INSTALLATION, OPERATION, CONFIGURATION AND MAINTENANCE MANUAL
January/2024

VTP10-H

HART® POSITION TRANSMITTER

VIVACE™ Process Instruments

HART® COMMUNICATION FOUNDATION

COPYRIGHT

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

HART® position transmitter **VTP10-H** integrates *Vivace Process Instruments* field device family, being developed to monitor linear and rotative length systems, such as valve actuators.

The transmitter can be powered by a 12 to 45 Vdc power supply, generating a 4-20 mA current channel (according to NAMUR NE43 standard), proportional to measured PV. Its main function is to calculate the correct position of installed system, according to user configuration and calibration, exporting this value through digital communication and analog signal (4-20 mA current).

The measurement sensor used on VTP10-H has no mechanical contact with the installed system whatsoever, since it works on magnetic field effect, which guarantees high precision and immunity to mechanical variations. Easy to install and to initialize, the transmitter also measures ambient temperature and executes several diagnostics for system predictive maintenance, such as reversal, strokes and mileage counters, and position histogram.

Configuration uses HART® 7 communication protocol, already established on the world of industrial automation, via Android or EDDL and FDT/DTM tools to configure measurement scales, work units and calibration, also monitoring the measuring values e device status. User can also execute configurations via local adjustment using a magnetic screwdriver.

Focusing on high performance and robustness, it was projected with the most recent electronic component and material technology, offering long-term reliability for every scale systems.

1.1. BLOCK DIAGRAM

Component modularization for transmitter is described on the following block diagram.

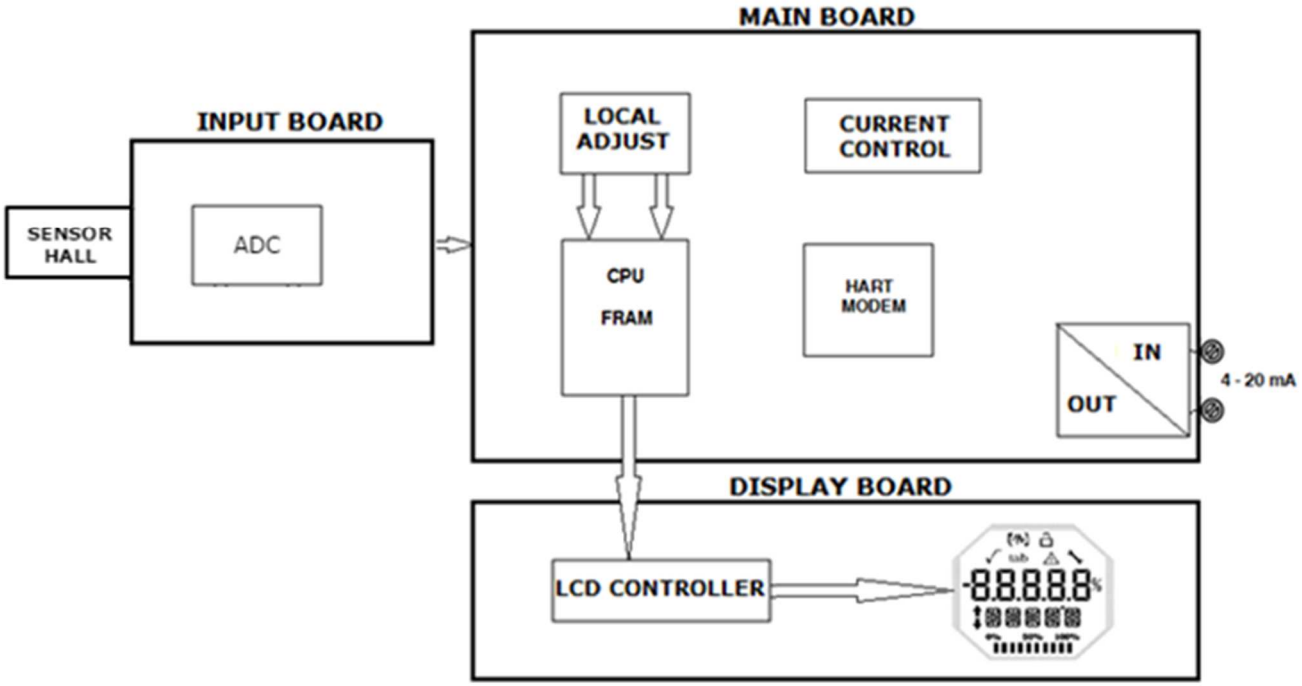

Figure 1.1 - VTP10-H block diagram.

The magnetic sensor signal goes to ADC block, where it is converted to a digital value and then to position, according to calibrated range and selected unit. Position value (PV) is then converted in an output current, proportional to the calibrated range on CPU block.

HART® modem block provide the interface between microcontroller signals and HART® bus. Local adjust block enables local configurations by user on display.

The display board has the controller block to interface LCD and CPU communication signals, adapting all the messages to be shown on display.

Finally, the CPU block can be seen as transmitter's brain, where all the activities are managed, such as time control, HART® machine, diagnosis, among common transmitter routines: configuration, calibration and output current generation, proportional to PV.

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.

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.*

Every device installation process must be executed by qualified personnel, following the procedures demanded by safety rules. It is highly recommended to begin with transmitter mechanics installation on plant, by correctly positioning the magnet and appropriate bracket for transmitter. Only after that, the electrical installation must be performed, connecting the power supply and communication cables to the transmitter.

2.1. INSTALLATION CONDITIONS

Environment conditions must always be considered on transmitter installation, since its performance can be affected by bad conditions of temperature, vibration and humidity. Temperature can affect some electronics behavior. Thus, care must be taken when placing transmitter to avoid high temperatures exposure.

As VTP10-H sensor is magnetic with no mechanical contact, light vibrations should not affect transmitter performance. It is very important that excessive magnetic field variations are avoided though, what might happen when excessive vibration exists on the transmitter. For the cases where considerable mechanical vibrations exist, Vivace offers a remote sensor (section 2.5), which separates transmitter body from magnetic sensor, avoiding measurement interference by those vibrations.

2.2. MECHANICAL ASSEMBLY

The transmitter's housing is IP67 protected, being immune to water contact to electronic circuit and electrical connections, since cable gland or conduit for electrical connection is correctly assembled and sealed with non-hardening substance. Covers must also be tight to avoid humidity, since housing screws are not protected by painting.

The electronic circuit is protected by varnish but constant water or corrosion exposure may compromise this protection and damage the electronic components.

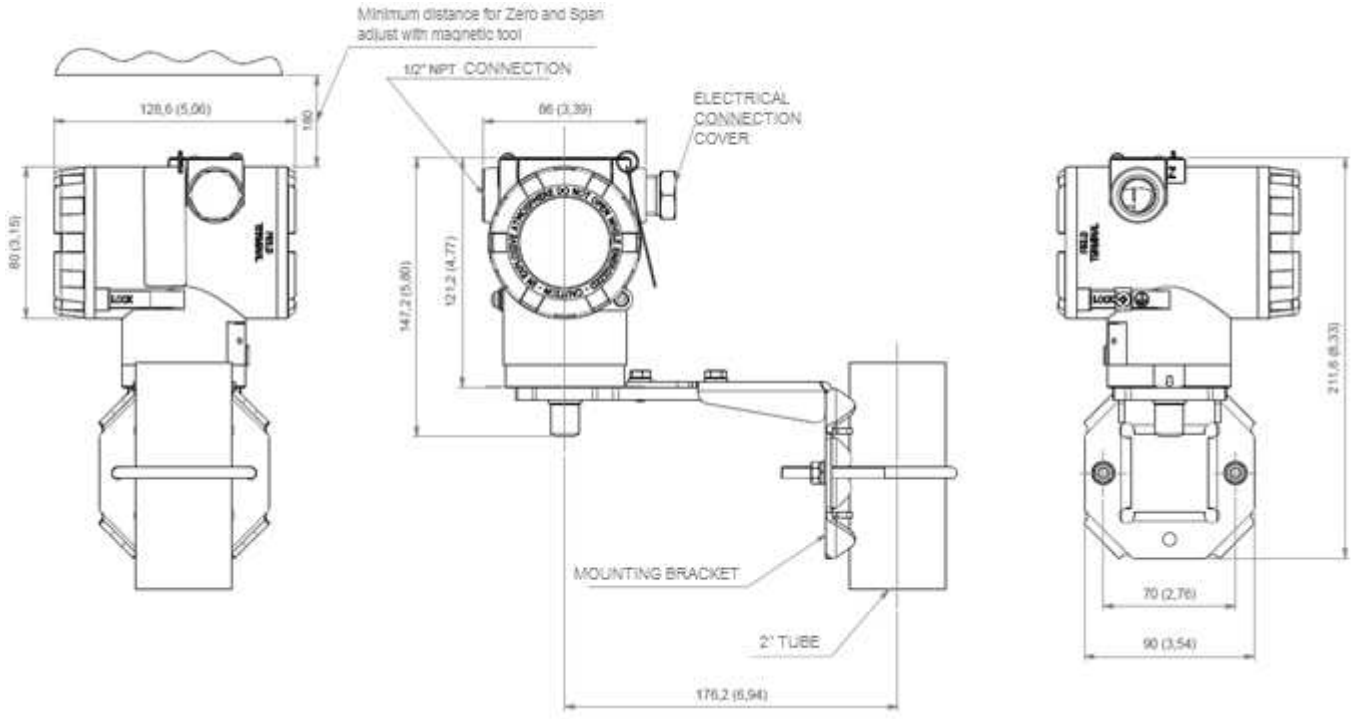

Figure 2.1 – Dimensional and mounting drawings for VTP10-H.

Figure 2.1 shows the dimensional drawing and mounting positions for VTP10-H on standard bracket. Magnets dimensional drawings can be found on section 2.4.

To avoid the risk of involuntary loss of VTP10-H covers due to vibration, for instance, it can be locked by screw, as shown on figure 2.2.

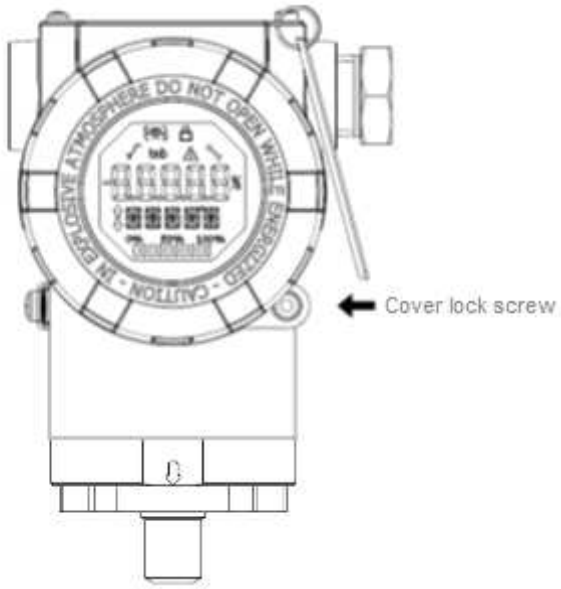

Figure 2.2 – Front cover lock.

VTP10-H is a field device, so it can be installed through a mounting bracket on a 2” tube attached with a U clip. The transmitter can also be attached with the same mounting bracket to a wall or panel.

For best LCD positioning device enables 4 x 90° housing rotation, as shown on figure 2.3

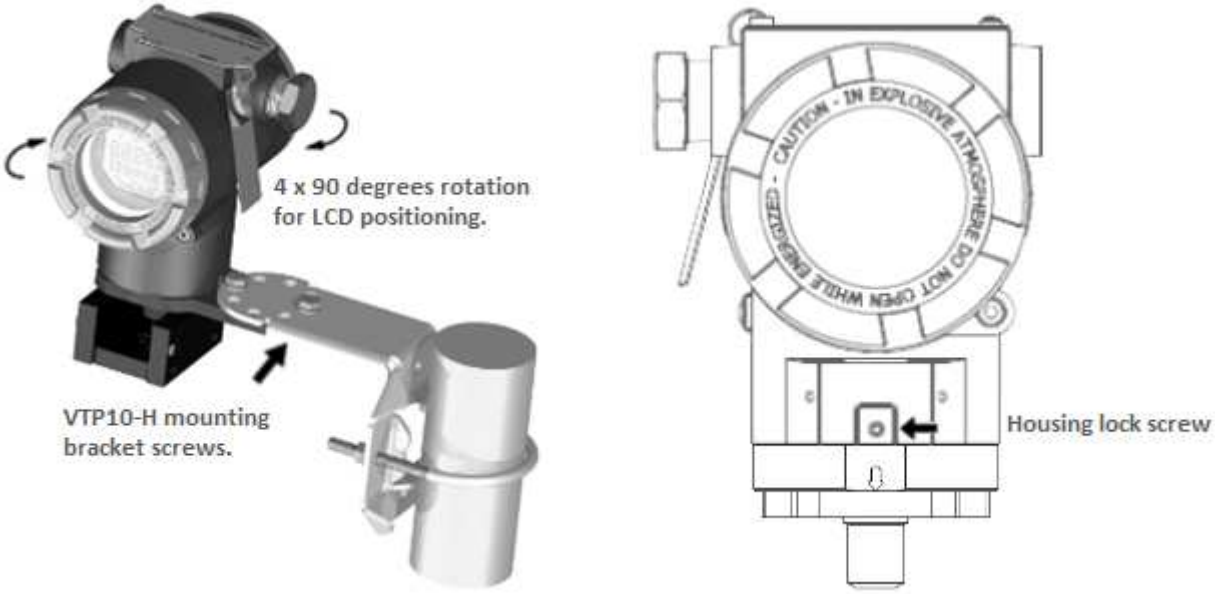

Figure 2.3 – VTP10-H bracket fixation and housing 4 x 90° rotation.

VTP10-H liquid crystal display can also be rotated 4 x 90° so indication will be adequate for user visualization. Figure 2.4 illustrates rotation possibilities for VTP10-H LCD.

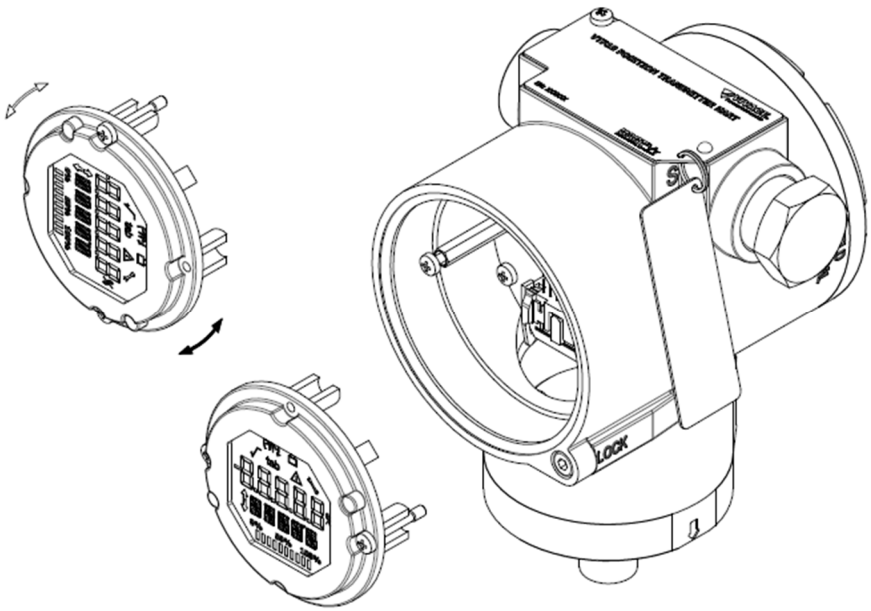

Figure 2.4 – 4 x 90° LCD rotation.

VTP10-H reference magnet installation must begin by positioning it on user system, in order to allow sensor to move through the entire extension to be measured, and aligning magnet indication arrow with transmitter indication arrow on system's central position (50% of length), where sensor will be located (indication arrow located on inferior part of transmitter housing).

After magnet positioning, it must be screwed to user system in order to avoid reference position dislocation, causing measurement failure. Figure 2.5 exemplifies VTP10-H installation on a rotative system, while figure 2.6 shows the installation on a linear system. Note that a minimum and maximum gap (2 mm to 4 mm) between magnet superior face and transmitter inferior face is necessary in order to guarantee sensor performance.

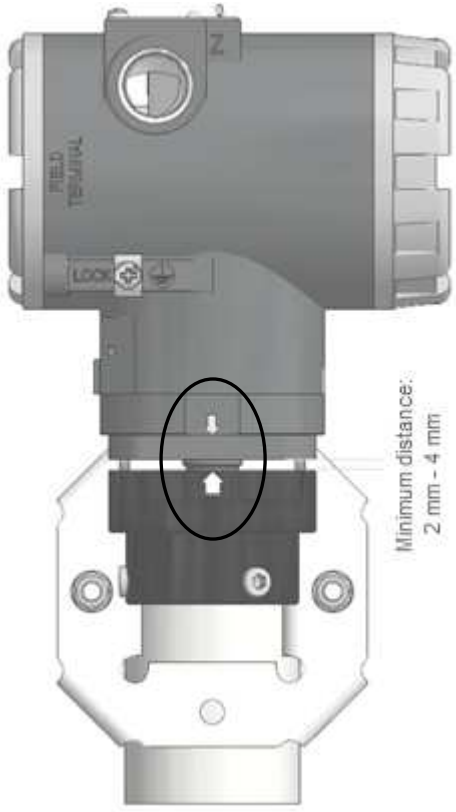

Figure 2.5 – VTP10-H assembly on rotative system.

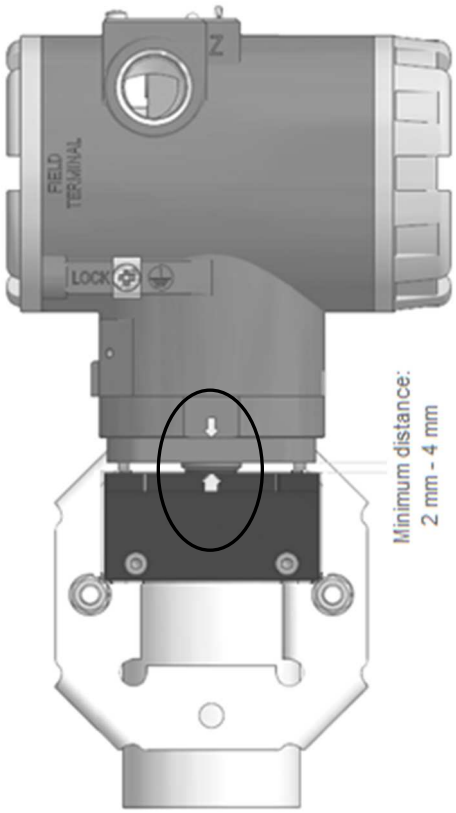

Figure 2.6 –VTP10-H assembly on linear system.

Figure 2.7 shows VTP10-H installed on both linear and rotative valve actuators. For more details on magnet types, check section 2.4.

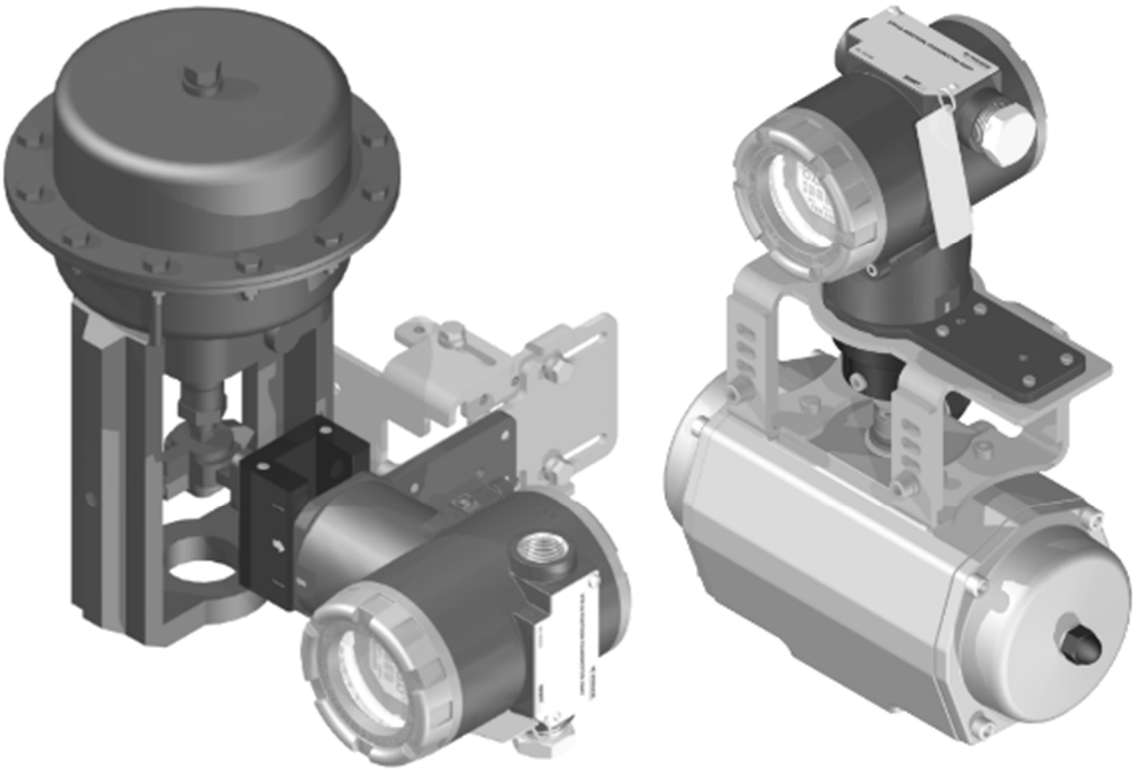

Figure 2.7 – VTP10-H assembly on valve actuators.

2.3. ELECTRICAL CONNECTION

To access the terminal block user must remove VTP10-H rear cover. First, loose cover lock screw (see figure 2.8) by turning it clockwise.

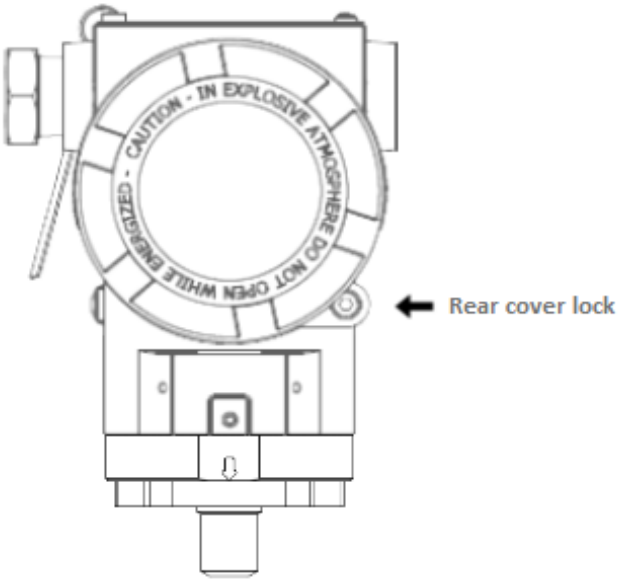

Figure 2.8 – Rear cover lock.

