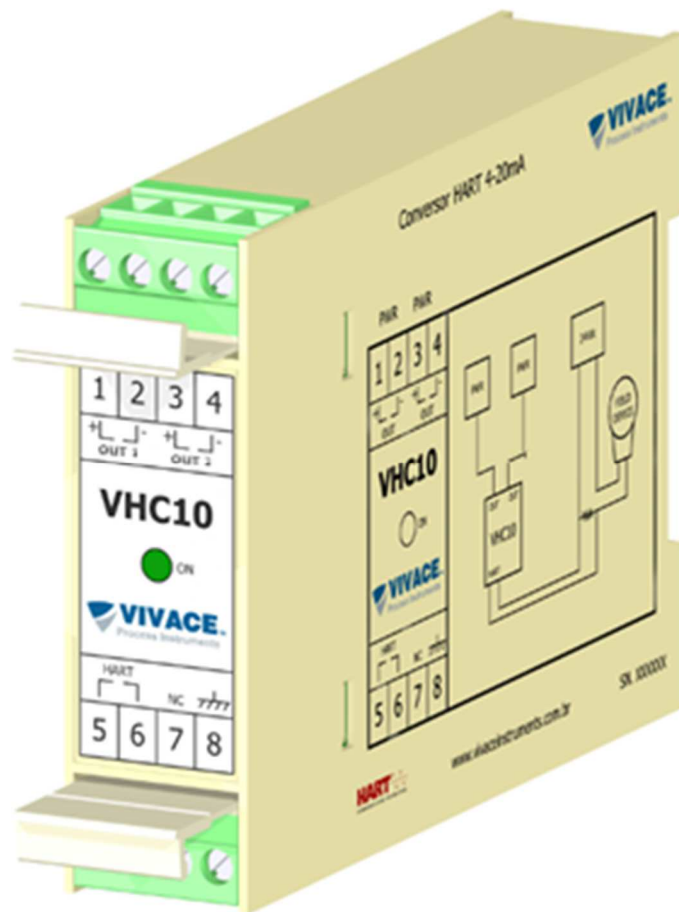


VHC10-P

HART® 4 – 20 mA CONVERTER

panel model



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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

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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.*

SYMBOLOLOGY

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

The HART® 4-20 mA **VHC10-P** converter is a member of the Vivace Process Instruments product family, designed to create up to two additional 4-20 mA current channels, aiding analog monitoring in devices that do not have this feature (valve positioners, for example) or that need this monitoring in more than one variable.

The converter can be powered by voltages between 12 and 45 Vdc, generating up to two 4-20 mA current channels (according to NAMUR NE43 standard). Its function is to monitor any user-configured variables of other HART® equipment (regardless of its version) and output them through the current channels.

Its configuration uses the HART®7 communication protocol, already established as the most used in the industrial automation world for configuration, calibration, monitoring and diagnostics.

The converter configuration is carried out at the beginning of its operating cycle, with the converter in "slave" mode, being completed by the user by changing the use mode to "master". Configurations can be performed using a HART® configurator or tools based on EDDL® or FDT/DTM®.

Prioritizing high performance and robustness, it was designed with the latest technologies in electronic components and materials, ensuring long-term reliability for systems of any scale.

