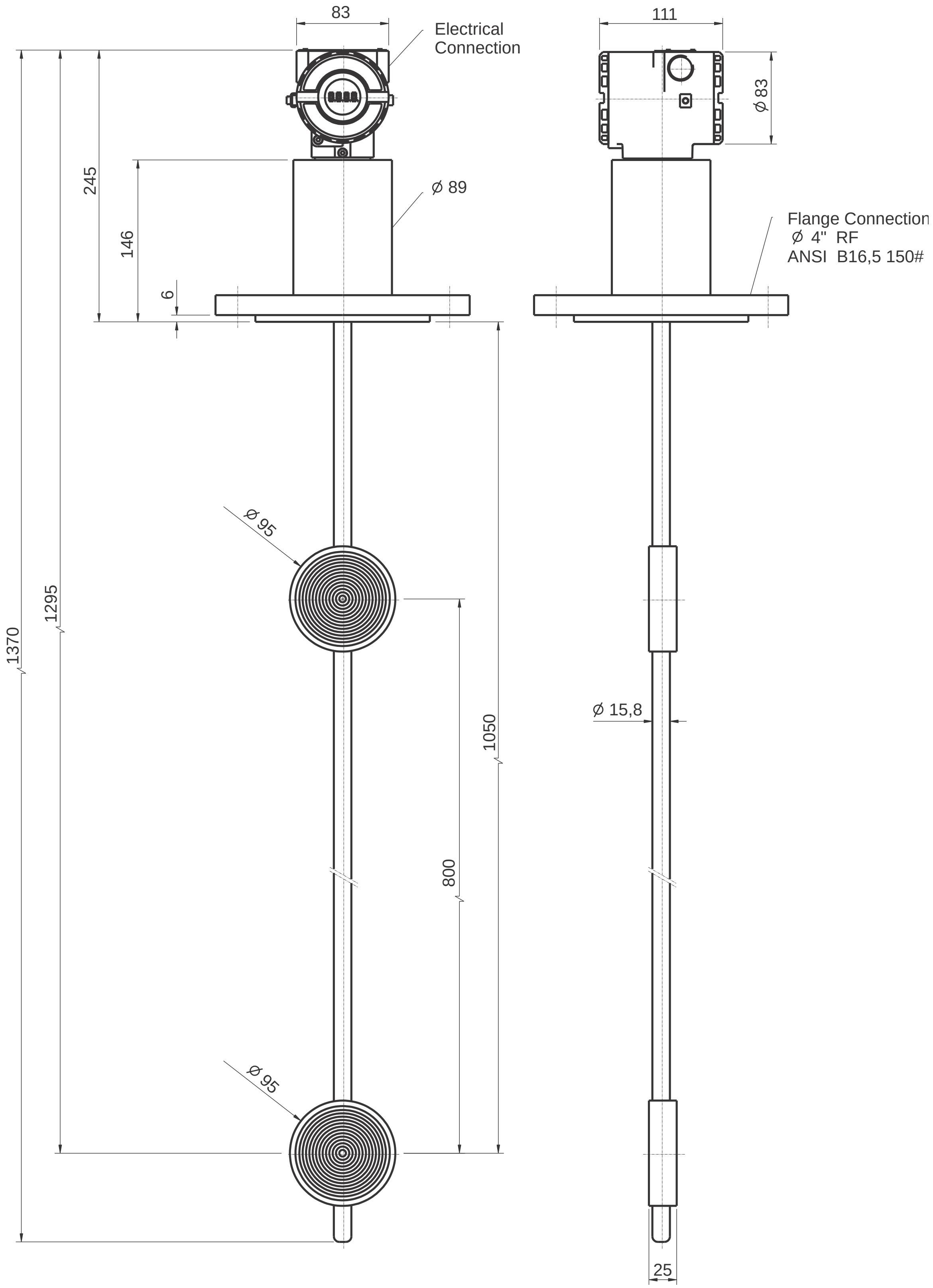


Figure 1.1 – DT302 Dimensional (F)

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

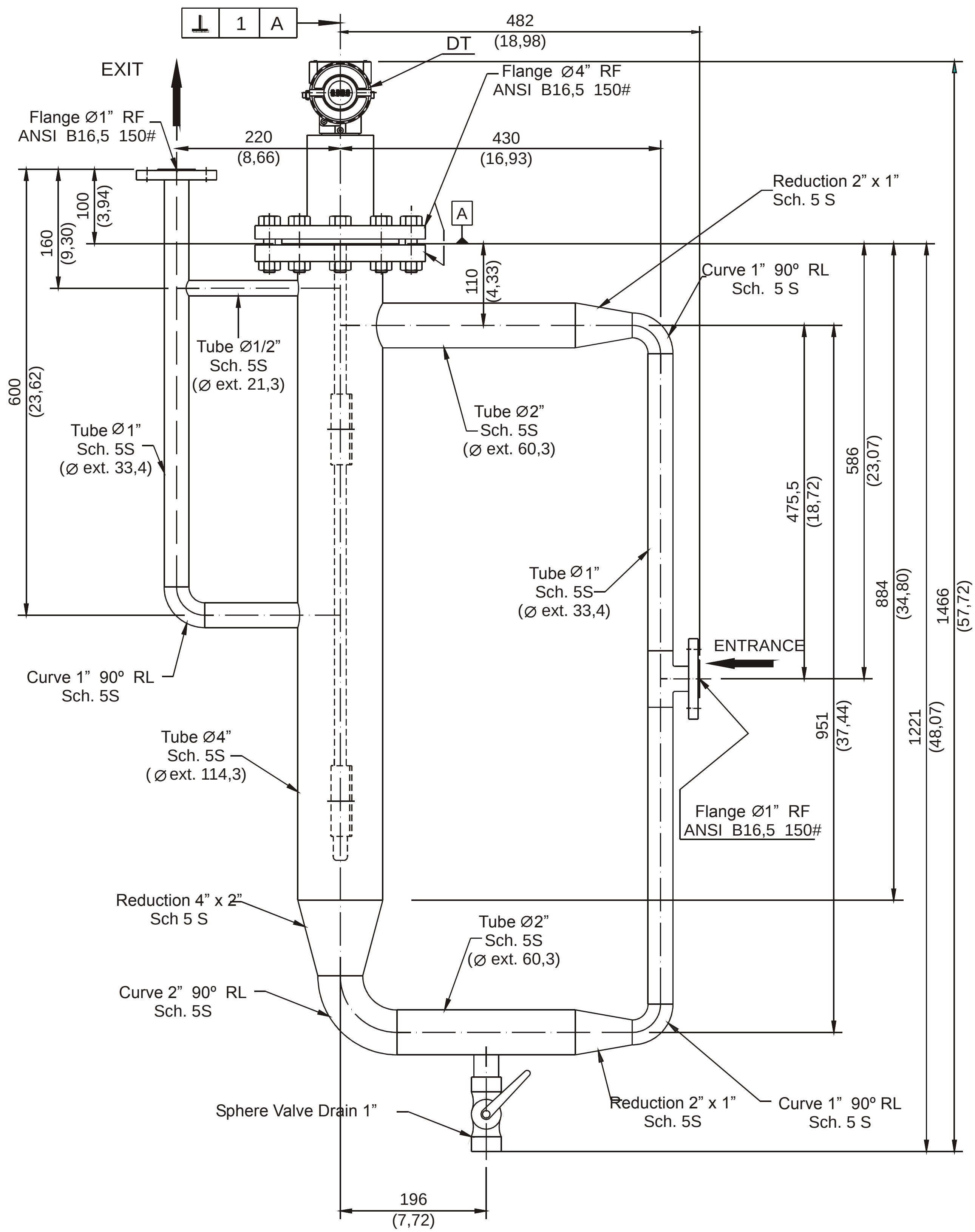


Figure 1.2 – Typical Installation for DT302 (A)

B – Typical Installation for Low Flow Tank (Sanitary Model)

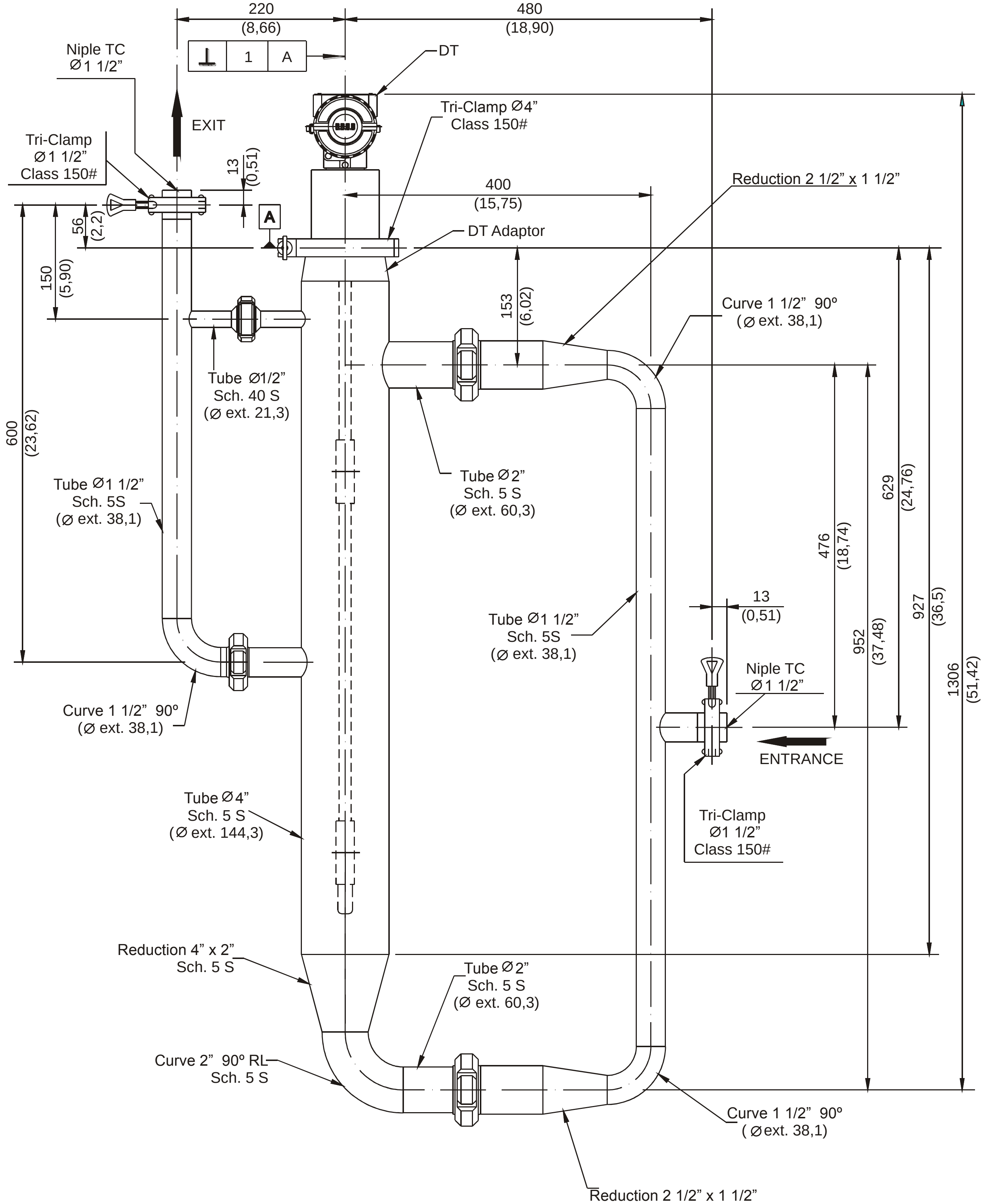


Figure 1.2 – Typical Installation for DT302 (B)

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

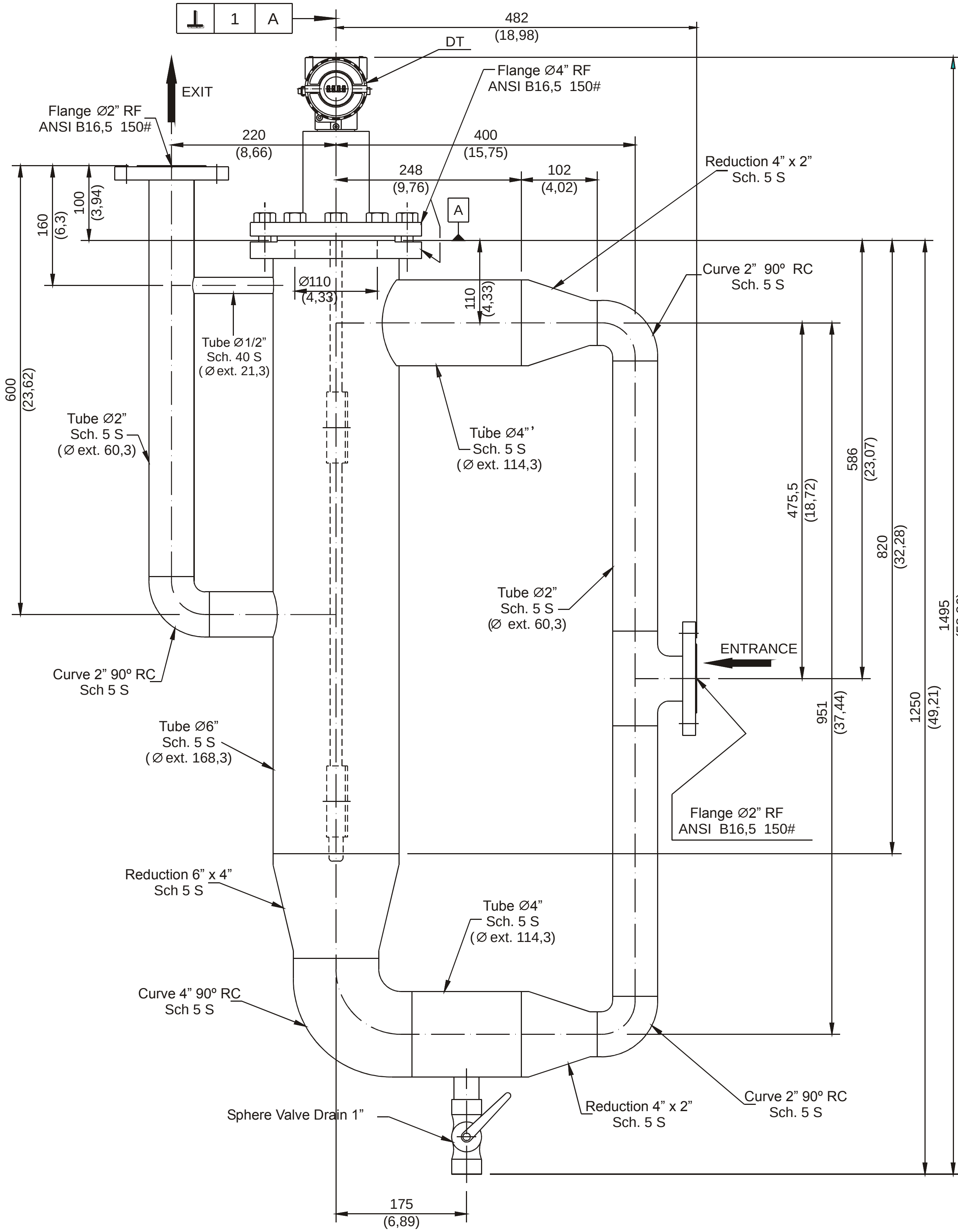


Figure 1.2 – Typical Installation for DT302 (C)

D – Typical Installation in Overflow Tanks

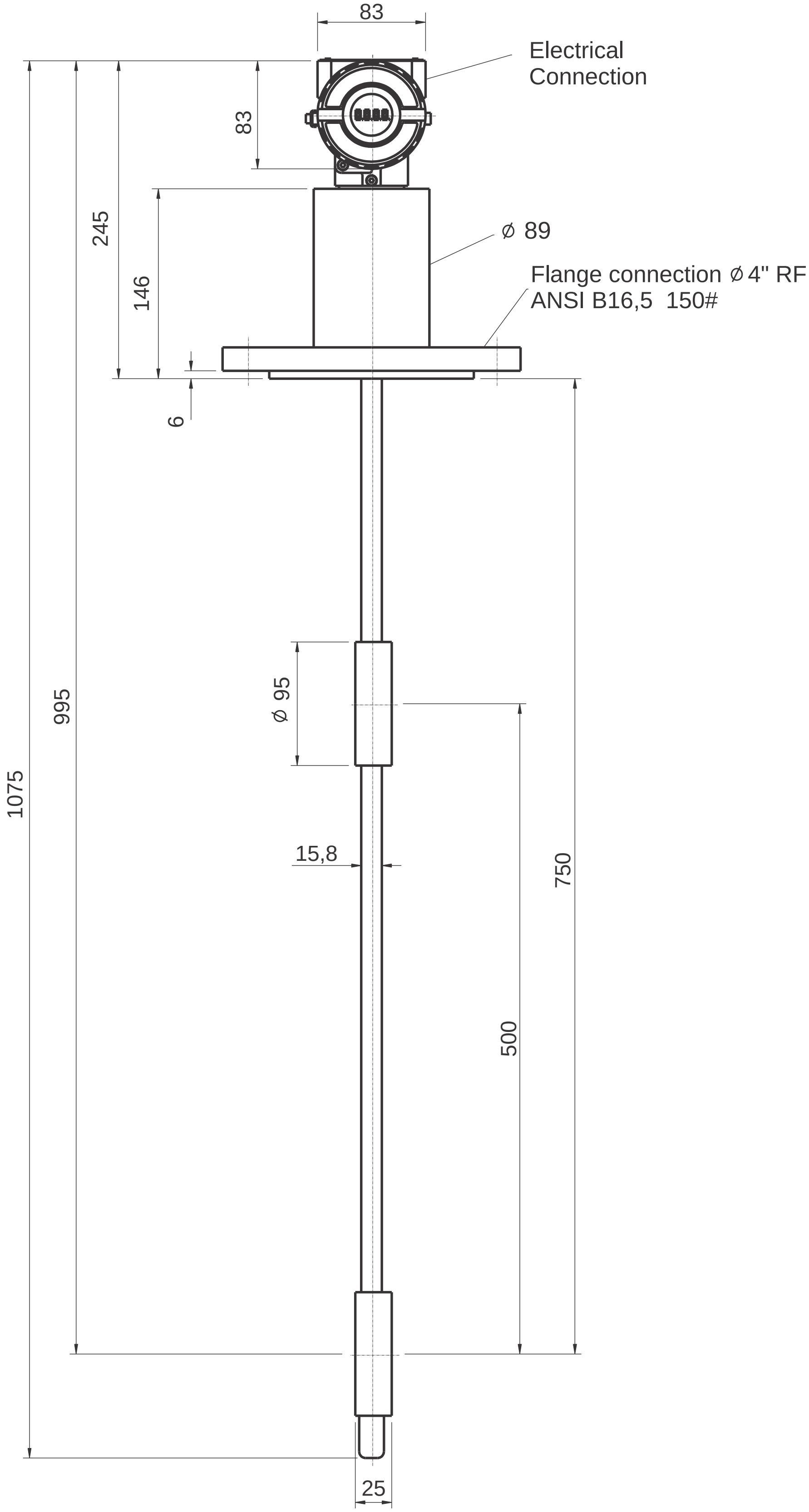


Figure 1.2 – Typical Installation for DT302 (D)

E – Typical Installation in Tank (Industrial Model)

