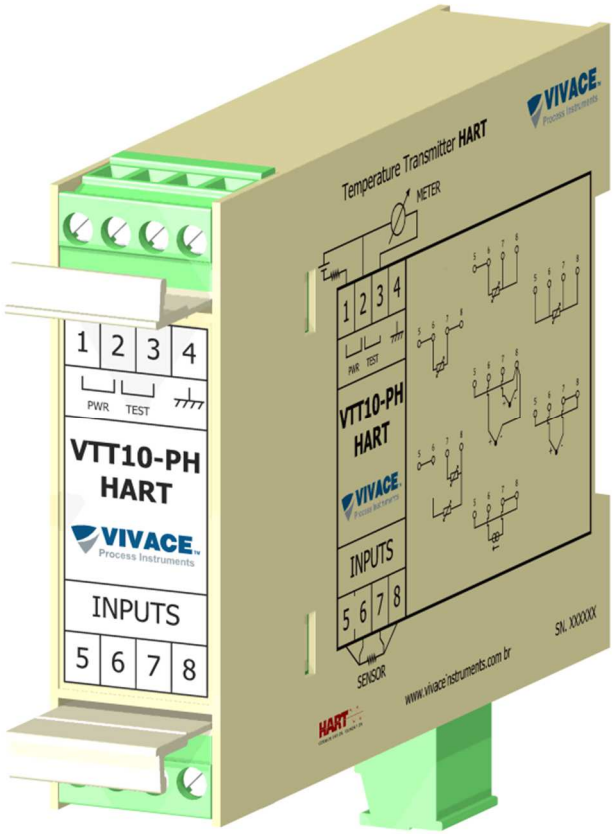
INSTALLATION, OPERATION, CONFIGURATION AND MAINTENANCE MANUAL
July/2019

VTT10-PH

HART® TEMPERATURE TRANSMITTER

panel model



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".

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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

VTT10-PH is a panel model for *Vivace*'s temperature transmitter family, designed for panel installation through DIN rail, standard T-type. It attends several sensor types, such as thermocouple, RTDs, resistance and millivoltage signals.

The transmitter is powered by a 12 to 45 Vdc voltage and modulates communication over a 4-20 mA output signal, according to NAMUR NE43 standard, using HART® protocol. The configuration uses HART 7 (older versions compatible) communication protocol, already established on the world of industrial automation for configuration, calibration, monitoring and diagnostics.

Through a HART configurator or any EDDL or FDT/DTM-based tool it is possible to configure sensor type, measuring range, work unit, calibration and to monitor measured variables with device status. Configuration via local adjust is also possible with an auxiliary 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 systems of any scale.

1.1. BLOCK DIAGRAM

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

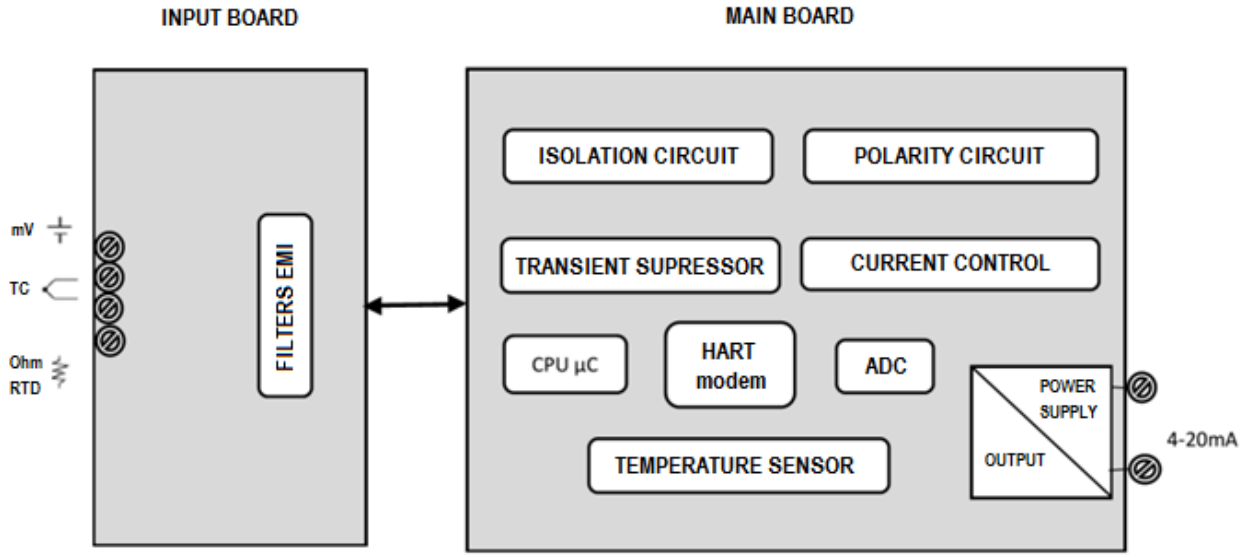

Figure 1.1 – Transmitter block diagram.