Terminal Description
Power Terminals - PWR BUS 24 Vdc not polarized (12 to 45 Vdc)
Grounding Terminals 1 internal and 1 external
Test Terminals – TEST Loop 4-20 mA Measurement without open circuit
Communication Terminals – COMM HART® communication with configurator

Table 2.1 – VTP10-H terminal description.

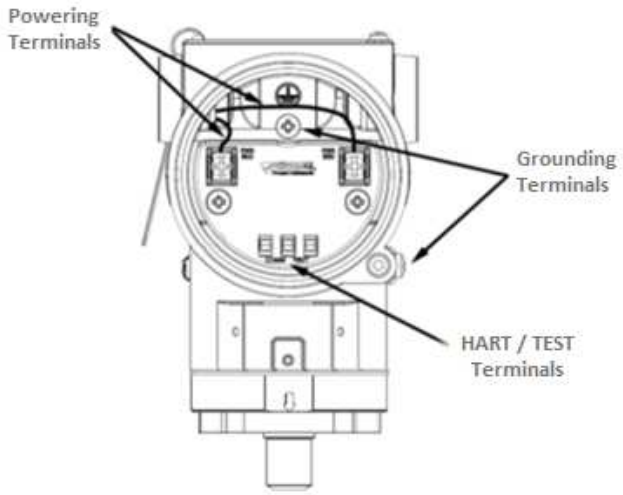

Figure 2.9 – VTP10-H connections and terminal description.

Figure 2.9 shows power supply (PWR BUS), grounding (internal and external) and HART communication terminals for VTP10-H. For powering the device, it is recommended to use a 22 AWG twisted pair cable.

Table 2.1 describes VTP10-H terminal functions.

NOTE

All cables used for connecting VTP10-H with HART® network must be shielded to avoid interference or 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.

Conduits used for power cables must be assembled in order to avoid water entrance in the device terminal block. Conduit screws must be sealed according to specific area required standards. Non-used electrical connection must be sealed with appropriate cover.

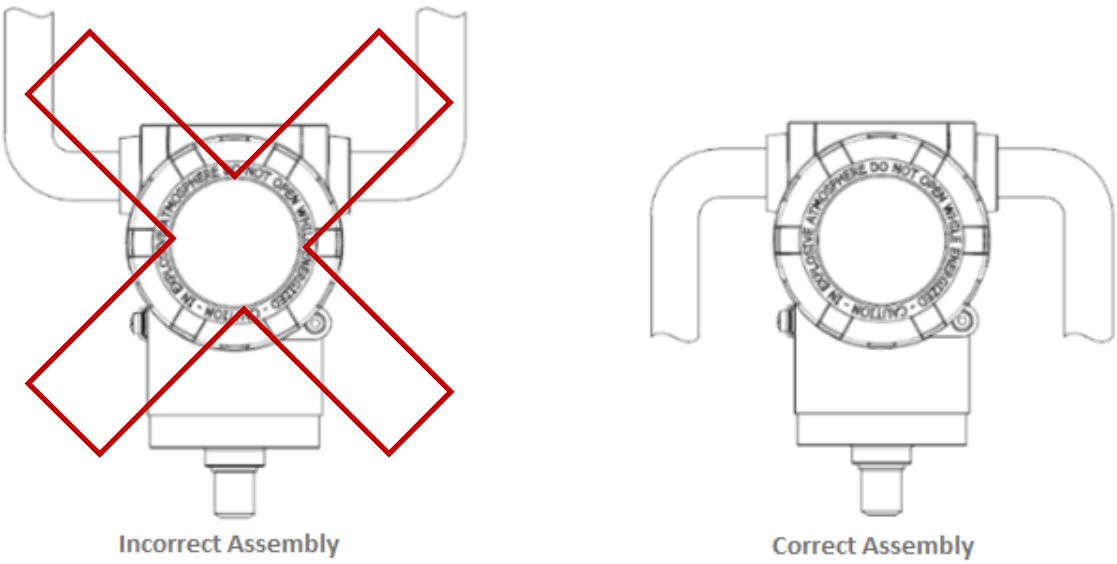

Figure 2.10 – Conduit installation.

Figure 2.10 shows the correct installation for conduit, in order to avoid the entrance of water or any corrosive material that may cause damage to the device.

2.4. MAGNET SPECIFICATION

Correct magnet dimensioning is a primordial for perfect performance of position measurement, allowing sensor to achieve all system length with the highest magnetic field variation possible.

User must consider installation environment, type of movement (rotative or linear) and amplitude (length), in addition to mounting bracket to be used, among other parameters.

Vivace offers the following magnet options for the position transmitter:

Rotative *Option **0** on Ordering Code*

Used on rotative systems, it has a standard diameter with measurement from 0º to 120º (minimum span of 5º between inferior and superior points).

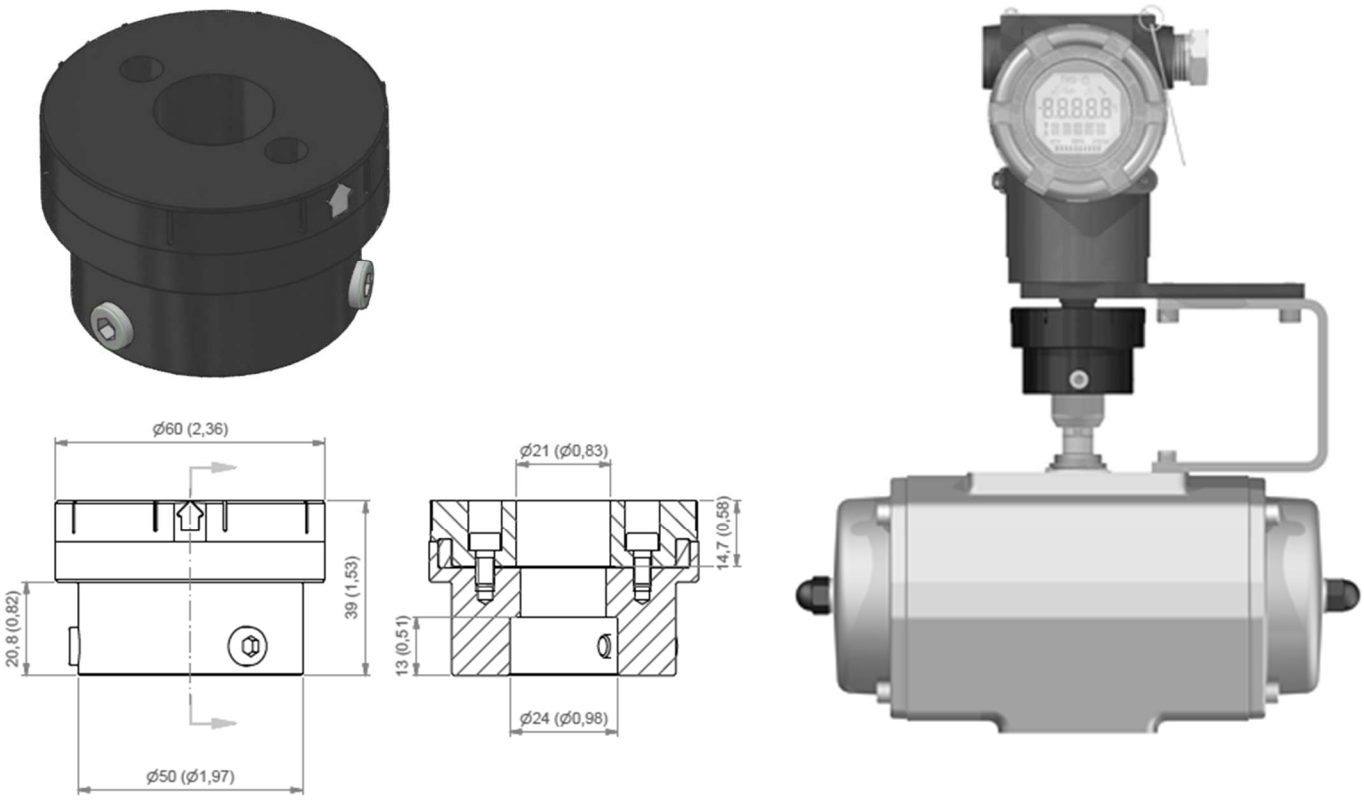

Figure 2.11 – Dimension and assembly of rotative magnet.

Linear 30 *Option **1** on Ordering Code*

Used on linear systems up to 30 mm, with measurement from 0 to 30 mm (minimum span of 10 mm between inferior and superior points).

Linear 70 *Option **2** on Ordering Code*

Used on linear systems of 40 mm to 70 mm, with measurement from 0 to 70 mm (minimum span of 40 mm between inferior and superior points).

Linear 100 *Option **3** on Ordering Code*

Used on linear systems of 70 mm to 100 mm, with measurement from 0 to 100 mm (minimum span of 70 mm between inferior and superior points).

Linear 150 *Option **4** on Ordering Code*

Used on linear systems of 100 mm to 150 mm, with measurement from 0 to 150 mm (minimum span of 100 mm between inferior and superior points).

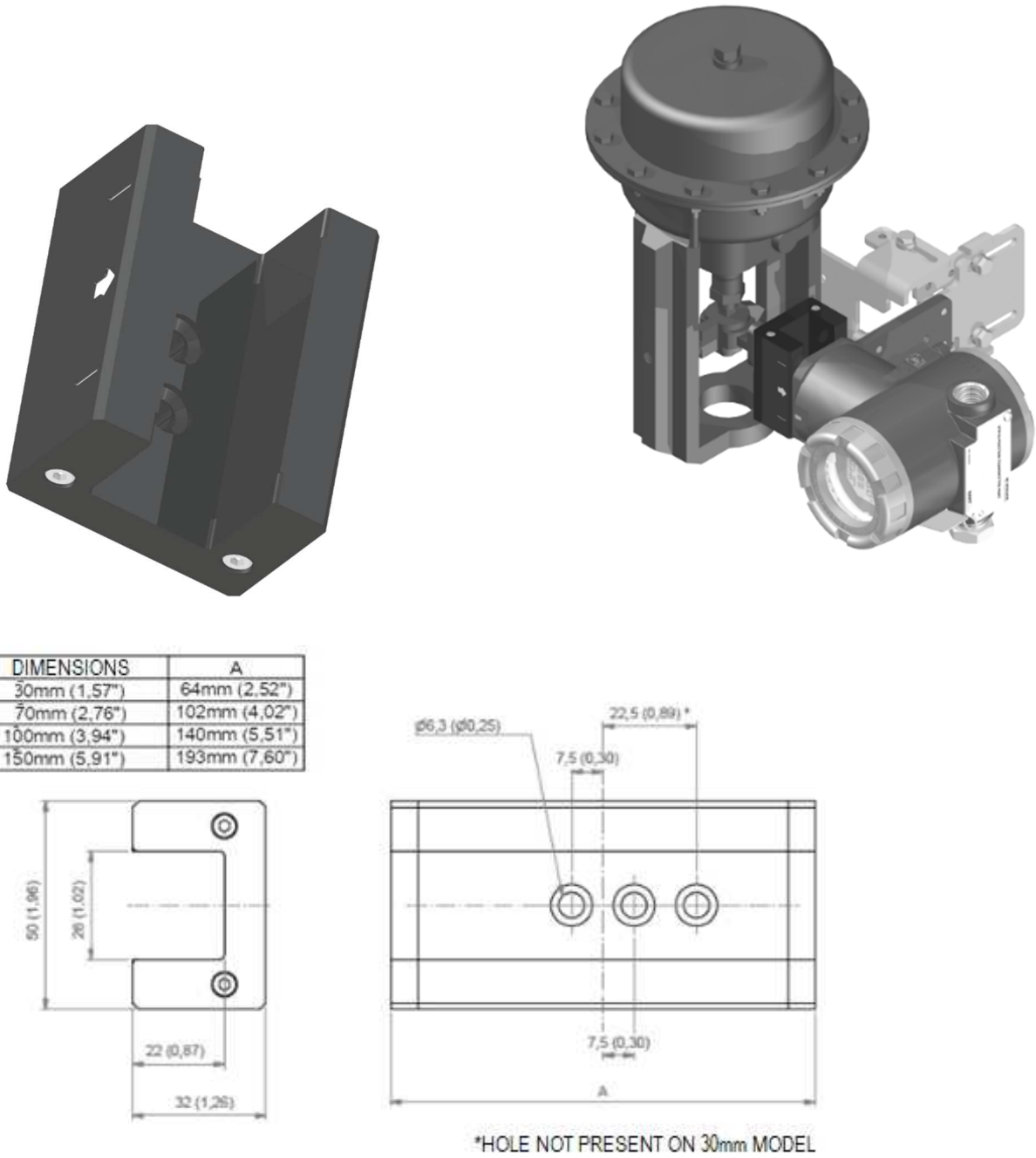

Figure 2.12 – Dimension and assembly for linear magnet models.

2.5. REMOTE SENSOR

For applications where excessive vibration or high temperatures (up to 105 ºC) exists on the measuring system or when the transmitter can not be installed due to its size, Vivace offers a remote sensor (optional) that works as an extension of the transmitter sensor, connected by a cable which has three length options to best adjust device mounting to user process.

Figure 2.13 shows the dimensional drawing of VTP10-H remote sensor components. At the left we can see the transmitter side that receives remote sensor signal, while on the right side we can find the opposite cable side, containing the magnetic sensor already adapted to a fixation support.

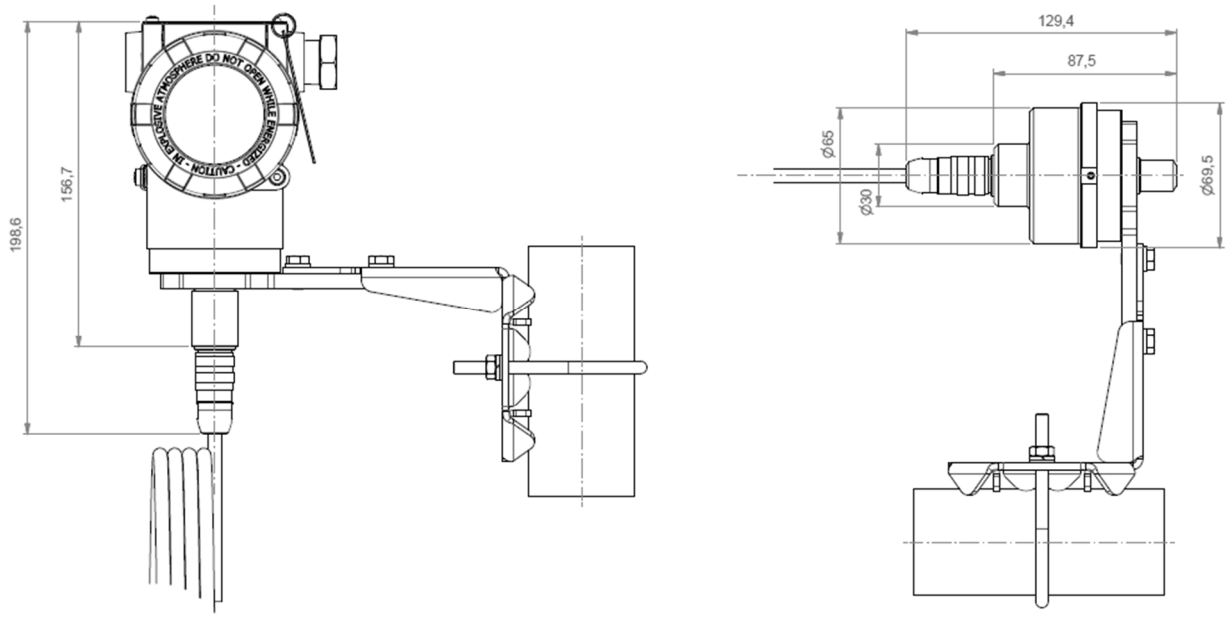

Figure 2.13 – Remote sensor dimensional drawing.

The remote sensor set is composed by three parts:

- Sensor itself, responsible for receiving the magnetic signal and sending it to transmitter as a milivoltage via sensor cable;
- Signal transmission cable from sensor to transmitter input board;
- Transmitter inferior base prepared for transmission cable connection.

An example of transmitter mounting using the remote sensor for a linear system measuring is shown on figure 2.14.

Figure 2.14 – VTP10-H remote sensor mounting.

3 CONFIGURATION

The transmitter can be configured by any HART® compatible programmer. Vivace offers the interfaces VCI10-H (USB, Android and Bluetooth) as a solution for configuring and monitoring any HART® device. VTP10-H can also be configured by local adjust using Vivace magnetic screwdriver.

3.1. LOCAL CONFIGURATION

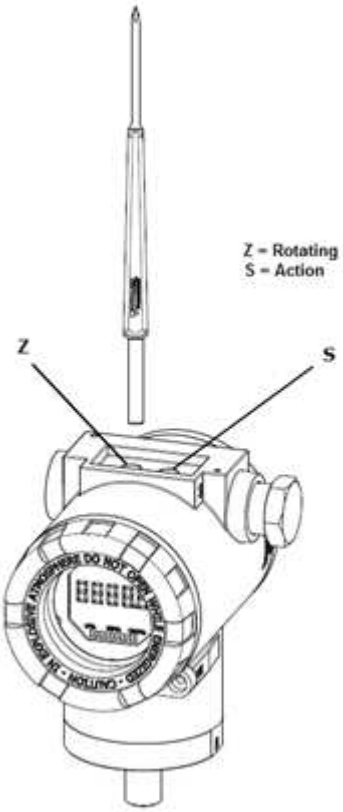

Figure 3.1 – Z and S orifices and magnetic screwdriver.

Transmitter's local configuration is executed by using Vivace's magnetic screwdriver 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 screwdriver actuation.

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

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

ORIFICE	ACTION
Z	**Select configuration tree function**
S	**Act 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 screwdriver into *Span* orifice (S). In case the parameter has pre-defined values, those will be rotate on display, while the magnetic screwdriver 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.

3.2. JUMPER CONFIGURATION FOR LOCAL ADJUST AND WRITE PROTECTION

VTP10-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.

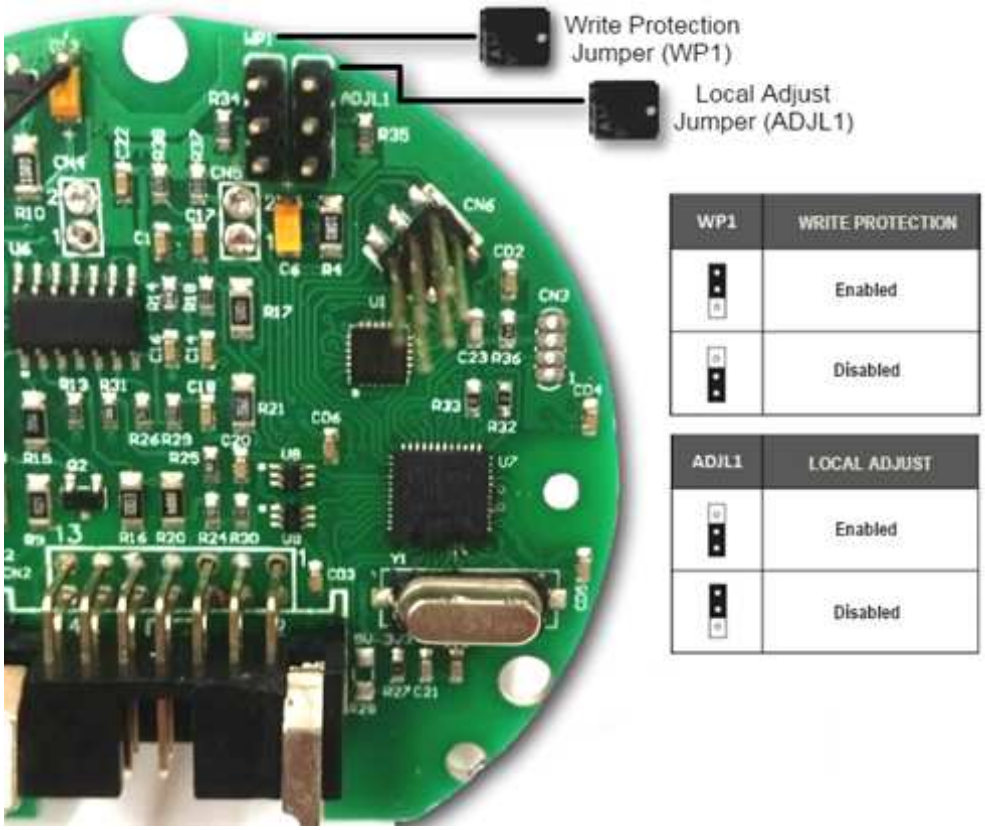

Figure 3.2 – Jumpers WP1 (write protection) and ADJL1 (local adjust) on VTP10-H main board.

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

3.3. LOCAL ADJUST CONFIGURATION TREE

Figure 3.3 shows available fields for local configuration and the sequence they are presented by magnetic screwdriver actuation on Z and S orifices.

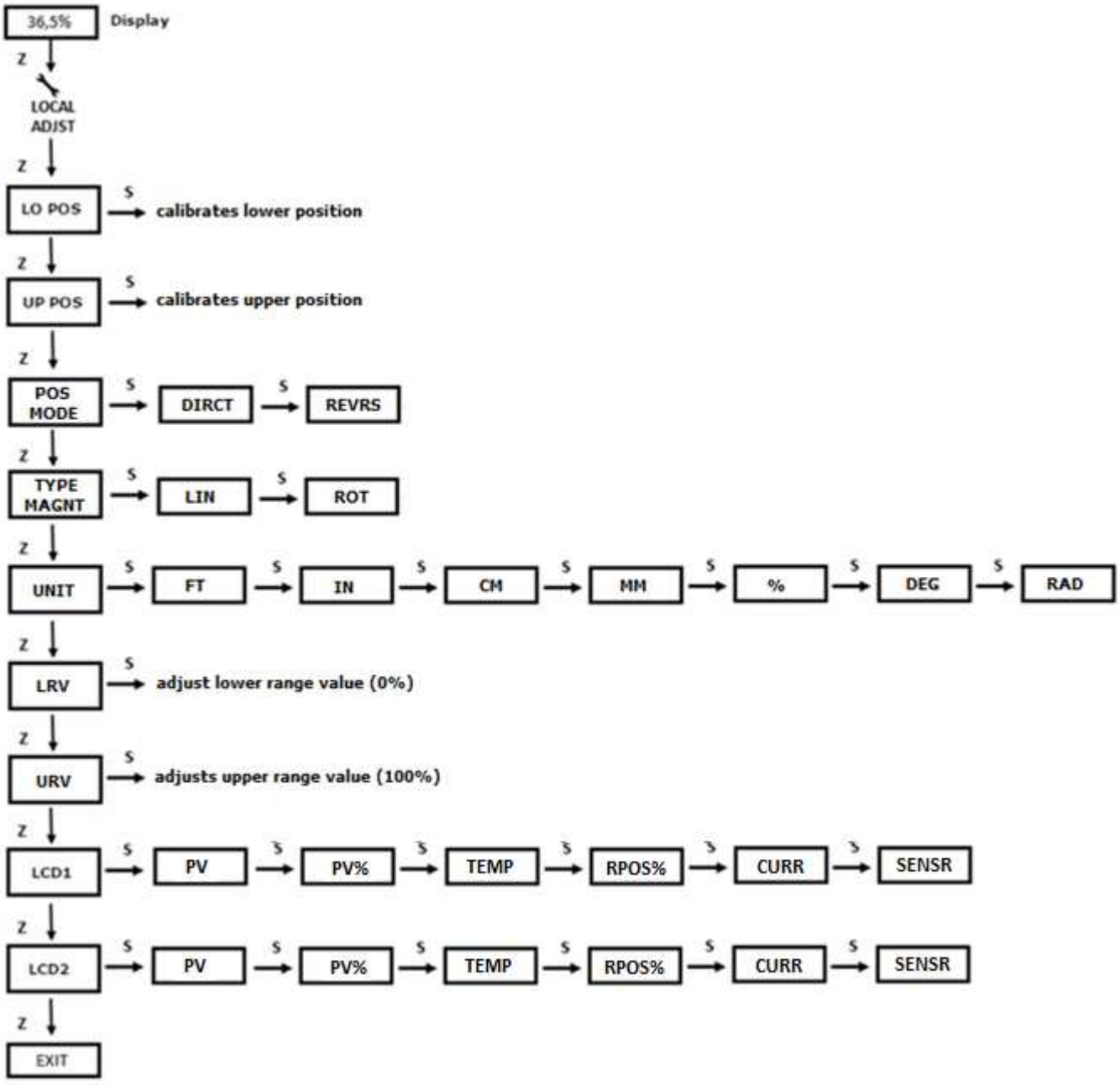

Figure 3.3 – Local adjust configuration tree.