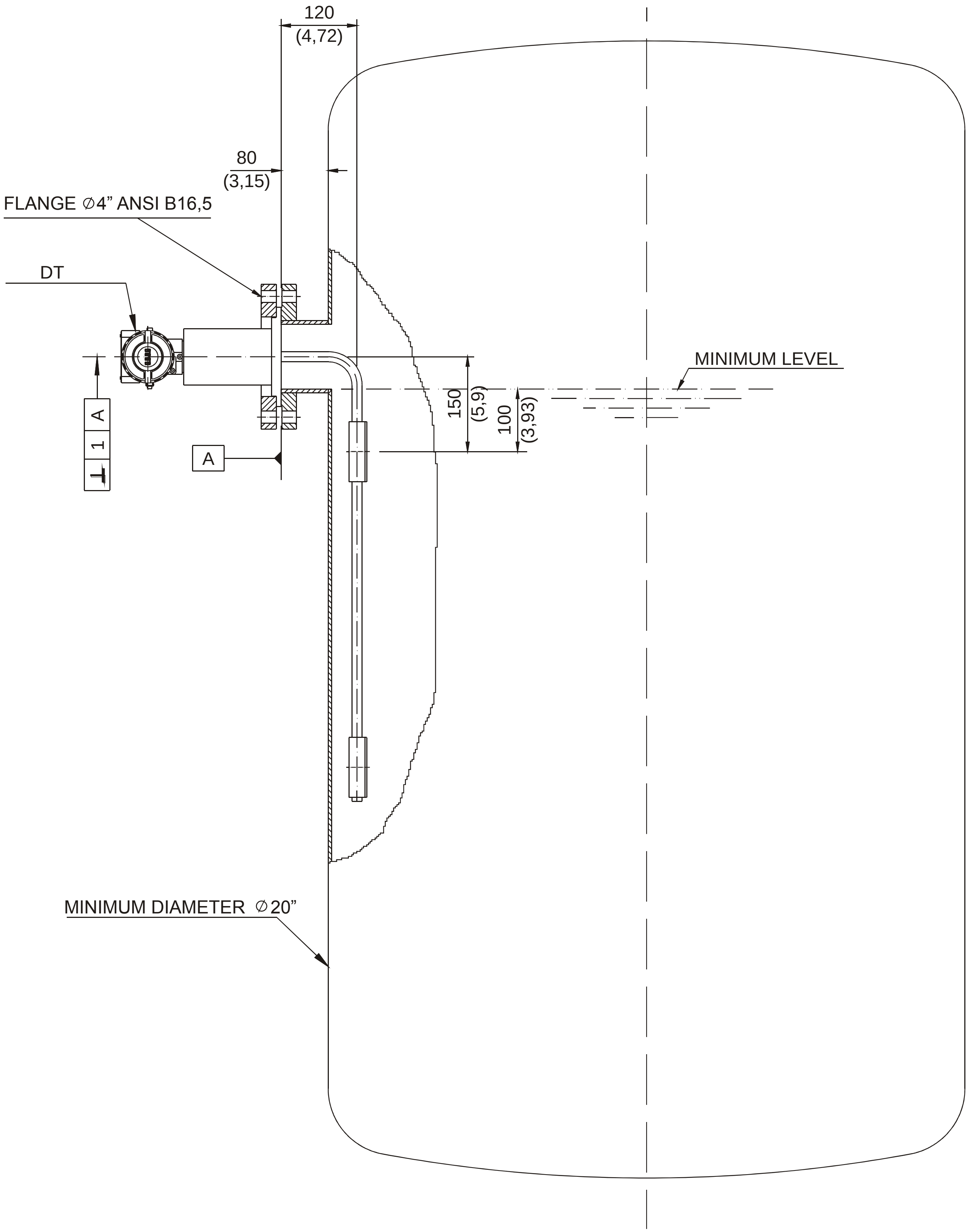


Figure 1.2 – Typical Installation for DT302 (E)

F – Typical Installation in Tank (Sanitary Model)

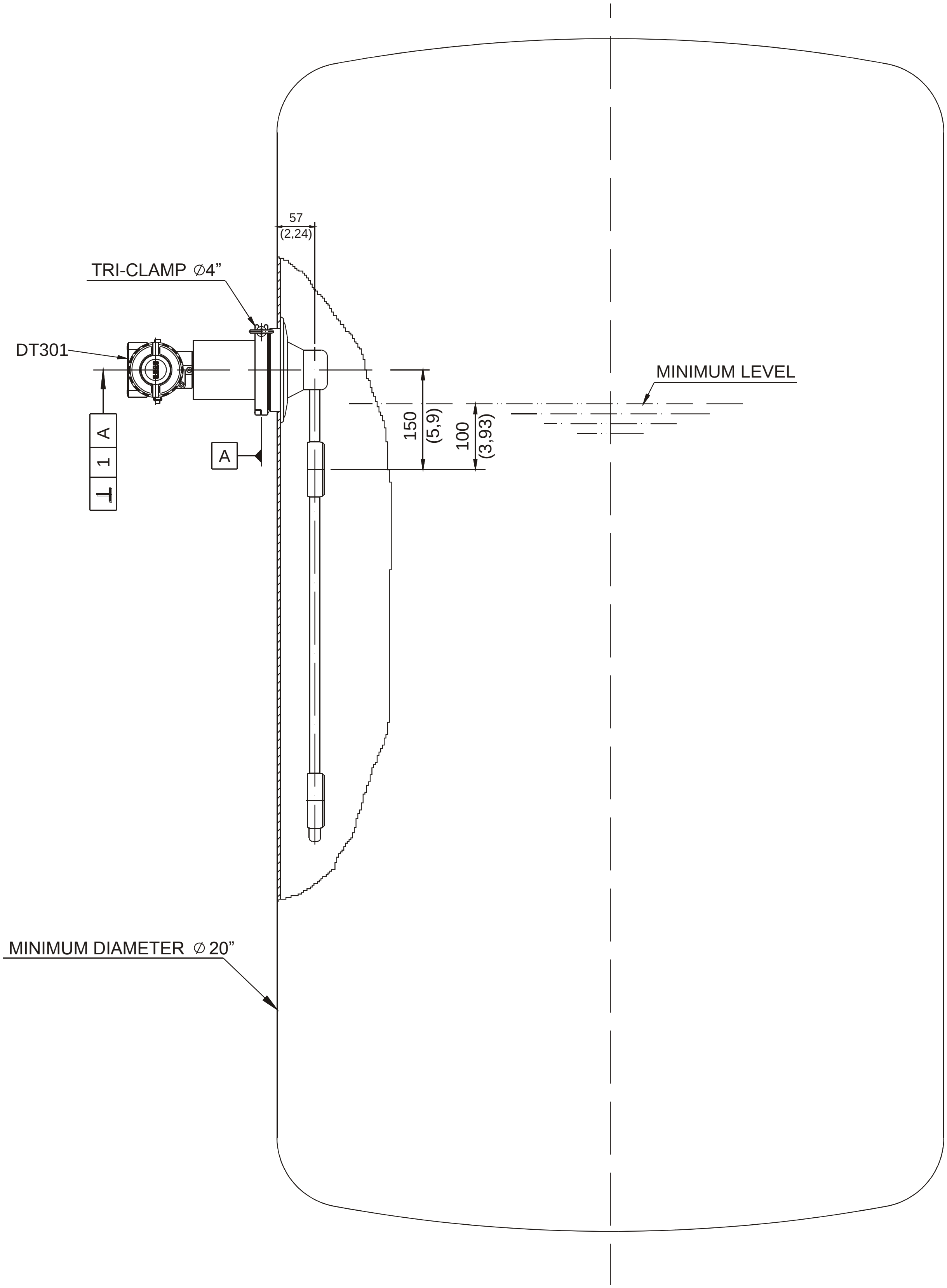


Figure 1.2 – Typical Installation for DT302 (F)

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

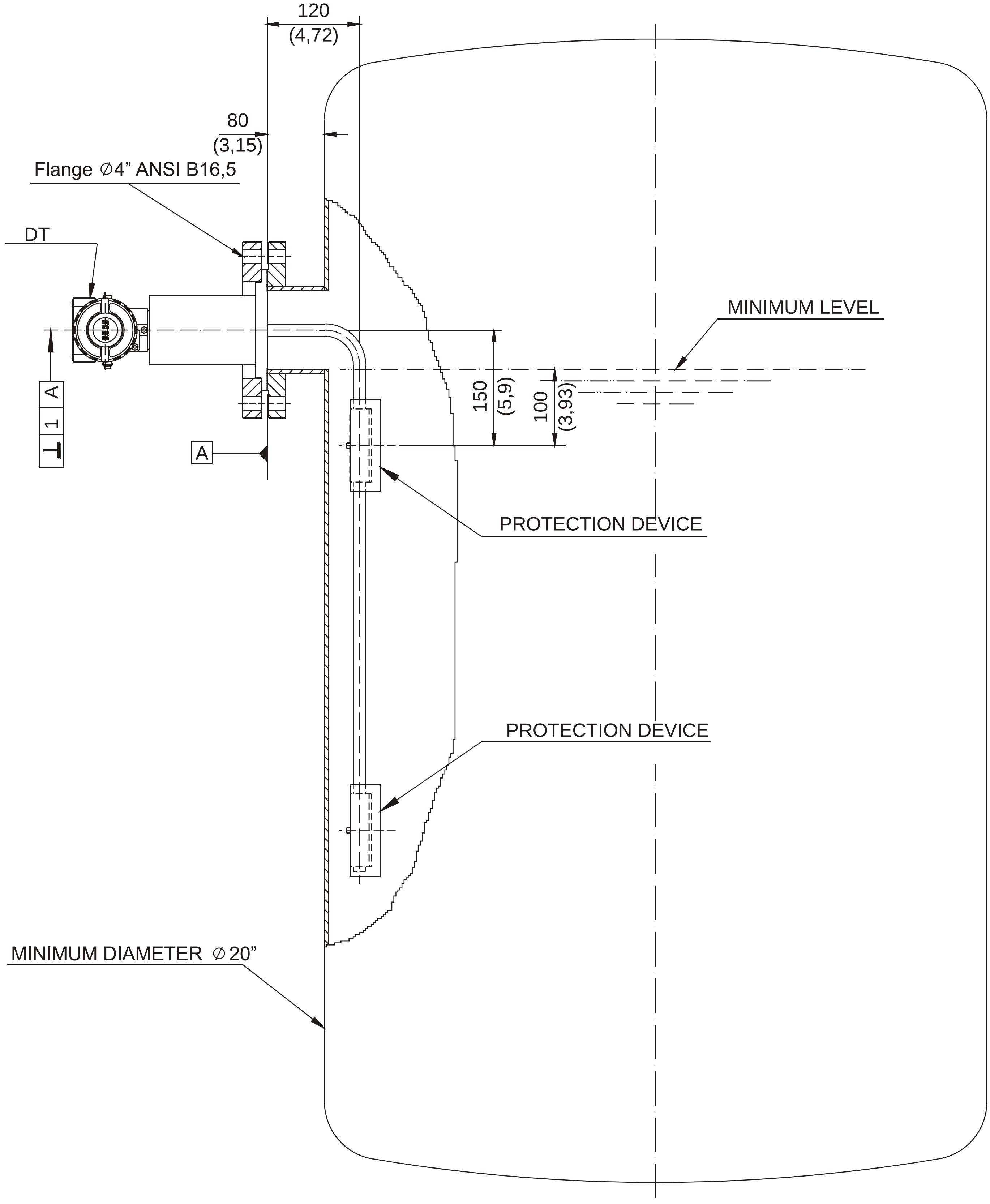


Figure 1.2 – Typical Installation for DT302 (G)

H - Typical Installation for Low Flow Tank (Industrial Model)

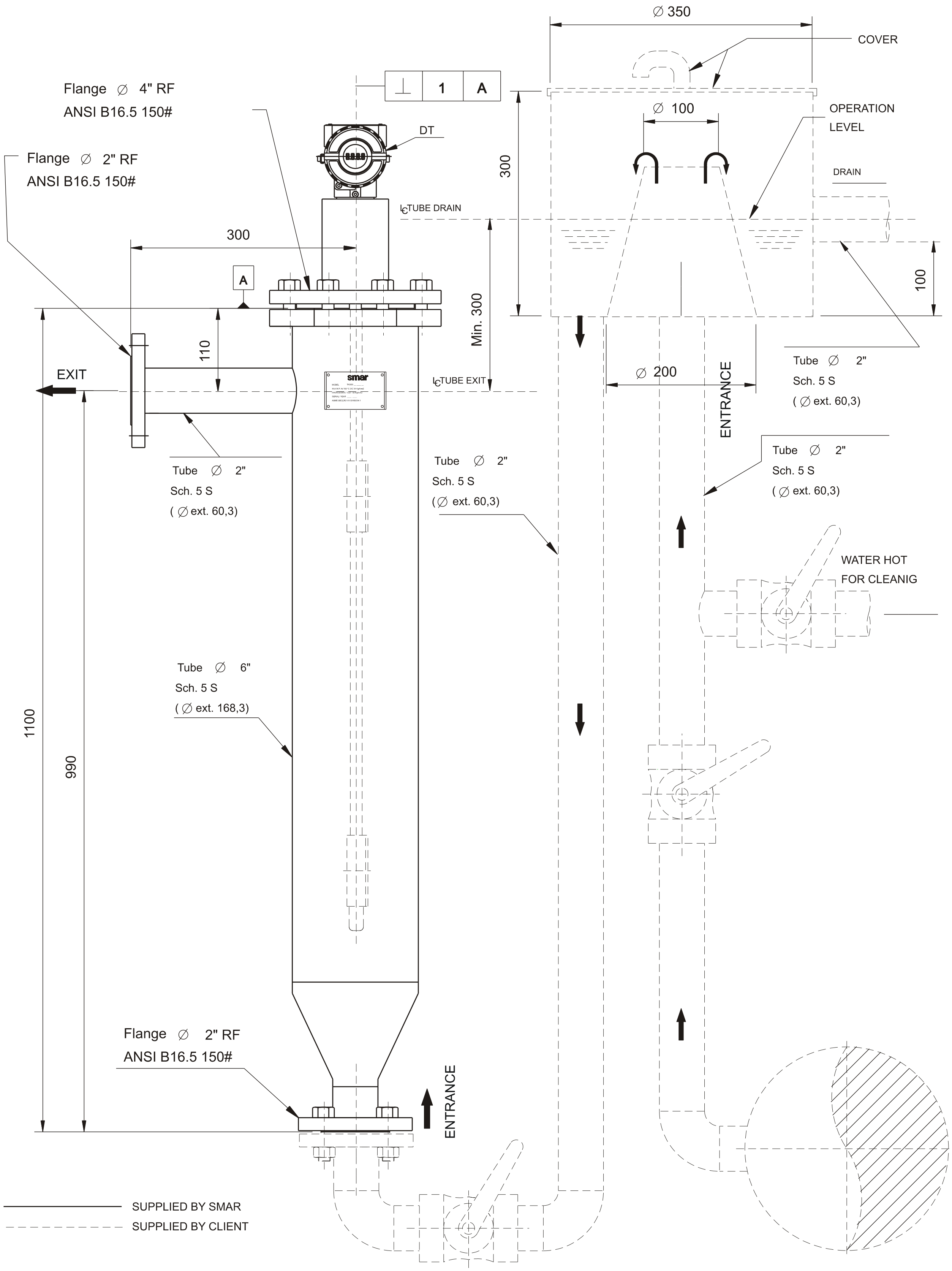


Figure 1.2 – Typical Installation for DT302 (H)

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

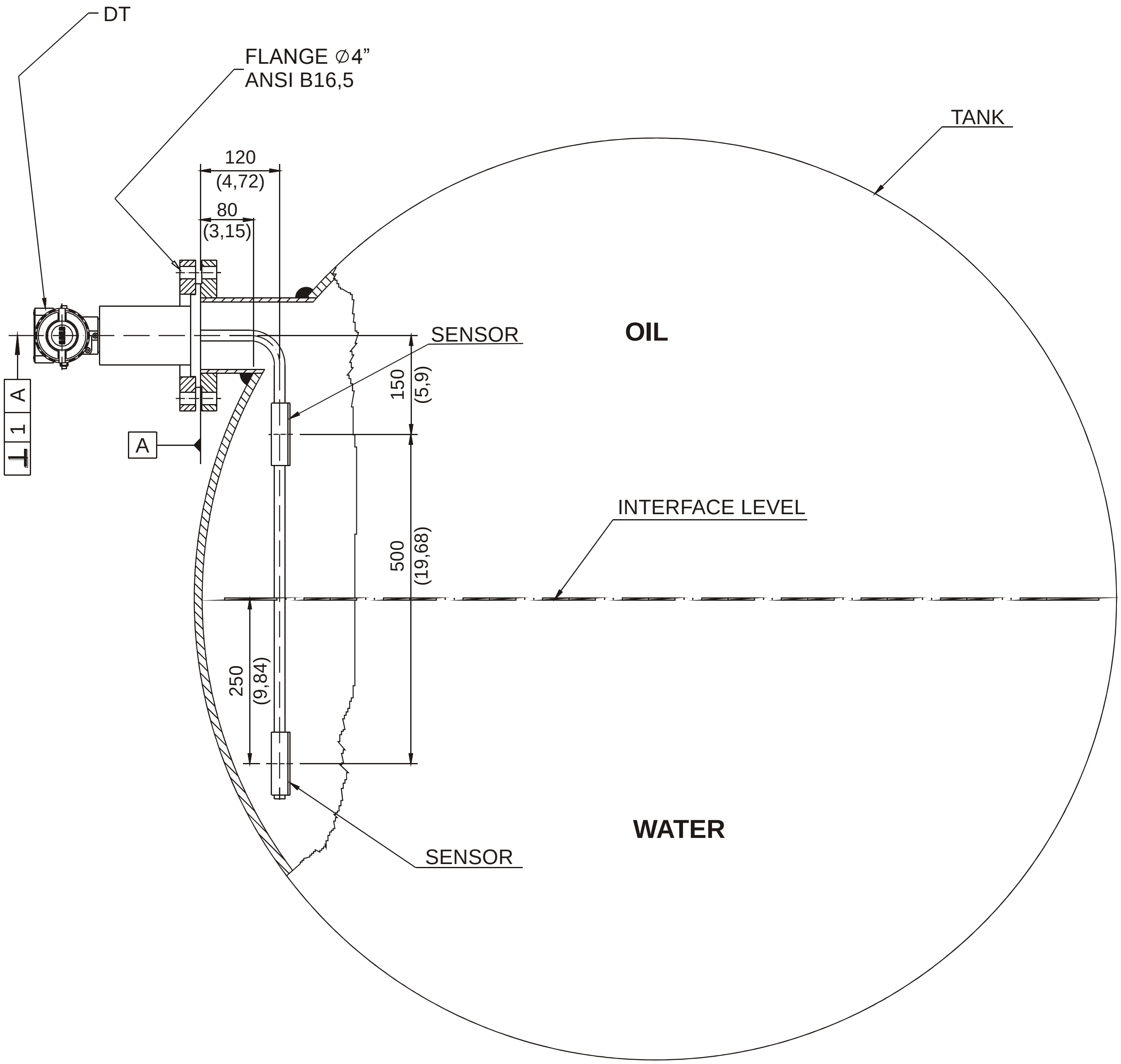


Figure 1.2 – Typical Installation for DT302 (I)

