INSTALLATION, OPERATION, CONFIGURATION AND MAINTENANCE MANUAL
July/2020

VPT10-H

HART® PRESSURE TRANSMITTER

VIVACE™ Process Instruments

HART® COMMUNICATION FOUNDATION

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NOTE

We have reviewed this manual with great care to maintain compliance with the hardware and software versions described herein. However, due to the dynamic development and version upgrades, the possibility of technical deviations cannot be ruled out. We cannot accept any responsibility for the full compliance of this material.

Vivace reserves the right to, without notice, make modifications and improvements of any kind in its products without incurring in any circumstances, the obligation to make those same modifications to products sold previously.

The information in this manual is frequently updated. Therefore, when using a new product, please check the latest version of the manual on the Internet through our website www.vivaceinstruments.com, where it can be downloaded.

You customer is very important for us. We will always be grateful for any suggestions for improvements as well as new ideas, which can be sent to the e-mail: contato@vivaceinstruments.com preferably with the title "Suggestions".

SUMMARY

WARNING

It is extremely important that all the safety instructions, installation and operation in this manual are followed faithfully. The manufacturer is not liable for damage or malfunction caused by improper use of this equipment.
It is recommended to strictly following the rules and good practice relating to installation, ensuring correct grounding, noise insulation and good quality cables and connections in order to provide the best performance and durability to the equipment.
Special attention must be considered in relation to installations in hazardous areas, where applicable.

SAFETY PROCEDURES

- *Appoint only skilled people, trained with process and equipment;*
- *Install equipment only in operation compatible areas, with the proper connections and protections;*
- *Use proper safety equipment for any handling device in field;*
- *Turn area power off before equipment installation.*

SYMBOLOGY

Caution - indicates risk or error source

Important Information

General or Specific Risk

Electric Shock Danger

GENERAL INFORMATION

Vivace Process Instruments ensures the operation of this equipment, according to the descriptions contained in its manual, as well as technical characteristics, not guaranteeing its full performance in particular applications.

The operator of this equipment is responsible for observing all aspects of safety and prevention of accidents applicable during the execution of the tasks in this manual.

Failures that might occur in the system, causing damage to property or injury to persons, shall additionally be prevented by external means to a safe outlet for the system.

This equipment must be used only for the purposes and methods proposed in this manual.

1 EQUIPMENT DESCRIPTION

VPT10-H is a transmitter for differential, absolute or gauge pressure, level or flow measurements with HART® technology, which integrates Vivace Process Instruments family of field devices.

The transmitter features intelligent, microprocessor-based capacitive sensor for safe operation and excellent field performance. It has integrated pressure and temperature compensations, providing high performance and stability of measurements.

VPT10-H must be powered by a voltage of 12 to 45 Vdc in order to generate a 4-20 mA current channel (according to NAMUR NE43) proportional to the measurement performed.

Its configuration uses HART® 7 communication protocol, already recognized as the most used in the world of industrial automation for configuration, calibration, monitoring and diagnostics, and can be performed by the user with the use of a HART® configurator or EDDL® or FDT/DTM®-based tools. In addition, the main parameters can be set via local adjustment using a magnetic tool.

VPT10-H intelligent pressure transmitter is factory calibrated before shipment to customers. If it is necessary to recalibrate this transmitter in the field, be sure to use a calibrator at least three times more accurate than the specifications. To ensure correct and efficient use of the transmitter, please read this manual before installation.

1.1. BLOCK DIAGRAM

The modularization of the transmitter components is described in the following block diagram.

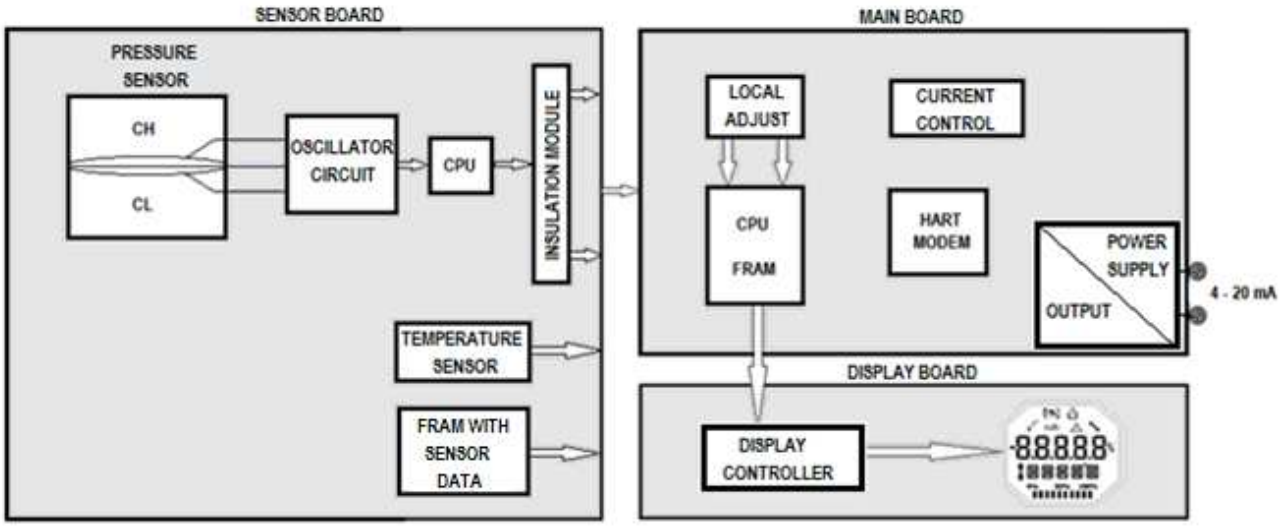


Figure 1.1 –VPT10-H block diagram.

The main board controls the main functions of the pressure transmitter. It contains a HART® Modem and a microcontroller (CPU). The sensor board is responsible for reading the capacitance of the capacitive sensor, as well as the temperature and its processing with the main CPU.

The HART® modem block interfaces the microcontroller signals with the HART® line to which the transmitter connects.

The display board has the controller block that interfaces between the LCD and the CPU, adapting the messages to be displayed.

Finally, the microcontroller block can be related to the transmitter's brain, which manages all the time controls, HART® state machines, diagnostics and routines common to transmitters, such as configuration, calibration and generation of the digital output value for current, proportional to the PV variable.

1.2. CAPACITIVE SENSOR

The pressure sensor used by VPT10-H pressure transmitter is capacitive (capacitive cell), shown schematically in figure 1.2.

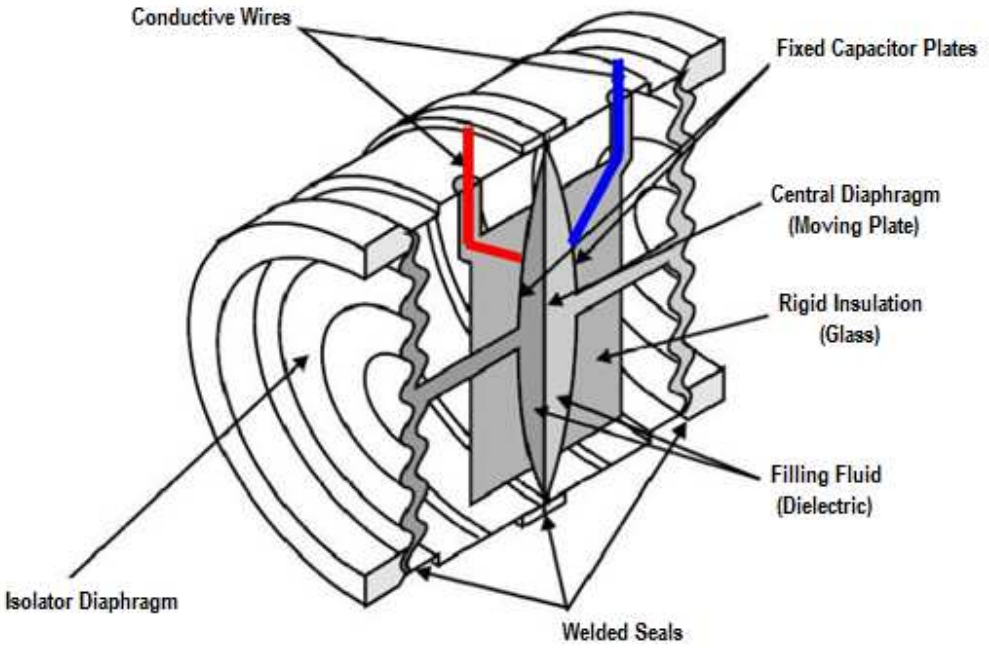


Figure 1.2 – High performance capacitive sensor.

See figure 1.3, below, to understand the working principle of the capacitive sensor.

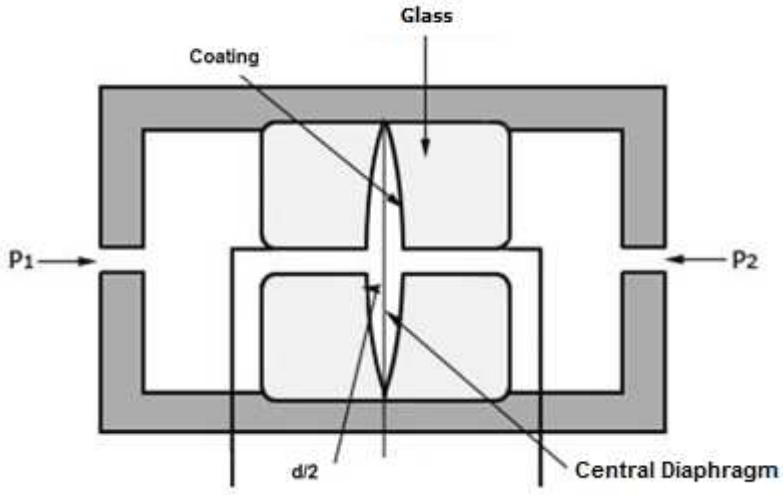


Figure 1.3 – Principle of operation of the capacitive sensor.

The core of the capacitive sensor is the central diaphragm. There are two measuring capacitances (CH and CL), according to the position of this diaphragm. These measuring capacitances share the central diaphragm (movable plate) and the other plate is attached to both sides of the sensor.

When the pressures on both sides are equal, the diaphragm is in the center and the capacitances on both sides are the same. However, when the pressure on the high pressure side (CH) is greater than the pressure on the low pressure side (CL), for example, the filling fluid will move, causing the diaphragm to move to the low pressure side . As a result, the capacitance on the high pressure side will be lower than the capacitance on the low pressure side.

However, when the differential capacitance structure is used, the distance between CL and CH plates has a linear variation with the relation between the difference and the sum of the measured capacitances.

When the displacement of the central diaphragm is inferior than its thickness, there will be a linear relationship between this displacement and the differential pressure. That is, if the differential pressure (ΔP) applied to the capacitive cell does not deflect the sensor diaphragm beyond d/4, we can assume that ΔP will be proportional to Δd.

In short:

P1 and P2 are applied pressures on the high and low pressure sides (H and L), respectively.

CH = capacitance on high pressure side, measured between P1 fixed plate and the central diaphragm.

CL = capacitance on low pressure side, measured between P2 fixed plate and the central diaphragm.

d = distance between the fixed plates of CH and CL.

Δd = deflection of the central diaphragm due to the application of the differential pressure ΔP = P1 - P2.

The capacitance of a capacitor of flat and parallel plates can be expressed as a function of the area (A) of the plates and the distance (d) separating them as:

$C = \frac{\in A}{d}$, where ϵ = the dielectric constant of the medium between the capacitor plates.

If we consider CH and CL as capacitances of flat plates of the same area and parallel, when P1> P2 we have:

$$CH = \frac{\in A}{(d/2) + \Delta d} \qquad CL = \frac{\in A}{(d/2) - \Delta d}$$

On the other hand, if the differential pressure (ΔP) applied to the capacitive cell does not deflect the sensor diaphragm beyond d/4, we can assume ΔP proportional to Δd. $\Delta P \propto \Delta d$

If we develop the expression (CL-CH) / (CL+CH) we get: $\Delta P = \frac{CL - CH}{CL + CH} = \frac{2\Delta d}{d}$

As the distance (d) between the fixed plates of CH and CL is constant, the expression (CL-CH) / (CL+CH) is proportional to Δd and therefore to the differential pressure to be measured.

Thus, it is concluded that the capacitive cell is a pressure sensor composed of two capacitors of variable capacitances, according to the applied differential pressure.

These capacitors are part of an oscillator circuit that has its frequency dependent on the applied differential pressure. This frequency will be inversely proportional to the applied pressure and is measured by the CPU of the pressure sensor with high resolution, accuracy and processing speed.

1.3. OPERATING PRINCIPLE

The main circuit of VPT10-H receives the capacitance readings (CL and CH) and temperature from the analog sensor board. The normalized pressure signal is calculated by applying the factory compensation polynomial to the CL and CH readings. From this value, using the sensor reading range, the pressure in the user unit (configurable) is calculated with the relevant calibrations of zero, maximum pressure and minimum pressure.

Depending on the sensor range, user can choose the form of treatment for the pressure value: Linear, Table, Square Root Extraction (single, triple or quintuple) or the combination between Table and Square Root Extraction. With the option of Table, it is possible to mount a custom curve of up to 16 points, mainly used with the characterization of volumes in tanks. The Square Root Extraction is used in the application of the mass and flow measurement transfer function.