1.1. BLOCK DIAGRAM

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

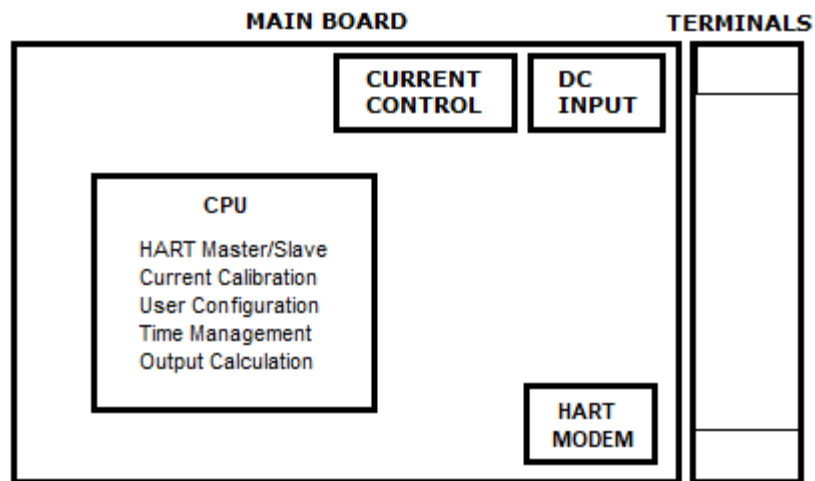


Figure 1.1 –VHC10-P block diagram.

The DC source input block is responsible for powering all circuits. The current control block is composed of a circuit that transforms the digital values generated by the microcontroller into 4-20 mA currents, proportional to the variables monitored by the converter.

The HART® modem block interfaces the microcontroller signals with the HART® line connected to the monitored equipment.

Finally, the CPU block can be related to the converter's brain, where all the time controls, switching between HART® Master/Slave state machines take place, in addition to routines common to transmitters, such as configuration, calibration and generation of output values digital for the currents, proportional to the monitored variables.

2 INSTALLATION

RECOMMENDATION



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

RECOMMENDATION



The equipment model and specifications are indicated on the identification labels located on the front and side of the enclosure. Check that the specifications and model provided are as specified for your application and requirements.

NOTE



All cables used to connect the VHC10-P to the HART® network must be shielded to avoid interference and noise.

NOTE



It is extremely important to ground the equipment for complete electromagnetic protection, in addition to ensuring the correct performance of the converter on the HART® network.

The electrical installation of the VHC10-P converter must be carried out after fixing it to the DIN rail. The HART channel must be connected between the converter and the equipment to be monitored and, only later, connect the supplies to the converter's current channels.

Converter connections are shown in figure 2.1 (2-channel model).

Note at the top, that the converter is powered by a voltage source (12 to 45 Vdc - OUT1) and its input is polarized, with the positive terminal being number 1 (on the left) and the negative terminal being the number 2 (on the right).

Terminals 3 and 4 must be powered by another voltage source (polarized input) to enable the output of current OUT2 for the two-channel model.

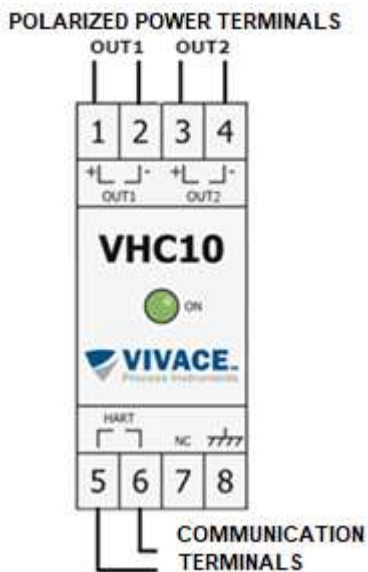


Figure 2.1 – Identification of converter terminals.

Terminal Description	
1 – 2	Terminals for Powering CHANNEL 1 - OUT1 12 to 45 Vcc polarized
3 – 4	Terminals for Powering CHANNEL 2 - OUT2 12 to 45 Vcc polarized
5 – 6	Terminals for Communication – HART HART® communication with monitored device
7	Not connected terminal
8	Ground terminal

Table 2.1 – VHC10-P terminal description.

At the bottom user can find the HART® communication terminals (terminals 5 and 6). In this case, there is no polarity. Terminal 7 must be left open and terminal 8 can be optionally grounded.

The VHC10-P can monitor variables from HART® devices powered by voltage (transmitters) or by current (valve positioners). The communication connections with these devices are represented, respectively, in figures 2.2 and 2.3, below.