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

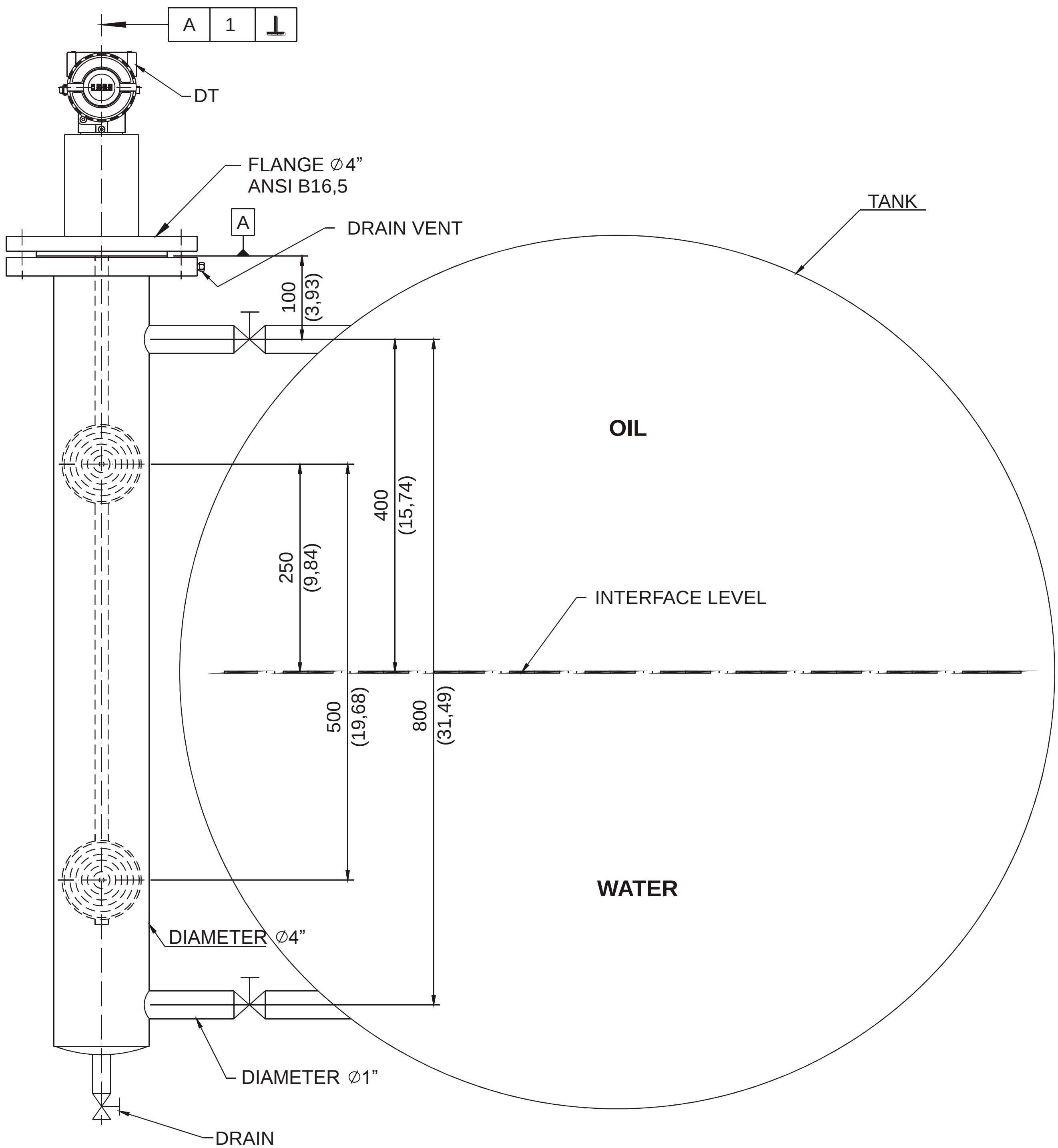


Figure 1.2 – Typical Installation for DT302 (J)

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.

The digital display itself can also be rotated***. See Figure 4.2 – Four Possible Positions of the Display.***

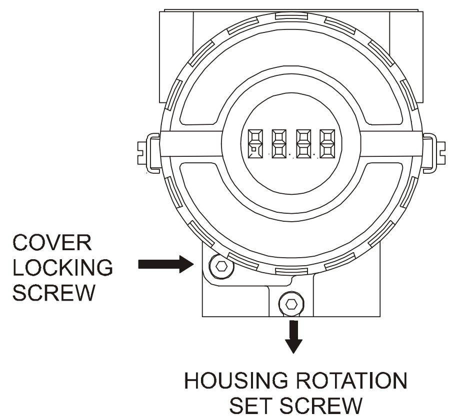


Figure 1.3 - Housing Rotation Set Screw

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

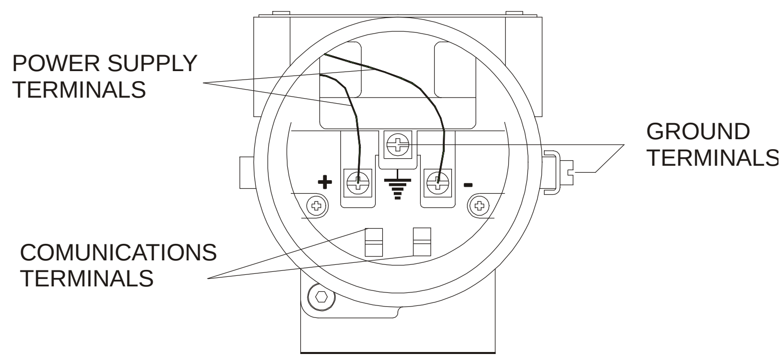


Figure 1.4 - Terminal Block

The **DT302** 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 **DT302** receives power from the bus via the signal wiring. The power supply may come from a separate unit or from another device such as a controller or DCS.

In hazardous area, the number of devices may be limited by intrinsically safe restrictions, according to the barriers limitation.
The **DT302** 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 and tree topology are supported. Both types have a trunk cable with two terminations. 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.

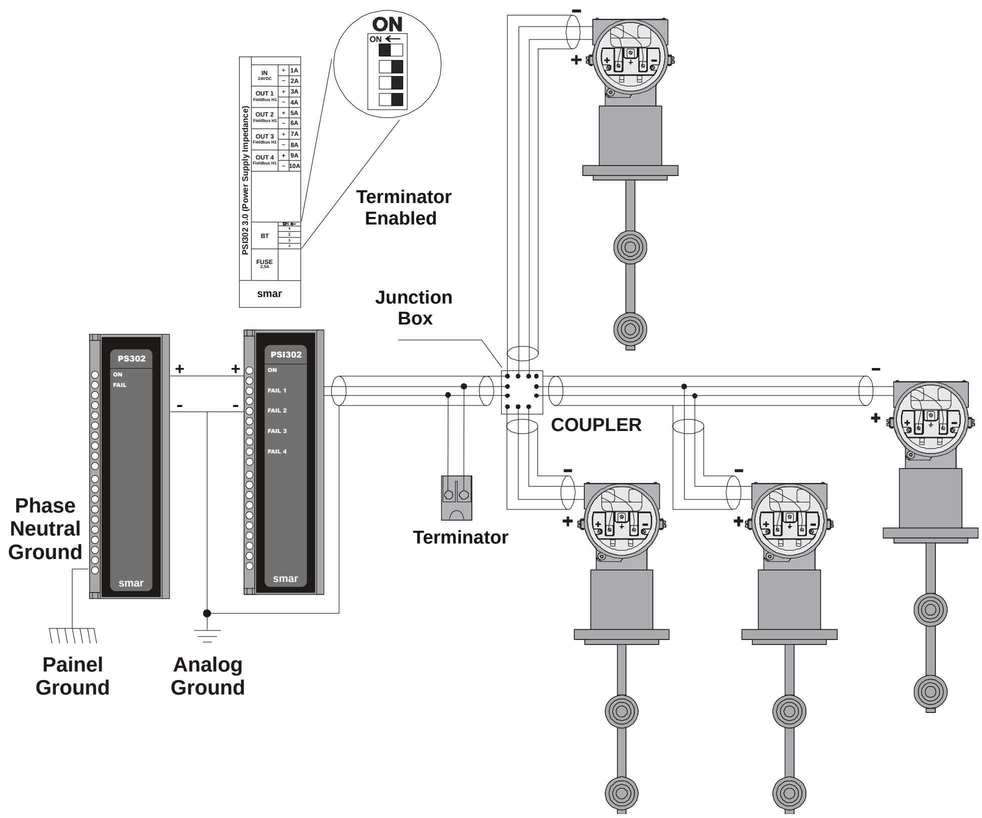


Figure 1.5 - Bus Topology

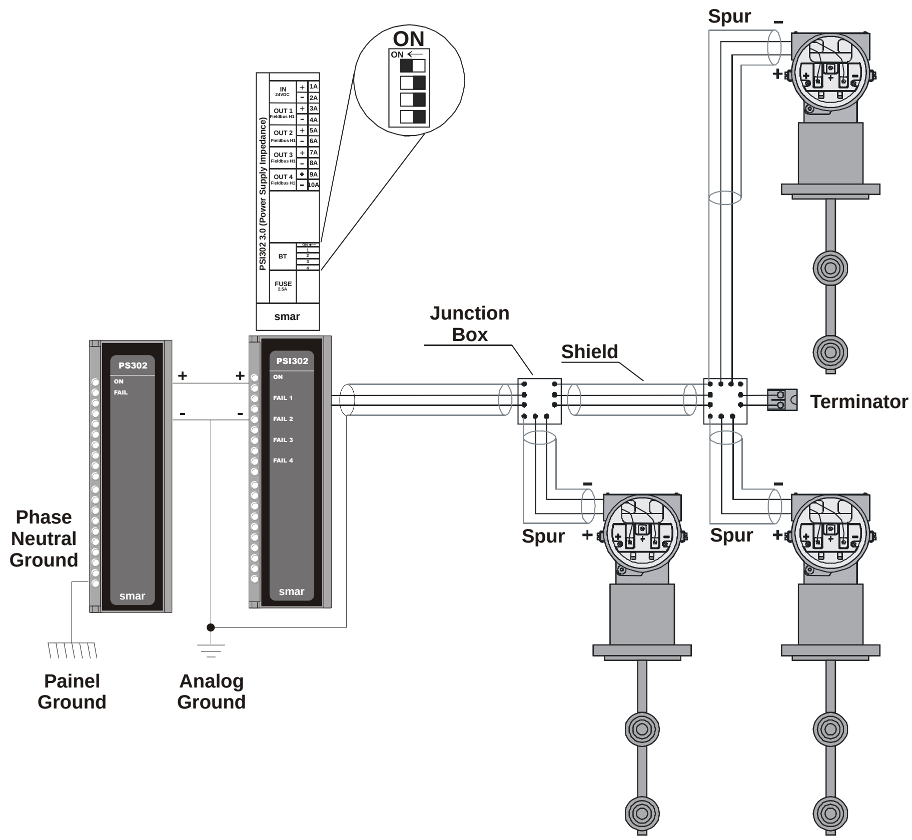


Figure 1.6 - Tree Topology

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 **DT302** main board must be correctly configured (See *Table 1.1 - Description of the Jumpers*).

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 **DT302** receives power from the bus via the 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 **DT302** Concentration Density Transmitter use capacitive sensors (capacitive cells) as pressure sensing elements. This is exactly the same sensor as the DT301 series uses, the sensor modules are therefore interchangeable.

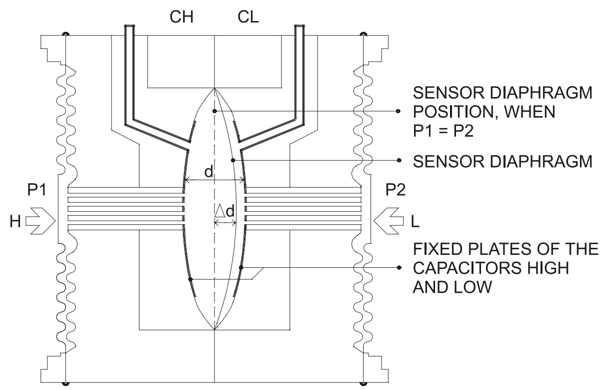


Figure 2.1 - Capacitive Cell

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 the 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 deflect 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 capacitance varies according to the applied differential pressure.

Functional Description – Electronics

Refer to the block diagram. The function of each block is described below.

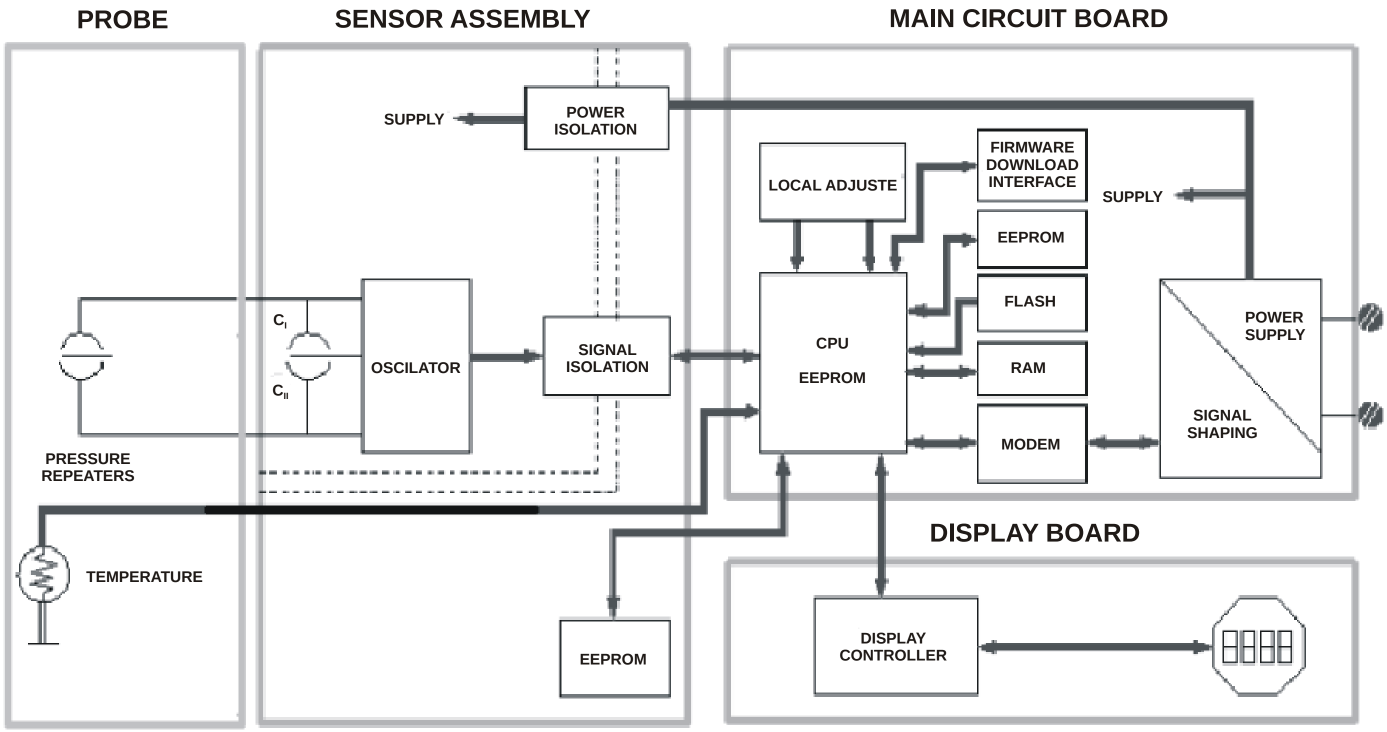


Figure 2.2 - DT302 Block Diagram Hardware

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

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

Temperature Sensor
It captures the process fluid temperature.

Oscillator
This 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 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.

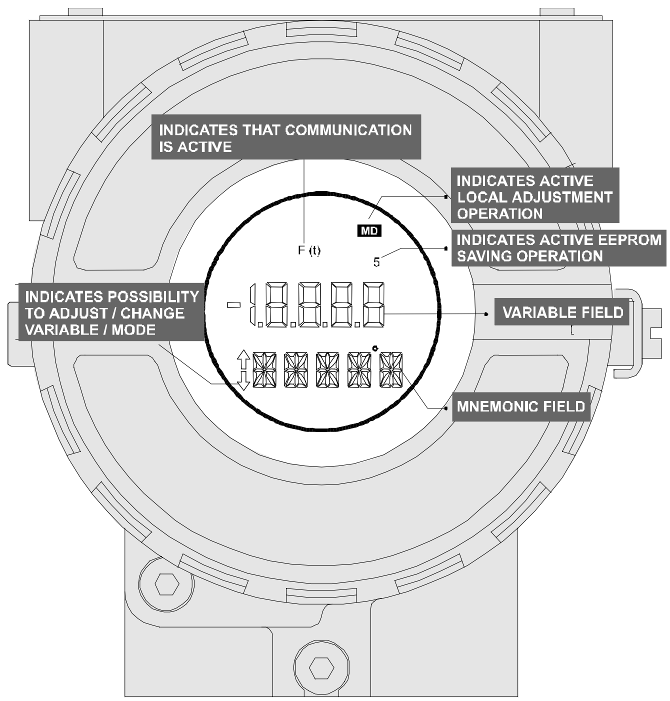


Figure 2.3 - LCD Indicator

CONFIGURATION

One of the many advantages of Fieldbus is that device configuration is independent of the configurator. The **DT302** may be configured by a third party terminal or operator console. Any particular configurator is therefore not addressed here.

The **DT302** contain one input transducer block, one resource, one display transducer block and functions blocks. Functions Blocks are not covered in this manual. For explanation and details see the "Functions Blocks Manual".

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

See transducer block diagram below.