The sensor signal passes through the RF EMI filter and goes to ADC block, where it is converted to a digital value. This digital value later will be converted into temperature, according to selected sensor type. The temperature value is finally converted into a current signal, proportional to the calibrated range.

The sensor signal is galvanic isolated from output signal, avoiding ground loop.

The input block (DC power supply) is responsible for the electric source for all circuits. Current control block is composed by a circuit to transform digital values generated by microcontroller into 4-20 mA electric current, proportional to the primary variable value.

HART® modem block provides the interface between microcontroller signals and HART® bus connected to device.

Finally, the CPU block can be seen as the transmitter brain, where all the activities happen, such as time control, HART® machine, plus common transmitter routines: configuration, calibration and generation of output current.

2 INSTALLATION

2.1. MECHANICAL ASSEMBLY

VTT10-PH was developed to be installed in DIN rail. Its enclosure is made of injected plastic and protects the electronic boards. The electronic circuit is protected by varnish but water or corrosion exposure may compromise this protection and damage the electronic components.

Optionally, the temperature transmitter VTT10-PH may be provided with two discrete outputs (open collector) for driving relays, for instance.

Figure 2.1 shows the dimensional drawing for VTT10-PH.

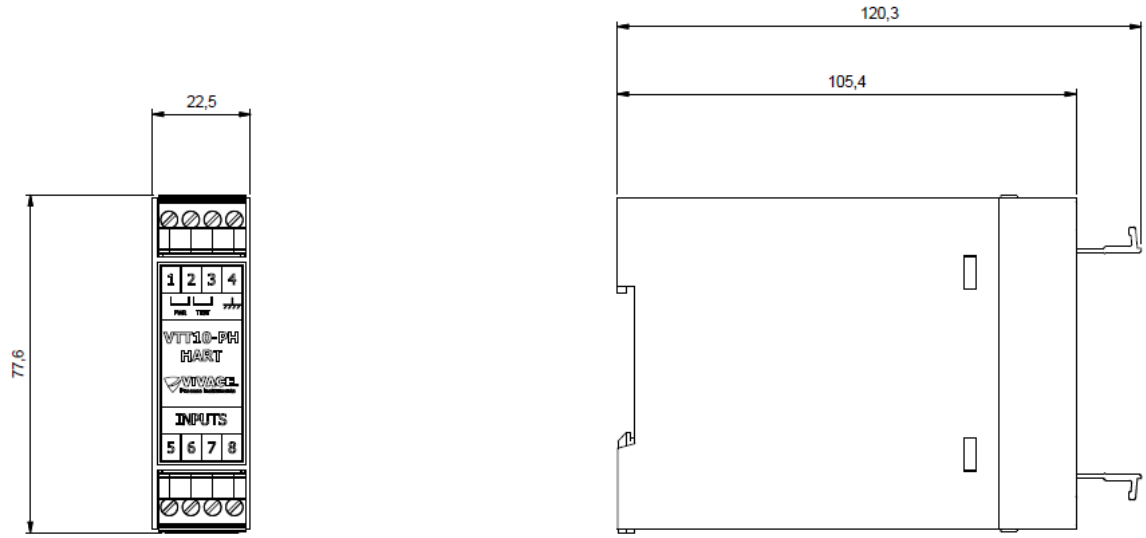

Figure 2.1 – VTT10-PH dimensional drawing.

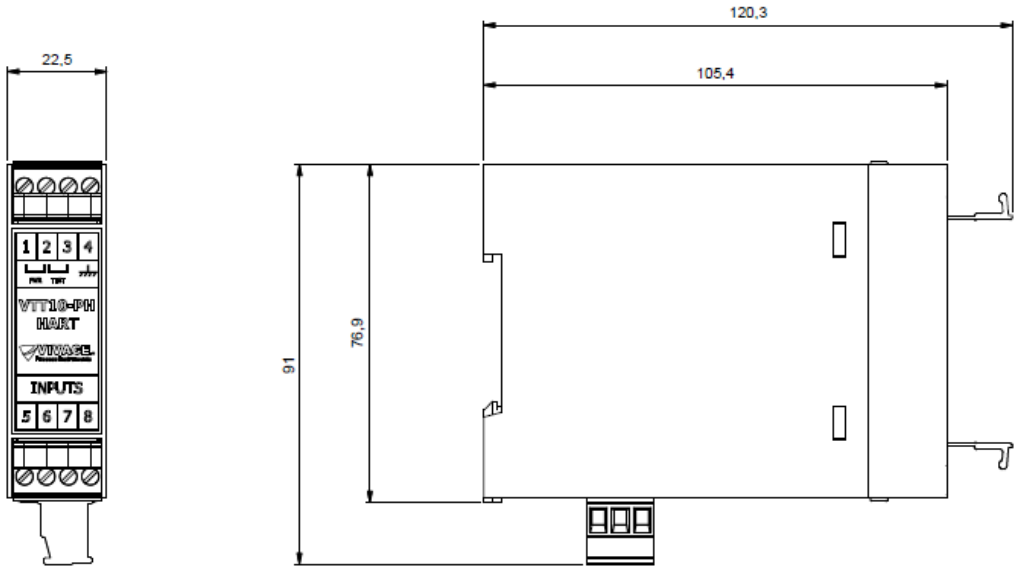

Figure 2.2 - VTT10-PH with open collector dimensional drawing.