In the case of monitoring a transmitter equipment (figure 1.4), a load of 250 ohms is required to enable the modulation of the current in the HART® standard, in series with the transmitter's supply voltage.

User must use an independent voltage source to power the transmitter, different from the source(s) of the VHC10-P converter, since the converter output currents will indicate the variables read from the transmitter, as indicated in the figures.

Communication terminals 5 and 6 of the converter must be connected over the 250 ohm load, where there is modulation of the HART® signal in the current.

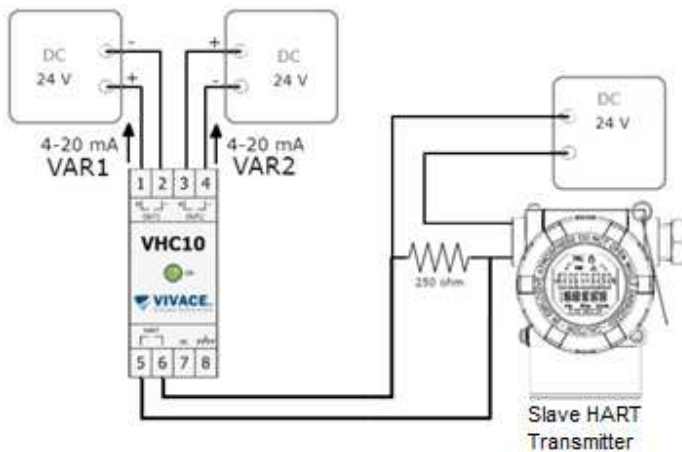


Figure 2.2 – Connection between converter and transmitter – 2-channel model.

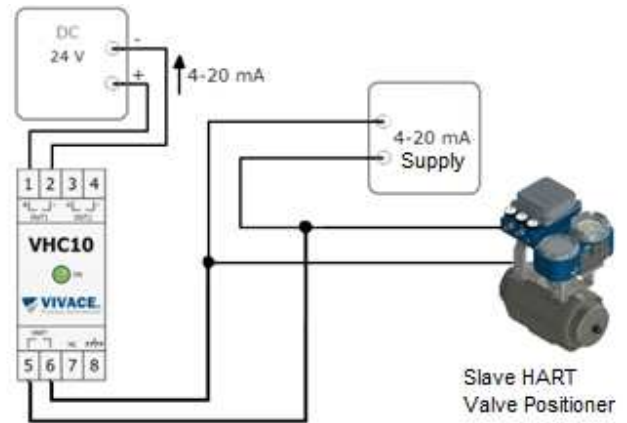


Figure 2.3 – Connection between converter and valve positioner.

In the case of monitoring a valve positioner (figure 2.3), a 250 ohm load is not required for communication, as the valve positioner is powered by a 4-20 mA current input.

Note that in this example only one output is used to monitor the valve position by reading the positioner's PV variable.

Communication terminals 5 and 6 of the converter must be connected directly to the current supply input of the positioner.

INSTALLATION



When mounting the equipment in panels or boxes in the field, make sure that the moisture seals are adequate and ensure that the connections to the unused box entries are closed, as the ingress of moisture can generate low insulation and damage the electronic circuits.

In wet conditions, damage caused to the equipment will NOT be covered by the warranty.



3 CONFIGURATION

3.1. JUMPERS FOR LOCAL ADJUST AND WRITE PROTECTION


In addition to the software write protection function, using a configurator, user can change the hardware protection (figure 3.1), in order to ensure that no user can remotely modify their settings. Software write protection does not disable hardware protection and vice versa. For write protection to be disabled, both must be disabled.



Figure 3.1 – Hardware write protection.

WP1	Write Protection
	Enabled
	Disabled

NOTE



The default condition for write protection jumper is **DISABLED**.

3.2. HART® PROGRAMMER

The configuration of the equipment can be performed using a programmer compatible with HART® technology. Vivace offers VCI10 HART® line interfaces (USB or Bluetooth) as a solution for configuration and monitoring of HART® line equipment.