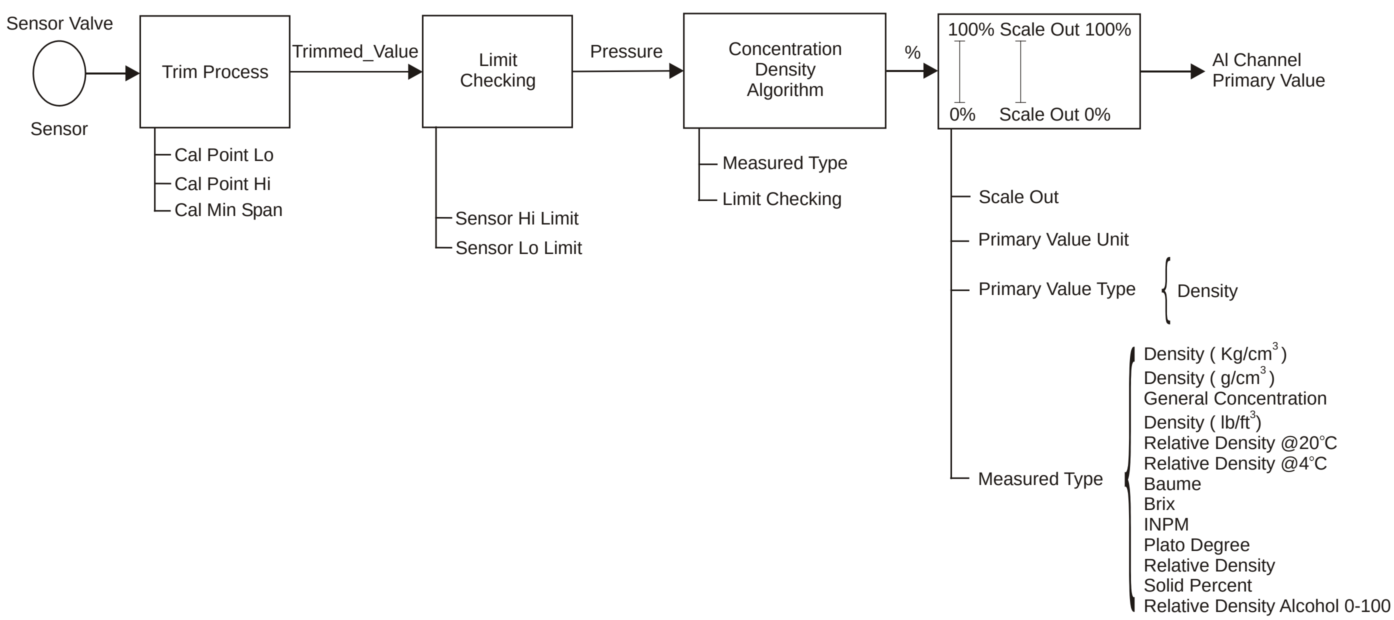


Figure 3.1 – Transducer Block Diagram

Concentration/Density Transducer Block Parameter Description

Parameter	Description
ST_REV	Indicates the level of static data.
TAG_DESC	Transducer block description.
STRATEGY	This parameter is not checked and processed by transducer block.
ALERT_KEY	Number of identification in the plant.
MODE_BLK	Indicates the operation mode of transducer block.
BLOCK_ERR	Indicates the status associated with hardware or software in the transducer.
UPDATE_EVT	Alert for any static data.
BLOCK_ALM	Used for configuration, hardware and other fail.
TRANSDUCER_DIRECTORY	Used to select several transducer blocks.
TRANSDUCER_TYPE	Indicates the type of transducer according to its class.
XD_ERROR	Used to indicate calibration status.
COLLECTION_DIRECTORY	Specifies the number of transducer index into transducer block.
PRIMARY_VALUE_TYPE	Defines the calculation type for transducer block.
PRIMARY_VALUE	Value and status used by channel.
PRIMARY_VALUE_RANGE	High and low range limit values, the engineering unit code and the number of digits to the right of the decimal point to be used for primary value.
CAL_POINT_HI	Highest calibrated value.
CAL_POINT_LO	Lowest calibrated value.
CAL_MIN_SPAN	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.
CAL_UNIT	Device description engineering units code index for the calibration values.
SENSOR_TYPE	Type of sensor.
SENSOR_RANGE	Range of sensor.
SENSOR_SN	Serial number of sensor.
SENSOR_CAL_METHOD	Method of last sensor calibration. ISO defines several standard methods of calibration. This parameter is intended to record that method, or if some other method was used.
SENSOR_CAL_LOC	Location of last sensor calibration. This describes the physical location at which the calibration was performed.
SENSOR_CAL_DATE	Date of the last sensor calibration.
SENSOR_CAL_WHO	Name of person who is in charge of last calibration.
SENSOR_ISOLATION_MTL	Defines the construction material of the isolating diaphragms.
SENSOR_FLUID	Defines the type of fill fluid used in the sensor
SECONDARY_VALUE	Secondary value (temperature value), related to the sensor.
SECONDARY_VALUE_UNIT	Engineering units to be used with SECONDARY_VALUE.
PRESS_LIN_NORMAL	Linear normalized pressure value.
PRESS_NORMAL	Normalized pressure value.
PRESS_CUTOFF	Cutoff pressure value.
CUTOFF_FLAG	Bypass flag for Pressure value.
DIGITAL_TEMPERATURE	Digital temperature value.
DIFF	Differential pressure value.
YDIFF	Differential pressure value.
CAPACITANCE_LOW	Low capacitance value.
CAPACITANCE_HIGH	High capacitance value.
BACKUP_RESTORE	This parameter is used to do backup or to restore configuration data.
SENSOR_RANGE_CODE	Indicates the sensor range code.
COEFF_POL0	Polynomial coefficient 0.
COEFF_POL1	Polynomial coefficient 1.
COEFF_POL2	Polynomial coefficient 2.
COEFF_POL3	Polynomial coefficient 3.
COEFF_POL4	Polynomial coefficient 4.
COEFF_POL5	Polynomial coefficient 5.
COEFF_POL6	Polynomial coefficient 6.
COEFF_POL7	Polynomial coefficient 7.
COEFF_POL8	Polynomial coefficient 8.
COEFF_POL9	Polynomial coefficient 9.
COEFF_POL10	Polynomial coefficient 10.
COEFF_POL11	Polynomial coefficient 11.
POLYNOMIAL_VERSION	Indicates the polynomial version.
CHARACTERIZATION_TYPE	Indicates the type of characterization curve.
CURVE _BYPASS_LD	Enable and disable the characterization curve.
CURVE_LENGTH	Indicates the length of characterization curve.
CURVE_X	Input points of characterization curve.
CURVE_Y	Output points of characterization curve.
CAL_POINT_HI_BACKUP	Indicates the backup for high calibration point.

Parameter	Description
CAL_POINT_LO_ BACKUP	Indicates the backup for low calibration point.
CAL_POINT_HI_FACTORY	Indicates the factory high calibration point.
CAL_POINT_LO_FACTORY	Indicates the factory low calibration point.
CAL_TEMPERATURE	Defines the temperature calibration point.
DATASHEET	Indicates information about the sensor.
ORDERING_CODE	Indicates information about the sensor and control from factory production.
MAXIMUM_MEASURED_PRESSURE	Indicates the maximum pressure measured.
MAXIMUM_MEASURED_TEMPERATURE	Indicates the maximum temperature measured.
ACTUAL_OFFSET	Indicates the actual calibrated offset.
ACTUAL_SPAN	Indicates the actual span offset.
MAXIMUM_OFFSET_DEVIATION	Defines the maximum offset before an alarm is generated.
MAXIMUM_GAIN_DEVIATION	Defines the maximum gain before an alarm is generated.
OVERPRESSURE_LIMIT	Defines the maximum overpressure limit before an alarm is generated.
MAXIMUM_NUMBER_OF_OVERPRESSURE	Defines the maximum number of overpressure before an alarm is generated.
GRAVITY	Gravity acceleration used in concentration/density calculation. The unit is m/s^2.
HEIGHT	Distance between the two pressure sensors. The unit is m.
MEASURED_TYPE	When the transducer type is density, it allows to measure: 0 - Density (g/cm^3), 1 - Density (Kg/m^3), 2 - Relative Density @ 20°C (g/cm^3), 3 - Relative Density @ 4°C (g/cm^3), 4 - Baume, 5 - Brix, 6 - Plato Degree, 7 - INPM, 8 - Relative Density Alcohol 0 - 100, 9 - Solid Percent, 10 - Density (lb/ft^3) 11 - API
LIN_DILATATION_COEF	Linear dilatation coefficient.
PRESSURE_COEFFICIENT	Coefficient of pressure.
TEMP_ZERO	Offset coefficient used to calculate the temperature.
TEMP_GAIN	Gain coefficient used to calculate the temperature.
ZERO_ADJUST_TEMP	Temperature of zero adjustment.
HEIGHT_MEAS_TEMP	Temperature of measurement of distance between the pressure sensors.
AUTO_CAL_POINT_LO	This parameter enables the lower self-calibration point. The sensor should be in air and the MEASURED_TYPE and XD_SCALE.UNIT should be Kg/cm^3. The calibration point is 1.2 Kg/cm^3.
AUTO_CAL_POINT_HI	This parameter enables the upper self-calibration point. The sensor should be on water and the MEASURED_TYPE AND XD_SCALDE.UNIT should be Brix. The calibration point is 0 Brix.
SOLID_POL_COEFF_0	Solid percent polynomial coefficient 0.
SOLID_POL_COEFF_1	Solid percent polynomial coefficient 1.
SOLID_POL_COEFF_2	Solid percent polynomial coefficient 2.
SOLID_POL_COEFF_3	Solid percent polynomial coefficient 3.
SOLID_POL_COEFF_4	Solid percent polynomial coefficient 4.
SOLID_POL_COEFF_5	Solid percent polynomial coefficient 5.
SOLID_LIMIT_LO	Solid percent limit low.
SOLID_LIMIT_HI	Solid percent limit high.
PRESS_COMP	Value used by the factory.
SIMULATE_PRESS_ENABLE	Enable the concentration simulation mode.
SIMULATE_PRESS_VALUE	Simulate pressure value in mmH_2O at 68 °F. Used together with SIMULATE_PRESS_ENABLE.
SIMULATE_DENSITY_VALUE	Density value used to obtain the correspondent pressure.
CALCULATED_PRESS_VALUE	Pressure calculated according to the SIMULATE_DENSITY_VALUE.
CALC_PRESS_CAL_POINT_LO	Calculated pressure value by AUTO_CAL_POINT_LO procedure.
CALC_PRESS_CAL_POINT_HI	Calculated pressure value by AUTO_CAL_POINT_HI procedure.
DT_RANGE_CODE	**DT302** range code: Range 1 (0.5 @ 1.8 g/cm^3) Range 2 (1.0 @ 2.5 g/cm^3) Range 3 (2.0 @ 5.0 g/cm^3)
DENSITY_KGM3	Density Value in Kg/m3.
DENSITY_STATUS	Density status information such as temperature between limits.
CONC	18 polynomial terms.
HI_LIM_DENS	Density upper limit for generic concentration.
LO_LIM_DENS	Density lower limit for generic concentration.
HI_LIM_TEMP	Temperature upper limit for generic concentration.
LO_LIM_TEMP	Temperature lower limit for generic concentration.
K_DENS	Density constant used to calculate generic concentration.

Parameter	Description
K_TEMP	Temperature constant used to calculate generic concentration.
MOUNTING_POSITION	Indicates de probe assembly position (direct or reverse).

Table 3.1 – Concentration/Density Transducer Block Parameter Description

Concentration/Density Transducer Block Parameter Attributes

Relative Index	Parameter Mnemonic	Object Type	Data Type	Store	Size	Access	Default –value
1	ST_REV	Simple	Unsigned16	S	2	R/W	0
2	TAG_DESC	Simple	VisibleString	S	32	R/W	TRD BLOCK
3	STRATEGY	Simple	Unsigned16	S	2	R/W	0
4	ALERT_KEY	Simple	Unsigned8	S	1	R/W	0
5	MODE_BLK	Record	DS-69	S	4	R/W	O/S
6	BLOCK_ERR	Simple	Bit String	D	2	R	
7	UPDATE_EVT	Record	DS-73	D	5	R	
8	BLOCK_ALM	Record	DS-72	D	13	R	
9	TRANSDUCER_DIRECTORY	Simple	Array of Unsigned16	N	Variable	R	
10	TRANSDUCER_TYPE	Simple	Unsigned16	N	2	R	100
11	XD_ERROR	Simple	Unsigned8	D	1	R	0
12	COLLECTION_DIRECTORY	Simple	Array of Unsigned 32	S	Variable	R	
13	PRIMARY_VALUE_TYPE	Simple	Unsigned16	S	2	R/W	107
14	PRIMARY_VALUE	Record	DS-65	D	5	R	0
15	PRIMARY_VALUE_RANGE	Record	DS-68	S	11	R	
16	CAL_POINT_HI	Simple	Float	S	4	R/W	5080.0
17	CAL_POINT_LO	Simple	Float	S	4	R/W	0.0
18	CAL_MIN_SPAN	Simple	Float	S	4	R	0.0
19	CAL_UNIT	Simple	Unsigned16	S	2	R	1149
20	SENSOR_TYPE	Simple	Unsigned16	S	1	R/W	117
21	SENSOR_RANGE	Record	DS-68	S	11	R	0-100%
22	SENSOR_SN	Simple	Unsigned32	S	4	R/W	0
23	SENSOR_CAL_METHOD	Simple	Unsigned8	S	1	R/W	103
24	SENSOR_CAL_LOC	Simple	VisibleString	S	32	R/W	NULL
25	SENSOR_CAL_DATE	Simple	Time of Day	S	7	R/W	
26	SENSOR_CAL_WHO	Simple	VisibleString	S	32	R/W	NULL
27	SENSOR_ISOLATION_MTL	Simple	Unsigned16	S	2	R/W	2
28	SENSOR_FLUID	Simple	Unsigned16	S	2	R/W	1
29	SECONDARY_VALUE	Record	DS-65	D	5	R	0
30	SECONDARY_VALUE_UNIT	Simple	Unsigned16	S	2	R	1001 (°C)
31	PRESS_LIN_NORMAL	Record	DS-65	D	5	R	0
32	PRESS_NORMAL	Record	DS-65	D	5	R	0
33	PRESS_CUTOFF	Record	DS-65	D	5	R	0
34	CUTOFF_FLAG	Simple	Unsigned8	S	1	R/W	True
35	DIGITAL_TEMPERATURE	Record	DS-65	D	5	R	0
36	DIFF	Simple	Float	D	4	R	0
37	YDIFF	Simple	Float	D	4	R	0
38	CAPACITANCE_LOW	Simple	Float	D	4	R	0
39	CAPACITANCE_HIGH	Simple	Float	D	4	R	0
40	BACKUP_RESTORE	Simple	Unsigned8	S	1	R/W	0
41	SENSOR_RANGE_CODE	Simple	Unsigned16	S	2	R/W	1
42	COEFF_POL0	Simple	Float	S	4	R/W	-1
43	COEFF_POL1	Simple	Float	S	4	R/W	0
44	COEFF_POL2	Simple	Float	S	4	R/W	1
45	COEFF_POL3	Simple	Float	S	4	R/W	0
46	COEFF_POL4	Simple	Float	S	4	R/W	2
47	COEFF_POL5	Simple	Float	S	4	R/W	0
48	COEFF_POL6	Simple	Float	S	4	R/W	0
49	COEFF_POL7	Simple	Float	S	4	R/W	0
50	COEFF_POL8	Simple	Float	S	4	R/W	0
51	COEFF_POL9	Simple	Float	S	4	R/W	0
52	COEFF_POL10	Simple	Float	S	4	R/W	0
53	COEFF_POL11	Simple	Float	S	4	R/W	25

Relative Index	Parameter Mnemonic	Object Type	Data Type	Store	Size	Access	Default –value
54	POLYNOMIAL_VERSION	Simple	Unsigned8	S	1	R/W	32
55	CHARACTERIZATION_TYPE	Simple	Unsigned8	S	1	R/W	255
56	CURVE _BYPASS_LD	Simple	Unsigned16	S	2	R/W	Enable&Backup Cal
57	CURVE_LENGTH	Simple	Unsigned8	S	1	R/W	5
58	CURVE_X	Record	Array of Float	S	20	R/W	
59	CURVE_Y	Record	Array of Float	S	20	R/W	
60	CAL_POINT_HI_BACKUP	Simple	Float	S	4	R	5080
61	CAL_POINT_LO_ BACKUP	Simple	Float	S	4	R	0
62	CAL_POINT_HI_FACTORY	Simple	Float	S	4	R	5080
63	CAL_POINT_LO_FACTORY	Simple	Float	S	4	R	0
64	CAL_TEMPERATURE	Simple	Float	S	4	R/W	17.496
65	DATASHEET	Record	Array of Unsigned8	S	10	R/W	
66	ORDERING_CODE	Simple	VisibleString	S	50	R/W	NULL
67	MAXIMUM_MEASURED_PRESSURE	Simple	Float	S	4	R/w	- INF
68	MAXIMUM_MEASURED_TEMPERATURE	Simple	Float	S	4	R/W	- INF
69	ACTUAL_OFFSET	Simple	Float	S	4	R	
70	ACTUAL_SPAN	Simple	Float	S	4	R	
71	MAXIMUM_OFFSET_DEVIATION	Simple	Float	S	4	R/W	0.5
72	MAXIMUM_GAIN_DEVIATION	Simple	Float	S	4	R/W	2.0
73	OVERPRESSURE_LIMIT	Simple	Float	S	4	R/W	+ INF
74	MAXIMUM_NUMBER_OF_OVERPRESSURE	Simple	Float	S	4	R/W	0
75	GRAVITY	Simple	Float	S	4	R/W	9.80665
76	HEIGHT	Simple	Float	S	4	R/W	0.500
77	MEASURED_TYPE	Simple	Float	S	4	R/W	0
78	LIN_DILATATION_COEF	Simple	Float	S	4	R/W	0.000016
79	PRESSURE_COEFFICIENT	Simple	Float	S	4	R/W	
80	TEMP_ZERO	Simple	Float	S	4	R/W	-30
81	TEMP_GAIN	Simple	Float	S	4	R/W	0.5
82	ZERO_ADJUST_TEMP	Simple	Float	S	4	R/W	20
83	HEIGHT_MEAS_TEMP	Simple	Float	S	4	R/W	0.5
84	AUTO_CAL_POINT_LO	Simple	Float	S	4	R/W	0
85	AUTO_CAL_POINT_HI	Simple	Float	S	4	R/W	0
86	SOLID_POL_COEFF_0	Simple	Float	S	4	R/W	0
87	SOLID_POL_COEFF_1	Simple	Float	S	1	R/W	1
88	SOLID_POL_COEFF_2	Simple	Float	S	4	R/W	0
89	SOLID_POL_COEFF_3	Simple	Float	S	4	R/W	0
90	SOLID_POL_COEFF_4	Simple	Float	S	4	R/W	0
91	SOLID_POL_COEFF_5	Simple	Float	S	4	R/W	0
92	SOLID_LIMIT_LO	Simple	Float	S	4	R/W	0
93	SOLID_LIMIT_HI	Simple	Float	S	4	R/W	100
94	PRESS_COMP	Simple	Float	D	4	R	0
95	SIMULATE_PRESS_ENABLE	Simple	Unsigned 8	D	1	R/W	Disable
96	SIMULATE_PRESS_VALUE	Simple	Float	D	4	R/W	0
97	SIMULATE_DENSITY_VALUE	Simple	Float	D	4	R/W	0
98	CALCULATED_PRESS_VALUE	Simple	Float	D	4	R	0
99	CALC_PRESS_CAL_POINT_LO	Simple	Float	D	4	R	0
100	CALC_PRESS_CAL_POINT_HI	Simple	Float	D	4	R	0
101	DT_RANGE_CODE	Simple	Unsigned 8	S	1	R/W	0
102	DENSITY_KGM3	Simple	Float	S	4	R	-
103	DENSITY_STATUS	Simple	Unsigned	S	1	R	-
104	CONC	Record	Array of Float	D	72	R/W	0
105	HI_LIM_DENS	Simple	Float	D	4	R/W	0
106	LO_LIM_DENS	Simple	Float	D	4	R/W	0
107	HI_LIM_TEMP	Simple	Float	D	4	R/W	0
108	LO_LIM_TEMP	Simple	Float	D	4	R/W	0
109	K_DENS	Simple	Float	D	4	R/W	1
110	K_TEMP	Simple	Float	D	4	R/W	1
111	MOUNTING_POSITION	Simple	Unsigned	D	1	R/W	-