2.2. ELECTRICAL CONNECTION

Figure 2.3 shows the electrical connection and sensor terminals for VTT10-PH.

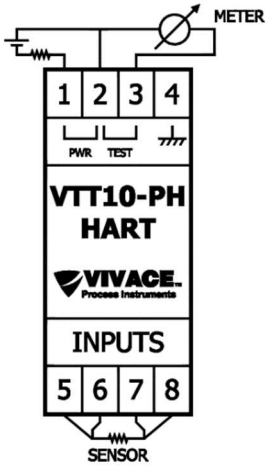

Figure 2.3 – Connections and description for VTT10-PH terminals.

Terminal	Description
1	Power Supply 24 Vdc, no polarity and 4 - 20 mA + HART® Comm.
2	Power Supply 24 Vdc, no polarity and 4 - 20 mA + HART® Comm.
3	Current test terminal
4	Ground Terminal
5	Sensor Terminal
6	Sensor Terminal
7	Sensor Terminal
8	Sensor Terminal

Table 2.1 – Terminal description for VTT10-PH.

NOTE

All cables used for connecting VTT10-PH 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.

2.3. PROCESS CONNECTION

Following are illustrated the VTT10-PH sensor connection for different sensor types:

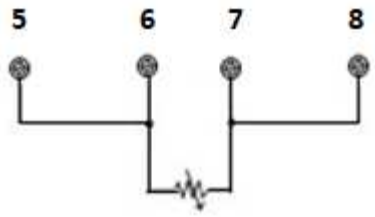

Figure 2.4 – 2-wire RTD or resistive sensor connection.

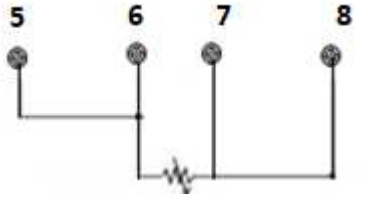

Figure 2.5 -3-wire RTD or resistive sensor connection.

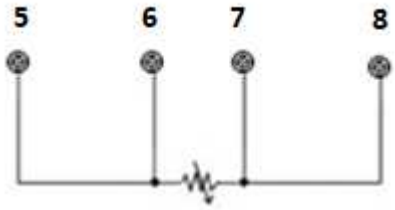

Figure 2.6 - 4-wire RTD or resistive sensor connection.

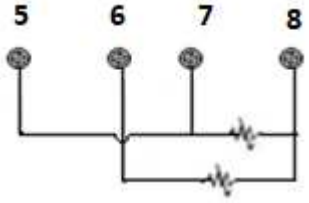

Figure 2.7 – Differential, maximum, minimum or backup RTD or resistive sensor connection.

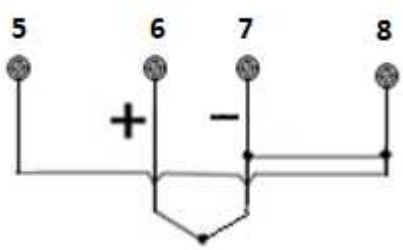

Figure 2.8 – Thermocouple or mV sensor connection.

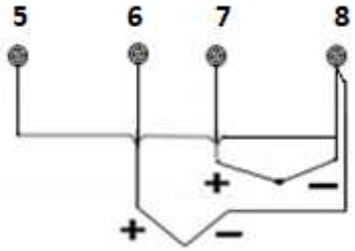

Figure 2.9 - Differential, maximum, minimum or backup thermocouple or mV sensor connection.

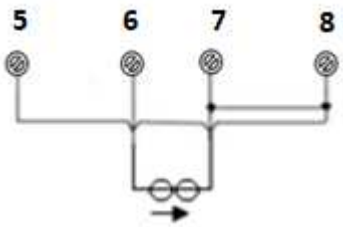

Figure 2.10 – 4–20 mA input connection

3 CONFIGURATION

The configuration for temperature transmitter VTT10-PH can be made using a HART® programmer or EDDL, FDT/DTM-based tools. Using a tablet or smartphone with Android technology, HART® 375 or 475 programmer, or PC with FDT/DTM tools installed.

3.1. HART® CONFIGURATOR

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.

Figures 3.1 and 3.2 exemplifie the use of USB interface with a personal computer that has a HART® configurator installed. For Figure 3.1 configuration, 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) to enable HART® communication over the 4-20 mA current. Vivace interface already has this resistance when used to power the field device, as shown on Figure 3.2.

Figure 3.1 – Transmitter installation for configuration with external power supply and 250 ohms resistance.

Figure 3.2 – Transmitter installation for configuration using VCI10-UH to power the device.

Figure 3.3 shows configuration known as multidrop. For VTT10-PH, the output current varies according to temperature range and sensor type configured by user, to control the final element on the plant, like a valve positioner, for instance, or only to monitor its variable from a control room.

Note that up to 63 devices can be paralleled connected on the same bus. Caution must be taken when many transmitters are connected on the same power line due to voltage drop on 250 ohm resistor in order to guarantee power supply voltage for all transmitters (Figure 3.4).

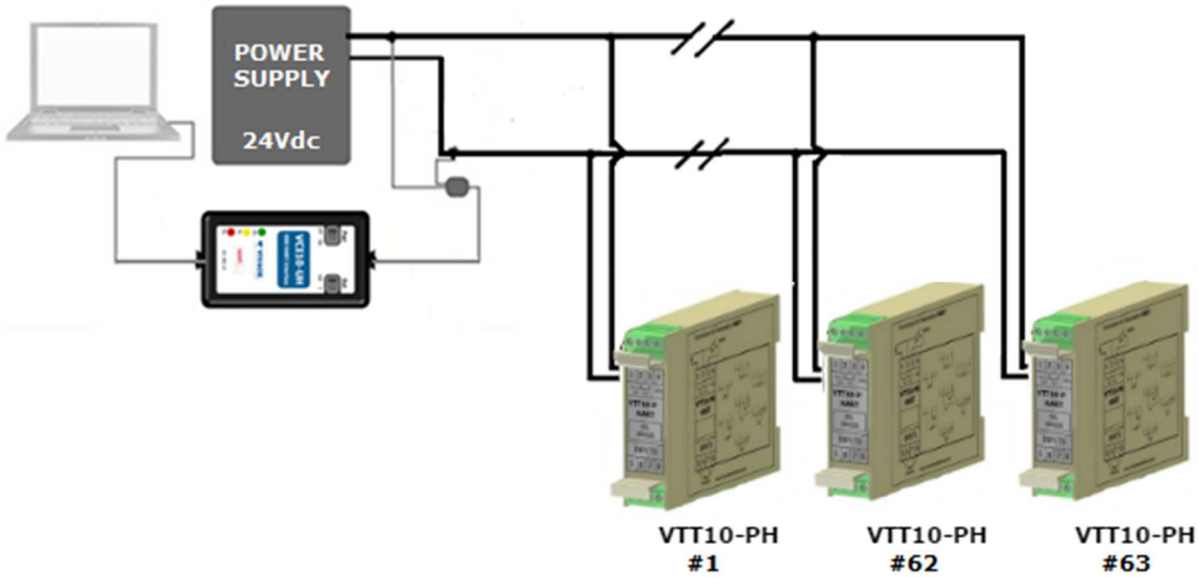

Figure 3.3 – Multidrop connection for VTT10-PH.

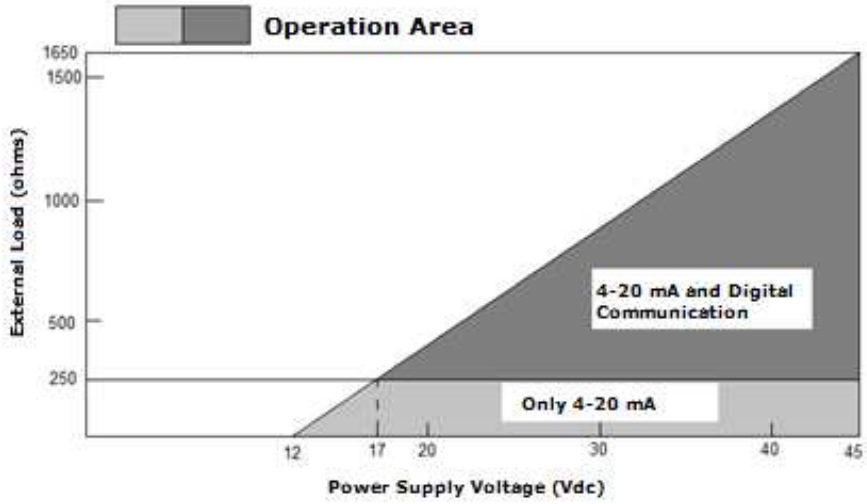

Figure 3.4 – VTT10-PH load curve.

3.2. HART CONFIGURATOR PROGRAMMING TREE

The configuration tree is a tree-shaped structure with menus for all software resources available, as shown on figure 3.5.

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

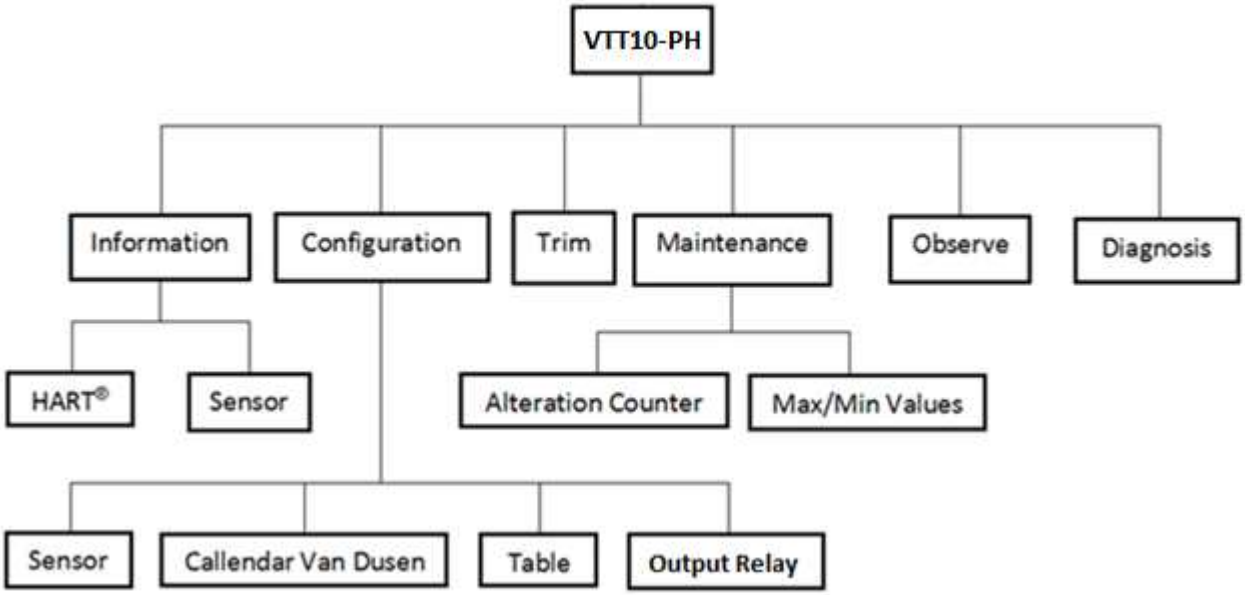

Figure 3.5 – VTT10-PH programming tree.

Information – Main device information can be accessed here.

- **HART® –** Main information about communication protocol are available here, such as: Manufacturer, Device Type, Device Profile, HART® Revision, Software Version etc.
- **Sensor –** Main information about the sensor are available here, such as: Sensor Type, Connection (2, 3 or 4 wires), Upper Range, Lower Range and Unit.

Configuration – Configuration of transmitter Work Ranges, Unit, Safe Mode and Damping are available here.

Damping is an electronic filter for PV variable which changes transmitter response time to smooth output reading variations caused by input fast variations. Damping value can be configured between 0 and 60 seconds, and its appropriated value must be adjusted based on process response time, output signal stability and other system requirements. Default value for damping is 0 seconds.

The damping value affects transmitter response time. When this time is configured as zero, the damping function is disabled and transmitter output will react immediately to the input variations, so the response time will be as short as possible.

An increase to the damping value will result on an increase to transmitter response time.

As the settling time constant is defined, transmitter output will achieve 63% of the input variation and transmitter will continue to approach the input value according to damping curve.

- **Sensor –** Sensor Type, Sensor Connection and Cold Junction Mode.
- **Callendar van Dusen –** R0, A, B and C parameters of Callendar van Dusen for RTDs.

Callendar-Van Dusen is an equation which describes the relation between the resistance (R) and the temperature (t) of RTD platinum resistance thermo-elements.

- **Table –** Table function with its parameters.
- **Output Relay –** This menu enable the relay function and configure the parameters for relay 1 and 2.

Trim – Enables the adjustment for transmitter output current, input temperature sensor (ohm or mV) and internal temperature sensor. Figure 3.6 shows the connection for current TRIM on VTT10-PH.

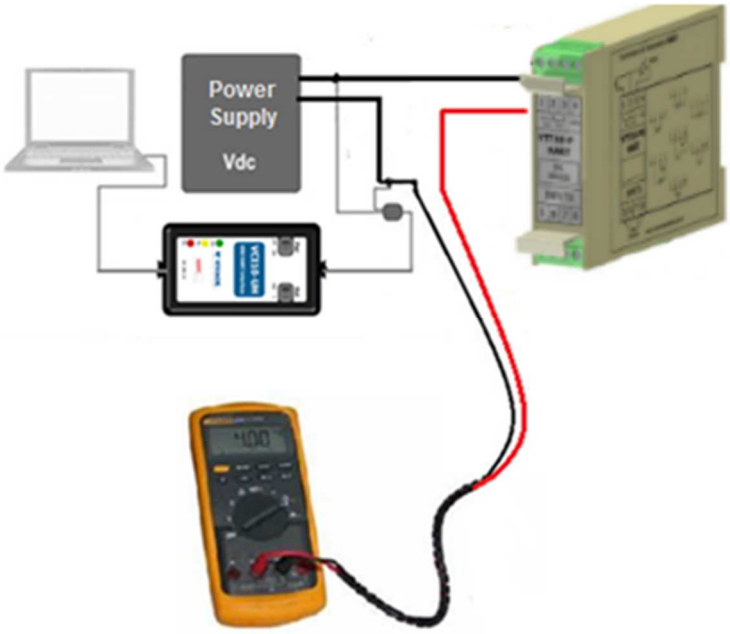

Figure 3.6 – VTT10-PH current trim configuration.

Maintenance – This menu enables transmitter reset, change counter verification/reset, write protection, data backup/restore and loop test function (fixed current mode).

- **Alteration Counter –** checks the number of changes executed in several parameters with the possibility of resetting them.
- **Max/Min Values –** Shows maximum and minimum values for PV and SV.

Observe – Monitoring view for output current, PV%, PV, SV, TV and QV.

Diagnosis – Monitoring view for device alarm status.

3.3. 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 exemplifie DTM configuration screens for VTT10-PH using Vivace's VCI10-UH interface and PACTware®.

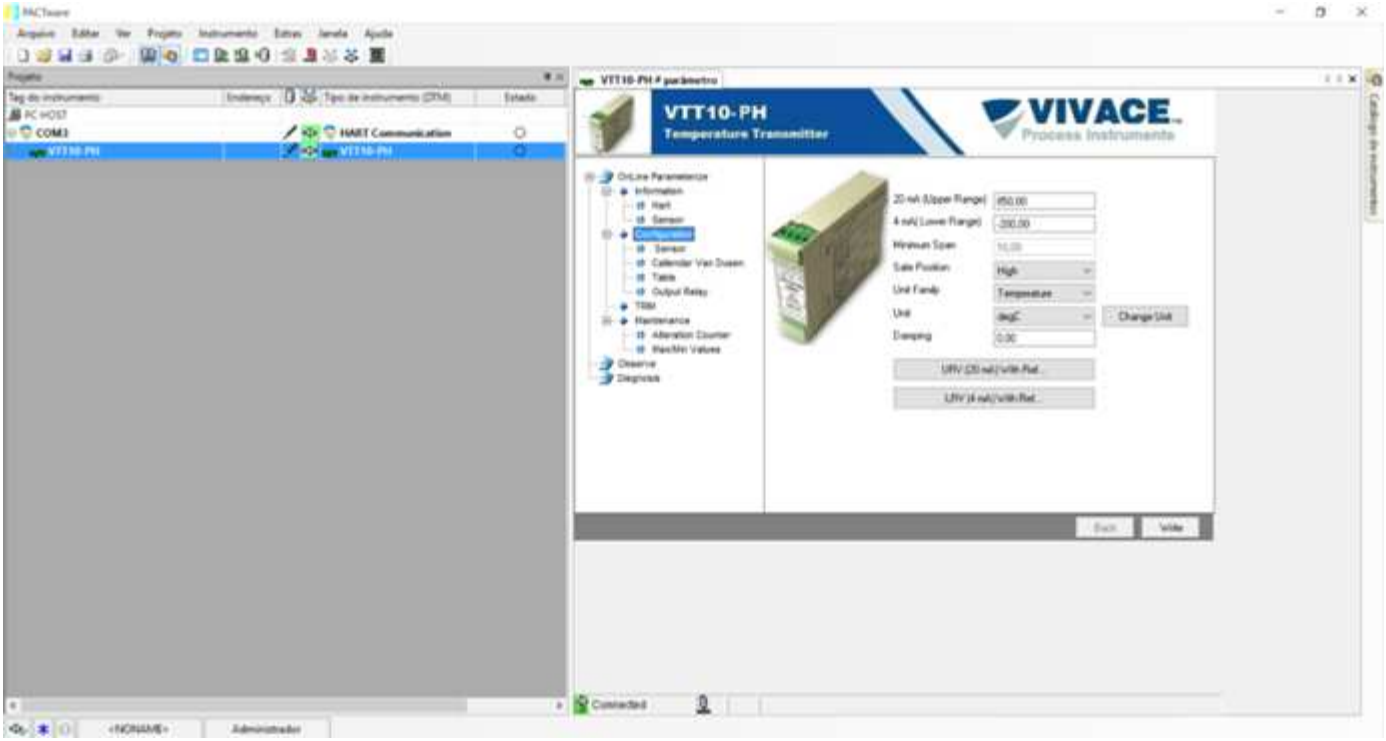

Figure 3.7 – DTM work range configuration screen for VTT10-PH.

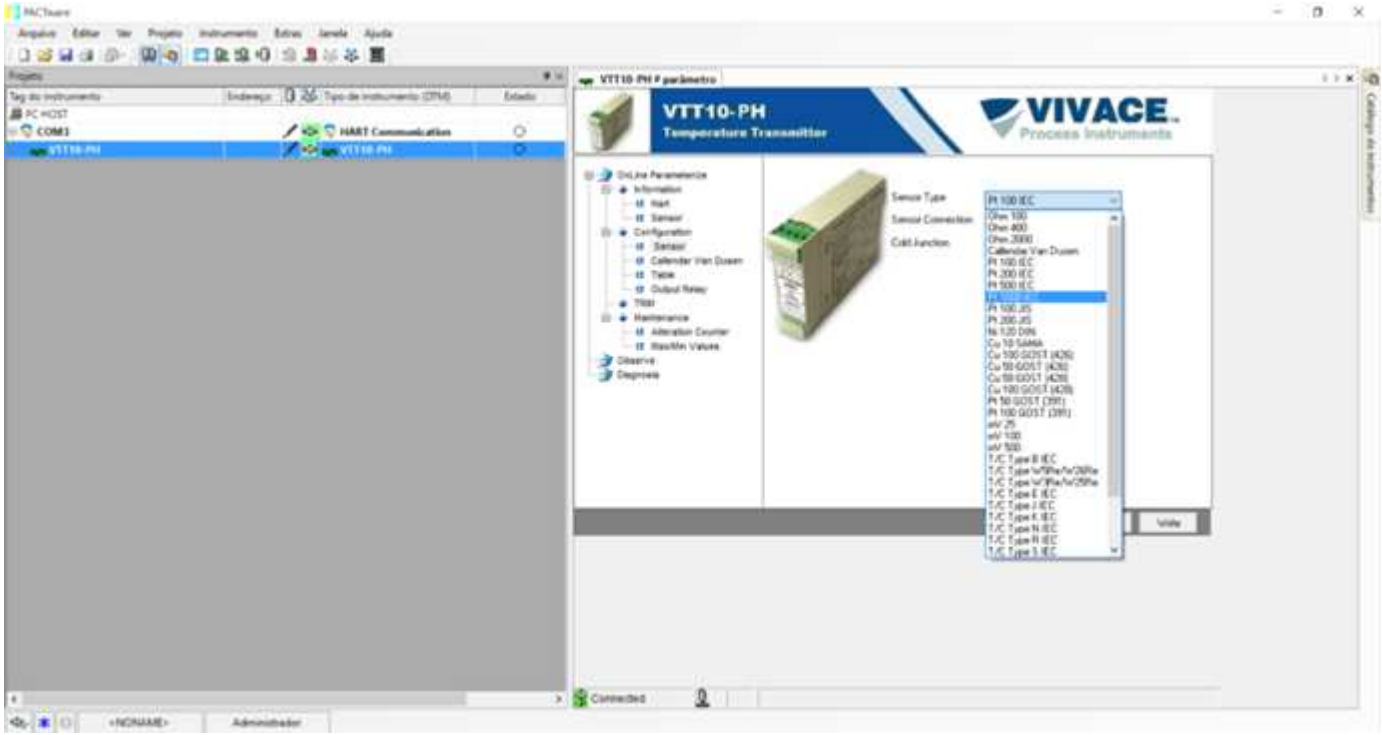

Figure 3.8– DTM sensor configuration screen for VTT10-PH.

4 MAINTENANCE

VTT10-PH, as all Vivace devices, suffers a several inspection before its shipping. However, some diagnostics are available in the case of malfunction to check what is causing the problem (installation, configuration or the device itself).

4.1. HART PROGRAMMER DIAGNOSTICS

HART communication can indicate some diagnostics itself through “device status” byte.

- FIELD DEVICE MALFUNCTION – Informs device has a hardware or configuration problem.

- CONFIGURATION CHANGED – Informs a write command was executed.

- COLD START – Informs device has been restarted.

- MORE STATUS AVAILABLE – Informs there is more information available on command 48.

- PRIMARY VARIABLE ANALOG OUTPUT FIXED – Informs analog current is in constant mode.

- PRIMARY VARIABLE ANALOG OUTPUT SATURATED – Informs sensor is working out of its configured range.

- NON-PRIMARY VARIABLE OUT OF LIMITS – Informs internal sensor has a problem.

- PRIMARY VARIABLE OUT OF LIMITS – Informs connected sensor has a problem.

5 CERTIFICATION

VTT10-PH was projected to attend national and international regulation for intrinsic safety.

6 TECHNICAL CHARACTERISTICS

6.1. IDENTIFICATION

VTT10-PH has two identification labels: one in the front panel and the other on the side of its housing. They describe transmitter model, device serial number, power supply terminals (PWR – 24 Vdc), current test (terminals 2 and 3), ground (terminal 4) and sensor inputs (terminals 5, 6, 7 and 8). In addition, the side label shows the different types of sensor connections. Both labels are illustrated in Figure 6.1.

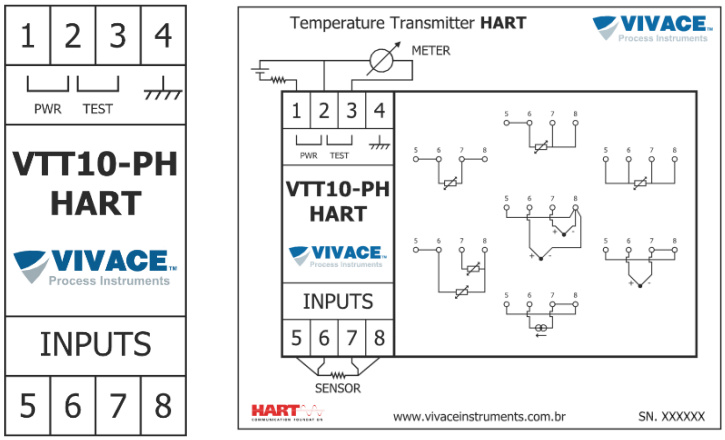

Figure 6.1 – VTT10-PH labels.

6.2. TECHNICAL SPECIFICATION

The following table shows the technical specifications for VTT10-PH:

Accuracy	According to Tables 6.2, 6.3 and 6.4
Power Supply / Output Current	2-wire, 12 to 45 Vdc (non- polarized) / 4-20 mA according to NAMUR-NE43
Communication Protocol	HART® 7
Hazardous Area Certification	Intrinsically Safe
Environment Temperature Limits	- 40 to 85°C
Configuration	EDDL and FDT/DTM tools for Windows and Android plattforms.
Assembly	DIN rail
Protection	IP00 / IP66 (Installed)
Electric Insulation	Galvanic Isolation, 1.5 kVac
Housing Material	Injected ABS Plastic
Approximated Weight (with mounting bracket)	76 x 23 x 105 mm / 105 g

Table 6.1 – VTT10-PH technical specifications.

In the case of malfunction, NAMUR NE43 guarantees output current to 3.6 or 21 mA, according to user configuration. Also it goes to 3.8 or 20.5 mA when saturation occurs.

6.3. COMPATIBLE SENSORS

The following tables list sensor types and its work ranges for best performance and accuracy.

RTD – Temperature sensor based on resistance (2, 3 or 4-wire connection).

SENSOR OPTION	REFERENCE	INPUT RANGE (°C)	MINIMUM SPAN (°C)	ACCURACY (°C)
Pt100 (α=0.00385)	IEC751	-200 to 850	10	0.10
Pt200 (α=0.00385)	IEC751	-200 to 850	10	0.50
Pt500 (α=0.00385)	IEC751	-200 to 850	10	0.20
Pt1000 (α=0.00385)	IEC751	-200 to 300	10	0.20
Pt100 (α=0.003916)	JIS1604	-200 to 645	10	0.15
Pt200 (α=0.003916)	JIS1604	-200 to 645	10	0.70
Ni120	Edison Curve #7	-70 to 300	10	0.08
Cu10	Edison Copper Winding #15	-50 to 250	10	1.00
Pt50 (α=0,00391)	GOST 6651-94	-200 to 850	10	0.20
Pt100 (α=0,00391)	GOST 6651-94	-200 to 850	10	0.12
Cu50 (α=0.00426)	GOST 6651-94	-50 to 200	10	0.34
Cu50 (α=0.00428)	GOST 6651-94	-185 to 200	10	0.34
Cu100 (α=0.00426)	GOST 6651-94	-50 to 200	10	0.17
Cu100 (α=0.00428)	GOST 6651-94	-185 to 200	10	0.17

Table 6.2 – Temperature RTD specification.

TC – Temperature sensor based on mV (2-wire connection).

SENSOR OPTION	REFERENCE	INPUT RANGES (°C)	MINIMUM SPAN(°C)	ACCURACY (°C)
Thermocouple B	IEC584	100 to 1820	25	0.75
Thermocouple E	IEC584	-50 to 1000	25	0.20
Thermocouple J	IEC584	-180 to 760	25	0.25
Thermocouple K	IEC584	-180 to 1372	25	0.25
Thermocouple N	IEC584	-200 to 1300	25	0.40
Thermocouple R	IEC584	0 to 1768	25	0.60
Thermocouple S	IEC584	0 to 1768	25	0.50
Thermocouple T	IEC584	-200 to 450	25	1.00
Thermocouple L	DIN43710	-200 to 900	25	0.35
Thermocouple U	DIN43710	-200 to 600	25	0.35
Thermocouple W3	ASTM E988-96	0 to 2000	25	0.70
Thermocouple W5	ASTM E988-96	0 to 2000	25	0.70
Thermocouple L	GOST R 8.585	-200 to 800	25	0.45

Table 6.3 – Temperature mV specification.

Ohm or mV – Linear resistive or mV sensor (2, 3 or 4-wire connection).

SENSOR OPTION	INPUT RANGES	ACCURACY
mV Input	-10 mV to 100 mV	0.015 mV
Ohm Input	0 Ohm to 2000 Ohm	0.45 Ohm

Table 6.4 – Ohm or mV specification.

6.4. ORDERING CODE

VTT10-P *Temperature Transmitter - Panel*

Communication Protocol	**H**	HART
	P	PROFIBUS
Certification Type	**0**	NO CERTIFICATION
	1	INTRINSICALLY SAFE
Certification Body	**0**	NO CERTIFICATION
	1	INMETRO
Discrete Output	**0**	NO DISCRETE OUTPUT
	1	WITH DISCRETE OUTPUT

Ordering Code Example:

VTT10-P	**H**	**-**	**0**	**0**	**0**

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:			