3.4. LIQUID CRYSTAL DISPLAY (LCD)

Main information related to transmitter are indicated on its liquid crystal display (LCD). Figure 3.4 shows the LCD with all its indication fields. Numerical field has 5 digits and is used mainly for monitored variable indication. Alphanumerical field indicates which variable is being monitored, units or auxiliary messages. Each indication icon use is described on table 3.2.

Figure 3.4 – LCD fields and icons.

SYMBOL	DESCRIPTION
	Sending Communication
	Receiving communication
	Write protection enabled
√	Square root function enabled
tab	Characterization table enabled
	Diagnostic occurence
	Recommended maintenance
	Increment values in the local adjust
	Decrement values in the local adjust
°	Degrees symbol for temperature units
0% 50% 100%	Bargraph to indicate the measured variable range

Table 3.2 – LCD icon description.

3.5. HART® CONFIGURATOR

Transmitter configuration can be executed via HART® technology compatible configurator. Vivace offers the VCI10-H family (USB, Android or Bluetooth HART®) as a solution for identification, configuration and monitoring HART® devices.

Figures 3.5 and 3.6 exemplify the use of USB interface with a personal computer that has a HART® configurator installed. A 250Ω resistance must be serially connected with the power supply (for voltage supply and if the power supply does not have this resistance internally) in order to enable HART® communication over the 4-20 mA current (Figure 3.5). Vivace interface already has this resistance when used to power the field device (Figure 3.6).

Figure 3.7 shows transmitter installation on *multidrop* mode.

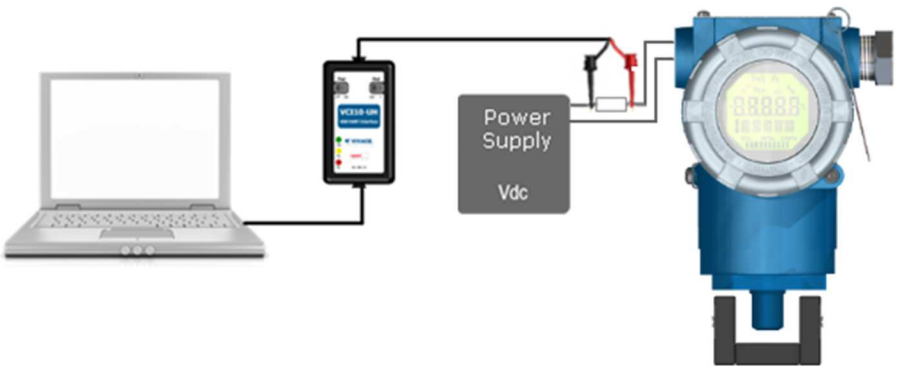

Figure 3.5 - Transmitter installation for configuration with external power supply and 250 ohms resistance.

.

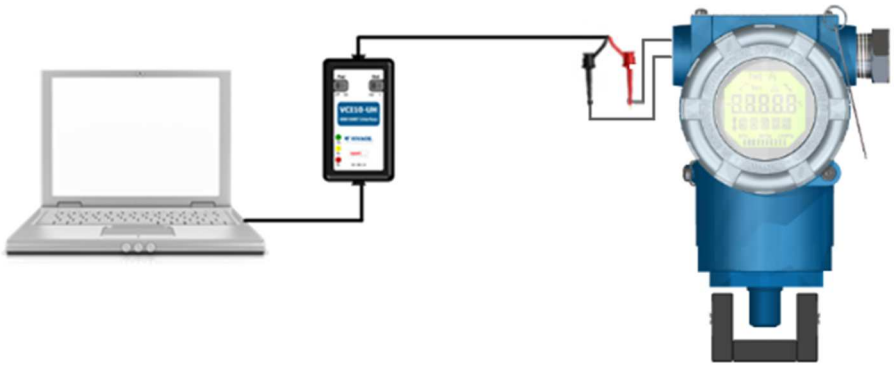

Figure 3.6 - Transmitter installation for configuration using VCI10-UH to power the device.

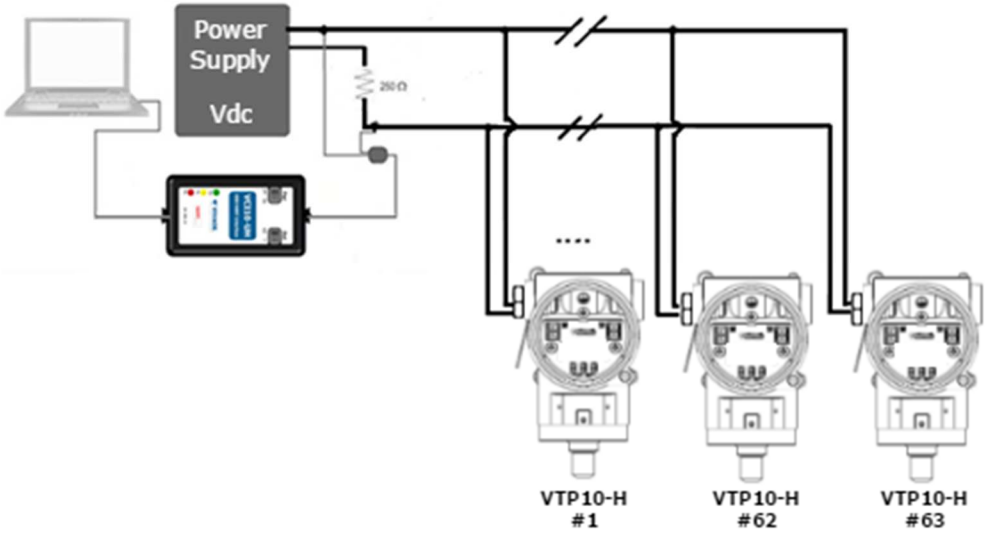

Figure 3.7 – Multidrop connection for VTP10-H.

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 3.8).

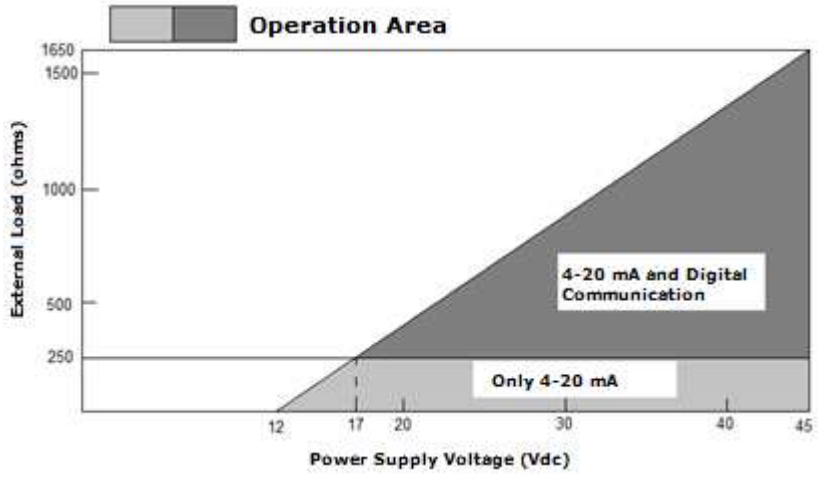

Figure 3.8 – VTP10-H load curve.

3.6. HART CONFIGURATOR PROGRAMMING TREE

The configuration tree is a structure tree-shaped 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.

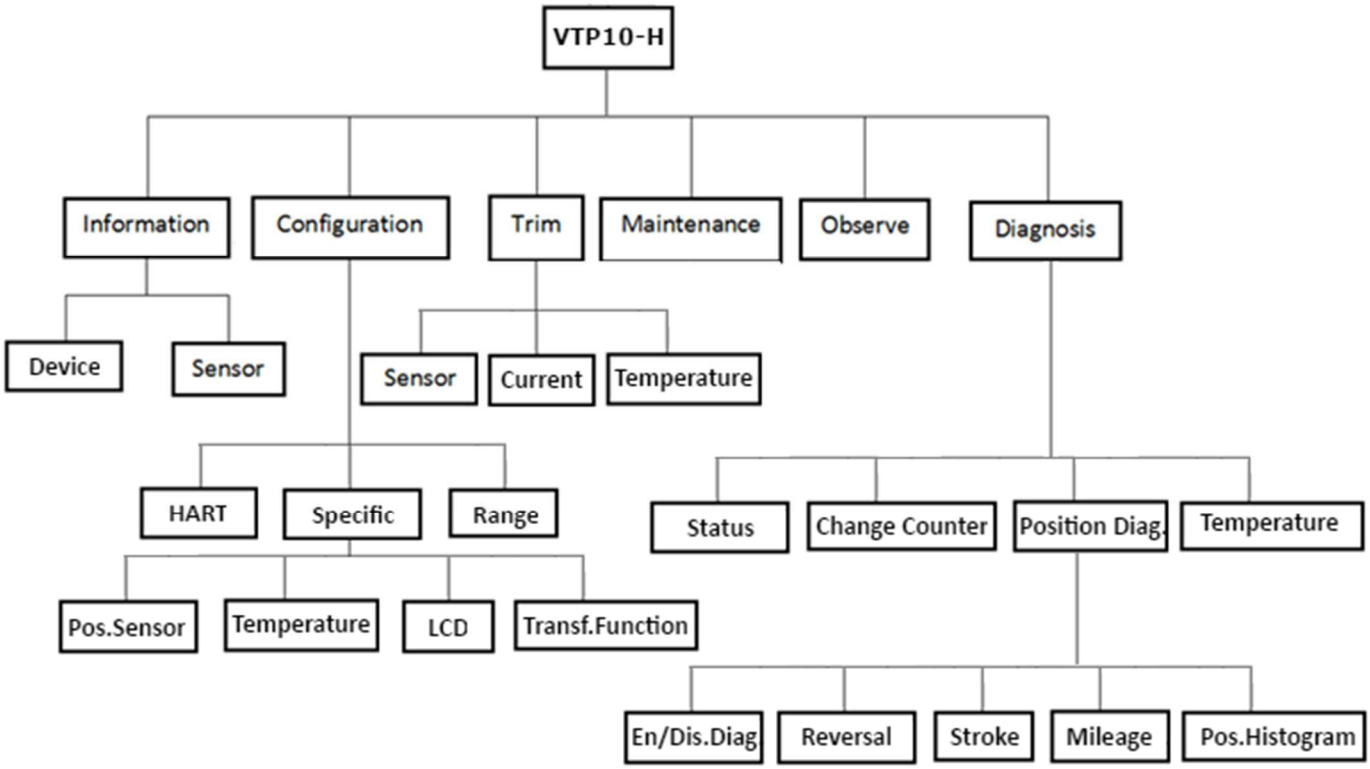

Figure 3.9 – VTP10-H programming tree.