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		2
2	TAG_DESC				
3	STRATEGY				2
4	ALERT_KEY				1
5	MODE_BLK	4			
6	BLOCK_ERR	2			
7	UPDATE_EVT				
8	BLOCK_ALM				
9	TRANSDUCER_DIRECTORY				
10	TRANSDUCER_TYPE	2	2	5	2
11	XD_ERROR	1			
12	COLLECTION_DIRECTORY			5	
13	PRIMARY_VALUE_TYPE		2	5	
14	PRIMARY_VALUE	5			
15	PRIMARY_VALUE_RANGE				11
16	CAL_POINT_HI		4	5	
17	CAL_POINT_LO		4	4	
18	CAL_MIN_SPAN			4	4
19	CAL_UNIT			4	2
20	SENSOR_TYPE			4	2
21	SENSOR_RANGE				11
22	SENSOR_SN				4
23	SENSOR_CAL_METHOD				1
24	SENSOR_CAL_LOC				
25	SENSOR_CAL_DATE				
26	SENSOR_CAL_WHO				
27	SENSOR_ISOLATION_MTL				2
28	SENSOR_FLUID				2
29	SECONDARY_VALUE	5			
30	SECONDARY_VALUE_UNIT		2		
31	PRESS_LIN_NORMAL				
32	PRESS_NORMAL				
33	PRESS_CUTOFF				
34	CUTOFF_FLAG				
35	DIGITAL_TEMPERATURE				
36	DIFF				
37	YDIFF				
38	CAPACITANCE_LOW				
39	CAPACITANCE_HIGH				
40	BACKUP_RESTORE				1
41	SENSOR_RANGE_CODE				2
42	COEFF_POL0				4
43	COEFF_POL1				4
44	COEFF_POL2				4
45	COEFF_POL3				4
46	COEFF_POL4				4
47	COEFF_POL5				4
48	COEFF_POL6				4
49	COEFF_POL7				4
50	COEFF_POL8				4
51	COEFF_POL9				4
52	COEFF_POL10				4
53	COEFF_POL11				4
54	POLYNOMIAL_VERSION				1
55	CHARACTERIZATION_TYPE		1		
56	CURVE _BYPASS_LD		2	52	
57	CURVE_LENGTH		1		
58	CURVE_X		20		
59	CURVE_Y		20		
60	CAL_POINT_HI_BACKUP		4		
61	CAL_POINT_LO_ BACKUP		4		
62	CAL_POINT_HI_FACTORY				
63	CAL_POINT_LO_FACTORY				
64	CAL_TEMPERATURE				

Relative Index	Parameter Mnemonic	View_1	View_2	View_3	View_4
65	DATASHEET				
66	ORDERING_CODE				
67	MAXIMUM_MEASURED_PRESSURE				
68	MAXIMUM_MEASURED_TEMPERATURE				
69	ACTUAL_OFFSET				
70	ACTUAL_SPAN				
71	MAXIMUM_OFFSET_DEVIATION				
72	MAXIMUM_GAIN_DEVIATION				
73	OVERPRESSURE_LIMIT				
74	MAXIMUM_NUMBER_OF_OVERPRESSURE				
75	GRAVITY				
76	HEIGHT				
77	MEASURED_TYPE				
78	LIN_DILATATION_COEF				
79	PRESSURE_COEFFICIENT				
80	ZERO_ADJUST_TEMP				
81	HEIGHT_MEAS_TEMP				
82	TEMP_ZERO				
83	TEMP_GAIN				
84	AUTO_CAL_POINT_LO				
85	AUTO_CAL_POINT_HI				
86	SOLID_POL_COEFF_0				
87	SOLID_POL_COEFF_1				
88	SOLID_POL_COEFF_2				
89	SOLID_POL_COEFF_3				
90	SOLID_POL_COEFF_4				
91	SOLID_POL_COEFF_5				
92	SOLID_LIMIT_LO				
93	SOLID_LIMIT_HI				
94	PRESS_COMP				
95	SIMULATE_PRESS_ENABLE				
96	SIMULATE_PRESS_VALUE				
97	SIMULATE_DENSITY_VALUE				
98	CALCULATED_PRESS_VALUE				
99	CALC_PRESS_CAL_POINT_LO				
100	CALC_PRESS_CAL_POINT_HI				
101	DT_RANGE_CODE				
102	DENSITY_KGM3				
103	DENSITY_STATUS				
104	CONC				
105	HI_LIM_DENS				
106	LO_LIM_DENS				
107	HI_LIM_TEMP				
108	LO_LIM_TEMP				
109	K_DENS				
110	K_TEMP				
111	MOUNTING_POSITION				
	TOTAL	**21 bytes**	**68 bytes**	**52 bytes**	**99 bytes**

Table 3.3 Concentration/Density Transducer Block View Object

How to Configure the Transducer Block

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 manufacturers' 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 Syscon (System Configurator) configuration software from Smar, for example, can configure many parameters of the blocks.

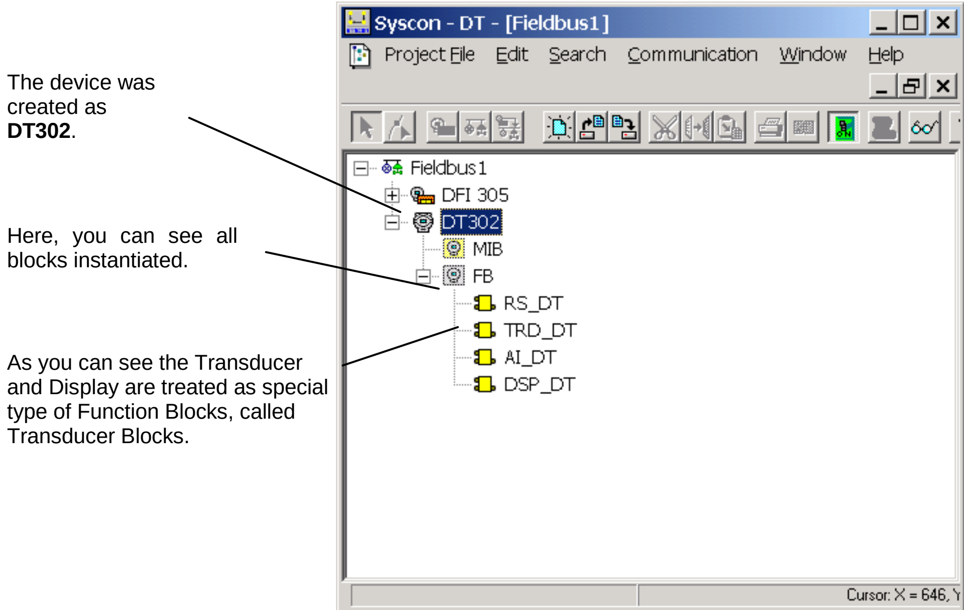


Figure 3.2 - Function and Transducers Blocks

To make the configuration of Transducer Block, we need to select this block and right click with the mouse to choose 'On Line Configuration'.

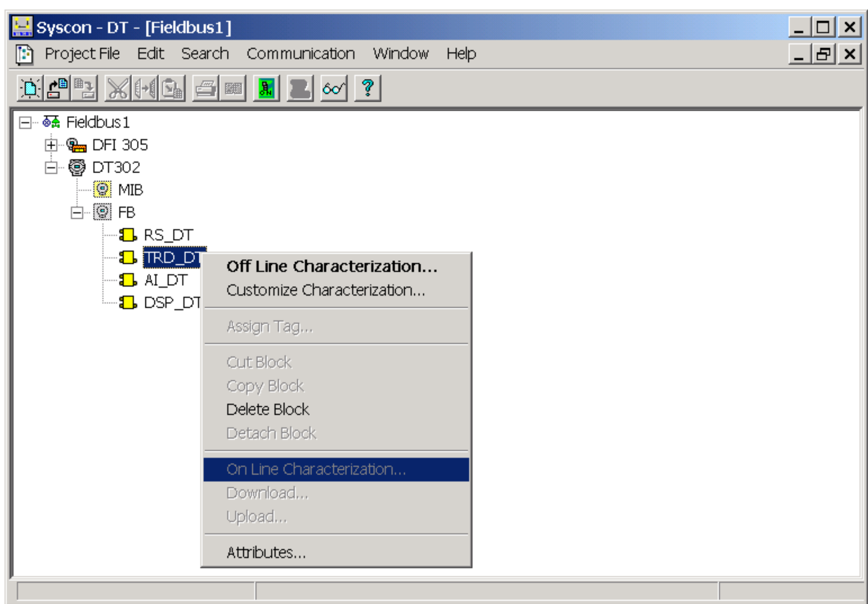


Figure 3.3 - Online Configuration – Transducer

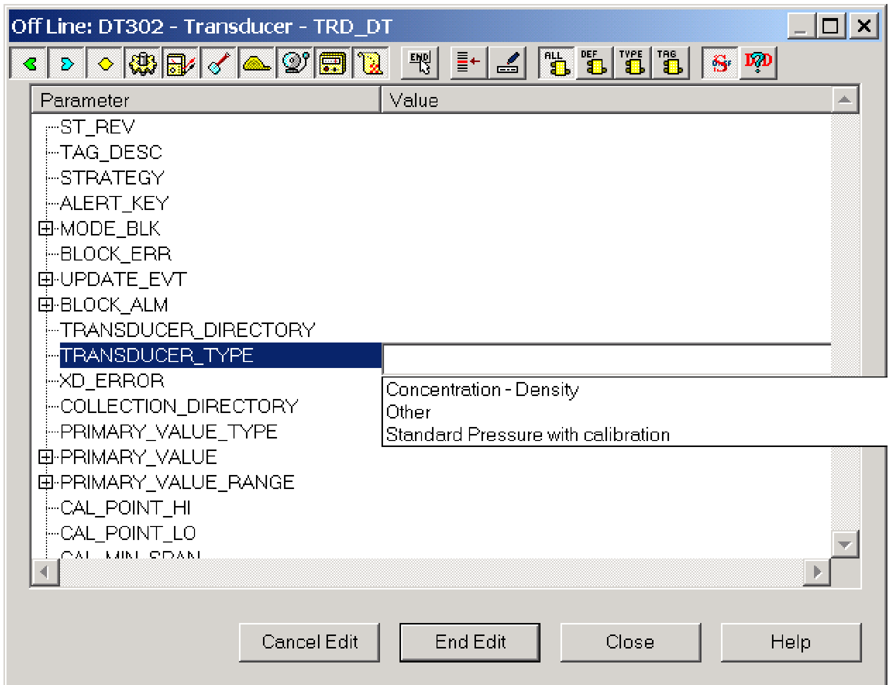


Figure 3.4 - Transducer Type Configuration

Using this window, the user can set the transducer type according to the application, selecting "Density".

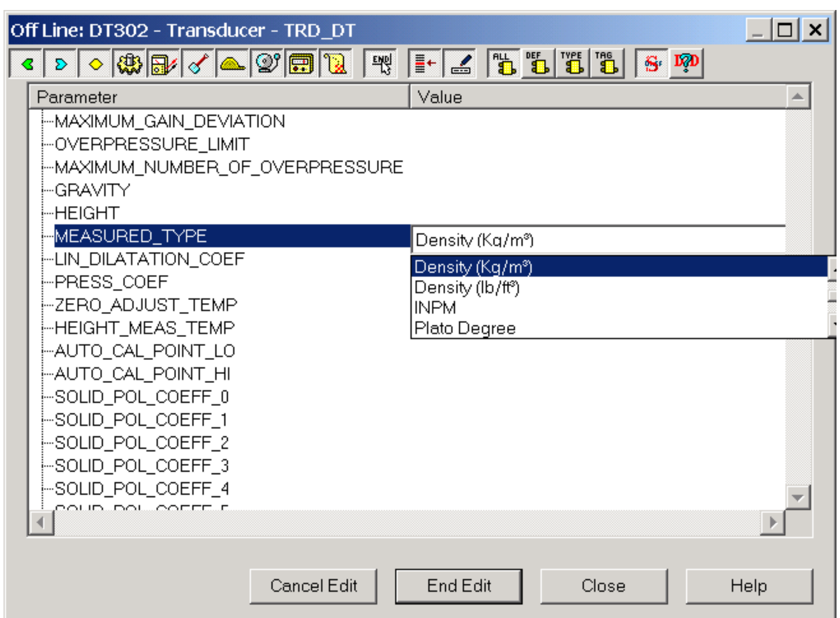


Figure 3.5 - Measured Type Configuration

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), Baumé, Brix, Plato Degree, INPM, Relative Density Alcohol 0 - 100, Solid Percent, Density (lb/ft³) and API.

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
- Generic Concentration
- Baume
- Brix
- Plato Degree
- INPM
- GL
- Solid Percent
- Density (lb/ft³)
- API.

Solid Percent (% sol)

The concentration/ density transmitter **DT302** offers resources with the objective of relating Baume degree to solid percent.

The general equation to determine the solid percent is:

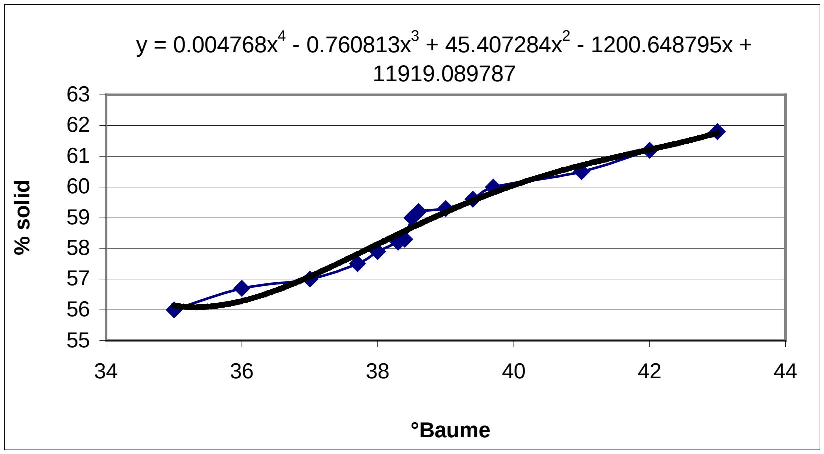
%sol = a0 + a1 bme1 + a2 bme2 + a3 bme3 + a4bme4 + a5 bme5

The table and the graph below indicate the application of the **DT302** polynomial that relates Baume degree to solid percent, generating the polynomial:

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

	X	Y
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

POLYNOMIAL REGRESSION



Generic 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.

WARNING
The XD_SCALE from transducer block should follow the measured type unit and its range; otherwise an error is going to appear in the XD_ERROR.

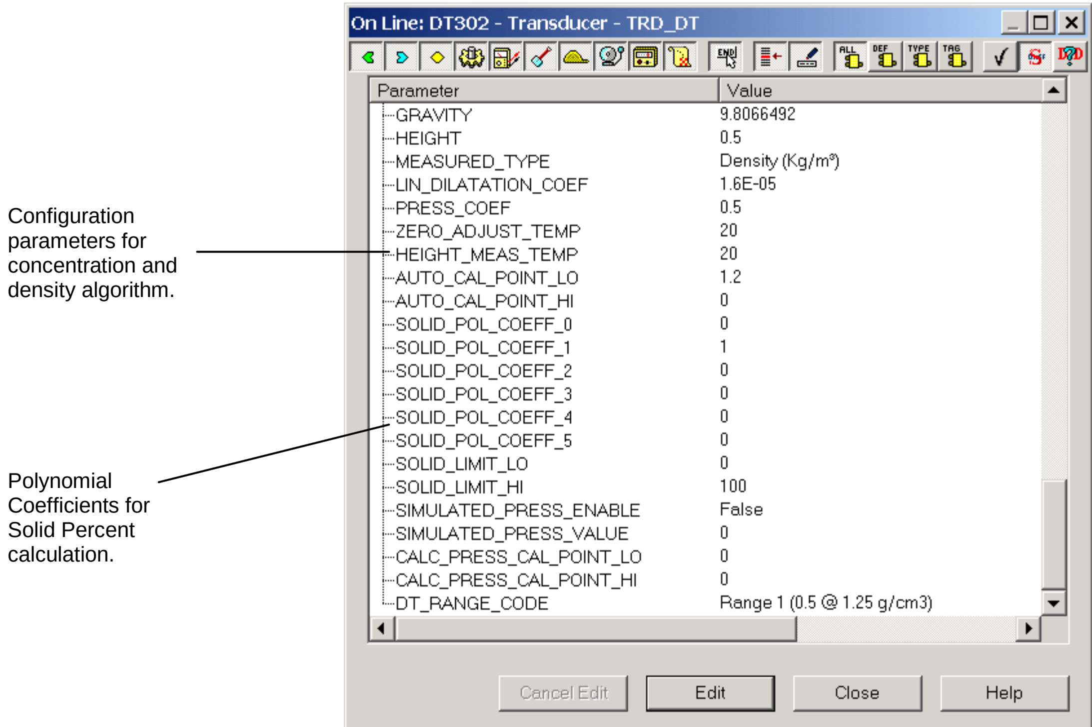


Figure 3.6 – Density Parameters

AI XD_SCALE.unit for Concentration/Density							
Measured Type	Range 1		Range 2		Range 3		**AI Unit**
	Lower	Upper	Lower	Upper	Lower	Upper	
Density (g/cm³)	0.445	1.98	0.9	2.75	2.25	5.5	g/cm³
Density (Kg/m³)	445.0	1980.0	900.0	2750.0	2250.0	5500.0	Kg/m³
Density (lb/ft³)	27.9	124.3	55.8	171.6	140.4	343.2	lb/ft³
Relative Density @ 20°C (g/cm³)	0.445	1.98	0.9	2.75	2.25	5.5	Kg/m³
Relative Density @ 4°C (g/cm³)	0.445	1.98	0.9	2.75	2.25	5.5	Kg/m³
Baume	-5.2	57.2	-	-	-	-	degBaum
Brix	-10.0	110.0	-	-	-	-	degBrix
Plato Degree	-10.0	110.0	-	-	-	-	%Plato
INPM	-10.0	110.0	-	-	-	-	INPM
Relative Density Alcohol 0 100	-10.0	110.0	-	-	-	-	Alcohol 0 100
Solid Percent	-10.0	55.0	-	-	-	-	%Soli/wt

How to Configure the Analog Input Block

The Analog Input block takes the input data from the Transducer block, selected by channel number, and makes it available to other function blocks at its output. When the Measured Type is changed in the transducer block, the unit and the range of XD_SCALE must be 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 in offline mode, please, go to the main menu and select "Device Offline Configuration - Analog Input Block. 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.

XD Scale value and unit should be according to Measured Type process.