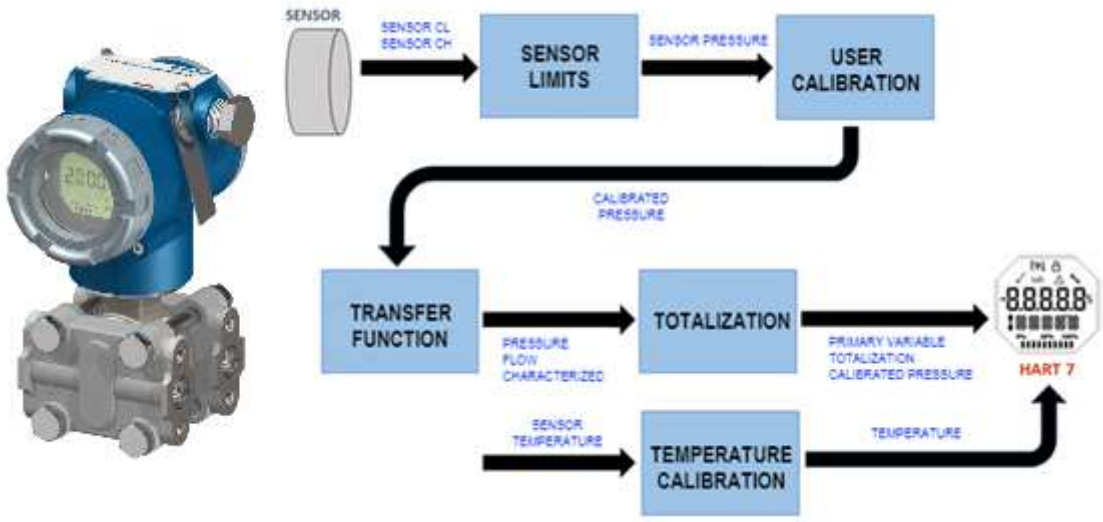


Figure 1.4 – Operating principle of VPT10-H.

VPT10-H still provides the ambient temperature reading as a secondary variable and the pressure reading as a tertiary variable (even if the primary variable is set as flow measurement).

The primary variable (PV) can be configured to indicate pressure or flow according to the configured transfer function (Linear and Table for Pressure, Square Root Extraction for Flow).

According to the type of variable to be indicated, user can also configure unit, work range, limits and alarms (for pressure and flow, separately).

In addition, the transmitter can calculate the Totalization, considering the flow rate, according to the unit configured by user (mass or volume in time). It is possible to reset the Totalization, enable/disable it and also set a limit value so an alarm can be generated.

2 INSTALLATION

RECOMMENDATION

When taking the equipment to the installation location, transfer it in the original packaging. Unpack the equipment at the installation location to avoid damage during transportation.

RECOMMENDATION

Model and specification of equipment are indicated on identification plate, located at the top of the housing. Check if supplied specification and model correspond to application requirements. Be aware of the maximum and minimum specifications and sensor range. After installation in the field, see Calibration topic.

STORAGE

The following precautions should be observed when storing the equipment, especially for a long period:

(1) Select a storage area that meets the following conditions:

- *a) No direct exposition to rain, water, snow or sunlight.*
- *b) No exposition to vibration and shocks.*
- *c) Normal temperature and humidity (around 20°C / 70°F, 65% RH).*

However, it can also be stored under the following temperature and humidity intervals:

- *Ambient Temperature: -40°C to 85°C (without LCD)* or -30°C to 80°C (with LCD)*
- *Relative Humidity: 5% to 98% RH (@ 40°C)*

(2) For equipment storage, use original factory package (or similar).

(3) If storing an already used Vivace equipment, dry every moist part and clean all connections that was in contact with the process. Keep covers and connections closed and properly protected for its specific application and requirements.

** Only for general use. For explosion proof version, follow product certification requirements.*

2.1. MECHANICAL ASSEMBLY

VPT10-H transmitter is designed for field installation and thus supports weather exposure, having good performance with variations in temperature, humidity and vibration.

Its housing has an IP67 degree of protection, being immune to water entering its electronic circuit and terminal block, provided that the cable gland or conduit of the electrical connection is correctly assembled and sealed with non-hardenable sealant. The covers should also be tightly closed to prevent moisture entering, as the threads of the housing are not protected by paint.

The electronic circuit is coated with a moisture-proof varnish, but constant exposures to moisture or corrosive media can compromise its protection and damage electronic components.

Figure 2.1 shows the dimensional design and mounting forms of the VPT10-H.

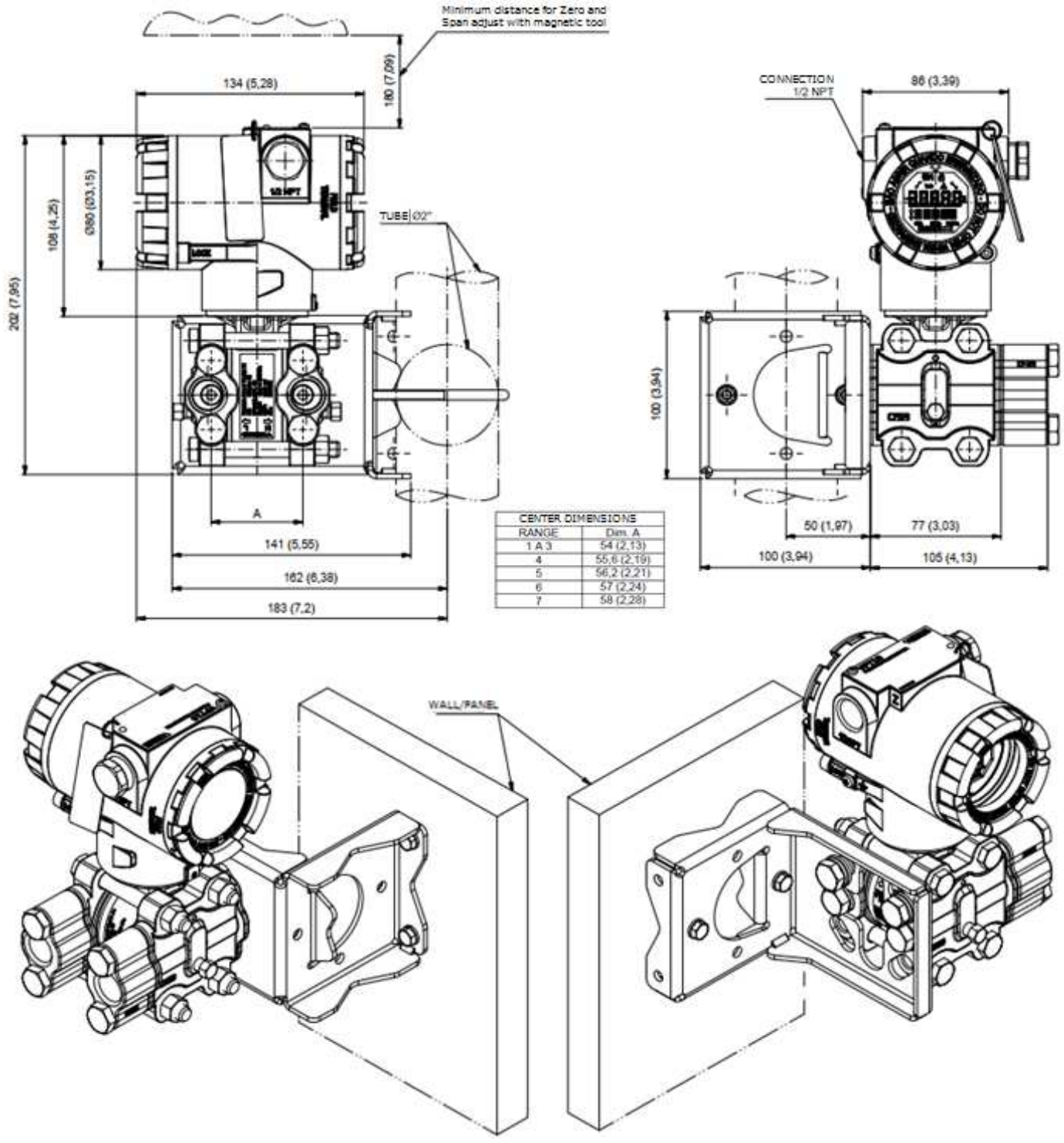


Figure 2.1 –Dimensional drawing and mounting for VPT10-H.

In order to avoid risk of the VPT10-H covers being released unintentionally due to vibrations, for example, they can be locked by means of a screw, as shown in figure 2.2.

VPT10-H is a field device that can be installed through a bracket in a 2" tube holded by a U-clamp. For best LCD positioning the equipment can rotate 4 x 90°, as shown in figure 2.3 . The transmitter can also be fixed with the same bracket on wall or panel.

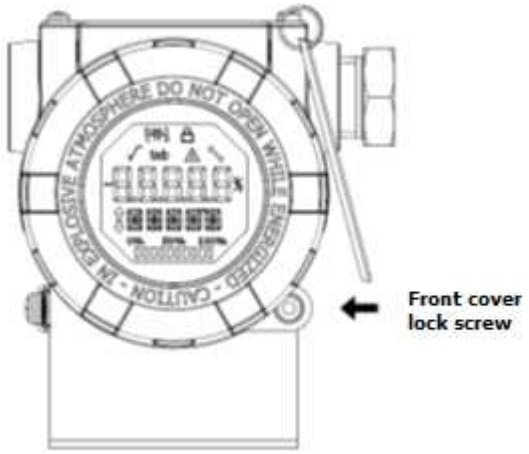


Figure 2.2 – Front cover lock.

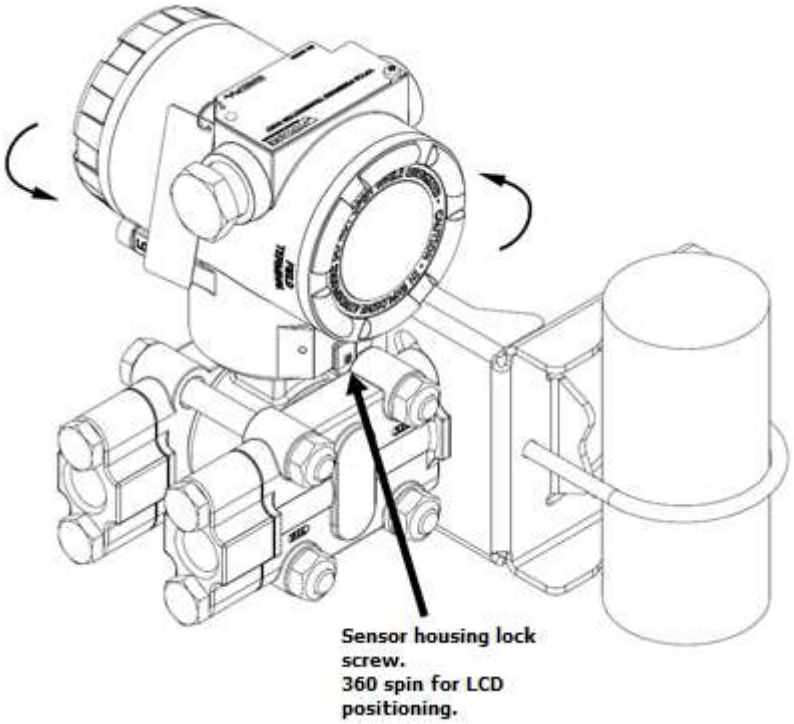


Figure 2.3 – Housing position adjustment.

The LCD liquid crystal display of VPT10-H can be rotated 4 x 90° so that the display is as adequate as possible for easy user viewing.

Figure 2.4 illustrates the possible rotation for VPT10-H LCD.

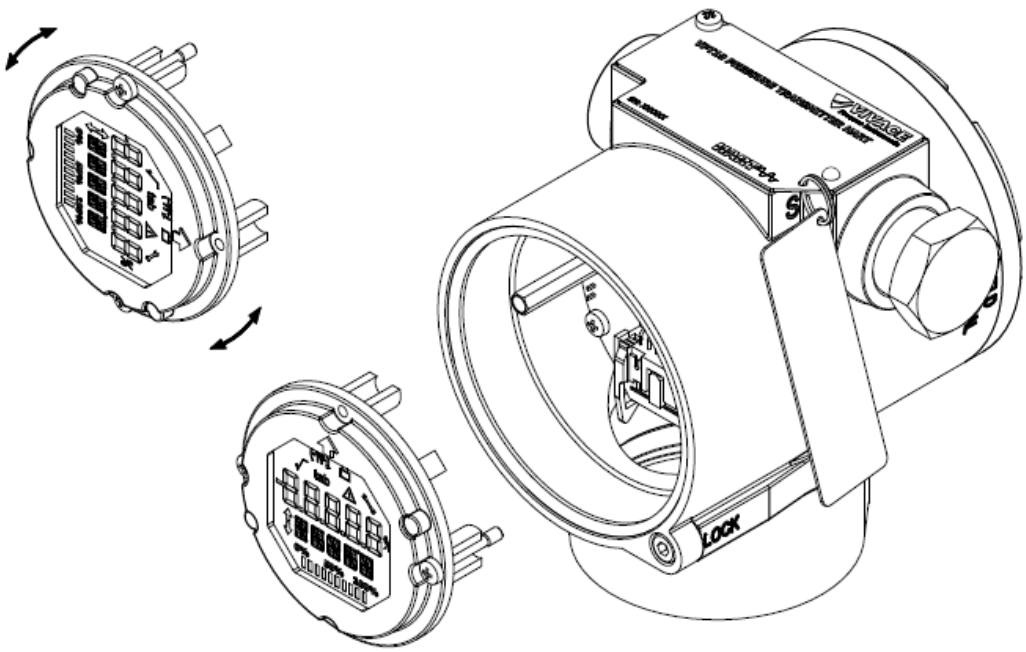


Figure 2.4 –4 x 90° LCD rotation.

VPT10-H pressure transmitter is designed to withstand harsh environmental conditions. However, to ensure stable and accurate operation for a long time, the following precautions must be observed when selecting an installation location.

(1) Ambient Temperature

VPT10-H has an intrinsic algorithm to compensate temperature variations. In the production process each transmitter is subjected to several cycles of temperature and a polynomial is created in order to minimize temperature variation, ensuring high performance of pressure measurements at any temperature. However, it is recommended to avoid locations subject to large variations in temperature or temperature gradients. If the site is exposed to radiant heat, provide adequate thermal insulation or ventilation. Also, facilities where process fluid can freeze inside the transmitter chamber should be avoided, which could cause permanent damage to the capacitor cell.

(2) Atmospheric Conditions

Avoid installing the transmitter in a corrosive atmosphere. If necessary, provide adequate measures to prevent or minimize intrusion/stagnation of rainwater or condensation that may accumulate through the electrical input. In addition, proper precautions should be taken in regard to corrosion due to condensation or moisture at the terminal block. Inspect it regularly, checking for proper closure of its covers. The covers must be completely closed manually until the o-ring is compressed, ensuring complete sealing. Avoid using tools in this operation. Be careful not to remove housing covers in the field, as each opening introduces more moisture to the circuits.

(3) Shock and Vibration

Select an installation location subject to minimum shocks and vibrations. Although the transmitter is designed to be relatively resistant and insensitive to vibration, it is recommended to follow good engineering practice. Mounts close to pumps, turbines or other equipment that generate excessive vibration should be avoided. If vibration is unavoidable, install the transmitter on a solid base using flexible hoses that do not transmit vibration.

(4) Installation of Transmitters with Explosion Proof Certification

Transmitters with this certification must be installed in hazardous areas according to the classification of the area for which they are certified. Installations in classified areas should follow the recommendations of standard NBR/IEC60079-14.

(5) Accessibility

Always select a location that provides easy access to the transmitter for maintenance and/or calibration. If so, rotate the LCD for proper viewing.

When the measured fluid contains suspended solids, install valves at regular intervals to clean the tubing (discharge).

Clean pipes internally (using steam or compressed air) or drain the line with the process fluid itself, whenever possible, before connecting these lines to the pressure transmitter.

Do not allow steam to enter the measuring chamber. Close the valves well after each drain or discharge operation.

Some examples of assemblies, showing the location of the transmitter relative to the taps, are shown in figure 2.5. The location of the pressure taps and the relative position of the transmitter are shown in table 2.1.

Process Fluid	Taps Location	VPT10-H Location in relation to the Taps
Gas	Superior or Lateral	Above
Liquid	Lateral	Below or at same level
Steam	Lateral	Below using condensation chamber

Table 2.1 – Location of pressure taps.

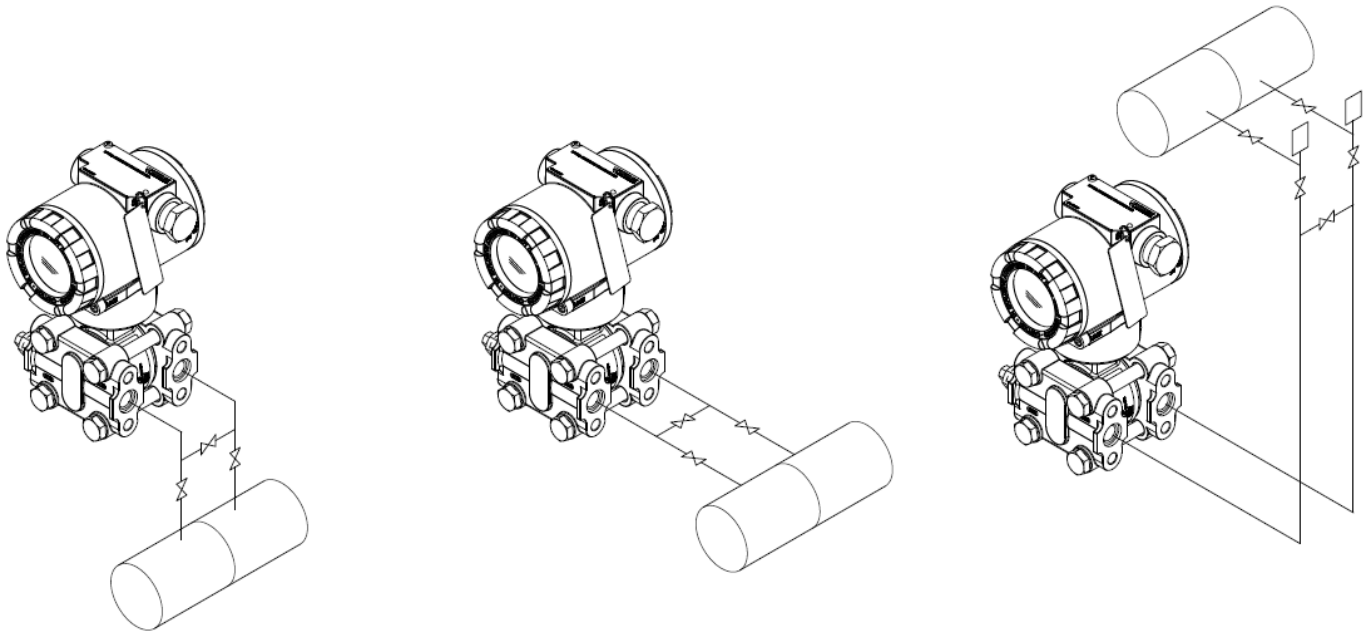


Figure 2.5 – Examples for transmitter mounting, in relation to pressure taps.

2.2. ELECTRICAL CONNECTION

To access the terminal block, remove the rear cover of VPT10-H. To do this, loosen the cover locking screw (see figure 2.6) by turning it clockwise.

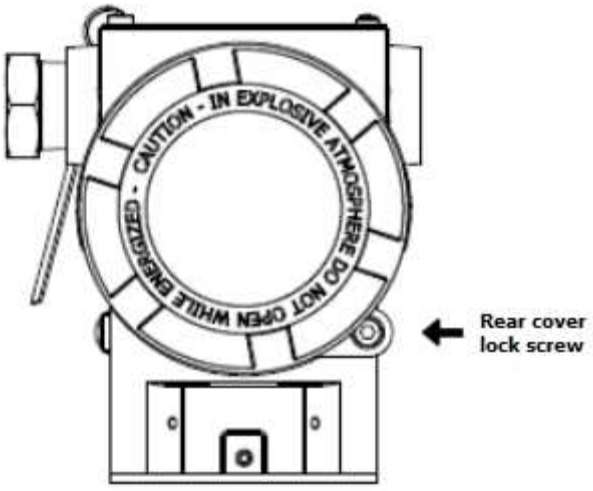


Figure 2.6 – Rear cover lock.

Figure 2.7 shows the power terminals (PWR BUS), the ground terminals (one internal and one external), in addition to the communication and test terminals. To power the equipment it is recommended to use twisted-pair 22 AWG.

Table 2.2 describes the functions of the VPT10-H.

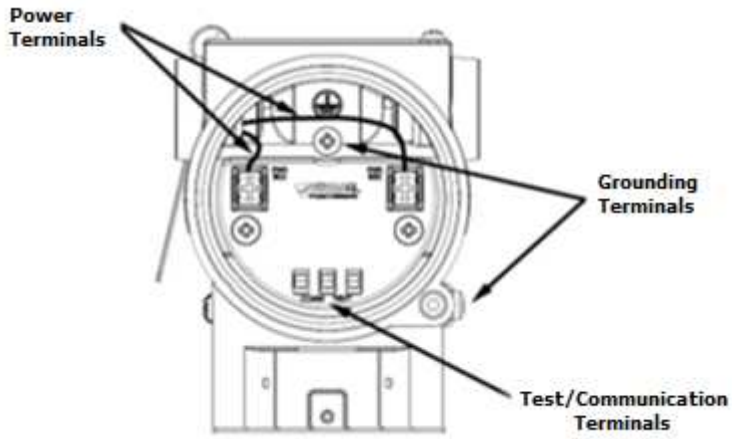


Figure 2.7 – Connections for VPT10-H.

Terminal Description
Power Terminals - PWR BUS 24 Vdc without polarity (12 to 45 Vdc)
Grounding Terminals 1 internal and 1 external
Test Terminals - TEST 4-20 mA measurement without circuit opening
Communication Terminals - COMM Communication with HART® Configurator

Table 2.2 – Terminal description for VPT10-H.

NOTE

All cables used to connect the VPT10-H to the HART® network must be shielded to avoid interference and noise.

NOTE

It is extremely important to ground the equipment for complete eletromagnetic protection and also to ensure the correct performance of transmitter on the HART network.

The conduits through which the power cables of the equipment pass must be mounted in such a way as to prevent water from entering the terminal block. The threads of the conduits must be sealed according to the standards required by the area. The unused electrical connection must be sealed with a suitable plug and sealant.

Figure 2.8 shows the correct way to install the conduit in order to avoid the entrance of water or other product that could cause damage to the equipment.

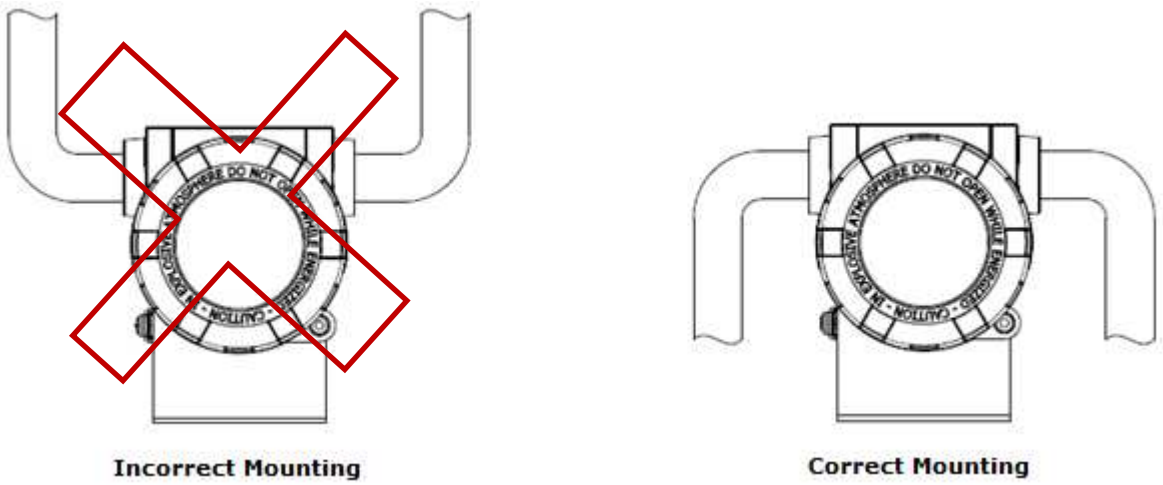


Figure 2.8 – Conduit installation.

3 CONFIGURATION

The transmitter can be configured by any HART® compatible programmer. Vivace offers the interfaces VCI10-H (USB and Bluetooth) as a solution for configuring and monitoring any HART® device. VPT10-H can also be configured by local adjust using Vivace magnetic screwdriver.

3.1. LOCAL CONFIGURATION

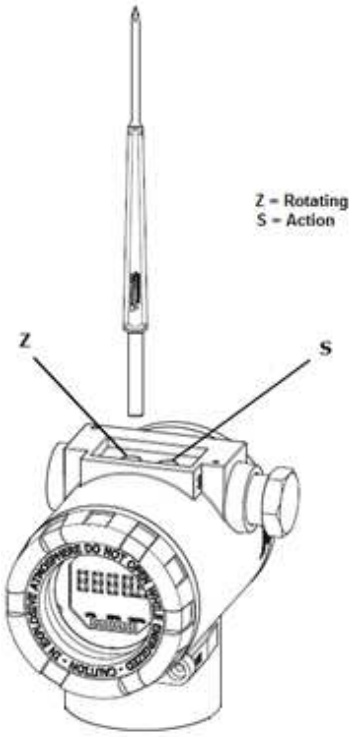


Figure 3.1 – Z and S orifices and magnetic tool.

Transmitter's local configuration is executed by using Vivace's magnetic tool on Z and S orifices, located at housing superior side, under identification plate. Orifice Z starts local configuration and changes the field to be configured. Orifice S is responsible for changing and saving the new value on the selected field. Saving after LCD value changing is automatic.

Figure 3.1 shows orifices Z and S for local configuration, stamped on device housing, and their functions on magnetic tool actuation.

Insert the magnetic tool on *Zero* orifice (Z). icon appears to indicate that device has recognized the tool action. Keep the magnetic tool inside until "LOCAL ADJST" message is shown on display, then remove it for 3 seconds. Insert the magnetic tool into Z orifice again, so user can navigate through local adjust parameters.

Table 3.1 indicates actions executed by magnetic tool when inserted on Z and S orifices.

Orifice	Action
Z	Selects configuration tree function
S	Acts on selected function

Table 3.1 – Z and S orifices actions.

Some parameters show the icon to allow user configuration on it by inserting the magnetic tool into *Span* orifice (S). In case the parameter has pre-defined values, those will be rotate on display, while the magnetic tool remains into *Span* orifice (S).

In the case of a numeric parameter, this field will enter edit mode and the decimal point will begin to blink shifting to the left. When entering Z orifice, the least significant digit (on the right) will begin to blink, indicating it is ready for editing. When entering the key in S, user can increment this digit, varying from 0 to 9.

After editing the least significant digit, user must enter the key in Z so that the next digit (on the left) starts blinking, allowing its edition. User can edit each digit independently, until the most significant digit (5th digit left) is configured. After the 5th digit is edited, the numeric value signal can be edited with the key in S.

During each step, if the user removes the magnetic key from the local adjustment holes, editing will be completed and configured value will be saved to the device.

If the configured value is not acceptable by that device parameter (invalid value), it will be returned to the last valid value before edition. Depending on the parameter, some values can be shown on numerical or alphanumerical fields, adjusting the best option view to user.

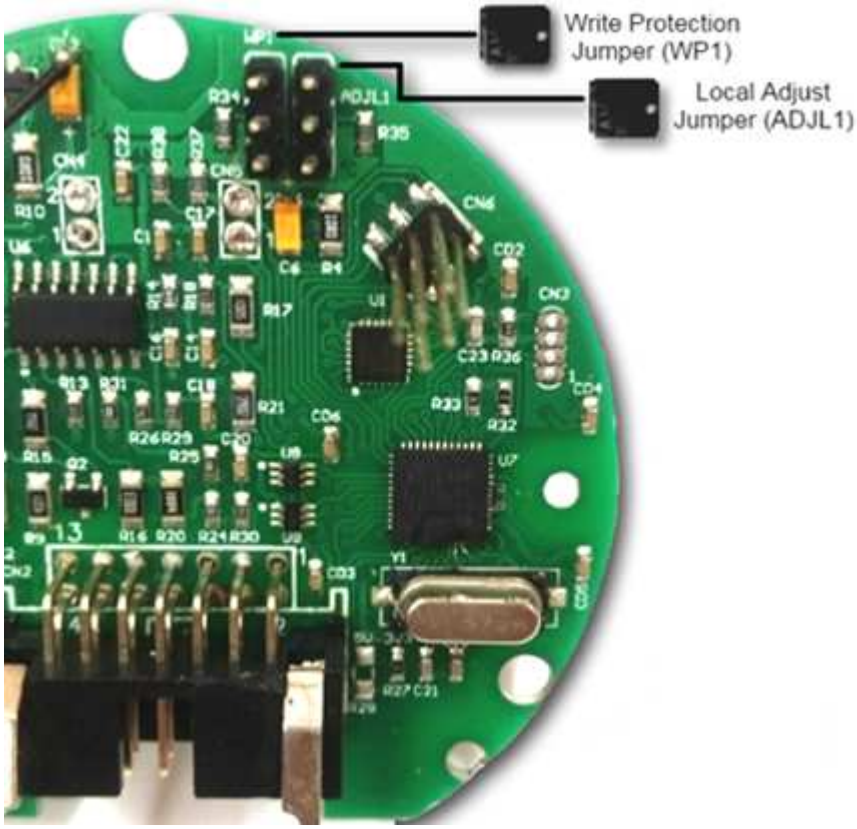
With the magnetic screwdriver out of Z and S orifices, device will leave local adjust mode after some seconds and monitoring mode will be shown.

CONFIGURATION RESTORE

Should the user require a full factory reset of the transmitter (including current and sensor calibrations), insert two magnetic switches (one in each hole - Z and S) at the local adjust and restart the equipment, waiting for the numeric count to be completed until display shows the word "donE". After that, simply reconfigure transmitter with the desired values for the application.

3.2. JUMPER CONFIGURATION FOR LOCAL ADJUST AND WRITE PROTECTION

VPT10-H has two jumpers on its main board to protect data writing (WP1) and also enabling/disabling local adjust (ADJL1). Figure 3.2 presents those jumpers.



WP1	Write Protection
	Enabled
	Disabled

ADJL1	Local Adjust
	Enabled
	Disabled

Figure 3.2 – Jumpers of main board.

NOTE

*Default selection for these jumpers is Write Protection **DISABLED** and Local Adjust **ENABLED.***

3.3. LIQUID CRYSTAL DISPLAY (LCD)

The main information regarding the equipment is available on the LCD display. Figure 3.3 shows the LCD with all its display fields. The numerical field is mainly used to indicate the values of the monitored variables. The alphanumeric indicates the currently monitored variable, units, or auxiliary messages. The meanings of each of the icons are described in table 3.2.

Figure 3.3 – LCD fields and icons.

Símbolo	Descrição
	Sending communication.
	Receiving communication.
	Write protection enabled.
√	Square root function enabled.
tab	Characterization table enabled.
⚠	Diagnostic ocurrence.
	Recommended maintenance.
	Increment values in local adjust.
	Decrement values in local adjust.
°	Degree symbols for temperature units.
0% 50% 100%	Bargraph to indicate measured variable range.

Table 3.2 – LCD icon description.

3.4. HART® PROGRAMMER

The configuration of the equipment can be carried out by means of a programmer compatible with HART® technology. Vivace offers the VCI10-H interfaces (USB or Bluetooth HART®) as a solution for identification, configuration and monitoring of HART® line devices.

Figures 3.4 and 3.5 illustrate the use of the USB VCI10-UH interface with a personal computer that has installed HART® configurator software. In Figure 3.4, the interface is serially installed with the power supply of the equipment. The interface requires a 250 Ω resistor to enable HART® communication over the 4-20 mA current when powered externally. In Figure 3.5, the interface is also used to power the transmitter, not requiring the communication resistor.

Figure 3.6 shows the assembly configuration of the transmitter called multidrop.

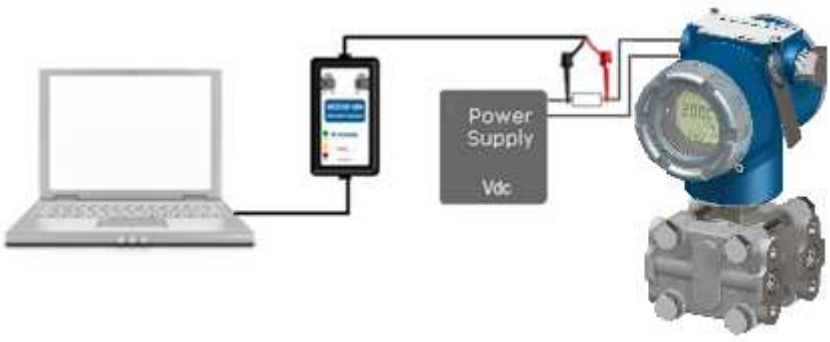


Figure 3.4 - VCI10-UH connection to VPT10-H using external power supply.

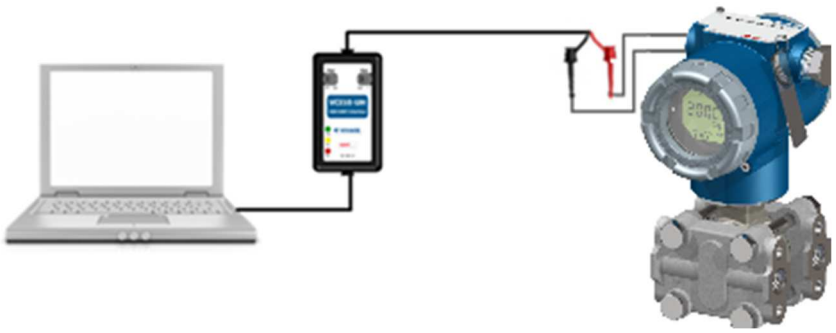


Figure 3.5 - VCI10-UH powering VPT10-H.

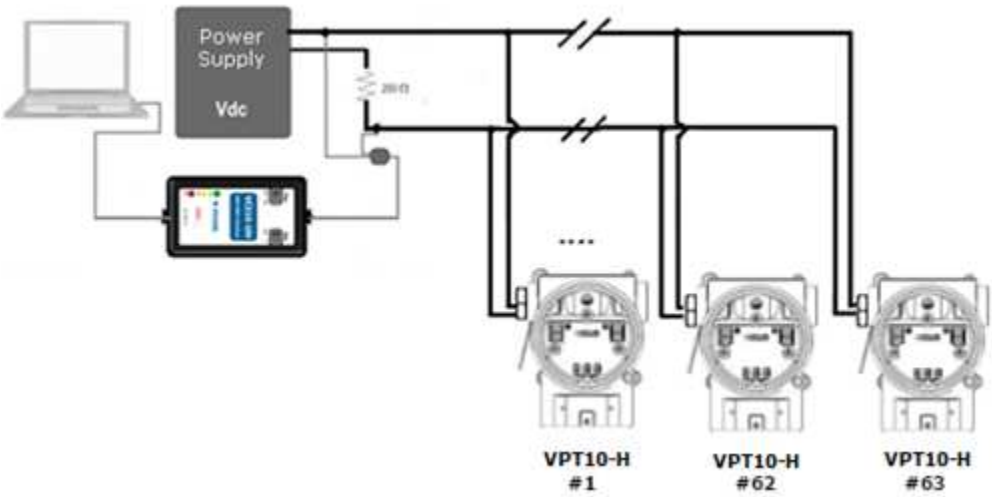


Figure 3.6 –VPT10-H connection in multidrop mode.

Note that up to 63 devices can be paralleled connected on the same line. Caution must be taken when many transmitters are connected on the same power line due to voltage drop on 250 ohm resistor and guarantee power supply voltage is enough (Figure 3.7).

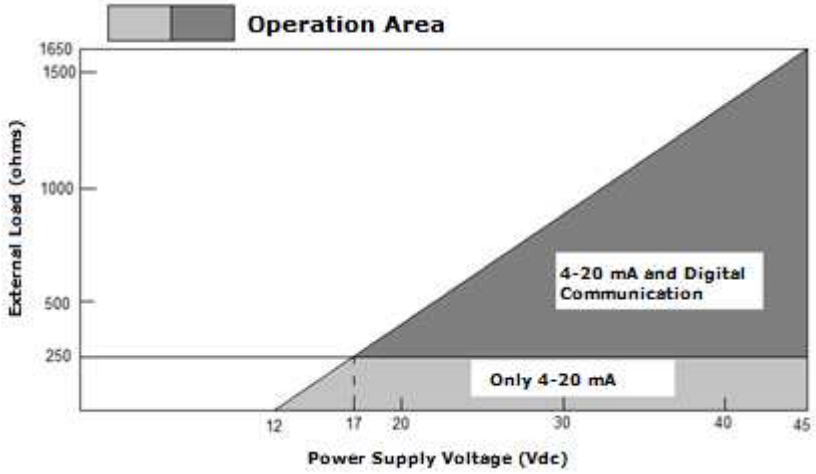


Figure 3.7 – VPT10-H load curve.

3.5. LOCAL ADJUST CONFIGURATION TREE

Figure 3.8 shows available fields for local configuration and the sequence they are presented by magnetic tool actuation on Z and S orifices.

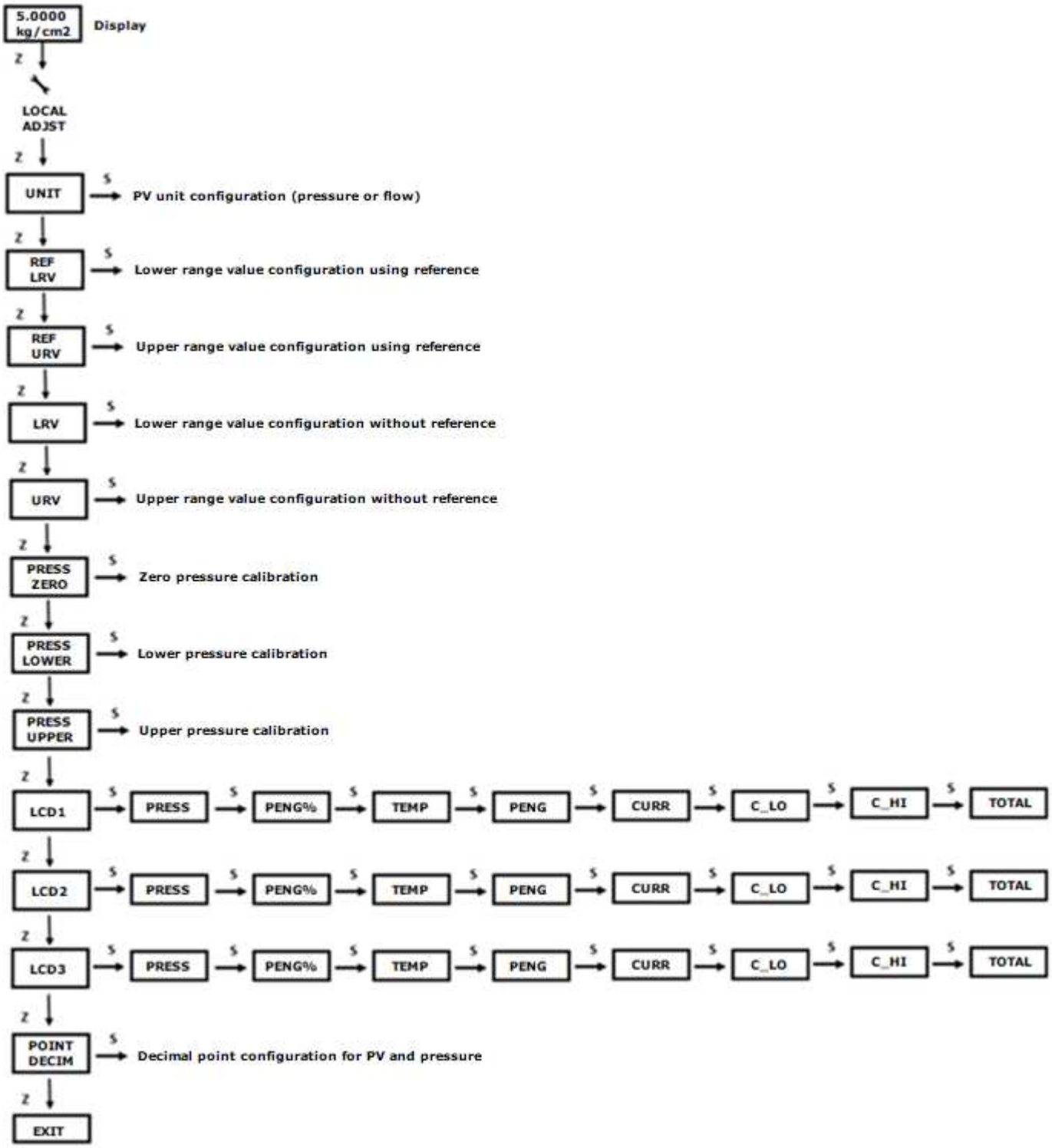


Figure 3.8 – Local adjust programming tree for VPT10-H.

3.6. HART CONFIGURATOR PROGRAMMING TREE

The configuration tree is a tree-shaped structure with the menus for all software resources available, as shown on figure 3.9.

For online configuration of the transmitter, check it is correctly installed, powered by the adequate voltage and with the minimum load of 250 Ω impedance on the line, necessary for communication.

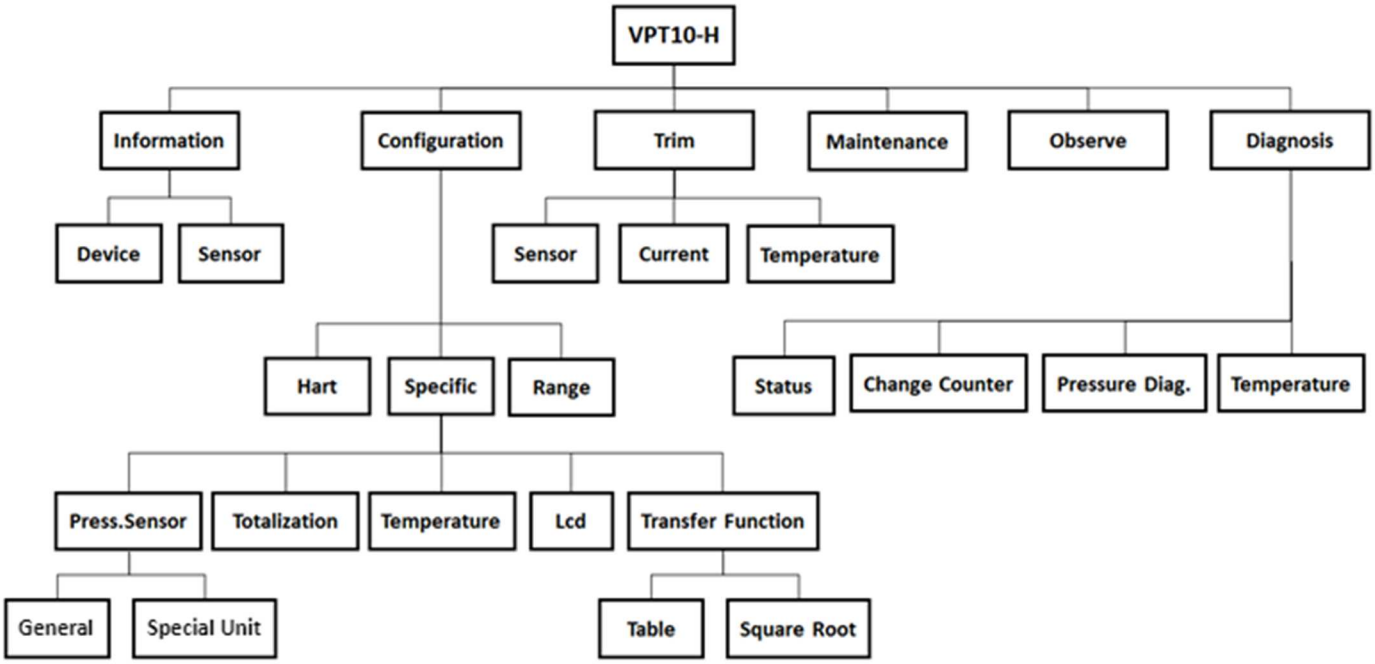


Figure 3.9 – VPT10-H programming tree.

Information – The main transmitter information can be accessed here.

- **Device –** The main equipment information is found here, such as: Tag, Description, Address, Manufacturer, Device Type, Device Profile, HART® Revision, Software Version and Ordering Code.
- **Sensor –** Here user can find the main information for pressure sensor: Serial Number, Manufacturer, Sensor Type, Model, Range, Material Characteristics and Construction Fluids, Remote Seal, Linearization Polynomial, Upper Range, Lower Range and Measurement Unit.

Configuration – Here the transmitter is configured in relation to the communication variables, sensor operation and temperature reading.

- **Hart –** In this directory user can configure the parameters of Polling Address, Loop Current Mode, Number of Preambles and Write Protection, all related to HART communication.
- **Specific –** In this directory the general operation of the transmitter and the pressure and temperature sensors are configured, such as: Pressure Unit, Flow Unit, Special Unit, Damping, Zero Cutoff, Totalizing Mode, Temperature Unit, LCD Display Variables with Decimal Point, Transfer Function, Curve Characterization and Square Root Cutoff.
- **Range –** In this directory, user can configure the Fail Safe point and Working Range, either for pressure or flow, according to the value set in the "Transfer Function" parameter (URV and LRV).

Damping

It is an electronic pressure reading filter that changes the response time of the transmitter to smooth the variations in the output readings caused by rapid variations in the input. The damping value can be set between 0 and 60 seconds and its appropriate value should be based on process response time, output signal stability and other system requirements. *Damping default value is 0.4 s.*

The value chosen for damping affects the response time of the transmitter. When this value is set to zero, the damping function will be disabled and the output of the transmitter will react immediately to changes in its input, so the response time will be as short as possible.

Increasing the damping value leads to an increase in the transmitter response time. At the time the damping time constant is set, the transmitter output will go to 63% of the input change value and the transmitter will continue to approach the input value according to the damping equation.

Flow Measurement

VPT10-H can calculate mass or volumetric flow. For flow measurement, user must configure the Transfer Function for Square Root Extraction (or Table + Square Root Extraction) and the Flow Unit to be used, according to the process.

According to Figure 3.10, note that there is a zero cutoff point that can be configured by the user through the Square Root Cutoff parameter. This value refers to the Percent Pressure that will be converted to flow.

For example, if Square Root Cutoff is set to 1%, the flow values will only be different than zero when above 10% (according to the equation in the graph below).

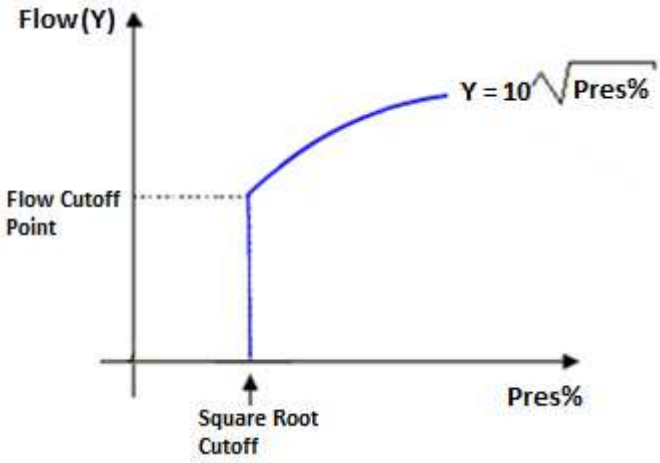


Figure 3.10 – Flow and square root cutoff measurement.

Once the transfer function has been defined according to the application, user can choose the output unit, with which the pressure or flow value will be made available to the system.

User Table (Characterization Curve)

Used for level, volume, or any other measurement that requires custom output. VPT10-H has a user table with 16 points with input and output as a percentage (depending on the PV%, which may be Pressure or Flow, as a percentage of the specific Working Range).

User must set up at least two points in the table. The points will define the characterization curve to be used to calculate the PV% to be converted to 4-20 mA.

It is recommended to select equally distributed points over the desired curve or over a part of the curve where better precision is required. The table should be monotonically increasing, ie all points in increasing order of x, as in the example of the following figure.

For measuring volume, mass or level, user can select a specific unit with its respective range, on the “Special Unit” menu from “Pressure Sensor” directory.

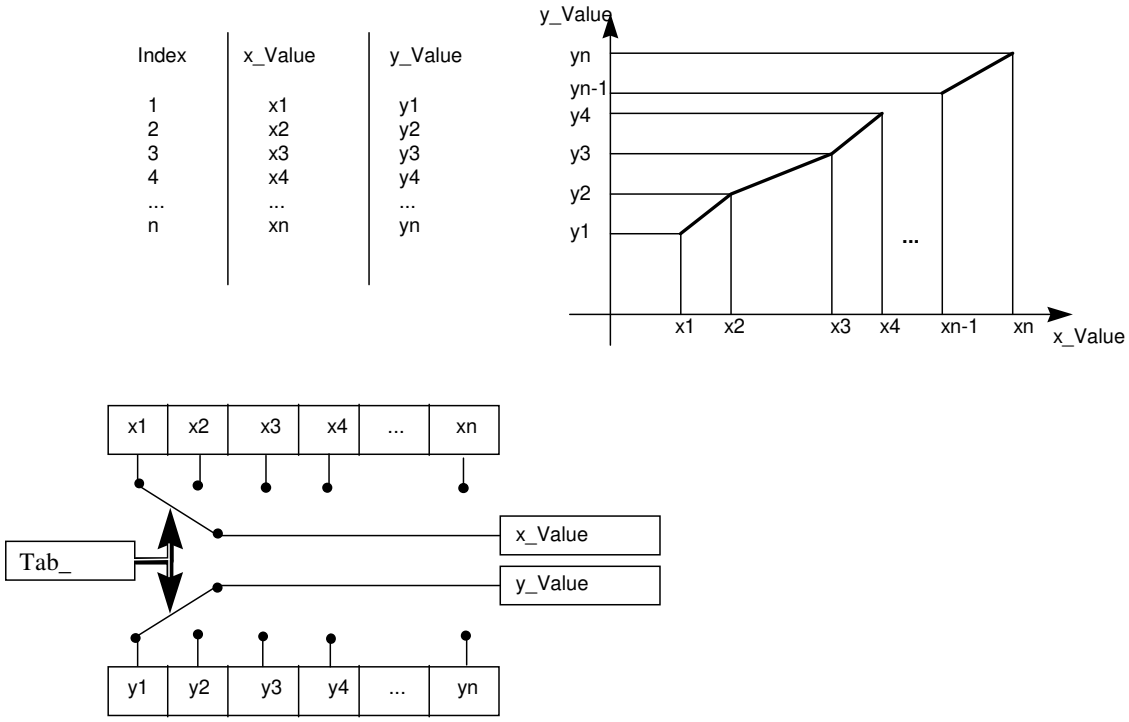


Figure 3.11 – User table.

Trim – In this directory user can adjust the pressure sensor (calibration of lower and upper points, zero point), the output current (4 mA and 20 mA) and the temperature sensor. Figure 3.12 shows the connection of the multimeter with the transmitter for current trim. See further details in item 3.7, below.

For any calibration procedure user can use the Restore option on “Maintenance” menu, which restores all sensor data, including factory calibration data, in case of any problem during process.

NOTE
VPT10-H intelligent pressure transmitter is factory calibrated before shipment to the customer. If it is necessary to recalibrate this transmitter in the field, be sure to use a calibrator at least three times more accurate than the specifications.

NOTE
After installation, it is recommended to zero the transmitter, since the zero point may change due to the mounting position and the sensor.

Adjusting Pressure Zero: Apply zero input pressure to the transmitter before starting the zero adjustment calibration and wait until the zero reading stabilizes. Note that in the case of absolute pressure transmitter, an absolute zero pressure source must be used. If the model is differential, apply the same pressure on the high and low pressure sides, and finally, if it is a manometric model, open the valve installed to atmospheric pressure.

Maintenance – In this directory user can run Fixed Current mode for testing, Restart the device by software, Restore Default settings of the transmitter or Save/Restore user data in/from sensor memory.

Observe – In this directory the values of the output current, PV% (Pressure or Flow, in percentage), PV (Pressure or Flow), SV (Temperature) and TV (Pressure) can be read.

**If the transmitter is configured for pressure measurement (instead of flow), PV will display pressure characterized by user (using Table) or the variable configured on "Special Unit" (volume, mass, level), while TV will display pressure without characterization.*

Diagnosis – In this directory user can configure and view the device diagnostics.

- **General Device Status –** Informs if there is any problem or alert related to communication or general sensor status and calculated pressure values such as Overpressure Alert, Sensor Communication Error, Sensor Not Initialized, Sensor Fail, Read Capacitance Fail, Incompatible Sensor, Totalizing Limit Alert, Malfunction, Fixed Current, PV Out of Operating Limit, Temperature Out of Operating Limit and Saturated Current.

- **Changing Counter –** Informs the change counters for each of the following transmitter parameters. User can also reset the counters in this directory.
  - *Damping*
  - *PV Range*
  - *Pressure Unit*
  - *Current Trim*
  - *Pressure Trim*
  - *Totalization*
  - *HART Polling Address*
  - *Fail Safe Point*
  - *Transfer Function*
  - *Software Write Protection*
  - *Display LCD Variables*
  - *Characterization Curve Points*
  - *Temperature Unit*
  - *Square Root Cutoff*
  - *Zero Cutoff*

- **Pressure Diagnosis –** Configures and reports the diagnostics of Flow Totalization (enables/disables), Maximum and Minimum applied pressures and Overpressure Counter.

- **Temperature –** It reports the maximum and minimum temperature values recorded by the transmitter during its operation, according to user calibration.

- **HART –** Counters for receiving and sending HART communication commands, plus a parameter that indicates the rate of loss of those commands. Assists the user in analyzing the performance of the HART network. Can be reset anytime.

3.7. CALIBRATION

VPT10-H allows user to calibrate several variables, according to their own measurement standards, to perfectly fit the process. Following are the variables that can be calibrated, with their respective procedures.

PRESSURE

It allows the user to adjust the maximum and minimum values to be used in the process, according to the reference value of the pressure generator used in the calibration. By applying the lower pressure value, user must perform the lower pressure trim (or zero trim if wishes to calibrate zero pressure). Subsequently, by applying the upper pressure value, user must perform the upper pressure trim.

ATTENTION

For pressure calibration, minimum span (difference between upper and lower pressure according to sensor range) must be respected. Otherwise, transmitter will not accept the new calibration values, maintaining the previous calibration.

With these two calibrations, transmitter starts to have its pressure references for the measurement with maximum precision offered. The pressure value in percent (%) will be calculated using the user-configured work range in the parameters previously described in section 3.6.

CURRENT

Current calibration is common for all transmitters and also for the HART® protocol, which provides standard commands and routines for this functionality. Generally, configuration and calibration softwares provide methods that automatically set the output current to 4 mA and 20 mA according to the calibration point to be executed (zero or span, respectively).

After generating the fixed current through the transmitter, with an ammeter connected in series (see figure 3.12), user can check the actual current generated and send it by means of HART® commands to the equipment, which will perform the internal calibration and generate the corrected current, allowing user to verify the new current in the connected ammeter, automatically. This process can be repeated as many times as user deems necessary, until current is perfectly calibrated at both ends (4 mA and 20 mA).

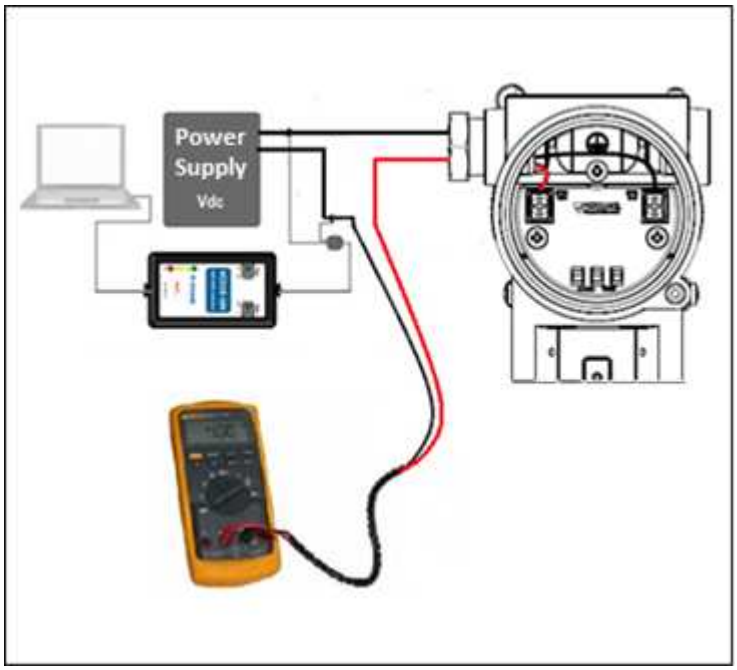


Figure 3.12 –Mounting for current trim on VPT10-H.

TEMPERATURE

The temperature calibration is the simplest offered by the transmitter, where user only sends the value of the ambient temperature measured by an external thermometer. The transmitter automatically adjusts the internal temperature measurement based on the value sent by the user. This process can be repeated as many times as user deems necessary, until the temperature is perfectly calibrated.

3.8. DIAGNOSIS

VPT10-H has several diagnostics in order to assist the predictive maintenance of the transmitter, minimizing the problems in the process. By setting the parameters according to the specific application, user can count on a series of indicators that will assist in the decision to execute the necessary system maintenance.

In addition, it also offers sensor and measurement status to alarm user for system abnormal behavior. These alarms indicate faults common to HART® or pressure transmitter specific equipment, as described below.

HART® COMMON ALARMS

PV OUT OF LIMITS: primary variable value is outside normal range.

NON-PV OUT OF LIMITS: a variable other than primary variable has its value outside normal range. For VPT10-H this variable is the temperature and its limits are -40 °C and 85 °C.

LOOP CURRENT SATURATED: the output current value is saturated, above or below limits.

LOOP CURRENT FIXED: output current in fixed mode.

MORE STATUS AVAILABLE: indicates that device-specific alarms are active.

COLD START: there was a restart of the device.

CONFIGURATION CHANGED: some parameter of the device has been configured.

DEVICE MALFUNCTION: some important transmitter variable is malfunctioning.

VPT10-H SPECIFIC ALARMS

In the event of these alarms, the diagnostics alert icon and the message "-E-" will be displayed on the LCD display.

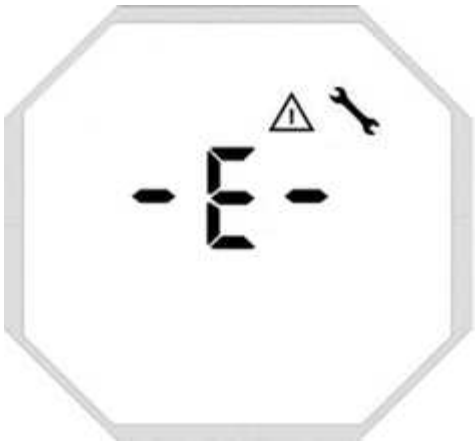


Figure 3.13 – Indication of specific error on VPT10-H.

INCOMPATIBLE SENSOR: the pressure sensor connected to the transmitter is not compatible with models supported by the VPT10-H.

SENSOR NOT CONNECTED: the pressure sensor is not properly connected to the transmitter. Check the polarity of the connector or if it is not damaged.

SENSOR NOT INITIALIZED: the pressure sensor is not correctly initialized to factory settings, which will inevitably result in incorrect process measurements.

VPT10-H allows user to identify the following statuses via Diagnosis menu:

- *Overpressure: the pressure applied to the transmitter exceeds allowed safe value.*
- *Sensor Communication Failure: CL and CH reading is not running successfully.*
- *Faulty Sensor: the number of overpressures has exceeded limit recommended by manufacturer.*
- *Cap.Low Read Failure: CL reading is bringing BAD status.*
- *Cap.High Read Failure: CH reading is bringing BAD status.*
- *Totalizing Alarm: the totalization value has exceeded limit configured by user.*

When in communication failure with the sensor, capacitances, pressure and flow values are indicated as Nan (Not-a-Number) in the communication and "-E-" on display numeric field (Figura 3.13).

In the case of a saturated measurement* (above 103.125% of URV or below -1.25% of LRV), display will indicate “SAT” message on alphanumeric field (Figure 3.14), alert icon will be displayed and “Loop Current Saturated” and “PV Out of Limits” status will become active on HART communication.

Figure 3.14 – Indication of measurement saturation on VPT10-H.

**Saturation values are defined on NAMUR NE 43 standard.*

3.9. FDT/DTM CONFIGURATION

FDT/DTM-based tool (Ex. PACTware®, FieldCare®) can be used for device information, configuration, monitoring, calibration and diagnosis with HART® technology. Vivace offers the DTM files for all of its devices (HART® and Profibus PA).

PACTware® is property of *PACTware Consortium* and can be found on http://www.vega.com/en/home_br/Downloads.

The following figures exemplify DTM configuration screens for VPT10-H using Vivace's VCI10-UH interface and PACTware®.

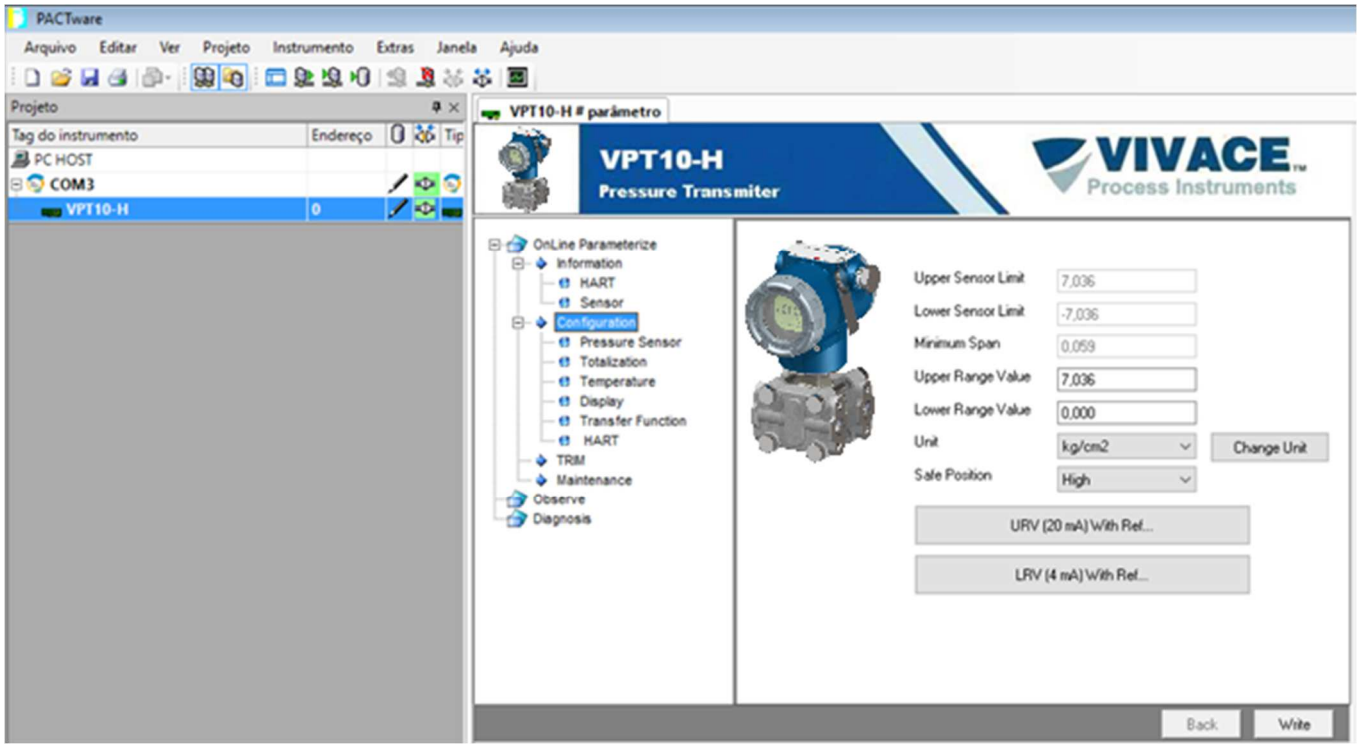


Figure 3.15 – Range configuration screen for VPT10-H on PACTware.

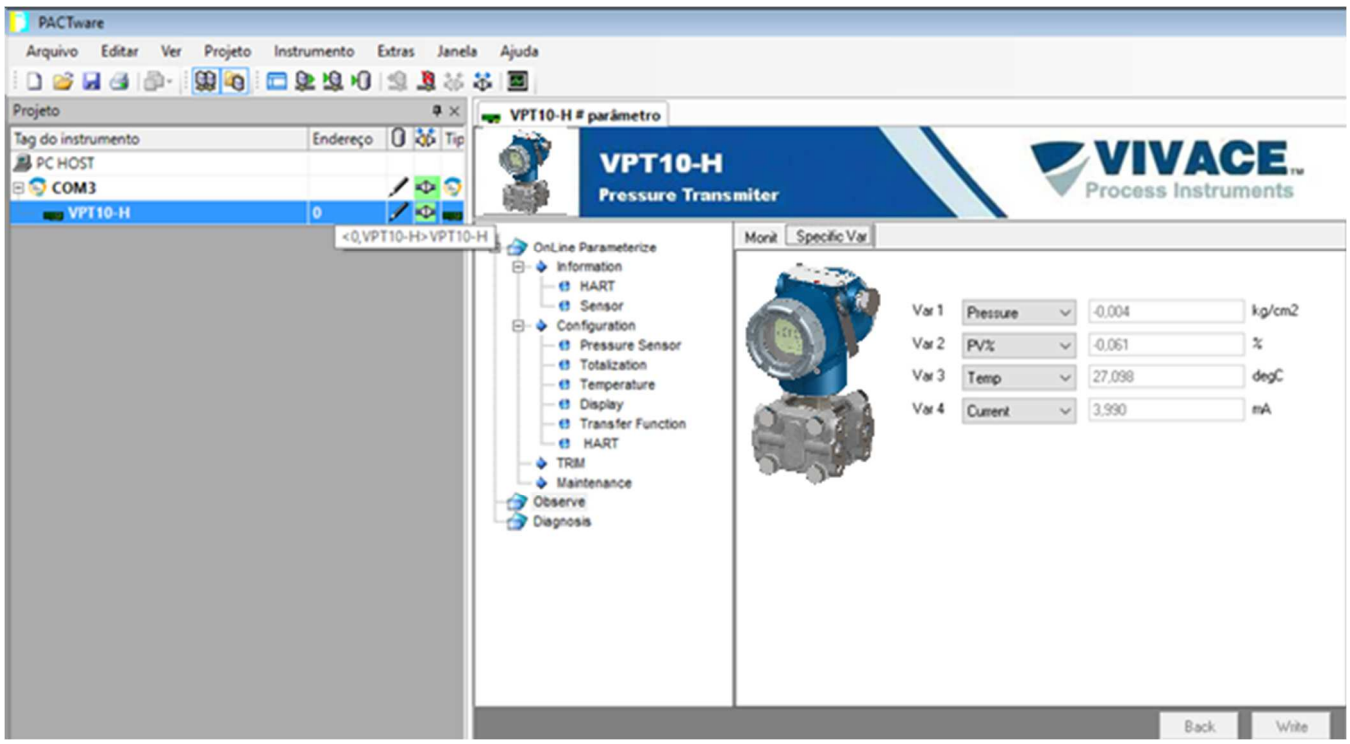


Figure 3.16 – Monitoring screen for VPT10-H on PACTware.

4 MAINTENANCE

VPT10-H transmitter, like all Vivace products, is rigorously evaluated and inspected before being sent to the customer. However, in case of a malfunction, a diagnosis can be made to check whether the problem is located in the installation, in the configuration of the equipment or if there is a problem in the transmitter.

4.1. ASSEMBLY AND DISASSEMBLY PROCEDURES

Figure 4.1 shows in detail all components of the VPT10-H. Before disassembling the equipment, it must be switched off. Maintenance of electronic boards should not be performed under penalty of loss of equipment warranty.

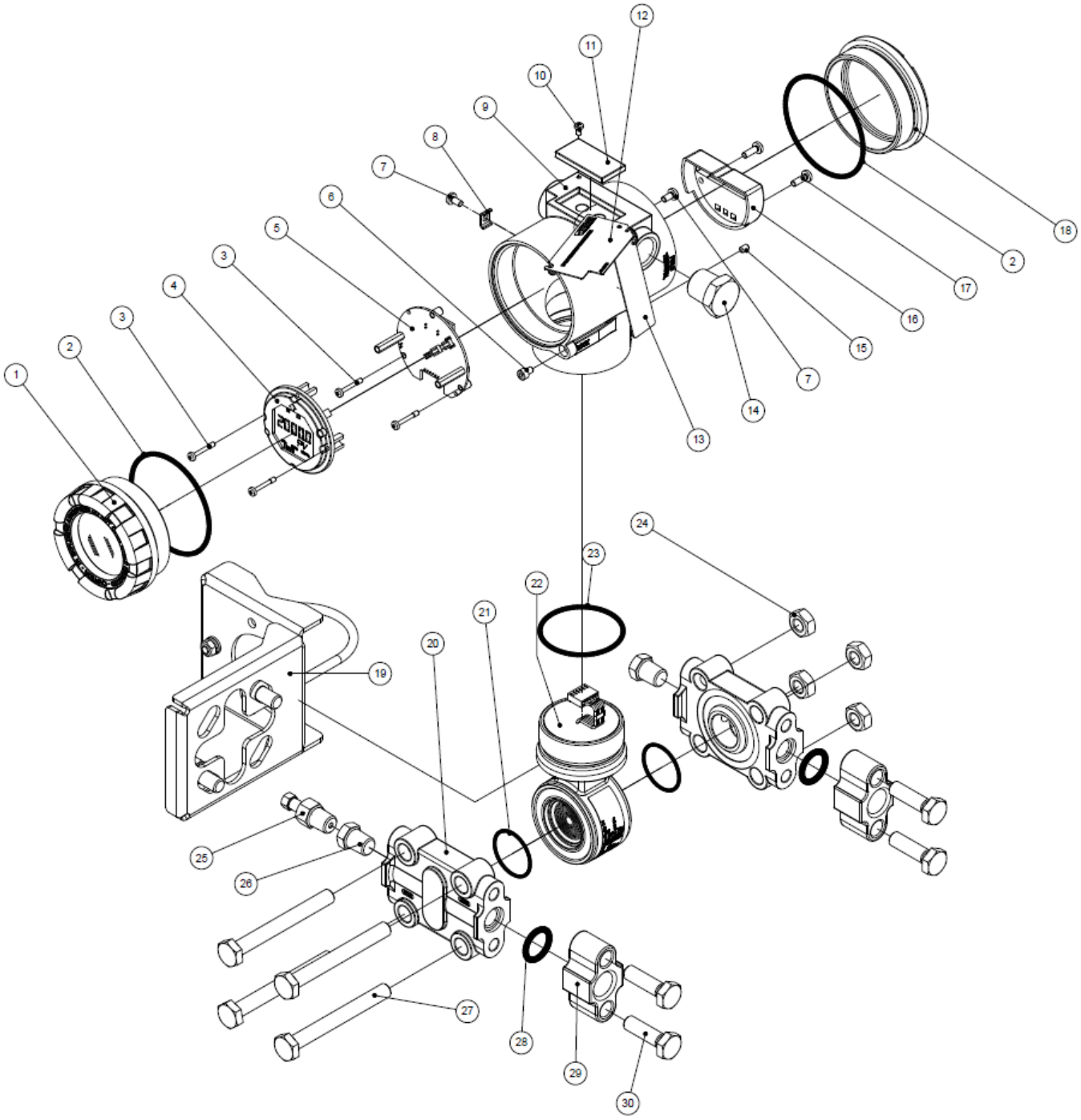


Figure 4.1 – Exploded view for VPT10-H.

Following are the steps for disassembling the pressure transmitter for maintenance and repair of the parts. The values in parentheses indicate the part identified in the exploded view (Figure 4.1). To mount VPT10-H simply follow the reverse sequence of the steps.

1 Remove the back cover (18);
2 Remove power from the transmitter by removing all wiring through the side holes;
3 Remove the front cover (1) and remove the securing screws from the main electronic board (3);
4 Disconnect power and sensor cables connected to the main board (5);
5 Unscrew the sensor (22) from housing (9);
6 Loosen the nuts (24) and remove the screws (27) to remove flanges (20).

CAUTION
Vivace does not recommend any kind of maintenance on pressure sensor by user!

4.2. SPARE PARTS

The list of spare parts of the VPT10-H that can be purchased directly from Vivace Process Instruments are listed in tables 4.1 and 4.2.

VPT10-H - SPARE PARTS CODES		
DESCRIPTION	POSITION FIG. 4.1	CODE
COVER WITH WINDOW (includes o´ring)	1	2-10002
COVER REAR (includes o´ring)	18	2-10003
O´RING (covers)	2	1-10001
HOUSING WITH TERMINAL BLOCKS AND FILTERS	9	2-10016
DISPLAY (includes screws)	4	2-10006
MAIN BOARD (includes screws and spacers)	5	2-10058
DISPLAY AND MAIN BOARD SCREWS	3	1-10002
TERMINAL BLOCK COVER (includes screws)	16	2-10019
TERMINAL BLOCK SCREWS	17	1-10003
SENSOR FLANGE	20	2-10059
O´RING (sensor)	21	* See Table 4.2
EXTERNAL GROUND TERMINAL (includes screws)	8 e 7	2-10010
PLUG OF THE ELECTRICAL CONNECTION	14	1-10005
MOUNTING BRACKET (includes U clamp, bolts, nuts and washers)	19	2-10060
COVERS LOCK SCREWS	6	1-10006
PROTECTION RUBBER OF Z and S	11	2-10015
IDENTIFICATION PLATE SCREW	10	1-10007
HOUSING LOCK SCREWS	15	1-10008
CAPACITIVE SENSOR* (see figure 4.2)	22	2-10061
O´RING (sensor neck)	23	1-10015
FLANGES SCREWS (includes nuts)	27 e 24	1-10016
DRAIN/VENT VALVE	25	2-10083
PLUG OF THE FLANGE	26	1-10017
O´RING (adapter)	28	1-10018
1/2 NPT ADAPTER	29	2-10084
1/2 NPT ADAPTER SCREWS	30	1-10019
IDENTIFICATION PLATE	12	2-10085
TAG PLATE (includes ring)	13	2-10086

Table 4.1 – Spare parts available for VPT10-H.

* Sensor O'rings – Table of Codes	
1-10014	O'ring - Buna N
1-10020	O'ring - Viton
1-10021	O´ring - Teflon

Table 4.3 – Sensor o´rings spare parts.

2-10061 *Capacitive Sensor Pressure*

Accuracy Class	**S**	STANDARD
	H	HIGH PERFORMANCE (SEE NOTE 1)
Sensor Type	**A**	ABSOLUTE
	D	DIFFERENTIAL
	H	DIFFERENTIAL HIGH STATIC PRESSURE
	M	MANOMETRIC
Sensor Range	**1**	-7.5 to 7.5 kPa (-30 to 30 inH_2O)
	2	-37.4 to 37.4 kPa (-150 to 150 inH_2O)
	3	-147.1 to 147.1 kPa (-21 to 21 psi)
	4	-690 to 690 kPa (-100 to 100 psi)
	5	-2068 to 2068 kPa (-300 to 300 psi)
	6	-6890 to 6890 kPa (-1000 to 1000 psi)
	7	-0.1 to 20.68 MPa (-14.7 to 3000 psi)
Diafragm Material	**I**	SS 316L
Fill Fluid	**S**	SILICON OIL

Spare Part Code Example:

2-10061	-	S	D	1	I	S	

NOTE 1: Only available for Differential and Gauge models.

Figure 4.2 – Sensor spare parts.

5 CERTIFICATION

VPT10-H was projected to attend national and international regulation for explosion proof and intrinsic safety.

The transmitter is certified by INMETRO for intrinsic safety and explosion proof – dust ignition (Ex tb) and flame (Ex db).

6 TECHNICAL CHARACTERISTICS

6.1. IDENTIFICATION

VPT10-H has an identification plate affixed to the top of its housing, specifying the model and serial number, as shown in Figure 6.1.

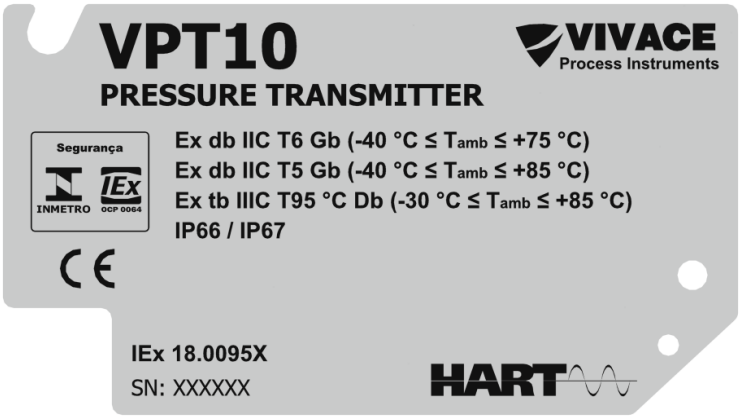


Figure 6.1 –Identification plate for VPT10-H.

The sensor also has its own identification label, containing the manufacturing data, such as Model, Pressure Range and Serial Number, among others. The sensor identification tag is shown in Figure 6.2.

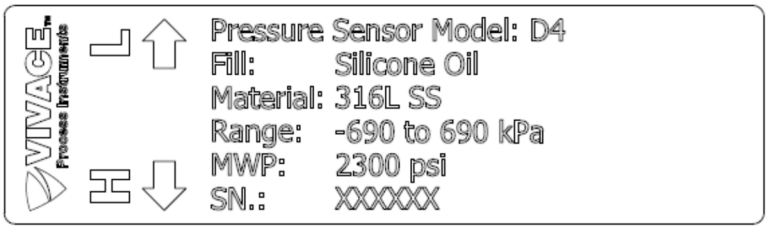


Figure 6.2 –Identification label for capacitive sensor.

6.2. TECHNICAL SPECIFICATION

Accuracy	Standard Model: ± 0.075% High Performance Model: ± 0.05%
Communication Protocol	HART® 7 / 4-20 mA according to NAMUR NE-43
Sensor Type	Capacitive sensor with microprocessor, digital reading and compensation algorithm.
Models / Measurement Range	D1 / -7.5 to 7.5 kPa (-30 to 30 inH_2O) D2 / -37.4 to 37.4 kPa (-150 to 150 inH_2O) D3 / -147.1 to 147.1 kPa (-21 to 21 psi) D4 / -690 to 690 kPa (-100 to 100 psi) D5 / -2068 to 2068 kPa (-300 to 300 psi) D6 / -6890 to 6890 kPa (-1000 to 1000 psi) M1 / -7.5 to 7.5 kPa (-30 to 30 inH_2O) M2 / -37.4 to 37.4 kPa (-150 to 150 inH_2O) M3 / -100 to 147.1 kPa (-14.7 to 21 psi) M4 / -100 to 690 kPa (-14.7 to 100 psi) M5 / -100 to 2068 kPa (-14.7 to 300 psi) M6 / -100 to 6890 kPa (-14.7 to 1000 psi) M7 / -0.1 to 20.68 MPa (-14.7 to 3000 psi) A2 / 0 to 37.4 (0 to 150 inH_2O) A3 / 0 to 147.1 kPa (0 to 21 psi) A4 / 0 to 690 kPa (0 to 100 psi) A5 / 0 to 2068 kPa (0 to 300 psi) A6 / 0 to 6890 kPa (0 to 1000 psi) H2 / -37.4 to 37.4 kPa (-150 to 150 inH_2O) H3 / -147.1 to 147.1 kPa (-21 to 21 psi) H4 / -690 to 690 kPa (-100 to 100 psi) H5 / -2068 to 2068 kPa (-300 to 300 psi)
Static Pressure and Overpressure Limits	Range 1: 8 MPa (81.6 kgf/cm^2) Ranges 2 to 6: 16 MPa (163.1 kgf/cm^2) Range 7: 40 MPa (407.9 kgf/cm^2) For model H: 31,2 MPa (318,15 kgf/cm^2)
Stability	Standard Model: ±0.2% URL (5 years) High Performance Model: ±0.2% URL (15 years)
Turndown	150:1 or 200:1 (depending on model)
Response Time	50 ms
Output Current	4-20 mA according to NAMUR-NE43
Output Type	Linear, Square Root and Table
Power Supply	12 to 45 Vdc, no polarity, with transient suppressor
Temperature Limits	Ambient: -40 to 85°C Process: -40 to 100°C Storage: -40 to 100°C
Humidity Limits	0 to 100% RH (relative humidity)
Configuration	Remote configuration using EDDL or FDT/DTM-based tools, as well as PALM and Android platforms. Local configuration via magnetic tool.
Write Proteção	Via hardware and software with indicative icon on display
Totalization	Non-volatile volumetric and mass flow
Hazardous Area Classification	Explosion Proof and Intrinsically Safe
Protection Degree	IP67
Mounting	Field, through a bracket on a 2” pipe
Housing Material	Aluminum
Approximated Weight with Bracket	3,5 Kg

Table 6.1 – Technical specification for VPT10-H.

6.3. ORDERING CODE

VPT10 *Pressure Transmitter*

Communication Protocol	H	HART
	P	PROFIBUS
Accuracy Class	S	STANDARD
	H	HIGH PERFORMANCE (SEE NOTE 1)
Sensor Type (SEE NOTE 2)	A	ABSOLUTE
	D	DIFFERENTIAL
	H	DIFFERENTIAL HIGH STATIC PRESSURE
	M	MANOMETRIC
Sensor Range	1	-7.5 to 7.5 kPa (-30 to 30 inH_2O)
	2	-37.4 to 37.4 kPa (-150 to 150 inH_2O)
	3	-147.1 to 147.1 kPa (-21 to 21 psi)
	4	-690 to 690 kPa (-100 to 100 psi)
	5	-2068 to 2068 kPa (-300 to 300 psi)
	6	-6890 to 6890 kPa (-1000 to 1000 psi)
	7	-0.1 to 20.68 MPa (-14.7 to 3000 psi)
Diafragm Material	I	SS 316L
Fill Fluid	S	SILICON OIL
Flange/Adapter/Purge Material	I	SS 316
Purge Position	0	NO PURGE
	1	PURGE ON PROCESS CONNECTION OPPOSITE SIDE
	2	PURGE ON SUPERIOR PROCESS SIDE
	3	PURGE ON INFERIOR PROCESS SIDE
Material Cell's Sealing Ring	B	BUNA-N
	V	VITON
	T	TEFLON
Process Connection	0	¼ - 18NPT (NO ADAPTER)
	1	½ - 14NPT (WITH ADAPTER)
Certification Type	0	NO CERTIFICATION
	1	INTRINSICALLY SAFE
	2	EXPLOSION PROOF
Certification Body	0	NO CERTIFICATION
	1	INMETRO
Housing Material	A	ALUMINUM
Electrical Connection	1	½ – 14 NPT
Painting	1	BLUE – RAL 5005
Mounting Bracket	0	NO BRACKET
	1	SS 304 BRACKET

Ordering Code Example:

VPT10-	H	S	-	D	1	-	I	S	I	0	B	0	-	0	0	-	A	1	1	0

Obs: Explosion Proof Certification Ex tb (dust ignition) and Ex db (flame)

NOTE 1: Only available for Differential and Gauge models

NOTE 2: Ranges might be extended up to 0.8xLRL and 1.2xURL with minimal accuracy degradation

LRL = Lower Range Limit ; URL = Upper Range Limit

VPT10 *Flanged Pressure Transmitter*

Communication Protocol	**H**	HART
	P	PROFIBUS
Sensor Type	**L**	LEVEL
Sensor Range (SEE NOTE 1)	**2**	-37.4 to 37.4 kPa (-150 to 150 inH_2O)
	3	-147.1 to 147.1 kPa (-21 to 21 psi)
	4	-690 to 690 kPa (-100 to 100 psi)
	5	-2068 to 2068 kPa (-300 to 300 psi)
Sensor Diafragm Material	**I**	SS 316L
Sensor Fill Fluid	**S**	SILICON OIL
Flange/Adapter/Purge Material (Low Side)	**I**	SS 316
Purge Position	**0**	NO PURGE
	1	PURGE ON PROCESS CONNECTION OPPOSITE SIDE
	2	PURGE ON SUPERIOR PROCESS SIDE
	3	PURGE ON INFERIOR PROCESS SIDE
Cell's Sealing Ring Material	**B**	BUNA-N
	V	VITON
	T	TEFLON
Process Connection (Reference Socket)	**0**	¼ - 18NPT (NO ADAPTER)
	1	½ - 14NPT (WITH ADAPTER)
Process Connection (Level Socket)	**1**	1 ½" 150 #ANSI B16.5
	2	2" 150 #ANSI B16.5
	3	3" 150 #ANSI B16.5
	4	2" 300 #ANSI B16.5
	5	3" 300 #ANSI B16.5
Process Connection Material (Flange)	**I**	SS 316
Extension Length	**0**	NO EXTENSION
	1	50 mm
	2	100 mm
	3	150 mm
Level Socket Diafragm Material	**I**	SS 316
Level Socket Fill Fluid	**S**	SILICON DC200/20
Certification Type	**0**	NO CERTIFICATION
	1	INTRINSICALLY SAFE
	2	EXPLOSION PROOF
Certification Body	**0**	NO CERTIFICATION
	1	INMETRO
Housing Material	**A**	ALUMINUM
Electrical Connection	**1**	½ – 14 NPT
Painting	**1**	BLUE – RAL 5005

Ordering Code Example:

VPT10-	H - L 2 - I S I 0 B 0 - 1 I 0 I S - 0 0 - A 1 1

Obs: Explosion Proof Certification Ex tb (dust ignition) and Ex db (flame)

NOTE 1: Ranges might be extended up to 0.8xLRL and 1.2xURL with minimal accuracy degradation

LRL = Lower Range Limit ; URL = Upper Range Limit

VPT10 *Sanitary Pressure Transmitter*

Communication Protocol	H	HART
	P	PROFIBUS
Sensor Type	S	SANITARY
Sensor Range (SEE NOTE 1)	2	-37.4 to 37.4 kPa (-150 to 150 inH_2O)
	3	-147.1 to 147.1 kPa (-21 to 21 psi)
	4	-690 to 690 kPa (-100 to 100 psi)
	5	-2068 to 2068 kPa (-300 to 300 psi)
Sensor Diafragm Material	I	SS 316L
Sensor Fill Fluid	S	SILICON OIL
Flange/Adapter/Purge Material (Low Side)	I	SS 316
Purge Position	0	NO PURGE
	1	PURGE ON PROCESS CONNECTION OPPOSITE SIDE
	2	PURGE ON PROCESS CONNECTION OPPOSITE SIDE
	3	PURGE ON PROCESS CONNECTION OPPOSITE SIDE
Cell's Sealing Ring Material	B	BUNA-N
	V	VITON
	T	TEFLON
Process Connection (Reference Socket)	0	¼ - 18NPT (NO ADAPTER)
	1	½ - 14NPT (WITH ADAPTER)
Process Connection (Sanitary Socket)	1	TRI CLAMP 1 ½" WITHOUT EXTENSION
	2	TRI CLAMP 2" 150 WITHOUT EXTENSION
	3	TRI CLAMP 2" 150 WITH EXTENSION
	4	SMS 1 ½" WITHOUT EXTENSION
	5	SMS 2" WITHOUT EXTENSION
	6	SMS 2" WITH EXTENSION
Process Connection Material (Sanitary Socket)	I	SS 316
Sanitary Socket Fill Fluid	S	SILICON DC200
	N	PROPILEN GLICOL (NEOBEE)
Sanitary Socket Diafragm Material	I	SS 316
Sanitary Socket Sealing Ring Material	0	NO SEALING RING
	B	BUNA-N
	V	VITON
	T	TEFLON
Adapter Glove	0	NO ADAPTER GLOVE
	1	SS 316L GLOVE
Certification Type	0	NO CERTIFICATION
	1	INTRINSICALLY SAFE
	2	EXPLOSION PROOF
Certification Body	0	NO CERTIFICATION
	1	INMETRO
Housing Material	A	ALUMINUM
Electrical Connection	1	½ – 14 NPT
Painting	1	BLUE – RAL 5005

Ordering Code Example:

VPT10-	H	-	S	2	-	I	S	I	0	B	0	-	1	I	S	I	B	0	-	0	0	-	A	1	1

Obs: Explosion Proof Certification Ex tb (dust ignition) and Ex db (flame)

NOTE 1: Ranges might be extended up to 0.8xLRL and 1.2xURL with minimal accuracy degradation

LRL = Lower Range Limit ; URL = Upper Range Limit

7 WARRANTY

7.1. GENERAL CONDITIONS

Vivace ensures its equipment from any defect on manufacturing or component quality. Problems caused by misuse, improper installation or exposure to extreme conditions are not covered by this warranty.

The user can repair some equipment by replacing spare parts, but it is strongly recommended to forward it to *Vivace* for diagnosis and maintenance in cases of doubt or impossibility of correction by the user.

For details about the product warranty, see the general term warranty on Vivace website: www.vivaceinstruments.com.br.

7.2. WARRANTY PERIOD

Vivace ensures the ideal operating conditions of their equipment by a period of two years, with full customer support regarding to installation, operation and maintenance for the best use of the equipment.

It is important to note that even after warranty period expires, *Vivace* assistance team is ready to assist customer with the best support service, offering the best solutions for the installed system.

APPENDIX

VIVACE Process Instruments	**FSAT** **Technical Analysis Solicitation Form**		
Company:		**Unit/Department:**	**Shipping Invoice nº:**
Standard Warranty: ( )Yes ( )No		**Extended Warranty: ( )Yes ( )No**	**Buying Invoice nº:**
COMMERCIAL CONTACT			
Complete Name:		**Position:**	
Phone and Extension:		**Fax:**	
e-mail:			
TECHNICAL CONTACT			
Complete Name:		**Position:**	
Phone and Extension:		**Fax:**	
e-mail:			
EQUIPMENT DATA			
Model:		**Serial Num.:**	
PROCESS INFORMATION			
Environment Temperature (ºC)		**Work Temperature (ºC)**	
Min:	**Max:**	**Min:**	**Max:**
Operation Time:		**Fail Date:**	
FAIL DESCRIPTION: Here user should describe in detail the observed behaviour of product, frequency of fail occurence and repeatability. Also, should inform operational system version and a quick description of control system architecture where the equipment was installed.			
ADDITIONAL OBSERVATION:			