Figure 3.2 exemplifies the use of the USB interface with a personal computer that has HART® configurator software installed, for communication with a valve positioner.

A 250Ω resistor must be used in series with the equipment power supply when the equipment to be monitored is powered via voltage, if the source does not have this load internally, to enable HART® communication over the 4-20 mA current. Vivace interfaces already have this load internally.

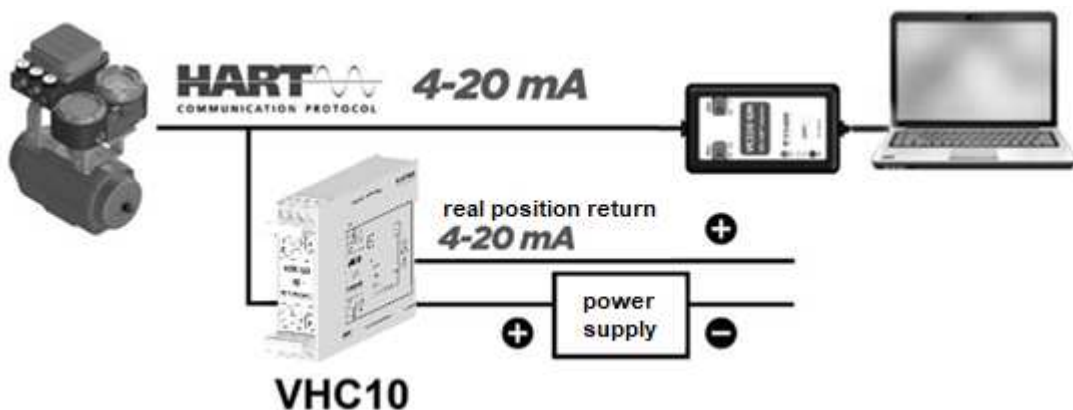


Figure 3.2 – Installation of converter for monitoring a valve positioner – only 1 channel.

3.3. CONFIGURATION PARAMETERS

Parameters are available for user configuration through a HART® programmer. In addition to the parameters inherent to the protocol, there are some basic parameters to be configured before starting the converter: the address of the equipment to be monitored, the codes of the variables to be monitored, units and working ranges for calculating the currents.

The parameters inherent to the protocol concern the converter itself, basically dealing with its identification (Tag, Description, Date, Address) and calibration of the currents to be used as output signals of the monitored variables. For more details on each of these parameters and where to configure them, see section 3.5.

CAUTION



As VHC10-P converter will be connected on the same HART® line as the equipment monitored, its default address is one (1). Therefore, when using the HART® configurator for configuration, this address must be entered by the user in the 'Polling Address' field.

CONFIGURATION WINDOW

VHC10-P normally works as a "master" in order to monitor the "slave" equipment and generate currents proportional to the monitored variables. So, converter will not receive HART® commands from another master, making it impossible to configure it when in this mode.

To configure it, the user must follow the procedure below.

CAUTION



If the converter enters monitoring mode and the user wants to change any configuration, the procedure must be restarted.

a. Reset VHC10-P converter

The converter will wait for configuration commands to be received. If no command is sent within 30 seconds, the "master mode will be enabled automatically.

b. Localize the conversor

Using a HART® configurator, poll device at address one (1) – or at the address modified by user user.

c. Change mode to Configuration

In the "Settings" directory, change the converter mode to "Configuration". From this moment on, the user will be able to make any configuration with peace of mind, without the converter going back to the "master" mode.

NOTE



Vivace configuration tools such as VMT-HART and converter DTM already send this command automatically. In this case, the user can go straight to item d..

d. Configure addresses, variables and ranges

User must verify that the address of the "slave" equipment, the codes of the variables to be monitored, working ranges and units are correct.

The variables to be monitored can be chosen among the dynamic variables (PV, SV, TV or QV) or by a variable-specific code index (check the indexes available in the monitored product manual).

e. Change mode to Monitoring


In the "Settings" directory, change the converter mode to "Monitoring" (or "Enable Master Mode", according to the configurator used). From this moment on, the user will no longer be able to configure the converter and it will work in "master" mode.

IDENTIFYING SLAVE DEVICE

After installing the converter on the HART® network, user must configure the address of the equipment to be monitored (0 to 15, for HART®6 or earlier; 0 to 63, for HART®7) and the variable codes of this equipment to be converted to 4-20 mA current.

In the case of variables, user can choose between main dynamics (PV, SV, TV or QV) or manually enter the code of the desired variable, if it is not one of the four above.

NOTE

 *The codes for each variable must be provided by the manufacturer of each equipment.*

With these configurations completed, user will be able to activate the monitoring of the slave equipment ('Enable Master Mode') in the "Configuration" menu, when the converter will start to try to identify the slave equipment at the configured address.

In case of success, the monitoring of the configured variables will start automatically, generating the 4-20 mA output currents proportional to the values configured in the parameters of the respective working ranges and current calibrations (HART® standard).

CONFIGURATION EXAMPLE:

Converter: Address 1
 Slave Device: Address 0

Monitored Variable 1: PV%
 Variable 1 Unit: %
 Variable 1 Range: 0% to 100%

Monitored Variable 2: SV
 Variable 2 Unit: °C
 Variable 2 Range: -20°C a 150°C

VAR1 = PV%	OUT1	VAR2 = SV	OUT2
0,0%	4,0 mA	-20,0°C	4,0 mA
25,0%	8,0 mA	22,5°C	8,0 mA
50,0%	12,0 mA	65,0°C	12,0 mA
75,0%	16,0 mA	107,5°C	16,0 mA
100,0%	20,0 mA	150,0°C	20,0 mA

Table 3.1 – Example of monitoring for 2-channel converter.

3.4. PROGRAMMING TREE FOR HART CONFIGURATOR

The programming tree is a tree-like structure with a menu of all available software features, as shown in the figure. 3.3.

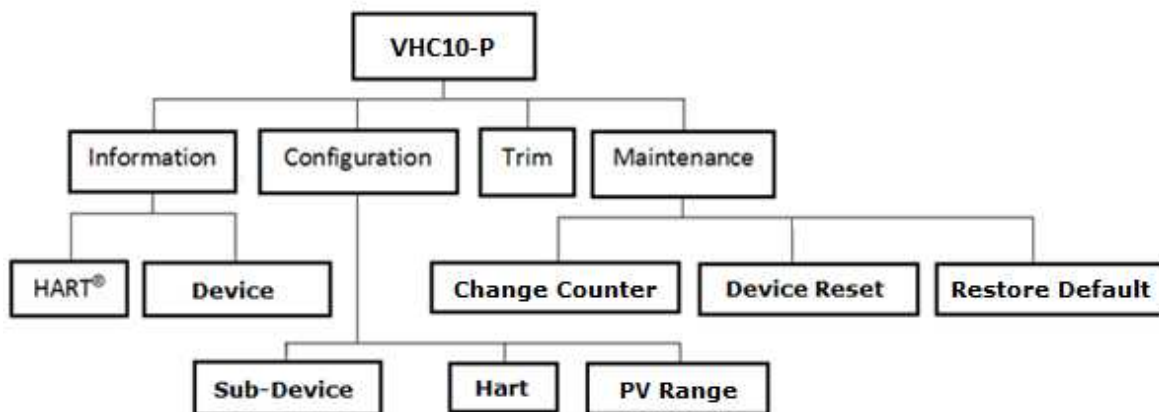


Figure 3.3 – VHC10-P programming tree.

To configure the converter online, make sure it is correctly installed, with the proper supply voltage and a minimum of 250 Ω of line impedance, necessary for communication with the slave equipment (in the case of voltage-supplied transmitters, only).

CAUTION

Make sure the converter is in Configuration Mode (see the 'Configuration Window' item) before initializing the settings.

INFORMATION

The main information about the converter can be accessed here.

HART® – The main equipment information regarding the communication protocol is found here, such as: Manufacturer, Device Type, Device Profile, HART® Revision, Software Version and Order Code.

Device – Here are the main equipment information: Tag, Description, Message, Serial Number and Order Code.

CONFIGURATION

Here you configure the Converter Mode, as Master (monitoring) or Slave (configuration). Also the items in this menu allow the following settings:

Sub-Device – Address and Variable Codes for the monitored device.

Range – Working Ranges (upper and lower points) and Units.

Hart – configures Current Mode, Safety Output, HART Master Mode, Write Protection and Communication Preambles.

TRIM

User can adjust the output currents of the converter. Figure 3.4 shows the assembly diagram for the TRIM of the current OUT1 of the VHC10-P. To trim the OUT2 current, just repeat the assembly of the figure, using the inputs of terminals 3 and 4 of the converter.

MAINTENANCE

In this menu you can perform maintenance tasks for the converter, as described below.

Change Counter – Informs the change counters for each of the following drive parameters. It is also possible to reset the counters in this directory.

- Converter Address
- Variable 1 Range
- Variable 2 Range
- Variable 1 Unit
- Variable 2 Unit
- Inferior Current Trim
- Superior Current Trim
- Slave Device Address
- Variables 1 and 2 Codes
- Software Write Protection
- Safety Output

Device Reset – resets converter via software.

Restore Default – restores factory default values to configuration and calibration parameters.

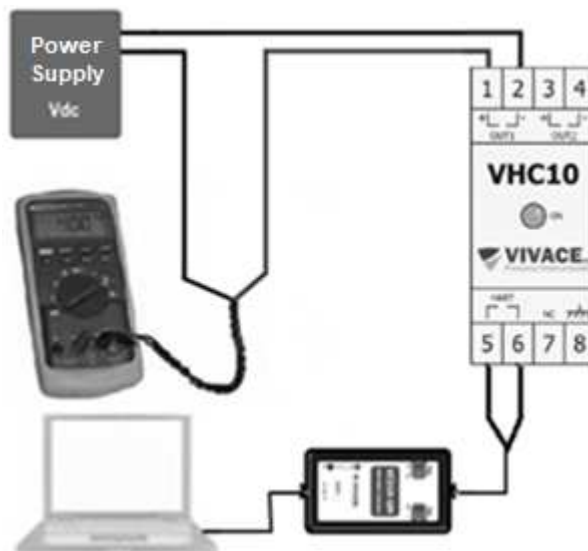


Figure 3.4 – Mounting for OUT1 current trim.

3.5. SAFE OUTPUT

The converter has a specific configuration to independently direct the output currents to a safety value, according to the user application.

This value is used whenever the slave equipment stops responding to monitoring commands, when configurator enters configuration mode or when the user uses the local adjustment with the magnetic tool.

The user can configure the following safety outputs, according to the NAMUR NE-43 standard:

HIGH – sets the respective safety output to 20.50 mA (103.125%);

LOW – sets the respective safety output to 3.8 mA (-1.25%);

LAST VALUE – sets the respective safety output to the last valid value read.

Converter will return to indicate the current proportional to the respective monitored variable as soon as the connection with the slave equipment is re-established or when the configuration mode is ended.

3.6. FDT/DTM CONFIGURATION

Tools based on FDT/DTM (Ex. PACTware® or FieldCare®) can be used for information, configuration, monitoring and visualization of diagnosis on devices with HART® technology. Vivace makes available on its website (www.vivaceinstruments.com.br) DTMs of all its equipment from the line with the protocols HART® and Profibus PA.

PACTware® is proprietary software of the PACTware Consortium and can be found on the website: http://www.vega.com/en/home_br/Downloads

The following figures show some of the VHC10-P DTM screens using the Vivace VCI10-UH interface with PACTware®. Note that the directory with menus available for the DTM (*OnLine Parameterize*) follows the format of the configuration tree displayed in the item 3.4 (figure 3.3).

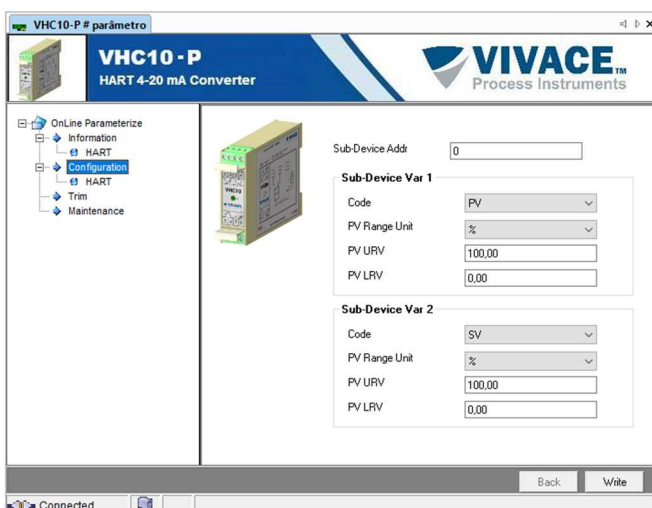


Figure 3.5 – Variable configuration screen.

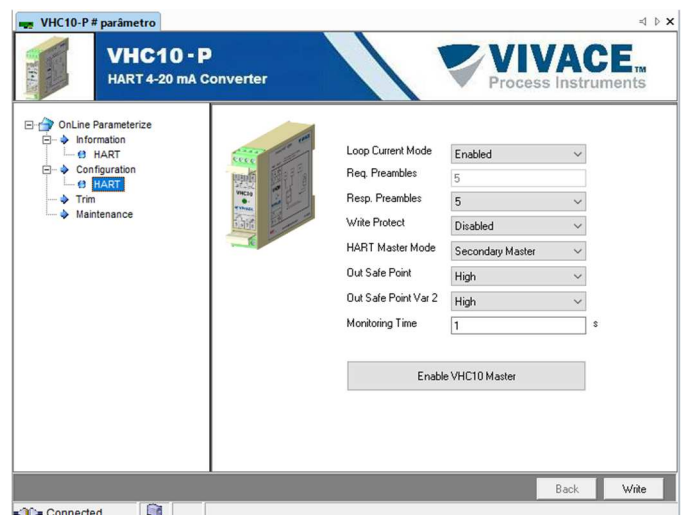


Figure 3.6 – Monitoring configuration screen.

NOTE



For complete details of each of the functions provided by the converter via DTM, see section 3.4 – Programming Tree for HART Configurator.

4 TECHNICAL CHARACTERISTICS

4.1. CASE DIMENSIONS

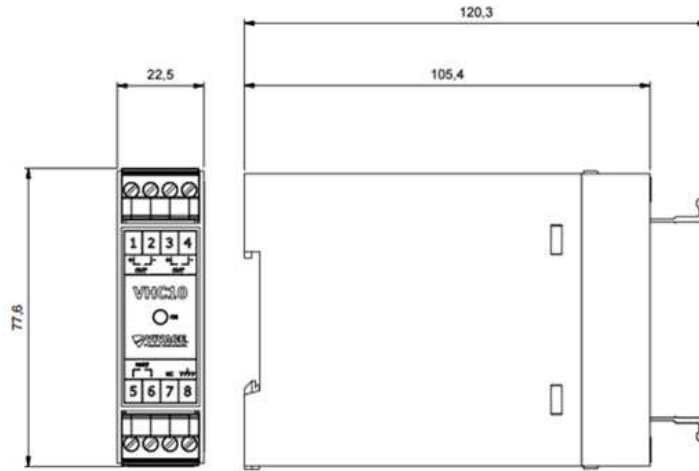


Figure 4.1 – Dimensions of housing case.

4.2. IDENTIFICATION

VHC10-P has an identification tag attached to its front face, specifying model, manufacturer and connections, as shown in Figure 4.2. It also has a side label with the converter connection diagram and the equipment serial number.

The indications of the connections of the HART® channel with the equipment to be monitored, of the power supplies and current outputs are also indicated on the labels.

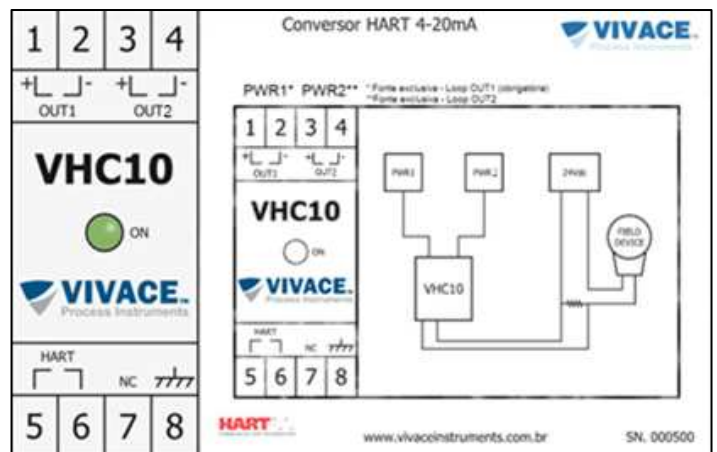


Figure 4.2 – Identification tags for VHC10-P – 2-channel model.

4.3. ORDERING CODE

VHC10-P Panel HART® 4-20 mA Converter

Monitoring Channels	1	1 CHANNEL
	2	2 CHANNELS
Certification Type	0	NO CERTIFICATION
Certification Body	0	NO CERTIFICATION

Ordering Code Example:

VHC10-P	-	1	0	0
---------	---	---	---	---

4.4. TECHNICAL AND PHYSICAL SPECIFICATIONS

The main technical and physical characteristics of the converter are listed in Table 4.1. These are important references that must be analyzed before installing the converter to the user's system, especially with regard to supply voltage, temperature and mechanical connection.

Accuracy	± 0,03% of calibrated span
Communication Protocol	HART® 7 (compatible with previous versions)
Output Current	Up to two 4-20 mA channels, according to NAMUR NE43
Power Supply	12 to 45 Vdc, not polarized, with transient protector
Temperature Limits	-10 to 70°C (14 to 158°F)
Configuration	Remote configuration using tools based on EDDL or FDT/DTM
Write Protection	Hardware and software
Hazardous Area Certification	Not certified
Protection Degree	IP00 / IP66 (installed)
Mounting	Panel, DIN 43880 rail
Case Material	Injected ABS Plastic
Approximated Weight	300 g

Table 4.1 – Specifications for VHC10-P converter.

4.5. SPARE PARTS

4-Way VHC10-P Protection Connector (upon request).

5 WARRANTY

5.1. GENERAL CONDITIONS

Vivace ensures its equipments 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.

User can repair some equipments 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.

5.2. 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 I – TECHNICAL ANALYSIS REQUEST

		FSAT Technical Analysis Solicitation Form		
		Company:	Unit/Department:	Shipping Invoice n°:
Standard Warranty: ()Yes ()No		Extended Warranty: ()Yes ()No		Buying Invoice n°:
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 (°C)			Work Temperature (°C)	
Min:	Max:		Min:	Max:
Operation Time:			Fail Date:	
FAIL DESCRIPTION: Here user should describe in detail the observed behaviour of product, frequency of fail occurrence and repeatability. Also, should inform operational system version and a quick description of control system architecture where the equipment was installed.				
ADDITIONAL OBSERVATION:				