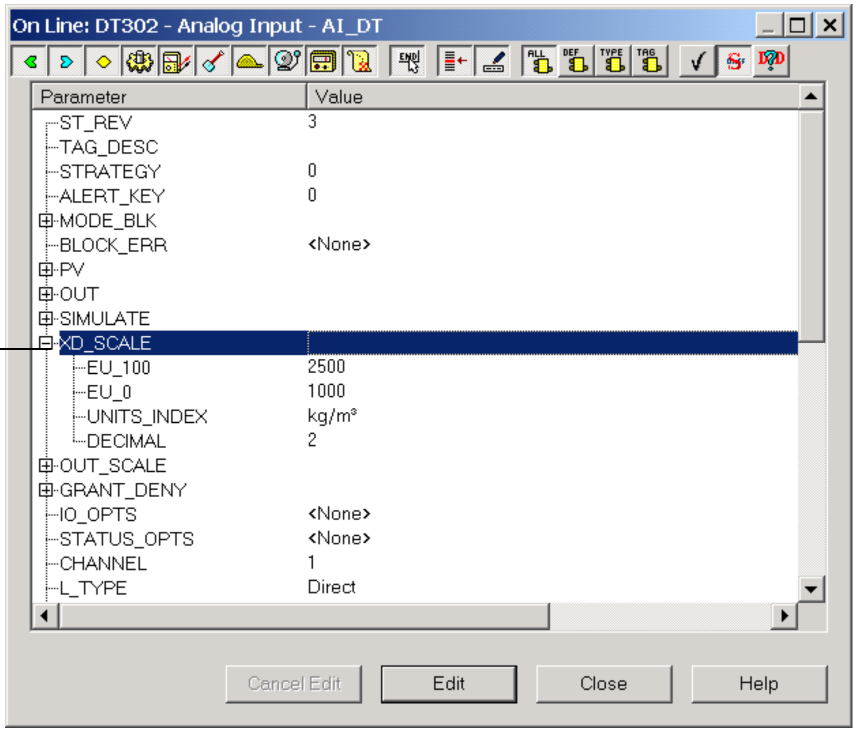


Figure 3.7 – AI Block – XD_SCALE Configuration

Lower and Upper Concentration/ Density Calibration

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 **DT302** is measuring concentration/density. Open the Transducer Block and see the Transducer Type parameter. Please, see the following figure:

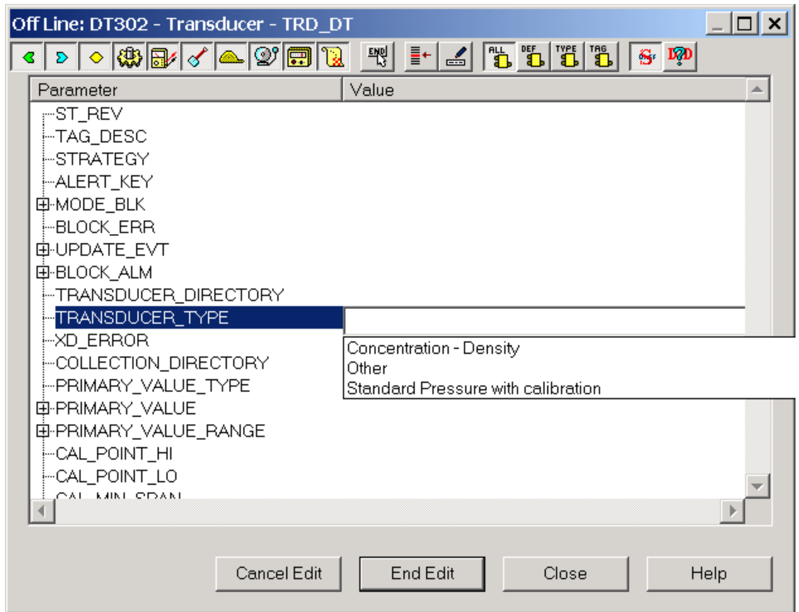


Figure 3.8 – Transducer Block – Transducer Type Selection

If is required an adjustment of unit, please just select the desired unit using the measured type parameter according to the application. 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 **Syscon** (or any configuration tool), 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:

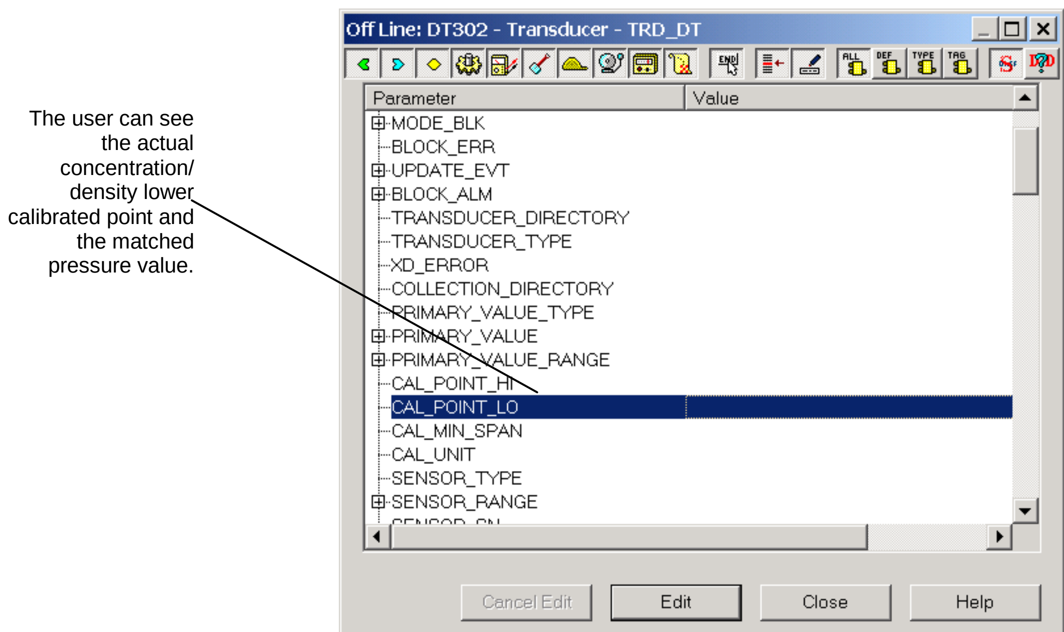


Figure 3.9 – Concentration / Density Calibration

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

With the self-calibration is possible to make a device precise calibration. In this procedure the air density is used as reference (in Kg/m^3) and water concentration (in BRIX). These references are used because it is easy to have it on the field.

Lower Calibration (Air Self-Calibration)
Place the **DT302** in work position (vertical) and facing the air, wait approximately **5** minutes for stabilization. To execute the lower calibration, write a value to AUTO_CAL_POINT_LO. Any value written will calibrate internally the transmitter in 1.2 Kg/m^3. Notice that the MEASURED_TYPE parameter should be configured to Density (Kg/m^3).

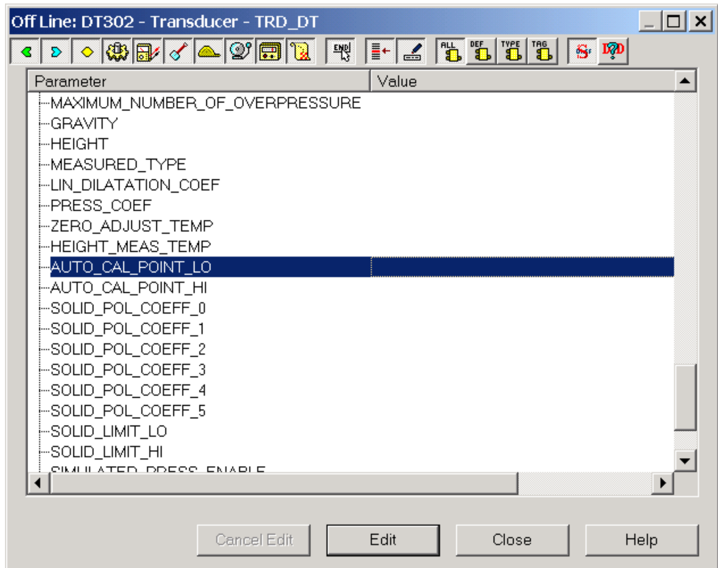


Figure 3.10 – Lower Concentration / Density Self-Calibration

Upper Calibration (Water Self-Calibration)
After air calibration, place the **DT302** in work position (vertical) and in water, immersing both diaphragms, wait approximately **5** minutes for stabilization and then writes a value to AUTO_CAL_POINT_HI. Any value written will calibrate internally the transmitter in 0.0 BRIX. Notice that the MEASURED_TYPE parameter should be configured to BRIX.

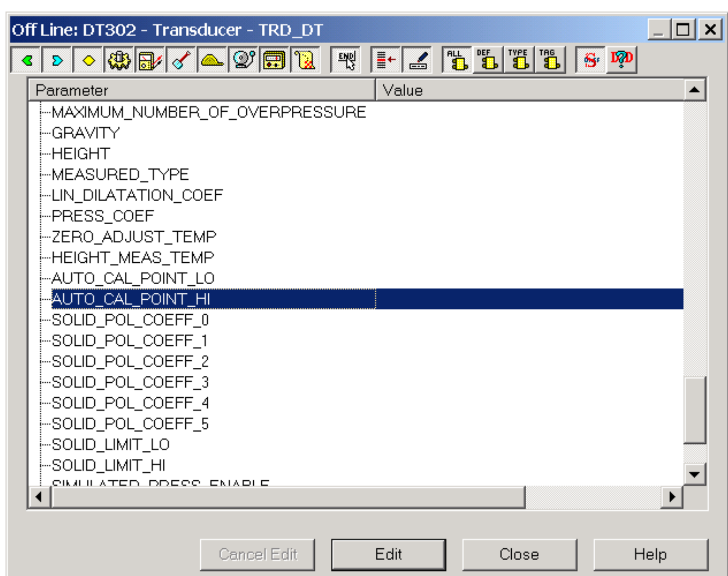


Figure 3.11 – Upper Concentration / Density Self-Calibration

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 via local adjustment, firstly is necessary to configure the TRDTY, LOWER and UPPER in the Display Function Block. For details, please see the section 'Display Transducer Block'.

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

Parameter (Name)	Parameter (Relative Index)	Item (Element)	Mnemonic
TRANSDUCER_TYPE	10	-	TRDTY
CAL_POINT_LO	17	-	LO
CAL_POINT_HI	16	-	HI

The adjustment is done following these 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 TRDTY parameter to select the Transducer 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/cm³)	0.445	1.98	0.9	2.75	2.25	5.5
Density (Kg/m³)	445.0	1980.0	900.0	2750.0	2250.0	5500.0
Density (lb/ft³)	27.9	124.3	55.8	171.6	140.4	343.2
Relative Density @ 20°C (g/cm³)	0.445	1.98	0.9	2.75	2.25	5.5
Relative Density @ 4°C (g/cm³)	0.445	1.98	0.9	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	-	-	-	-

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

Limit Conditions for Pressure 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, the operation will be well succeeded.

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 Display Function Block. For details, please see the section 'Display Transducer Block'.

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

Parameter (Name)	Parameter(Relative Index)	Item(Element)	Mnemonic
TRANSDUCER_TYPE	10	--	TRDTY
MEASURED_TYPE	77	--	MEAST
AUTO_CAL_POINT_LO	84	--	LO
AUTO_CAL_POINT_HI	85	--	HI

To execute the Lower calibration, firstly the user should apply air to the sensors and then 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 execute the Upper calibration, firstly the user should insert the sensors in water and then 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 (500.0 mmH_2O).

Temperature Calibration

Write in parameter CAL_TEMPERATURE any value in the range -10°C to +120°C. After that, check the calibration performance using parameter SECONDARY_VALUE.

By adjusting this parameter to the current temperature, the device's temperature indication is adjusted.

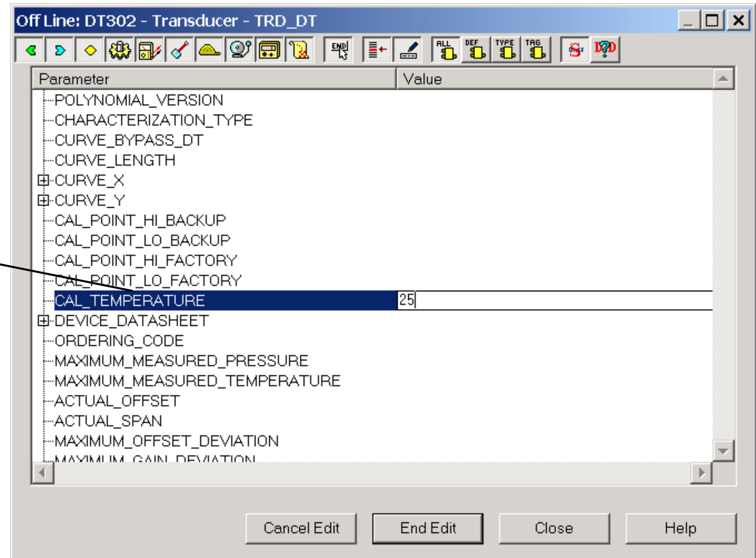


Figure 3.12 – Temperature Calibration Configuration Screen

Sensor Data Reading

Always when **DT302** 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.

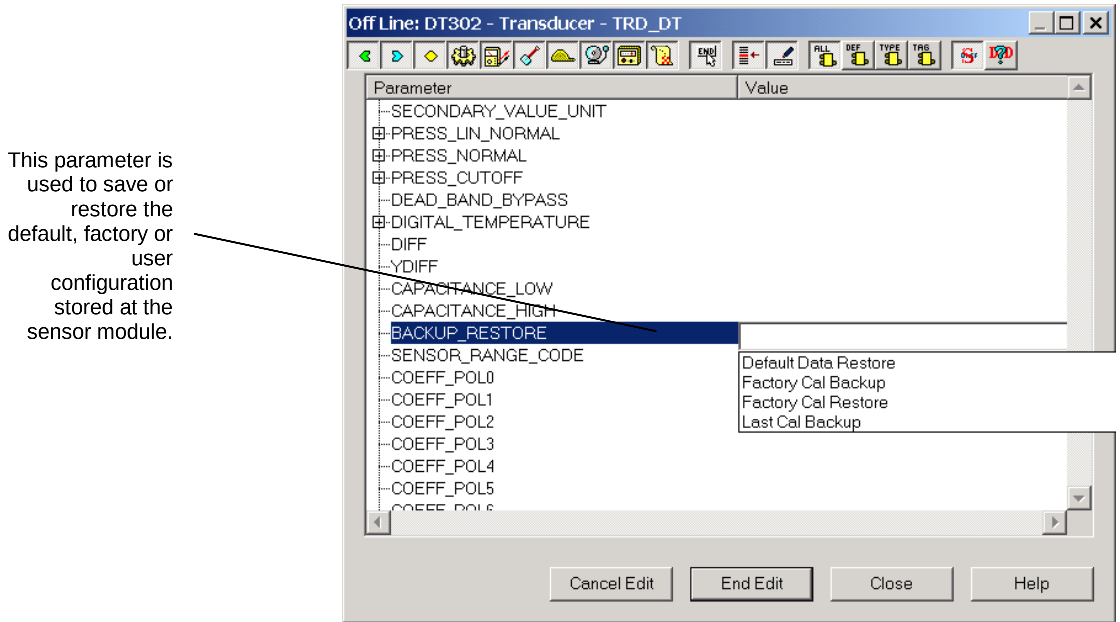


Figure 3.13 – Backup Restore Option

Transducer Display – Configuration

Using the Syscon or any other configuration tool 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 seven 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 first two parameters will be toggle in the display.

Display Transducer Block

The local adjustment is completely configured by SYSCON or any configuration tool. 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 SYSCON, 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 very detailed on the "General Installation, Operation and Maintenance Procedures Manual". Please take a detailed look at this manual in the chapter related to "Programming Using Local Adjustment". It is significantly the resources on this transducer display, also all the Series 302 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 functions 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 302 have been defined rigorously according the Foundation Fieldbus specifications in order to be interoperable to other parties.

In order to work with the local adjustment using the magnetic tool, it is necessary to previously prepare the parameters related with this operation via SYSCON (System Configuration).

There are seven 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 write an invalid Tag in the parameter Block_Tag_Param_X. Doing this, the device will not take the parameters related (indexed) to its Block as a valid parameter.

Definition of Parameters and Values

Block_Tag_Param
This is tag of the block to which the parameter belongs. Use up to a maximum of 32 characters.

Index_Relative
This is the index related to the parameter to be actuated or viewed (0, 1, 2…). Refer to the Function Blocks Manual to know the desired indexes, or visualize them on the **SYSCON** opening the desired block.

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

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.

Inc_Dec
It is the increment and decrement in decimal units when the parameter is Float or Float Status type, or integer, when the parameter is an integer type.

Decimal_Point_Numb
This is the number of digits after the decimal point (0 to 3 decimal digits).

Access
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.

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

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 zero, and for the sub-index equal to one (refer to paragraph Structure Block in the Function Blocks Manual).

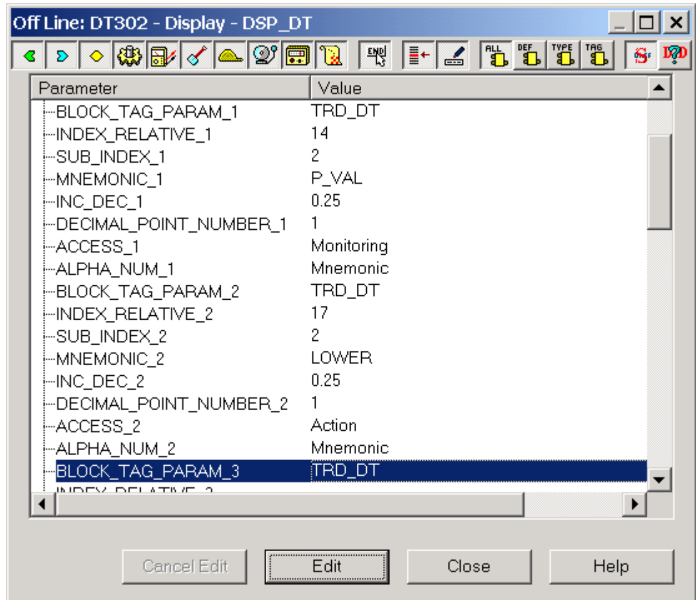


Figure 3.14 – Parameters for Local Adjustment Configuration

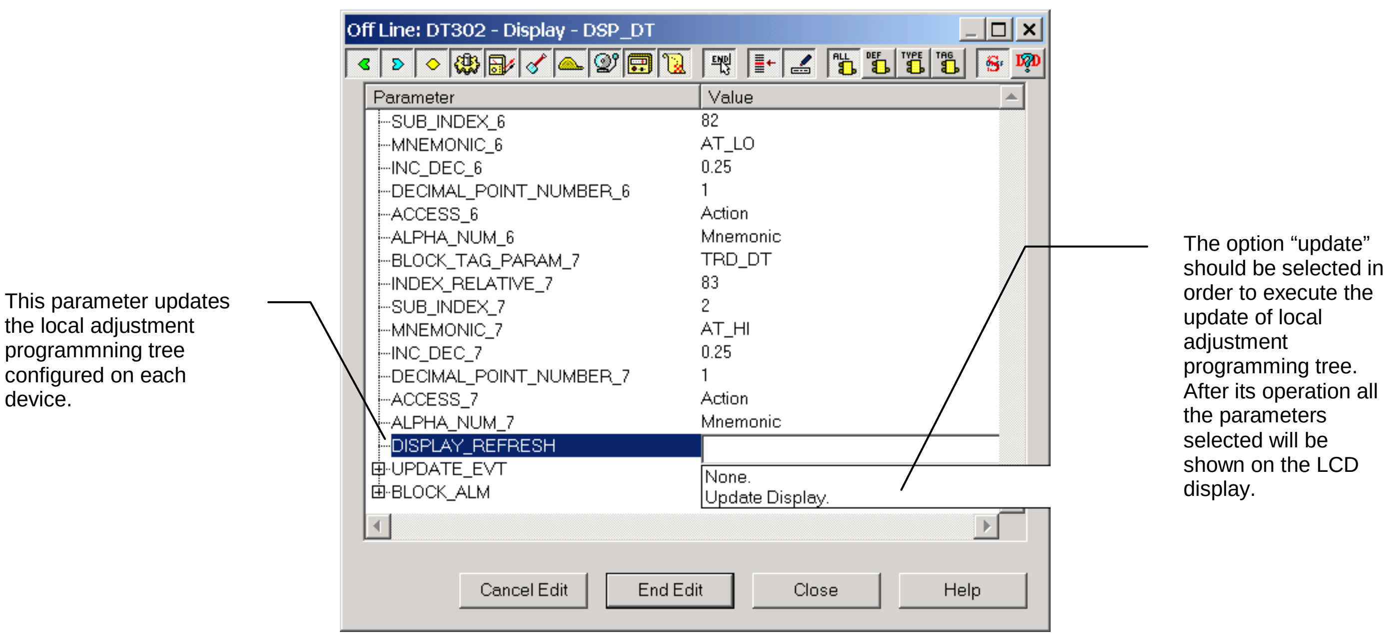


Figure 3.15 – Parameters for Local Adjustment Configuration

Calibrating Using Local Adjustment

In order to follow the example bellow the Display Transducer block should be configured to show these parameters: CAL_POINT_HI (mnemonic UPPER), CAL_POINT_LO (mnemonic LOWER) and TAG (mnemonic TAG).