Information – Main device information can be accessed here.

- **Device –** Informs transmitter information such as: Tag, Description, Address, Manufacturer, Device Type, Device Profile, HART® Revision, Software Version and Ordering Code.
- **Sensor –** Informs sensor information such as: Position Mode, Magnet Type, Superior Range Point, Inferior Range Point and Measuring Unit.

Configuration – Configures transmitter communication variables, sensor parameters and temperature reading.

- **Hart –** Configures address, current mode, number of preambles and write protection, all relative to HART communication.
- **Specific –** Configures general functions for transmitter, position sensor and temperature sensor, such as: Position Mode, Magnet Type, Temperature Unit, LCD Display Variables and Characterization Curve.
- **Range –** Configures position sensor range of working with User Unit, Superior Range Point, Inferior Range Point and Failure Safe Mode.

Trim – Adjusts position sensor calibration (inferior and superior points), output current (4 mA and 20 mA) and temperature sensor. Figure 3.10 shows an ammeter connection with transmitter in order to execute output current trim. See more details on item 3.7.

Maintenance – User can execute functions such as output current tests, device software reset or factory configuration restore.

Observe – Allows user to monitor the following variables: output current, PV%, PV (User Position), SV (User Position in Percentage), TV (Temperature) e QV (Real Position in Percentage).

Diagnosis – Configures and monitors device diagnosis.

- **General Device Status –** Informs if there is any kind of problem or alert related to communication or general state of sensor and calculated variables, such as Analog-Digital Converter Error, Sensor Not Detected, Reversal Limit, Stroke Limit, Mileage Limit, Device Malfunction, Fixed Output Current, PV Out of Operation Limits, Temperature Out of Operation Limits and Saturated Output Current.

- **Change Counters –** Informs change counters for each of the following transmitter parameters. It is also possible to reset these counters on this directory.
    - *Position Mode*
    - *Range*
    - *Magnet Type*
    - *Inferior Position Trim*
    - *Superior Position Trim*
    - *Characterization Curve*
    - *Characterization Curve Input Points*
    - *Characterization Curve Output Points*
    - *Characterization Curve Size*
    - *Software Write Protection*
    - *LCD Display Variables*
    - *Temperature Unit*
    - *Failure Safe Mode*
    - *HART Communication Address*
- **Position Diagnosis –** Enables/disables, configures and informs the diagnostics for Reversal, Stroke, Mileage and Position Histogram. For more details about each of these, see section 3.8.
    - **Reversal*s*:** configures Dead Band and Counter Limit for movement reversions.
    - ***Mileage*:** configures Dead Band and Movement Limit (accumulated).
    - ***Strokes*:** configures the Activation Zone (Stroke Edge) and Counter Limit for strokes inside this zone.
    - **Position Histogram:** informs the percentage of time on each position range (5%) from total transmitter working time.

- **Temperature –** Informs the values for maximum and minimum temperature, registered by transmitter during working time, according to user calibration.

3.7. CALIBRATION

VTP10-H allows calibration of its variables according to user standards and references, in order to be perfectly suitable to specific systems. Following are the available variables for calibration, with their respective procedures.

POSITION

Allows user to adapt the movement range to transmitter magnetic sensor references. With the moving system on inferior position, user should execute the inferior position trim. After that, move the system to superior position and execute superior position trim. This procedure can be executed via local adjustment (see section 3.4).

With those two calibrations, transmitter can refer to 0% and 100% of user system with the offered accuracy. Position value can be displayed on percentage (%) or according to range and unit configured by user on the parameters previously described on section 3.6.

OUTPUT CURRENT

Output current calibration is common for all transmitters and HART® protocol devices that offer standard commands and routines for this function. Usually configuration and calibration softwares offer methods that set output current to fixed mode automatically (4 mA or 20 mA, according to calibration point - *zero* or *span*).

After fixed current generation, user should connect an ammeter serially with the transmitter (see figure 3.10) in order to monitor real output current and set it on configurator via HART® commands, performing internal calibration to generate current according to user value. This process may be repeated as much as user wishes, until the correct value for output current is read on the ammeter for both trim values (4 mA e 20 mA).

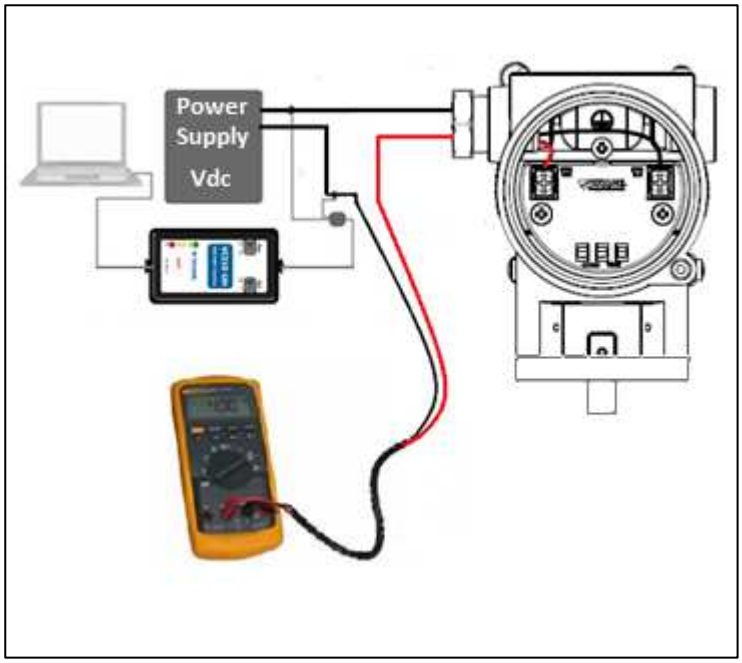

Figure 3.10 – Output current trim assembly.

TEMPERATURE

Temperature calibration is the simpler process offered by VTP10-H, where user only needs to send the current temperature value (measured by a specific thermometer, for example). Transmitter will automatically adjust the internal temperature measurement based on the difference with the temperature sent by user. This process may be repeated as much as user wishes, until the correct value for temperature is read.

3.8. DIAGNOSIS

VTP10-H has several diagnostics in order to help predictive maintenance on the measuring system. Configuring parameters according to specific application gives user a whole set of indicators to help the activities and decisions of system maintenance.

The transmitter also offers *status* for sensors and measurements so user can be alarmed when a possible unusual behavior happens to the system. Those alarms indicate common failures on HART® protocol devices or VTP10-H specific situations, as described below.

COMMON HART® ALARMS

PV OUT OF LIMITS: primary variable value is out of normal limits.

NON-PV OUT OF LIMITS: a variable different from primary variable has its value out of acceptable range limits. For VTP10-H this variable is the temperature and its limits are -40°C and 85°C.

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

LOOP CURRENT FIXED: output current has fixed value mode.

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

COLD START: a device reset just happened.

CONFIGURATION CHANGED: some device parameter configuration was changed.

DEVICE MALFUNCTION: an important device variable has a malfunction.

VTP10-H SPECIFIC ALARMS

On the occurrence of any of these alarms, diagnostic alert icon and the message “Error” will be displayed on the LCD.

Figure 3.11 – Specific error Indication on VTP10-H.

SENSOR NOT DETECTED: position sensor is not sending data to transmitter CPU. It might indicate a sensor problem or a damaged connection to the main board.

A/D CONVERTER ERROR: analog-digital converter (A/D) is not sending data to transmitter main board. It might indicate a connection problem between the main board and the input board or a converter malfunction.

PREDICTIVE DIAGNOSIS

REVERSAL

This diagnostic verifies movement way reversion on the measuring system. For each movement transition a counter is incremented. The movement reversion is considered based on the parameter REVERSAL DEADBAND, configured by user between 0% and 20%.

User can also configure a maximum value for this counter (REVERSAL COUNTER LIMIT), so an alarm can be generated (REVERSAL LIMIT EXCEEDED) when this value is exceeded.

Figure 3.12 shows an example of system behavior where, considering d1 and d2 variations (d1 < REVERSAL DEADBAND and d2 > REVERSAL DEADBAND), reversal counter will be incremented only at d2 occurrence, ignoring d1 small reversion, since it is inferior to the configured dead band.

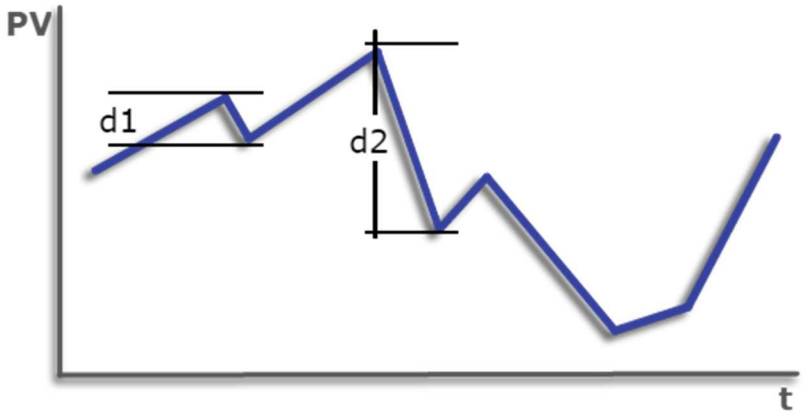

Figure 3.12 – Example of reversal occurence on VTP10-H.

STROKE

This diagnostic verifies the strokes on system edges. For each entrance in the stroke region a counter is incremented. The definition of stroke region is given by configuration of STROKE EDGE, varying between 0% and 20%. The stroke regions are the edges of measuring system, thus being considered by the transmitter as (STROKE EDGE) and (100% - STROKE EDGE).

User can also configure a maximum value for this counter (STROKE COUNTER LIMIT), so an alarm can be generated (STROKE LIMIT EXCEEDED) when this value is exceeded.

Figure 3.13 shows an example of system behavior where stroke counter will be activated on P1 and P2 areas, considering edges values (STROKE EDGE) as the black horizontal lines. Note that counter will not be incremented more than once on each area, since position variation will not be larger than 1% (STROKE EDGE + 1%).

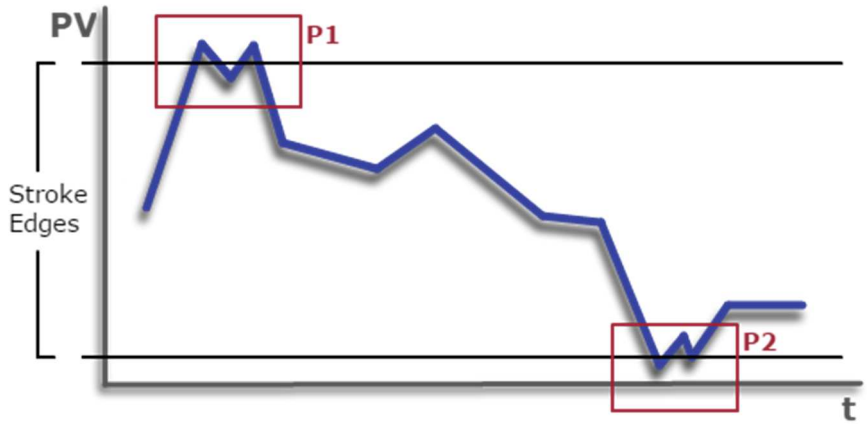

Figure 3.13 – Example of stroke occurence on VTP10-H.

MILEAGE

This diagnostic verifies the total movement of the measuring system. Any movement on the system above a minimum reference value defined by user (MILEAGE DEADBAND) will be added to the accumulator MILEAGE VALUE. The parameter MILEAGE DEADBAND can be configured by user with values between 0% and 20%.

User can also configure a maximum value for the accumulator (MILEAGE LIMIT), so an alarm can be generated (MILEAGE LIMIT EXCEEDED) when this value is exceeded.

Figure 3.14 shows an example of system behavior where the position variation inside d1 range will not be considered as a movement for mileage diagnostic, since d1 is the dead band for system movement (MILEAGE DEADBAND). As soon as the movement difference reachs this value (up or down), mileage counter will be incremented with this difference value.

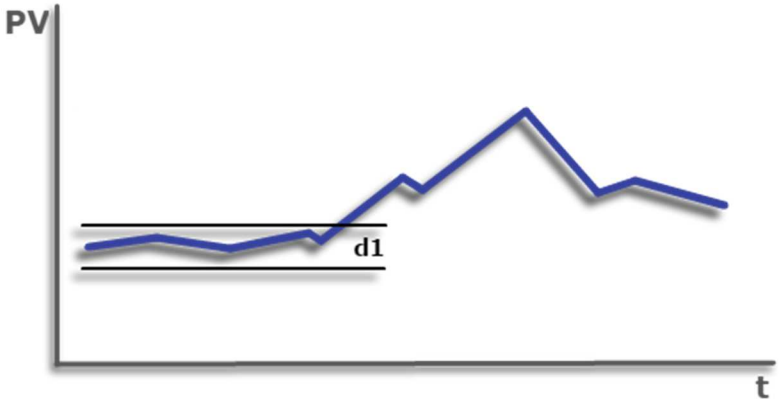

Figure 3.14 – Example of mileage counting on VTP10-H.

POSITION HISTOGRAM

This diagnostic allows user to read a position history for the several position ranges along the measuring system through working time. In possession of these data user can visualize a bar-shaped graphic indicating the amount of time (in percentage of total working time) that transmitter remained on each of 5% range of system course.

For this diagnostic user do not have any parameter to configure, just monitoring system behavior for future analysis and conclusions. Figure 3.15 shows an example of position history graphic for system positions across working time.

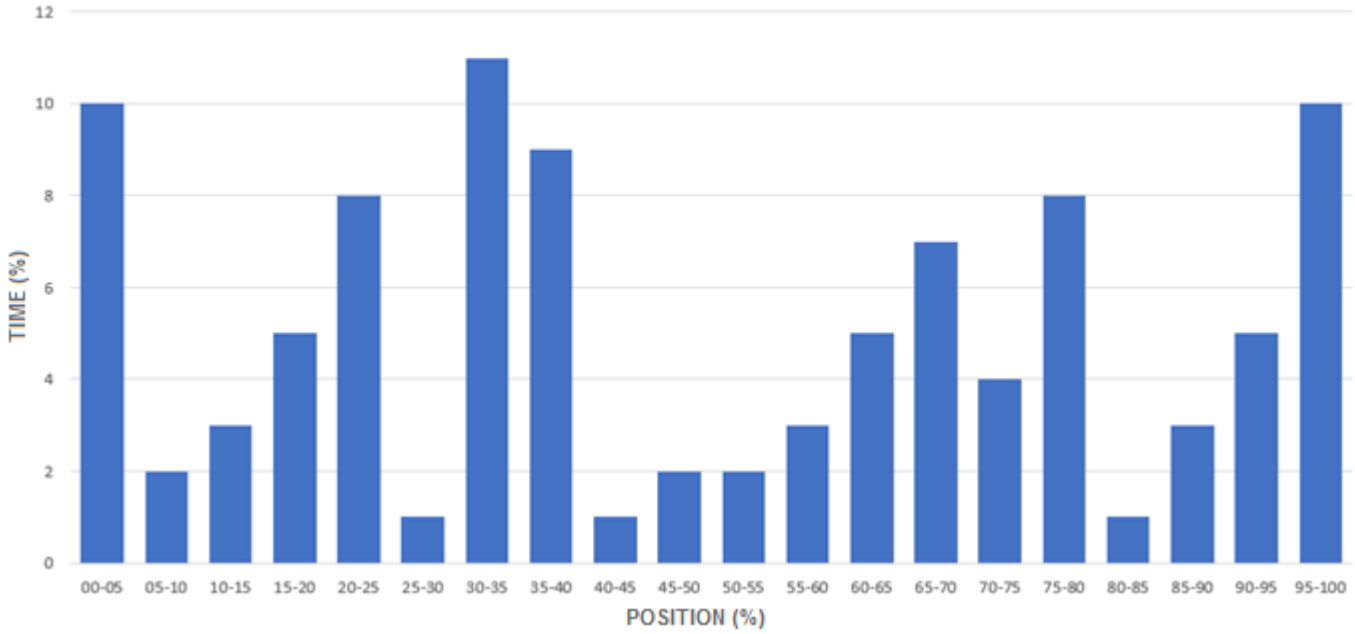

Figure 3.15 – Example of position history graphic on a system.

TEMPERATURE

The temperature diagnostic simply informs user with maximum and minimum temperature values measured by transmitter. The temperature limits are verified between -40°C and 85°C with the alarm being activated on the status NON-PV OUT OF LIMITS.

Attention! All diagnostics also have the option of *Enable/Disable* and *Reset*, allowing user to reset each diagnostic references, individually.

Attention! All diagnostics are DISABLED by default.

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 VTP10-H using Vivace's VCI10-UH interface and PACTware®.

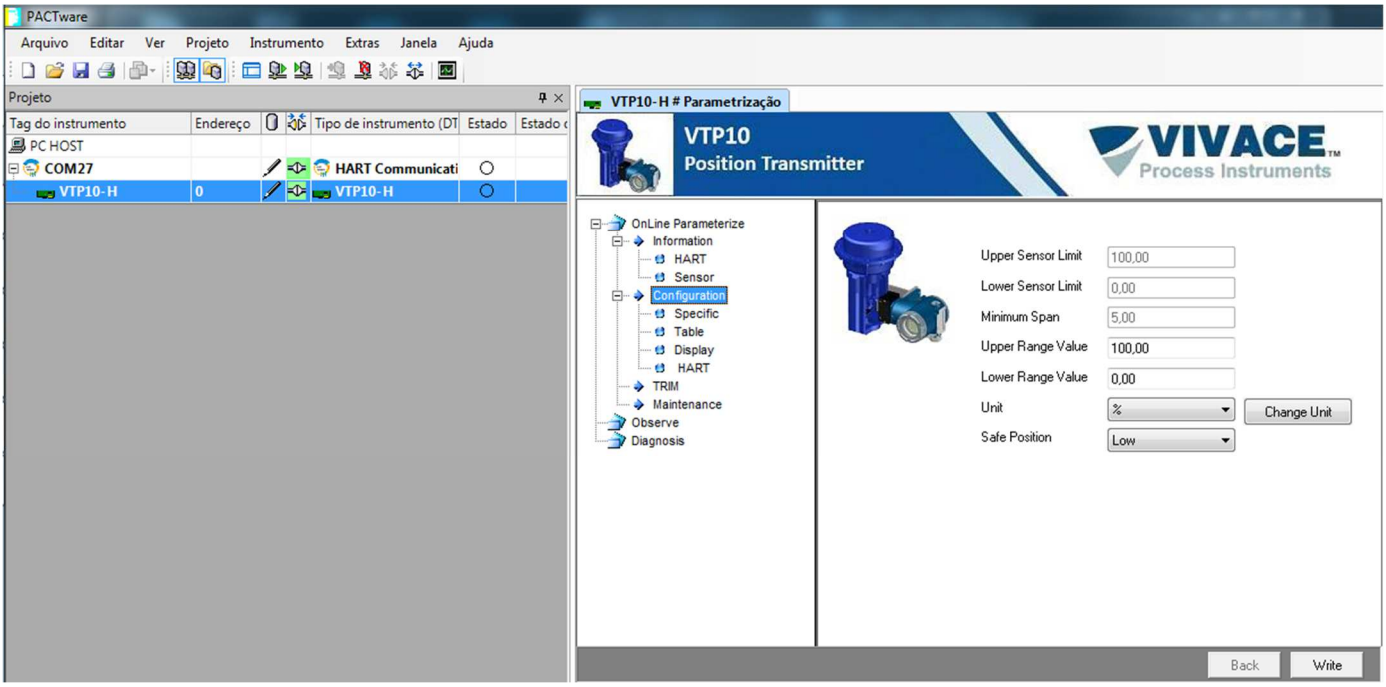

Figure 3.12 – DTM work range configuration screen for VTP10-H.

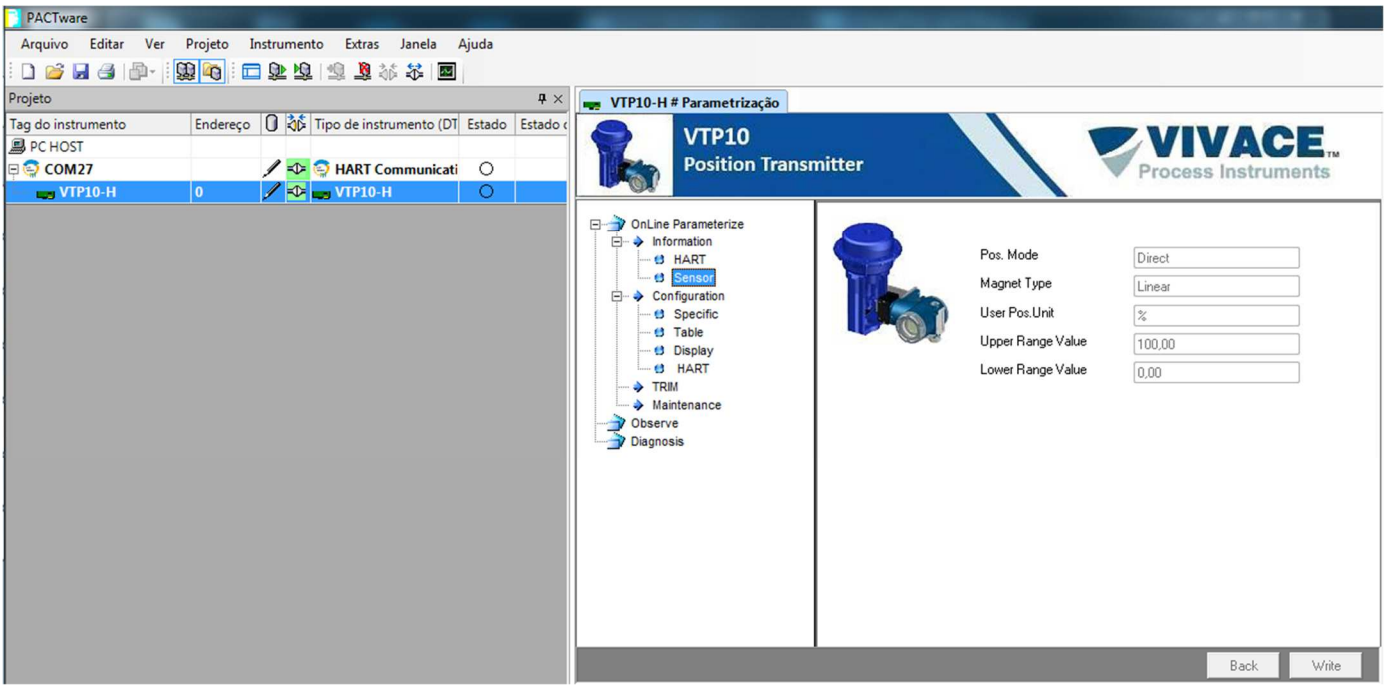

Figure 3.13 – DTM sensor configuration screen for VTP10-H.

4 MAINTENANCE

VTP10-H as all Vivace devices, suffers several inspections before its shipping. However, some diagnostics are available in the case of malfunction in order to check problem cause (installation, configuration or on device itself).

4.1. ASSEMBLY AND DISASSEMBLY PROCEDURES

Figure 4.1 shows VTP10-H component details. Before disassembling the device, make sure it is powered off. Maintenance on electronic boards must not be executed, under penalty of equipment warranty loss. Figure 4.2 shows remote sensor components.

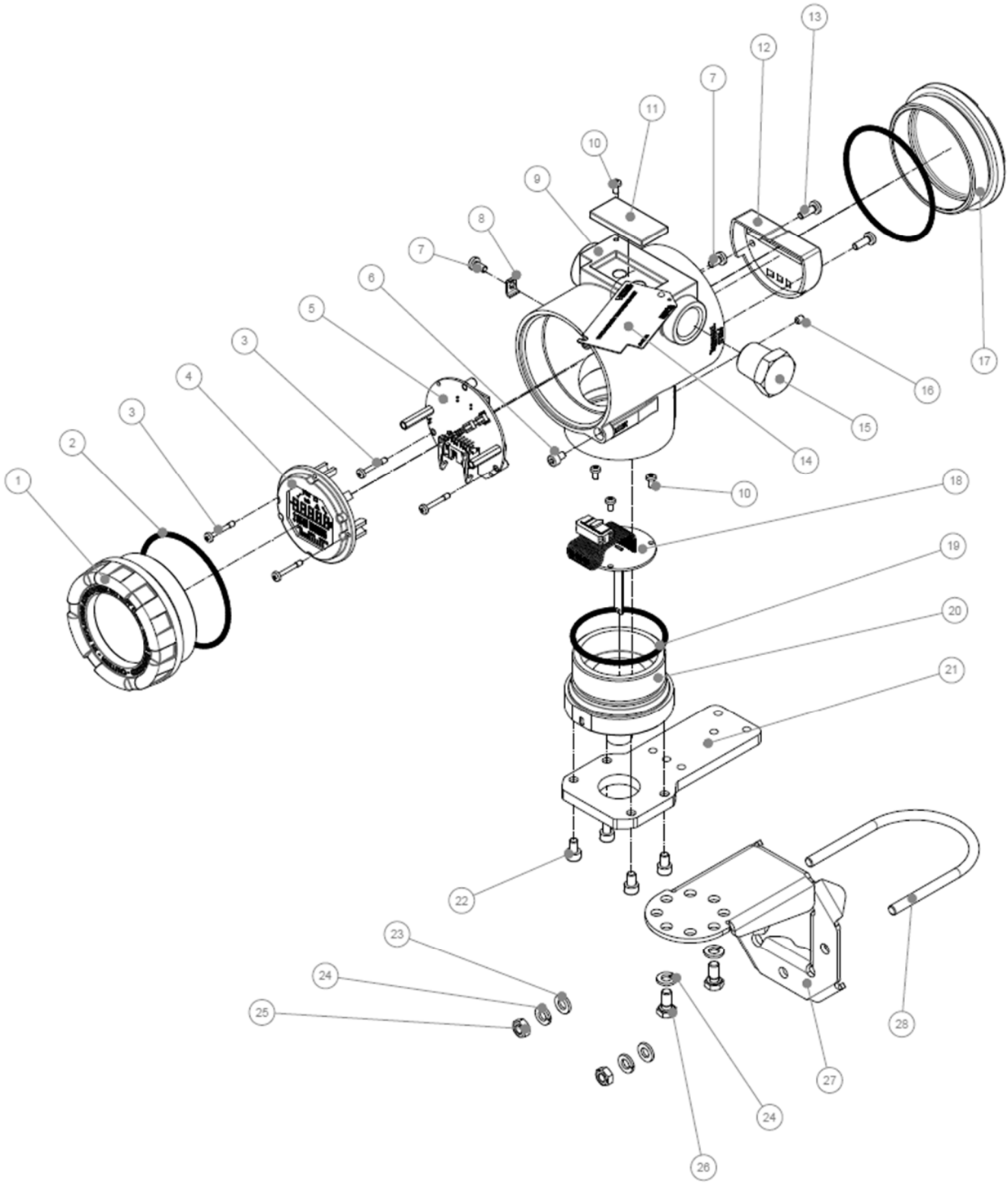

Figure 4.1 – VTP10-H exploded view.

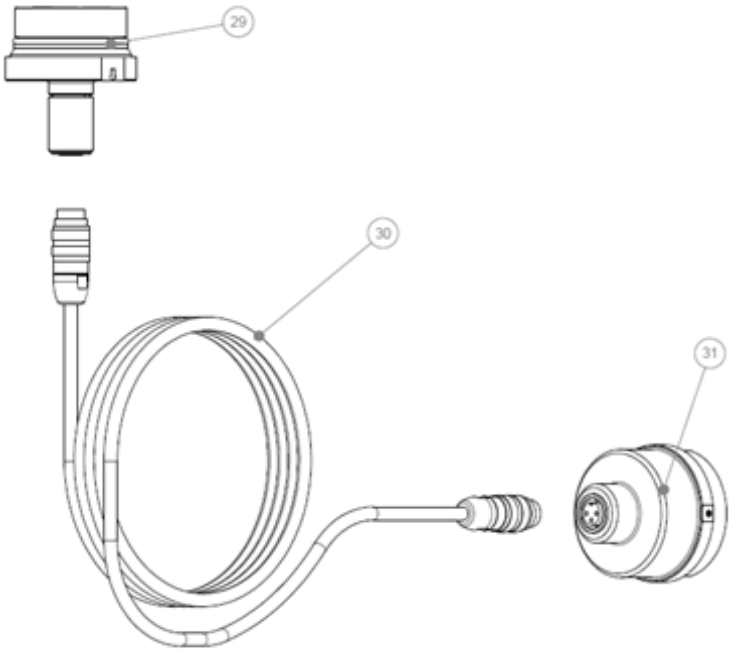

Figure 4.2 – Exploded view for VTP10-H remote sensor.

Following are the steps for VTP10-H maintenance and repair disassembly. Values between brackets identify the parts on the exploded view (Figure 4.1). For transmitter assembly, just follow the inverse sequence of previous steps.

1 Remove rear cover (17);
2 Disconnect power from transmitter, removing all cabling through side orifices;
3 Remove front cover (1) and loose main board screws (3);
4 Disconnect energy and sensor cables from main board (5);
5 Remove inferior cover (with magnetic sensor) from housing (20);
6 Loose analog board (18) fixation screws (10).
7 Disconnect the cable between analog board (18) and magnetic sensor located on housing inferior cover (20).

4.2. SPARE PARTS

All the spare parts available for VTP10-H can be bought directly from *Vivace Process Instruments.* Those parts are listed on table 4.1.

VTP10-H - SPARE PARTS LIST		
DESCRIPTION	**REFERENCE FIG. 4.1**	**CODE**
FRONT COVER (includes o'ring)	1	2-10002
REAR COVER (includes o'ring)	17	2-10003
O'RING (cover)	2	1-10001
HOUSING WITH TERMINAL BLOCK AND FILTERS	9	2-10032
DISPLAY (includes screws)	4	2-10006
MAIN BOARD (includes screws and spacers)	5	2-10017
ANALOG BOARD WITH SENSOR (includes screws)	18	2-10018
TERMINAL BLOCK COVER (includes screws)	12	2-10019
HOUSING INFERIOR COVER FOR MAGNETIC SENSOR (includes o'ring)	20	2-10021
INFERIOR COVER O'RING	19	1-10004
FIXATION ADAPTER (includes screws)	21	2-10020
MOUNTING SUPPORT (includes U clip and screws)	27	2-10009
Z/S PROTECTION COVER	11	2-10015
HOUSING PLUG	15	1-10005
EXTERNAL GROUND (includes screws)	7 and 8	2-10010
COVER LOCK SCREW	6	1-10006
IDENTIFICATION PLATE AND ANALOG BOARD SCREW	10	1-10007
HOUSING LOCK SCREW	16	1-10008
TERMINAL BLOCK COVER SCREW	13	1-10003
DISPLAY AND MAIN BOARD SCREW	3	1-10002
MAGNETIC TOOL	-	3-10001
ROTATIVE MAGNET	-	2-10022
LINEAR 40 MAGNET	-	2-10023
LINEAR 70 MAGNET	-	2-10024
LINEAR 100 MAGNET	-	2-10025
REMOTE SENSOR INFERIOR BASE	29	2-10038
REMOTE SENSOR 5 METER CABLE	30	2-10039
REMOTE SENSOR 10 METER CABLE	30	2-10040
REMOTE SENSOR 20 METER CABLE	30	2-10041
REMOTE SENSOR EXTENSION	31	2-10042

Table 4.1 – VTP10-H spare parts.

5 CERTIFICATION

VTP10-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

VTP10-H has an identification plate fixed on the superior side of its housing, specifying model, manufacturer and serial number, as shown on figure 6.1.

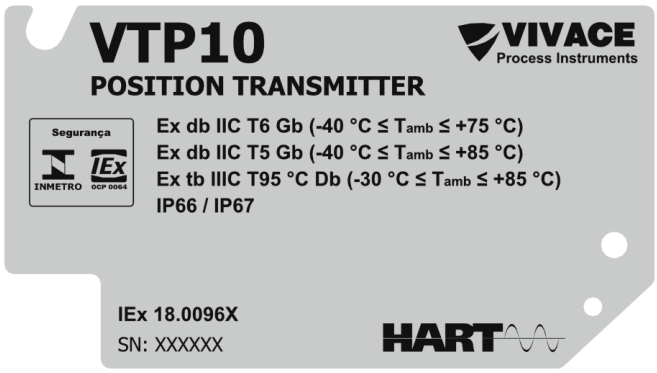

Figure 6.1 – VTP10-H identification plate.

6.2. TECHNICAL SPECIFICATION

The following table shows the technical specifications for VTP10-H:

Precision	±0.05% (Full Scale, not considering non-linearity and hysteresis effects).
Power Supply / Current Output	12 to 45 Vdc / 4-20 mA according to NAMUR-NE43
Communication Protocol	HART® 7
Classified Areas	Explosion Proof and Intrinsically Safe
Environment Temperature Limits	- 40 to 85°C (105°C for remote sensor)
Configuration	Local Adjust, EDDL, FDT/DTM and Android® Tools
Indication	5-digit, rotative, multifunctional LCD display.
Mounting	On field, with bracket for 2" tube. Remote sensor mounting is optional.
Measurement	Hall Effect Magnetic Sensor. Linear: 0 to 150 mm / Rotative: 0º to 120º (minimum span 10 mm or 5º)
Protection Degree	IP67
Housing Material	Aluminum
Weight without Bracket	1.5 Kg

Table 6.1 – VTP10-H technical specification.

6.3. ORDERING CODE

VTP10 *Position Transmitter*

Communication Protocol	**H**	HART
	P	PROFIBUS
Sensor Type	**0**	STANDARD
	1	REMOTE 05 M
	2	REMOTE 10 M
	3	REMOTE 20 M
Magnet for Actuator Course	**0**	ROTATIVE (30 TO 120 DEGREES)
	1	LINEAR (COURSE < 30 mm)
	2	LINEAR (30 mm < COURSE < 70 mm)
	3	LINEAR (70 mm < COURSE < 100 mm)
	4	LINEAR (100 mm < COURSE < 150 mm)
	A	NO MAGNET
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
	2	ROTATIVE VDI/VDE NAMUR

Ordering Code Example:

VTP10-	H	-	0	0	0	0	A	1	1	0

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

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:			