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 transmitter must be fitted with the digital display for access to the local adjustment. Without the display the local adjustment is not possible.

In order to enter the local adjustment mode, place the magnetic tool in orifice “Z” until flag “MD” lights up in the display. Removes magnetic tool from “Z” and place it in 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 the user removes the magnetic tool from “S”. By placing the magnetic tool in “Z” the user will be able to access the local adjustment/monitoring tree.

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

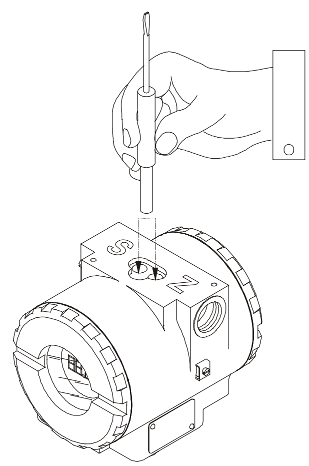


Figure 3.16 - Local Adjustment

Table 3.4 shows the actions on the **Z** and **S** holes on the **DT302** when Local Adjustment is enabled.

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

Table 3.4 - Purpose of the holes on the Housing

J1 Jumper Connections

If J1 (see figure 3.21) is connected to ON, then simulation mode in the AI block is enabled.

W1 Jumper Connections

If W1 (see figure 3.21) 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.

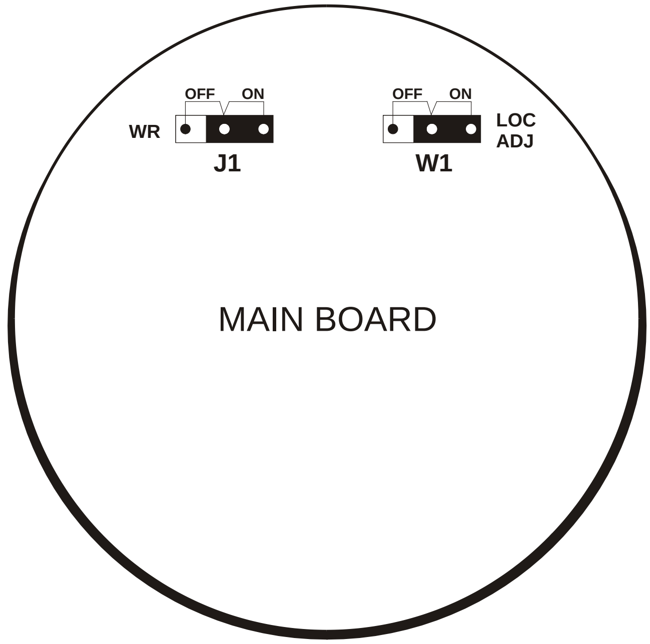


Figure 3.17 - J1 and W1 Jumpers

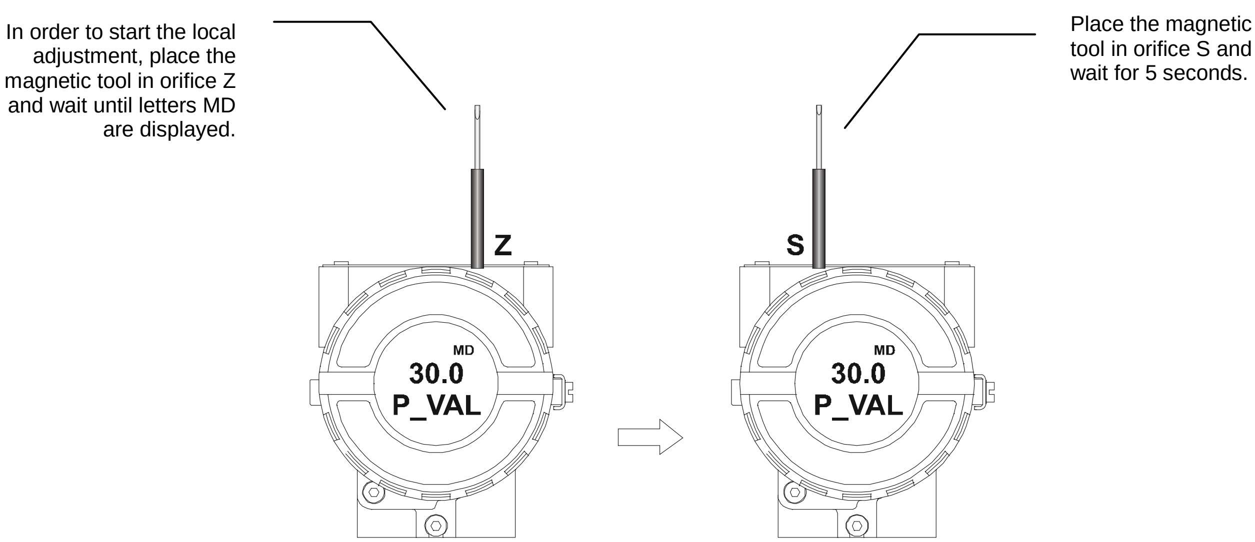


Figure 3.18 - Step 1 - DT302

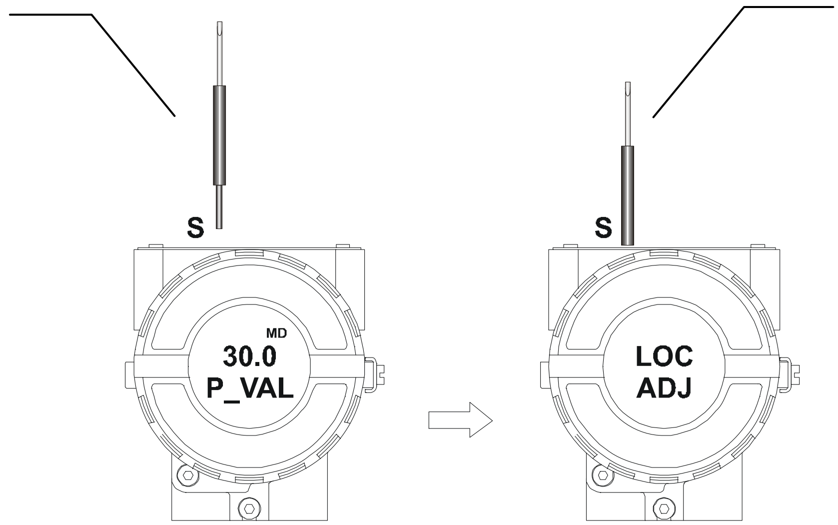


Figure 3.19 - Step 2 - DT302

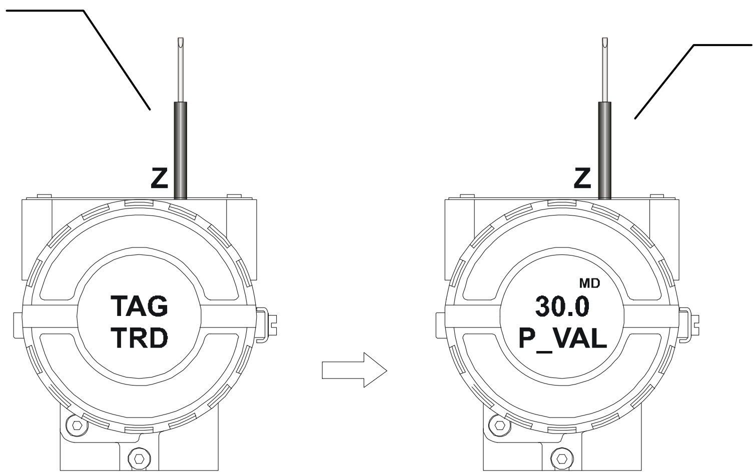


Figure 3.20 - Step 3 - DT302

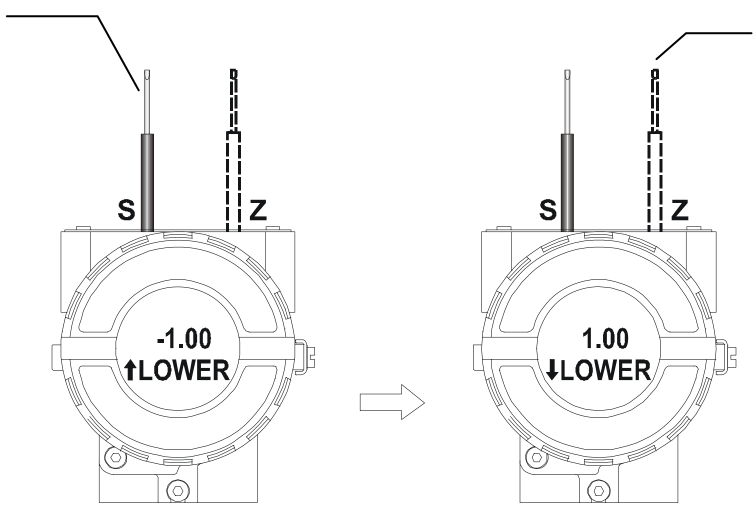
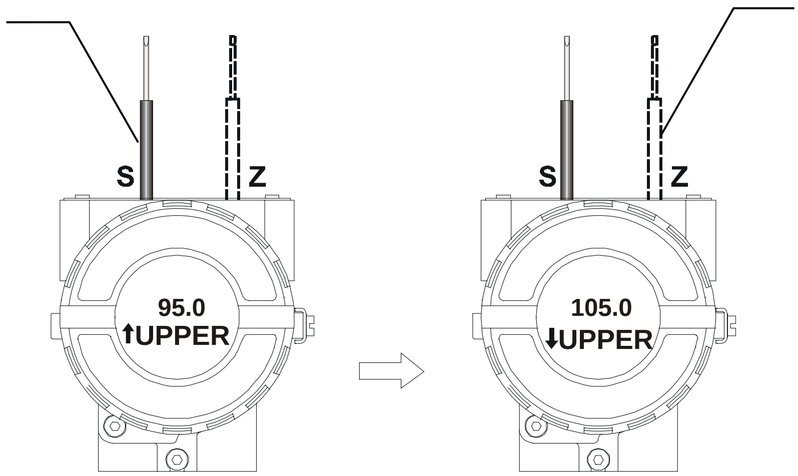


Figure 3.21 - Step 4 - DT302

In order to calibrate the upper value (UPPER), insert the magnetic tool in orifice S as soon as upper is shown in 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 inserted in S until the desired value is set.



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

Figure 3.22 - Step 5 - DT302

Section 4

MAINTENANCE PROCEDURES

General

DT302 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.

The **DT302** 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. The table 4.1 shows the symptoms and the probable source of problem cause:

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 **DT302** 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 Terminators are according to the specifications. Check length of trunk and spurs. Check spacing between couplers.
	• ***Network Configuration*** Check the network communication configuration.
	• ***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 **DT302** 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 **DT302** has been configured to. Check if process is within the range of the sensor and the **DT302**.

Table 4.1 - Symptoms and Probable Source of Problem

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

NOTE
The Factory Init should be tried as a last option to recover the equipment control when the equipment presents some problem related to the function blocks or the communication. **This operation must only be carried out by authorized technical personnel and with the process offline, since the equipment will be configured with standard and factory data.** This procedure resets all the configurations run on the equipment, after which a partial download should be performed. Two magnetic tools should be used to this effect. On the equipment, withdraw the nut that fixes the identification tag on the top of the housing, so that access is gained to the "**S**" and "**Z**" holes. The operations to follow are: 1) Switch off the equipment, insert the magnetic tools and keep them in the holes (the magnetic end in the holes); 2) Feed the equipment; 3) As soon as Factory Init is shown on the display, take off the tools and wait for the "**S**" symbol on the right upper corner of the display to unlit, thus indicating the end of the operation. This procedure makes effective the entire factory configuration and will eliminate eventual problems with the function blocks or with the equipment communication.

Procedure to change the DT302 Main Board

- Replace the GLL852 main board - 1.0X to 2.0X. version
- Read from sensor (Backup menu).
- 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.

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. 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 that is recommended to 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.

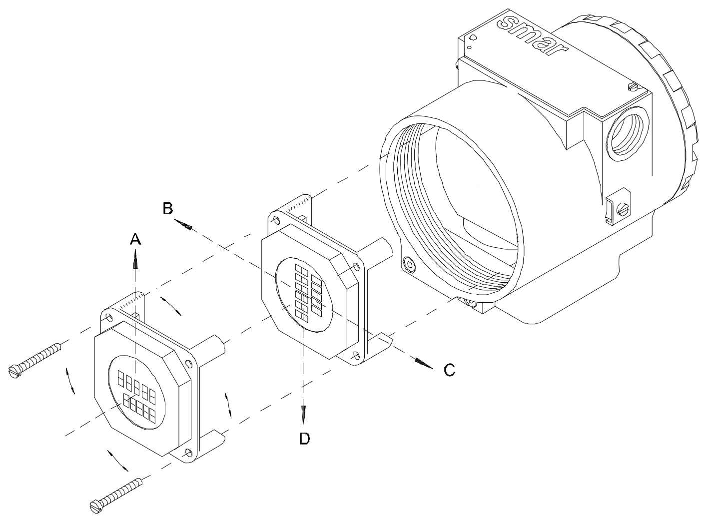


Figure 4.2 - Four Possible Positions for Display

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 DT302

The sensor and casing of the DT301 is exactly the same as the **DT302**. By changing the circuit board of the DT301 it becomes a **DT302**.

Upgrading the DT301 to a **DT302** is therefore very much 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 **DT302** 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

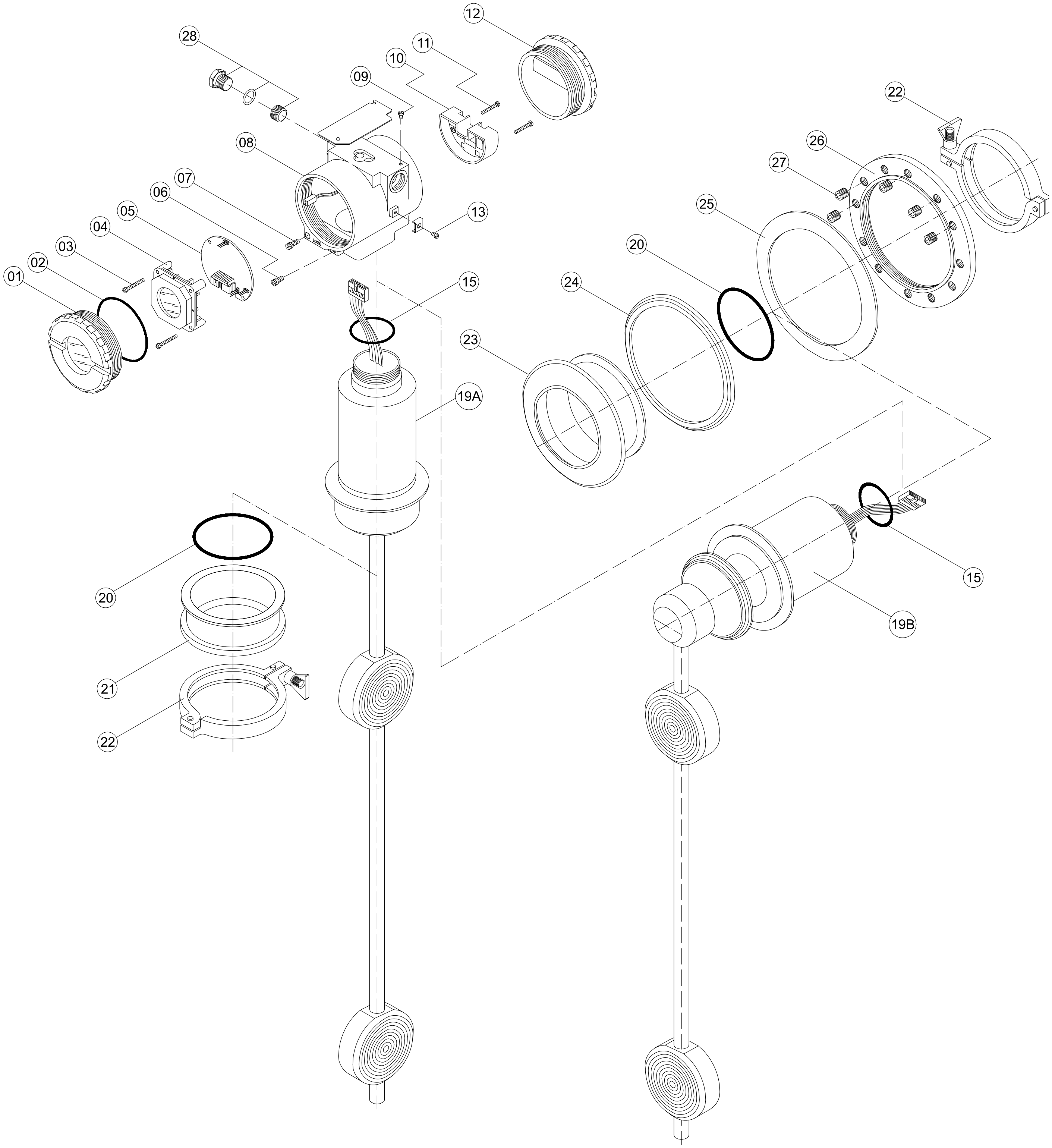


Figure 4.3 - DT302 Exploded View - Sanitary Model

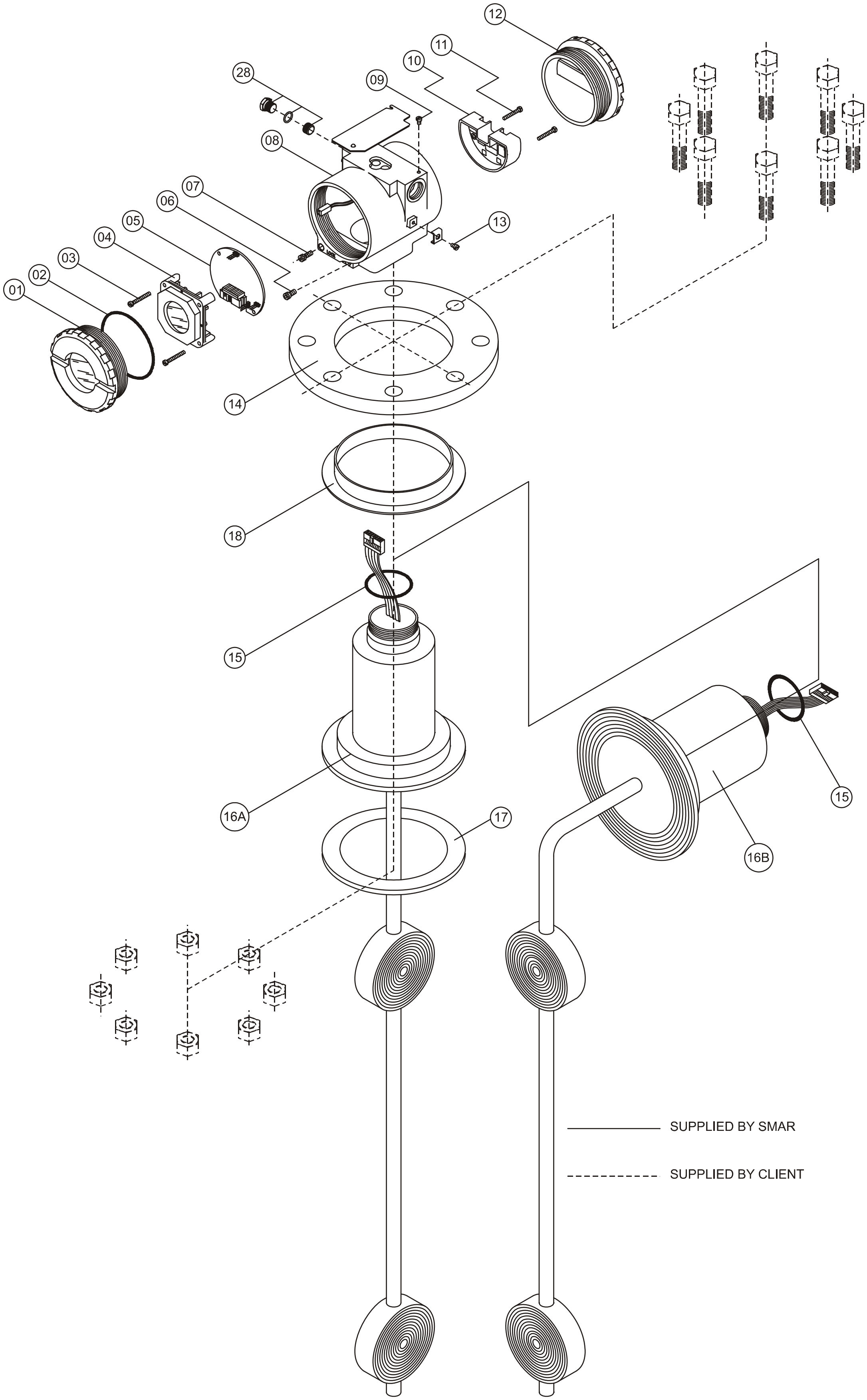


Figure 4.4 - DT302 Exploded View - Industrial Model

SPARE PARTS LIST			
DESCRIPTION OF PARTS	**POSITION**	**CODE**	**CATEGORY (NOTE 1)**
HOUSING, Aluminum (NOTE 2)			
½ - 14 NPT	8	400-0252	
M20 x 1.5	8	400-0253	
PG 13.5 DIN	8	400-0254	
HOUSING, 316 SS (NOTE 2)			
½ - 14 NPT	8	400-0255	
M20 x 1.5	8	400-0256	
PG 13.5 DIN	8	400-0257	
COVER (INCLUDES O-RING)			
Aluminum	1 and 12	204-0102	
316 SS	1 and 12	204-0105	
COVER WITH WINDOW FOR INDICATION (INCLUDES O-RING)			
Aluminum	1	204-0103	
316 SS	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 (NOTE 3)	5	400-0245	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	28	400-0808	
1/2" NPT Internal Socket set Plug in 304 SST BR-EX D	28	400-0809	
M20 X 1.5 External Socket set Plug in 316 SST BR-EX D	28	400-0810	
PG13.5 External Socket set Plug in 316 SST BR-EX D	28	400-0811	
3/4 NPT Adapter in 316 SST BR-EX D	28	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 **DT302** 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.

Table 5.1 presents the filling fluids, which are available for the **DT302**, together with physical properties and applications.

FILLING FLUID	VISCOSITY (cSt) at 25ºC	DENSITY (g/cm³ at 25ºC)	THERMAL EXPANSION COEFICIENT (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)
Sytherm 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
Digital, only. Foundation™ Fieldbus, 31.25 kbit/s, voltage mode with bus power.

Power Supply
Bus powered: 9 - 32 Vdc.
Quiescent current consumption: 12 mA.

Indicator
4 ½ -digit numerical and 5-character alphanumerical LCD indicator.

Hazardous Area Certifications
Explosion, weather and intrinsically safe proof. Certified by CEPEL, FM, Dekra/EXAM 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)

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

Turn-on Time
Approximately 5 seconds.

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

Humidity Limits
0 to 100% RH.

Temperature Compensation
Automatic with PT100.

Performance Specifications

Reference conditions: temperature 25°C (77°F), power supply of 24 Vdc, normal atmospheric pressure, silicone oil fill and range full - scale calibration.

RANGE	ACCURACY (1)	AMBIENT TEMPERATURE EFFECT / 10°C	STABILITY (For 3 Months)	STATIC PRESSURE EFFECT (2) (per 1 kgf/cm^2)
1	±0.0004 g/cm^3 (±0.1 °Brix)	0.003 kg/m^3	0.021 kg/m^3	0.001 kg/m^3
2	±0.0007 g/cm^3	0.013 kg/m^3	0.083 kg/m^3	0.004 kg/m^3
3	±0.0016 g/cm^3	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 FS per volt.

Electro-Magnetic 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 or Hastelloy C276.
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 Ib) - Industrial model: 14 kg (31 Ib).

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)**
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

DT302S	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	With 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

CODE	Optional Item (*)
ZZ	Special Options

DT302S	/	I6	H0	J0	P0	*

TYPICAL MODEL NUMBER

* Leave it blank for no optional items.

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 and EXAM).
(5) Certified for use in Explosive Atmosphere (CEPEL and FM).
(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	**Note**: For the concentration units: °Brix, °Plato, °INPM, °GL and °Baumé, specify code1.
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

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)**
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 Size, Rating and Standard
5	**1**	4” 150# ANSI B – 16.5
5	**2**	4” 300# ANSI B – 16.5
5	**3**	4” 600# ANSI B – 16.5
A	**C**	DN 100 PN25/40 DIN 2526 – FORM D
Z	**Z**	Others – Specify

CODE	Continues next page

DT302I	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	Sem Certificacao
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

DT302I	/	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 and EXAM).
(5) Certified for use in Explosive Atmosphere (CEPEL and FM).
(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.

Other Approvals

Device Registration ITK:

Fieldbus Foundation

Model: DT302
Device Type: Density Transmitter
ITK Ver: 4.6
ITK Campaign No.: IT031100
Registration Date: 3/2/2005
DD Revision: 0x01
CFF Revision: 070101.CFF

The above device has successfully completed rigorous testing by the Fieldbus Foundation and has received registration and the right to use the FF checkmark logo as specified by MT-045.

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

South American Certifications

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

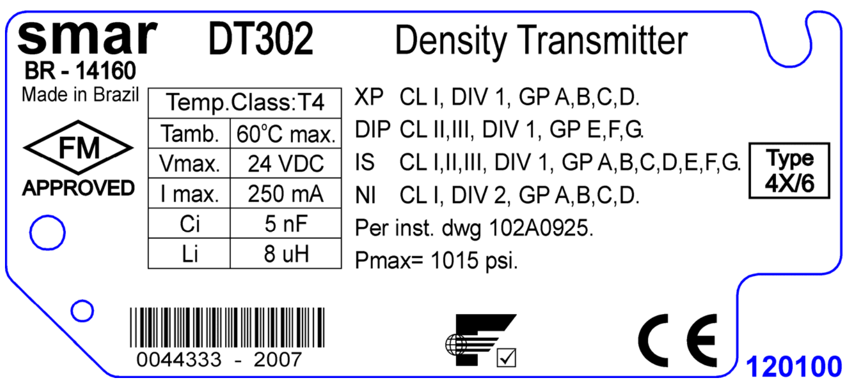
Special conditions for safe use:
The certificate number ends with the letter "X" to indicate that for the version of Density Transmitter model DT302 equipped with housing made of aluminum alloy, only can be installed in "Zone 0" if is excluded the risk of occurs impact or friction between the housing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

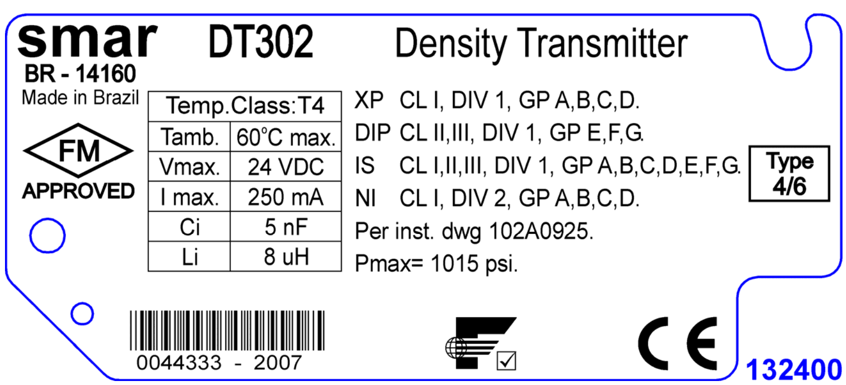
The Essential Health and Safety Requirements are assured by compliance with:
ABNT NBR IEC 60079-0:2008 General Requirements
ABNT NBR IEC 60079-1:2009 Flameproof Enclosures "d"
ABNT NBR IEC 60079-11:2009 Intrinsic Safety "i"
ABNT NBR IEC 60079-26:2008 Equipment with equipment protection level (EPL) Ga
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

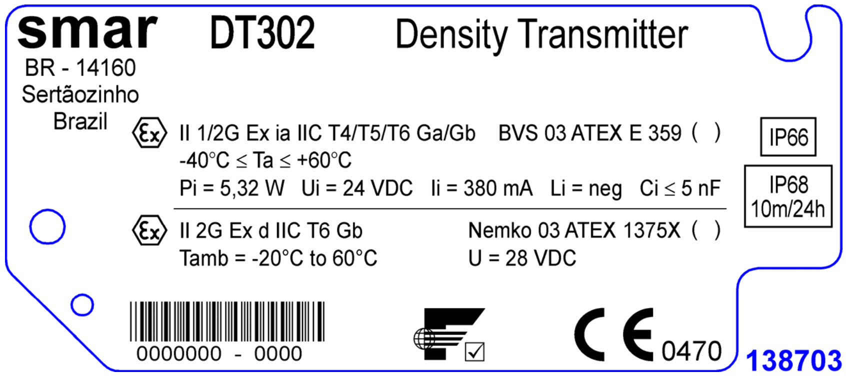
Identification Plate

FM





EXAM and NEMKO



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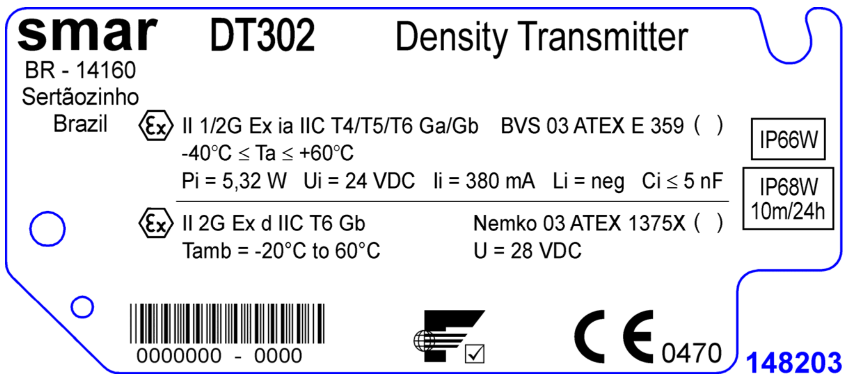

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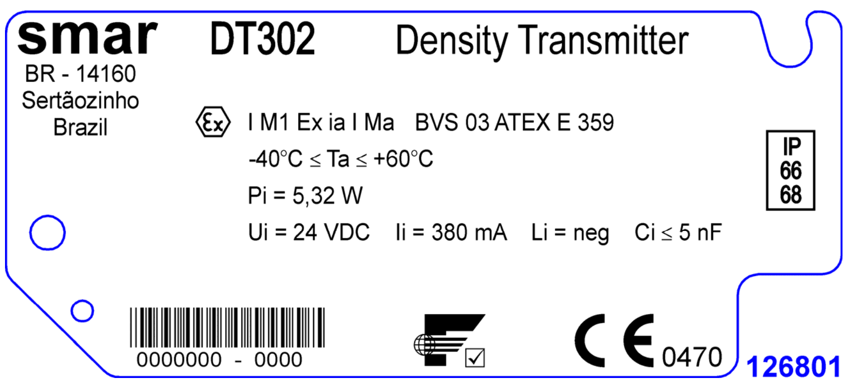

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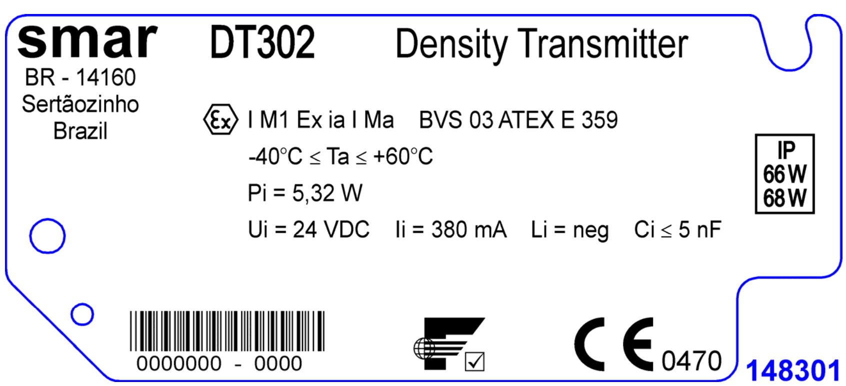

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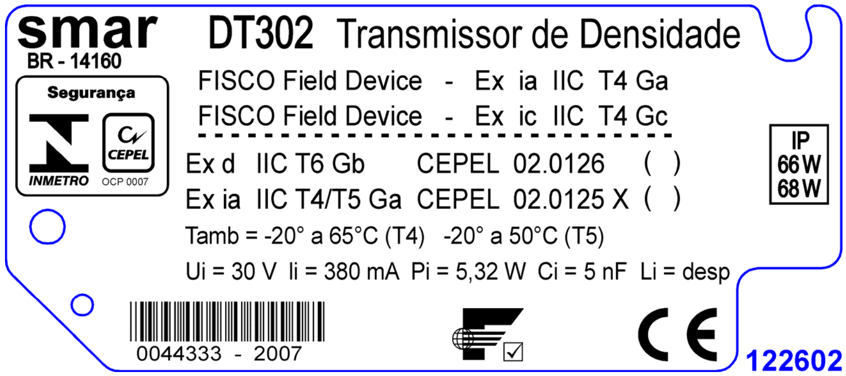

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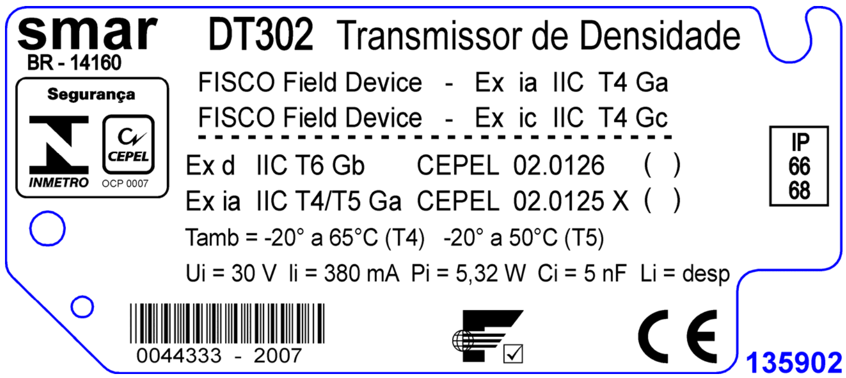
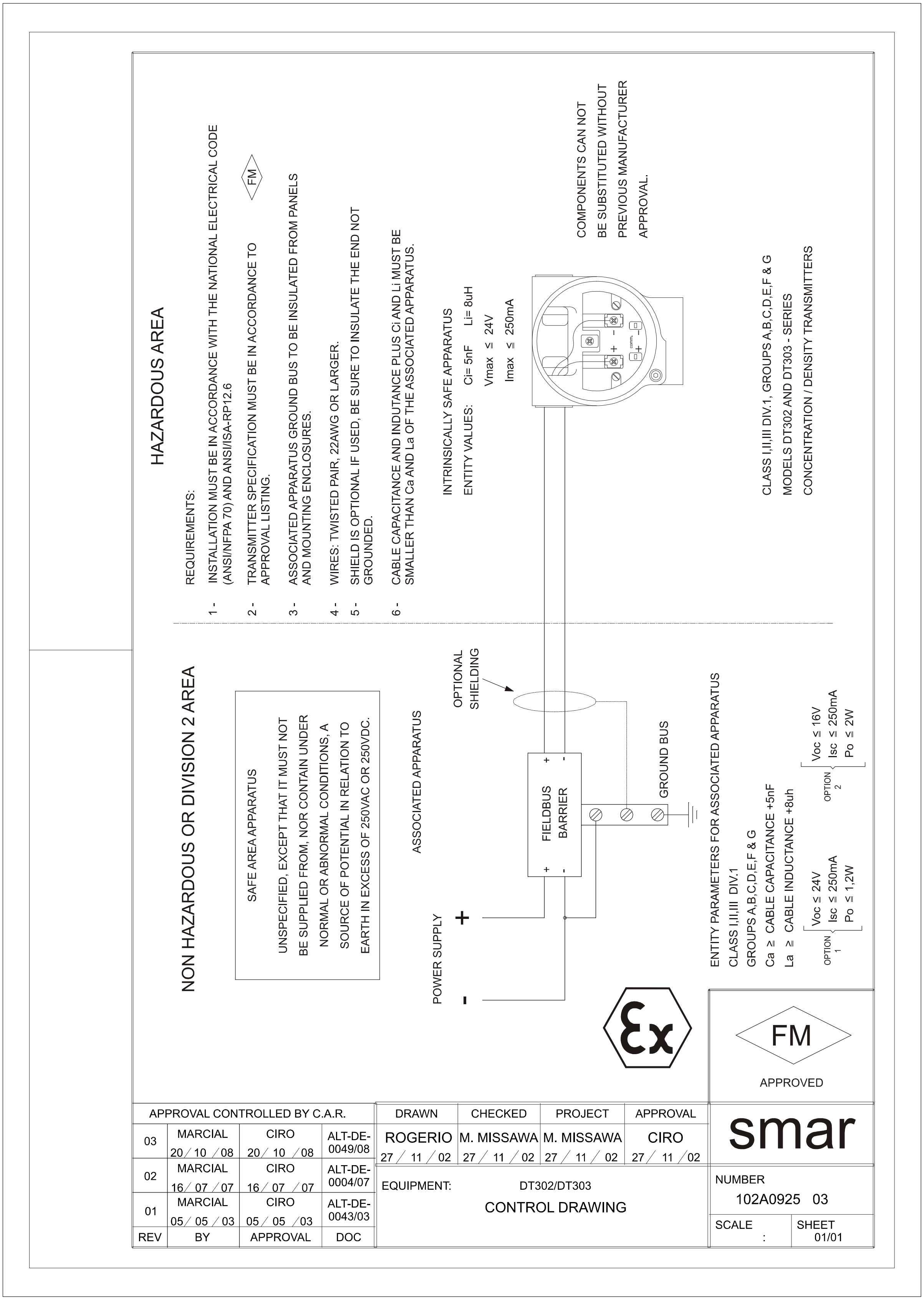


135902

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: