DC Voltmeter

DHC-96 mVdc, DHC-96 LVdc, DHC-96 HVdc

INSTRUCTION MANUAL

(M225B01-03-20A)

CE

SAFETY PRECAUTIONS

Follow the warnings described in this manual with the symbols shown below.

	**DANGER** Warns of a risk, which could result in personal injury or material damage.

	**ATTENTION** Indicates that special attention should be paid to a specific point.

If you must handle the unit for its installation, start-up or maintenance, the following should be taken into consideration:

	Incorrect handling or installation of the unit may result in injury to personnel as well as damage to the unit. In particular, handling with voltages applied may result in electric shock, which may cause death or serious injury to personnel. Defective installation or maintenance may also lead to the risk of fire. Read the manual carefully prior to connecting the unit. Follow all installation and maintenance instructions throughout the unit's working life. Pay special attention to the installation standards of the National Electrical Code.
	**Refer to the instruction manual before using the unit** In this manual, if the instructions marked with this symbol are not respected or carried out correctly, it can result in injury or damage to the unit and /or installations.

CIRCUTOR, SA reserves the right to modify features or the product manual without prior notification.

DISCLAIMER

CIRCUTOR, SA reserves the right to make modifications to the device or the unit specifications set out in this instruction manual without prior notice.

CIRCUTOR, SA on its web site, supplies its customers with the latest versions of the device specifications and the most updated manuals.

www.circutor.com

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REVISION LOG

Table 1: Revision log.

Date	Revision	Description
11/18	M225B01-03-18A	Initial Version
01/19	M225B01-03-19A	Change in the following sections: 6.1. - 7. - 10.
02/20	M225B01-03-20A	Change in the following sections: 5.1. - 5.3.2. - 5.3.3. - 5.4.5. - 5.4.6. - 6.1. - 6.3.1. -- 6.3.2. - 6.3.3. - 6.3.4. - 6.3.5.3. - 6.3.5.4. - 6.3.5.5. - Anexo A

SYMBOLS

Table 2: Symbols.

Symbol	Description
CE	In compliance with the relevant European directive.
	Device covered by European directive 2012/19/EC. At the end of its useful life, do not leave the unit in a household waste container. Follow local regulations on electronic equipment recycling.
⎓	DC current
~	AC current

Note : *Devices images are for illustrative purposes only and may differ from the actual device.*

1.- VERIFICATION UPON RECEPTION

Check the following points when you receive the device:

a) The device meets the specifications described in your order.
b) The device has not suffered any damage during transport.
c) Perform an external visual inspection of the device prior to switching it on.
d) Check that it has been delivered with the following:

- An installation guide,

	If any problem is noticed upon reception, immediately contact the transport company and/or **CIRCUTOR's** after-sales service.

2.- PRODUCT DESCRIPTION

The **DHC-96 Vdc** range is designed to measure and display the DC voltage. **CIRCUTOR** has 3 models, for different voltage ranges:

✓**DHC-96 HVdc** with a voltage measuring range of ± 1500 V
✓**DHC-96 LVdc** with a voltage measuring range of ± 10 V
✓**DHC-96 mVdc** with 5 programmable voltage scales: 60 mV, 75 mV, 100 mV, 150 mV and 200 mV.

The device features:

- **4 keys** that allow you to browse between the various screens and program the device.
- **LED display**, displays all parameters.
- **2** fully programmable **relay outputs**
- **2 digital inputs**.
- **1** programmable **analog output**
- Communications **RS-485**.

List of models:

✓DHC-96 mVdc

Table 3:DHC-96 mVdc list of models.

Model	Power Supply		
	80 ... 270 V ~	80 ... 270 V ⎓	18 .. 36 V ⎓
M22348	✓	✓	-
M223480030000	-	-	✓

✓DHC-96 LVdc

Table 4:DHC-96 LVdc list of models.

Model	Power Supply		
	80 ... 270 V ~	80 ... 270 V ⎓	18 .. 36 V ⎓
M22328	✓	✓	-
M223280030000	-	-	✓

✓DHC-96 HVdc

Table 5:DHC-96 HVdc list of models.

Model	Power Supply		
	80 ... 270 V ~	80 ... 270 V ⎓	18 .. 36 V ⎓
M22338	✓	✓	-
M223380030000	-	-	✓

3.- DEVICE INSTALLATION

3.1.- PRIOR RECOMMENDATIONS

	In order to use the device safely, it is critical that individuals who handle it follow the safety measures set out in the standards of the country where it is being used, use the necessary personal protective equipment, and pay attention to the various warnings indicated in this instruction manual.

The **DHC-96 Vdc** device must be installed by authorised and qualified staff.

The power supply plug must be disconnected and measuring systems switched off before handling, altering the connections or replacing the device. It is dangerous to handle the device while it is powered.

Also, it is critical to keep the cables in perfect condition in order to avoid accidents, personal injury and damage to installations.

The device's functionality is limited to the category of measuring voltage or specific current values.

The manufacturer of the device is not responsible for any damage resulting from failure by the user or installer to heed the warnings and/or recommendations set out in this manual, nor for damage resulting from the use of non-original products or accessories or those made by other manufacturers.

If an anomaly or malfunction is detected in the device, do not use it to take any measurements.

	Disconnect the device from the power supply (device and measuring system power supply) before maintaining, repairing or handling the device's connections. Please contact the after-sales service if you suspect that there is an operational fault in the device.

3.2.- INSTALLATION

⚠	Terminals, opening covers or removing elements can expose parts that are hazardous to the touch while the device is powered. Do not use the device until it is fully installed.

The device should be installed inside an electric panel or enclosure, and panel-mounted.

To install it, take the following steps:

1.- Make a cut in the panel, according to the dimensions in **Figure 1.**

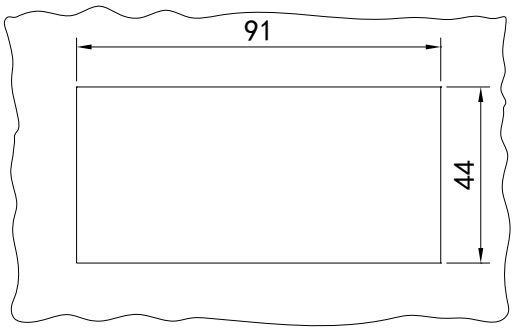


Figure 1: Cut in the panel.

2.- Remove the device's fixing clips (**Figure 2**).

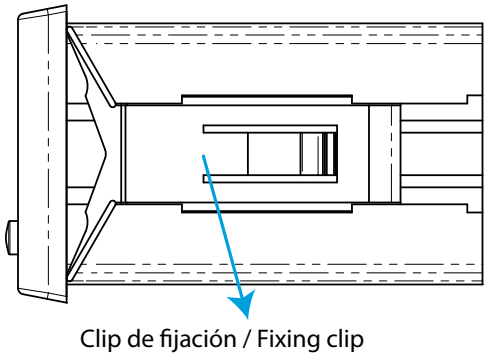


Figure 2: Installation.

3.- Insert the device into the cut in the panel.
4.- Fit the fixing clips until the device is fixed to the panel.

The device should be connected to a power circuit protected by a fuse with a maximum nominal current of **0.25 A**.

3.3.- DEVICE TERMINALS

Table 6:List of terminals of the DHC-96 Vdc.

Device terminals	
1 : L, Auxiliary power supply.	**31:** Alarm output 2, relay (Common)
2: N, Auxiliary power supply.	**32:** Alarm output 2, relay (NO)
11: +, Voltage measurement input	**58: A**, RS-485
14: -, Voltage measurement input	**59: B**, RS-485
15: -, Analog output	**70:** Common digital input
16: +, Analog output	**71:** Digital input 1
28: Alarm output 1, relay (Common)	**72:** Digital input 2
29: Alarm output 1, relay (NO)	

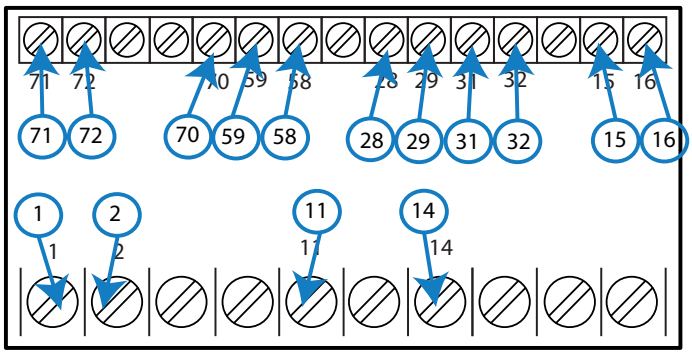


Figure 3:Terminals of the DHC-96 Vdc.

3.4.- CONNECTION DIAGRAM

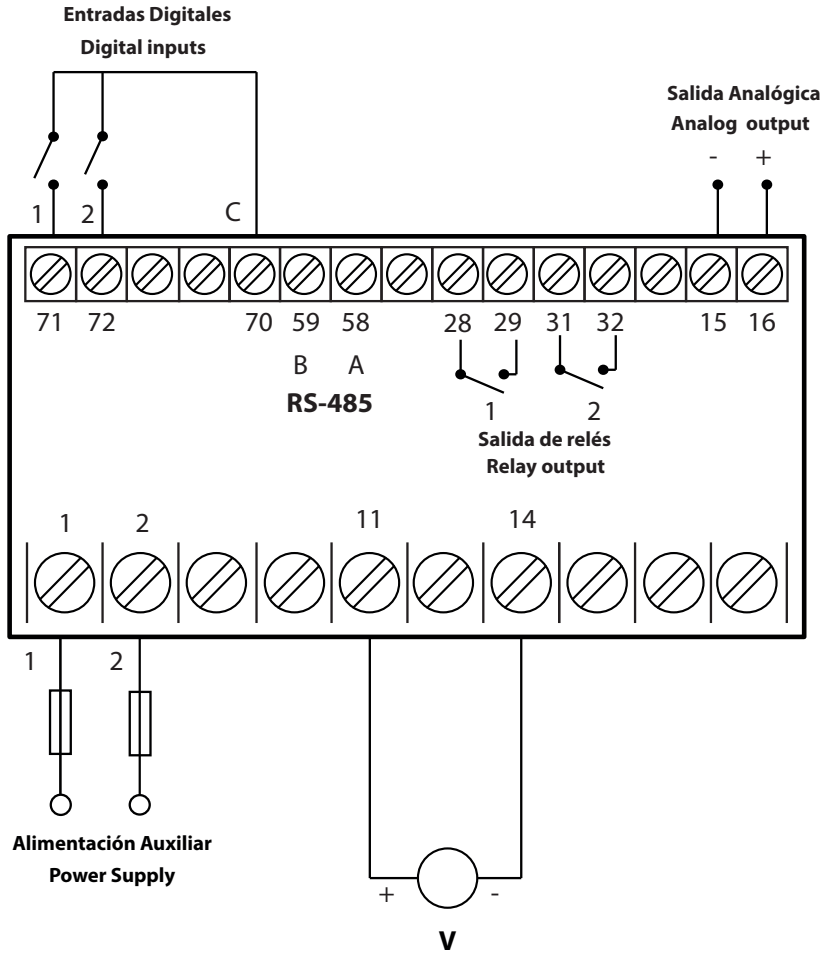


Figure 4: Voltage measurement DHC-96 Vdc.

Make sure that the positive and negative voltage terminals are as shown in the connection diagram.

4.- OPERATION

4.1.- DISPLAY

The device features a 5-digit LED display, which is used to display the measured parameters and to configure these parameters

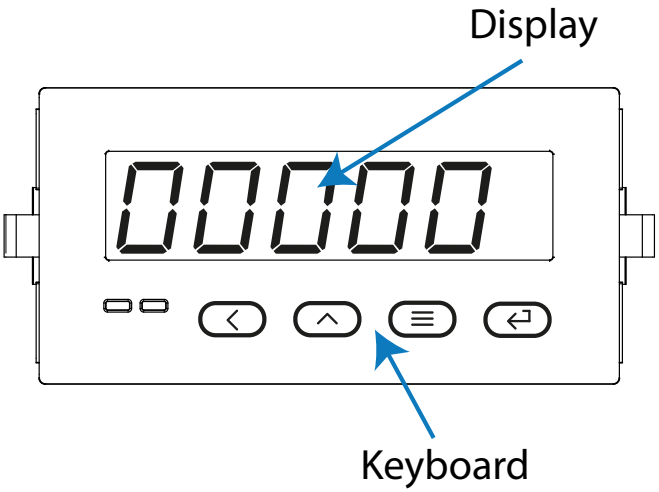


Figure 5: Display DHC-96.

4.2.- KEYBOARD FUNCTIONS

The **DHC-96 Vdc** features 4 keys to display and configure the device, **Figure 5**.

Table 7: Keyboard functions.

Key	Keystroke
	Previous screen **In the configuration menu:** Scroll through the digits
	Next screen **In the configuration menu:** Increase the value of the digit
	**Long keystroke (> 3s):** Enter in configuration menu
	**In the configuration menu:** Jump to the next level / Confirm an operation

4.3.- RELAY OUTPUTS

The device features two programmable relay outputs (terminals 28, 29, 31 and 32, as shown in **Figure 6**) that can be programmed as remote control signals or alarms in the setup menu (***"5.4.- RELAY OUTPUT 1"*** and ***"5.5.- RELAY OUTPUT 2"***).

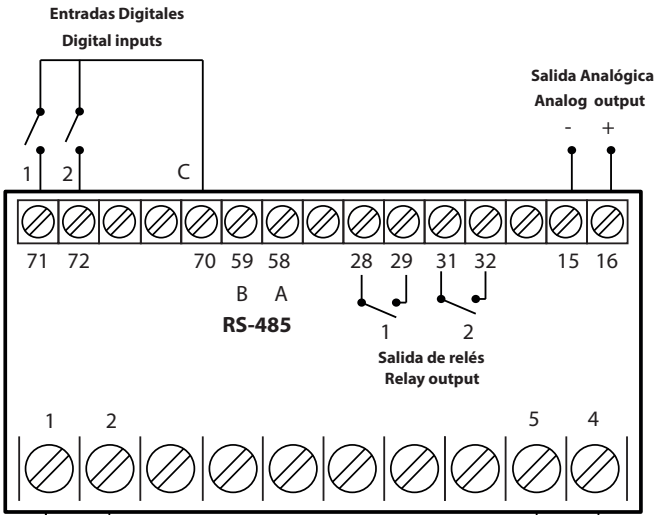


Figure 6: Relay outputs, digital inputs and Analog output.

4.4.- ANALOG OUTPUT

The device has an analog output (terminals 15 and 16 of **Figure 6**) programmable through the configuration menu (***"5.3.- ANALOG OUTPUT"***)

4.5.- DIGITAL INPUTS

The device has two digital inputs (terminals 70, 71 and 72 of **Figure 6**). The relay outputs can be activated depending on the value of the digital inputs (See ***"5.4.- RELAY OUTPUT 1"*** and ***"5.5.- RELAY OUTPUT 2"***)

4.6.- DISPLAY

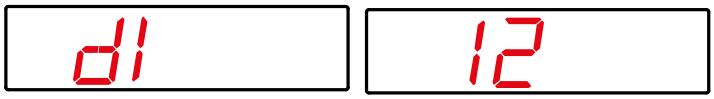
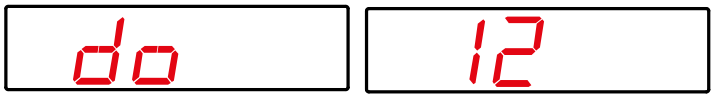
The **DHC-96 Vdc** features 3 display screens, **Table 8**.

Use the < and ^ keys to browse the screens.

Table 8: Display menu.

Display menu	
220.0	**Voltage**

Table 8 (Continuation) : Display menu.

Display menu
 **Status of digital inputs:** 1, status of the digital input 1: flashes when the input is activated 2, status of the digital input 2: flashes when the input is activated
 **Status of the relay outputs:** 1, status of the relay output 1: flashes when the relay is activated 2, status of the relay output 2: flashes when the relay is activated

If the voltage value measured by the device is higher than a % of the nominal value, the device can make the digits on the display start flashing, in the form of a light alarm. See ***"5.6.3.- LIGHT ALARM"***

5.- CONFIGURATION

Press and hold the ☰ key for more than 3 seconds to enter the configuration menu of the device.
The configuration of the device is organized in different menus, **Figure 7**.

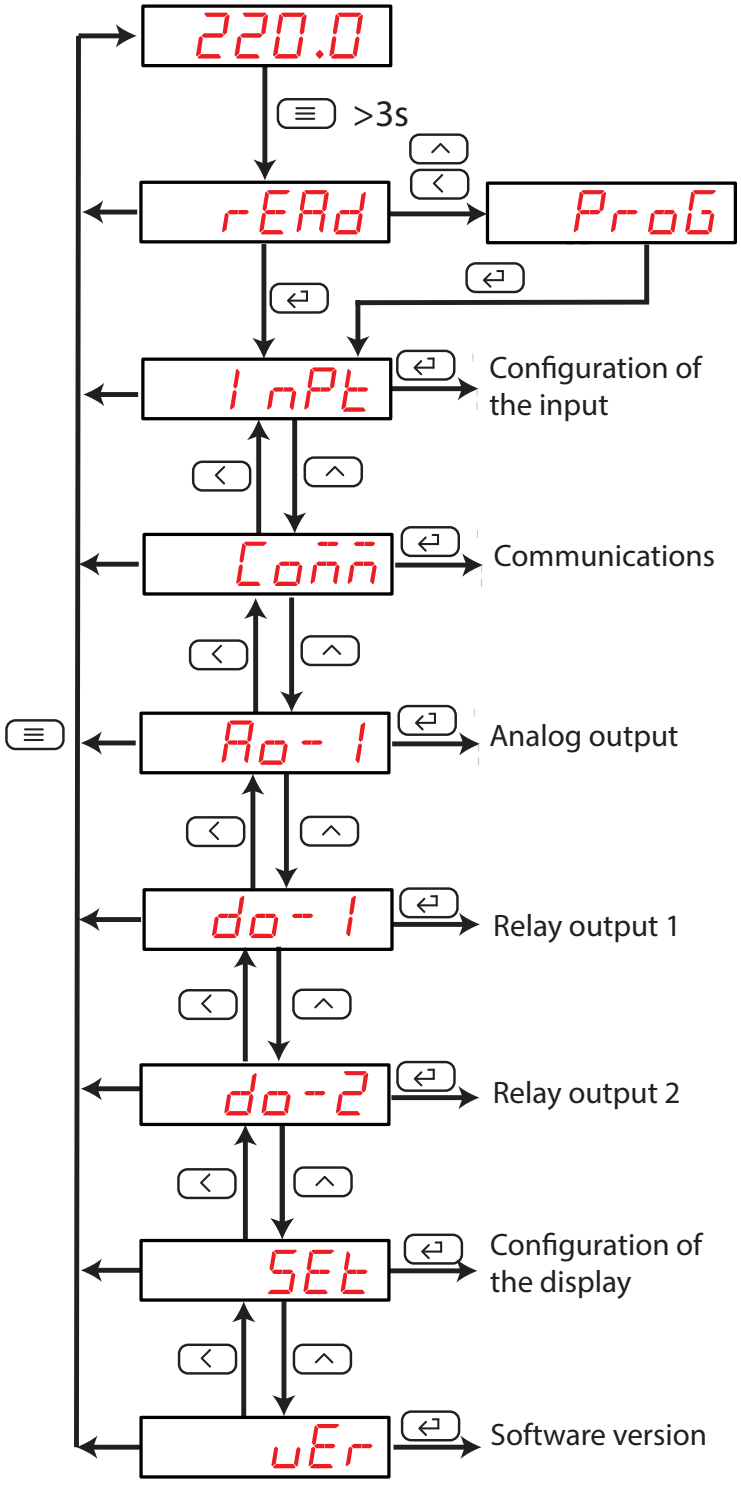


Figure 7: Configuration menu of the DHC-96 Vdc.

From any screen of the configuration menus, if no key is pressed for 4 minutes, the device leaves the configuration menu and returns to the display screen.

Note: *In* ***"ANNEX A.- CONFIGURATION MENU"*** *you can see the complete configuration menu.*

On the rEAd screen, press the ↵, key to access the configuration menu in the **display mode**, i.e., the configuration parameters cannot be modified.

On the rEAd screen, press the < or ^ keys to access the configuration menu in the **programming mode**, i.e., the configuration parameters can be modified.

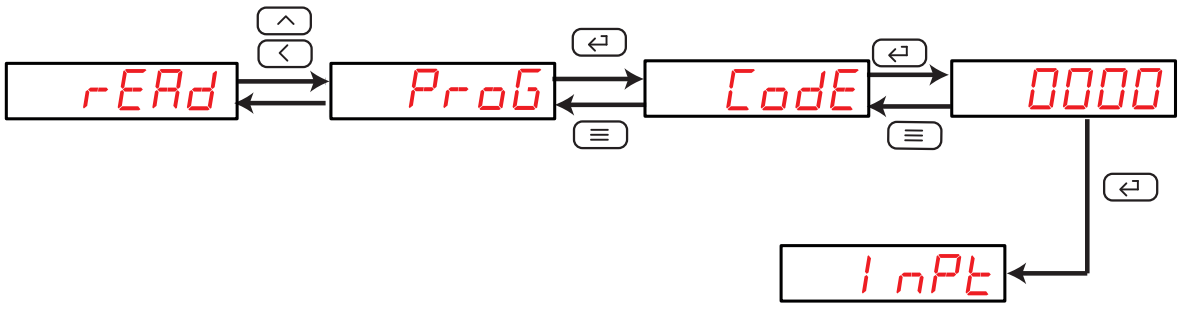


Figure 8: Access the configuration menu in the programming mode.

Before accessing the configuration menu, it is necessary to enter the access password.

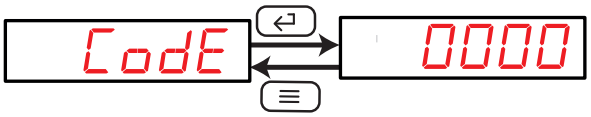


Figure 9: Access password.

Use the ^, key to modify the value of the flashing digit
When the desired value is shown on the screen, press the < key to skip the digit.

Default password: 0001

Note : *The password can be modified, see* ***"5.6.1.- PASSWORD OF ACCESS".***

To validate the data, press the ↵ key.

If the password entered is incorrect, the Err message will appear for a few seconds and the device will return to the password configuration screen, **Figure 9**.

5.1.- CONFIGURATION OF THE INPUT

Figure 10, shows the main screen of the input configuration menu, from which the display value and measurement range are configured.

Figure 10: Input configuration menu, main screen.

Press the ↵ key to open the configuration menu.

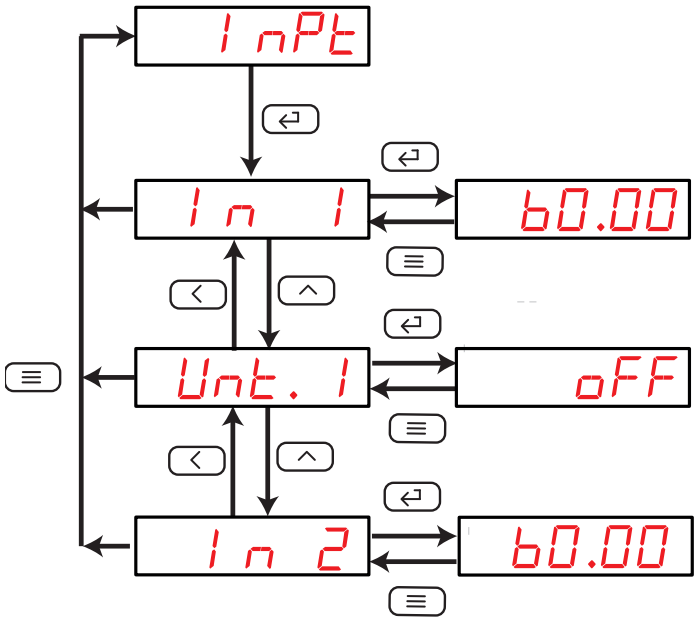
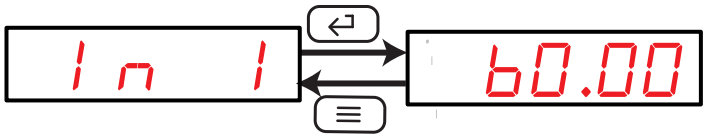


Figure 11:Input configuration menu.

5.1.1.- DISPLAY VALUE

In this screen, the value to be displayed is configured when the maximum value of the measurement range enters the device.



Use the ^, key to modify the value of the flashing digit
When the desired value is shown on the screen, press the < key to skip the digit.

When you reach the last digit and press the < key, you select the position of the decimal point. Use the ^ to modify the decimal point.

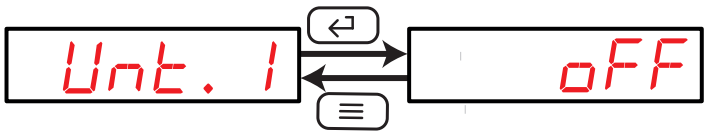
Minimum configuration value: 1.000.
Maximum configuration value: 9999.

To validate the data, press the ↵ key.

Use the ‹ and ^ keys to browse the configuration screens of the menu.

5.1.2.- UNITS OF THE DISPLAY VALUE

This screen is used to configure the units of the display value.



Use the ^,key to browse the different options:

oFF, the unit of the display value is **V**.

on, the unit of the display value is **kV**.

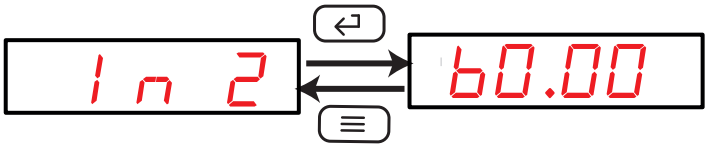
To validate the data, press the ↵ key.

Use the ‹ and ^ keys to browse the configuration screens of the menu.

5.1.3.- MEASUREMENT RANGE

Note: *In the **DHC-96 LVdc** and **DHC-96 HVdc** models, the value of the measurement range is fixed, and can not be modified.*

In this screen, the measurement range of the input signal is configured.



Use the ‹ and ↵ keys at the same time to configure the value.

Use the ^,key to browse the different options of the **DHC-96 mVdc** model:

b0.00, for the voltage scale of 60.00 mV.

75.00, for the voltage scale of 75.00 mV.

100.0, for the voltage scale of 100.0 mV.

150.0, for the voltage scale of 150.0 mV.

200.0, for the voltage scale of 200.0 mV.

To validate the data, press the ↵ key.

Use the ‹ and ^ keys to browse the configuration screens of the menu.

5.1.4.- SAVE CONFIGURATION

To save the configuration of the device, press the key, until the main screen of the input configuration menu is opened, **Figure 10**.

Press the key again to show the validation screen.

Use the ,key to browse the different options:

no, exit the configuration without saving the changed values.

YES, save the changed configuration values.

Press the key to validate the data and exit the configuration menu.

5.2.- RS-485 COMMUNICATIONS

Figure 12, shows the main screen of the communications menu, where the parameters of the RS-485 communications are configured.

Figure 12: RS-485 communications menu, main screen.

Press the key to open the configuration menu.

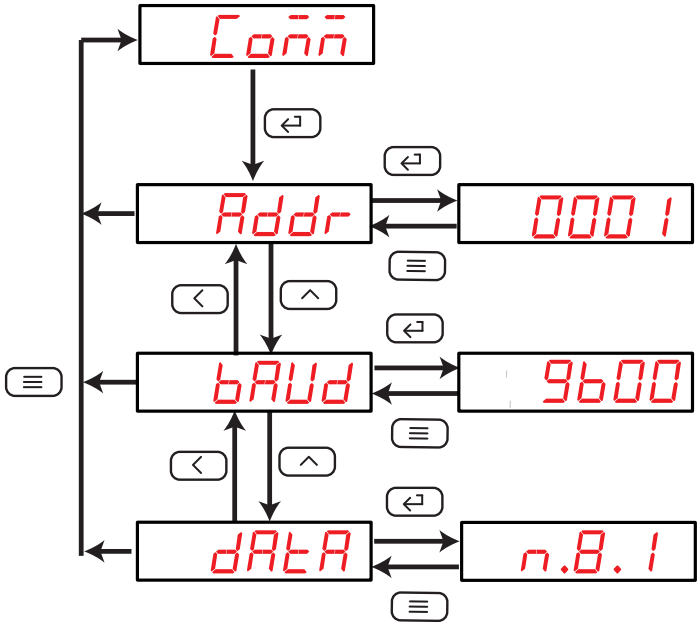
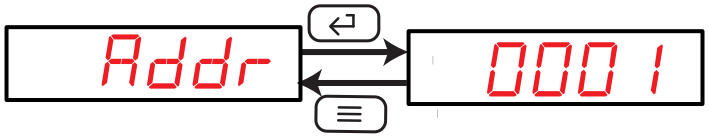


Figure 13:RS-485 communications menu

5.2.1.- MODBUS ADDRESS

This screen is used to configure the modbus address of the device.



Use the ^, key to modify the value of the flashing digit
When the desired value is shown on the screen, press the < key to skip the digit.

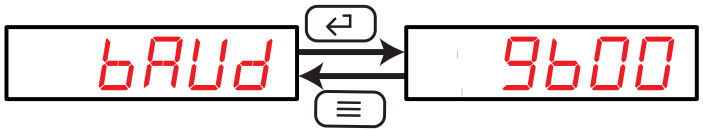
Minimum configuration value: 1
Maximum configuration value: 247.

To validate the data, press the ↵ key.

Use the < and ^ keys to browse the configuration screens of the menu.

5.2.2.- BAUD RATE

In this screen, the baud rate of RS-485 communications is selected.



Use the ^,key to browse the different options:

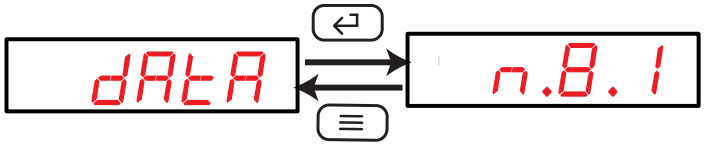
2400, 9600 bps.
4800, 9600 bps.
9600, 9600 bps.
19.20, 19200 bps.

To validate the data, press the ↵ key.

Use the < and ^ keys to browse the configuration screens of the menu.

5.2.3.- DATA FORMAT

This screen is used to configure the data format.



Use the ^,key to browse the different options:

n.8. 1, no parity, 8 data bits, 1 stop bit
o.8. 1, odd parity, 8 data bits, 1 stop bit
E.8. 1, even parity, 8 data bits, 1 stop bit
n.8.2, no parity, 8 data bits, 2 stop bit

To validate the data, press the ↵ key.

Use the ‹ and ^ keys to browse the configuration screens of the menu.

5.2.4.- SAVE CONFIGURATION

To save the configuration of the device, press the ≡ key, until the main screen of the input configuration menu is opened, **Figure 10**.

Press the ≡ key again to show the validation screen.

Use the ^ key to browse the different options:

no, exit the configuration without saving the changed values.
YES, save the changed configuration values.

Press the ↵ key to validate the data and exit the configuration menu.

5.3.- ANALOG OUTPUT

Figure 14, shows the main screen of the analog output menu.

Figure 14: Analog output menu, main screen.

Press the ↵ key to open the configuration menu.

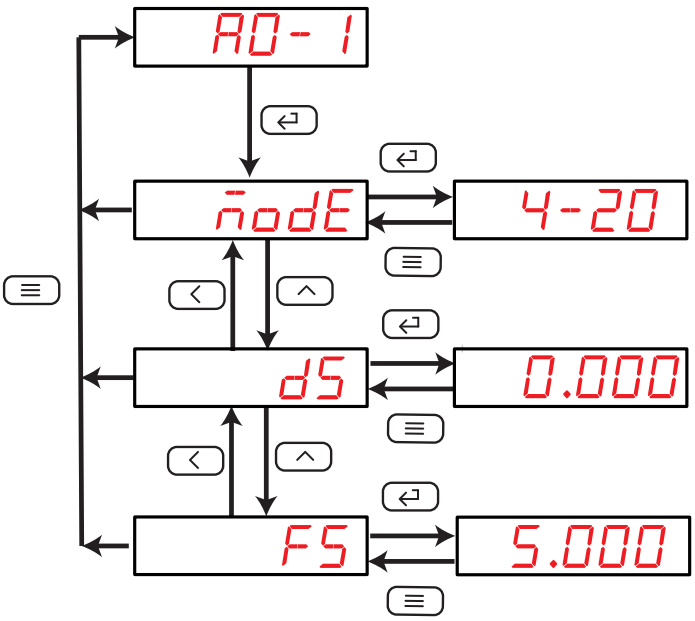
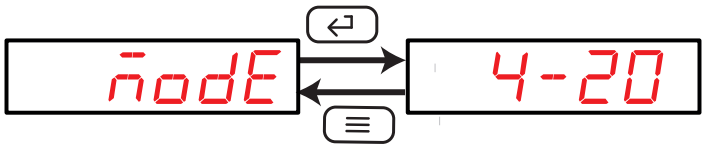


Figure 15:Analog output menu.

5.3.1.- TYPE OF OUTPUT

In this screen the output type of the analog output is configured



Use the  and  keys at the same time to configure the value.
Use the  ,key to browse the different options:

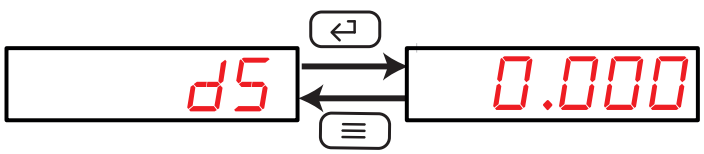
4-20, Current output 4 ... 20 mA
0-20, Current output 0 ... 20 mA
12.20, Current output 4 ... 12 ... 20 mA

To validate the data, press the  key.

Use the  and  keys to browse the configuration screens of the menu.

5.3.2.- READING FOR THE START OF THE ANALOG OUTPUT

In this screen, the reading value from which the analog output is started is configured.



Use the  , key to modify the value of the flashing digit

When the desired value is shown on the screen, press the key to skip the digit.

Minimum configuration value: 0.000
Maximum configuration value: 0.5 x **A.**

Note : *In the **DHC-96 HVdc** model the variable **A** has a value of 1500, in the **DHC-96 LVdc** model has a value of 1000.*
*In the **DHC-96 mVdc** model, the value of variable **A** varies depending on the programmed **Measurement Range**, see **Table 9**.*

Table 9: Value of variable A (DHC-96 mVdc).

Measurement Range	A
60.00	6000
75.00	7500
100.0	1000
150.0	1500
200.0	2000

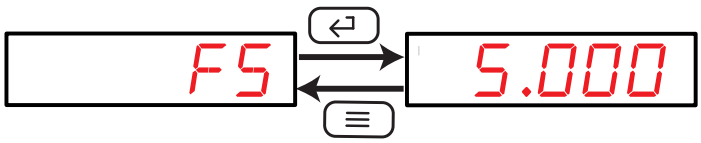
***Note: FS** (End of the analog output) - **DS** (Start of the analog output) ≥ 500*

To validate the data, press the key.

Use the and keys to browse the configuration screens of the menu.

5.3.3.- READING FOR THE END OF THE ANALOG OUTPUT

In this screen, the reading value from which the analog output ends is configured.



Use the , key to modify the value of the flashing digit
When the desired value is shown on the screen, press the key to skip the digit.

Minimum configuration value: 0.5 x ***A***.
Maximum configuration value: 1.2 x ***A***.

Note : *In the **DHC-96 HVdc** model the variable **A** has a value of 1500, in the **DHC-96 LVdc** model has a value of 1000.*
*In the **DHC-96 mVdc** model, the value of variable **A** varies depending on the programmed **Measurement Range**, see **Table 9**.*

Note: **FS** *(End of the analog output)* - **DS** *(Start of the analog output)* ≥ 500

To validate the data, press the key.

Use the ⟨ and ^ keys to browse the configuration screens of the menu.

5.3.4.- SAVE CONFIGURATION

To save the configuration of the device, press the ≡ key, until the main screen of the input configuration menu is opened, **Figure 10**.

Press the ≡ key again to show the validation screen.

Use the ^ key to browse the different options:

no, exit the configuration without saving the changed values.

YES, save the changed configuration values.

Press the ↵ key to validate the data and exit the configuration menu.

5.4.- RELAY OUTPUT 1

Figure 16, shows the main screen of the configuration menu of relay output 1.

Figure 16: Configuration menu of relay output 1, main screen.

Press the ↵ key to open the setup menu.

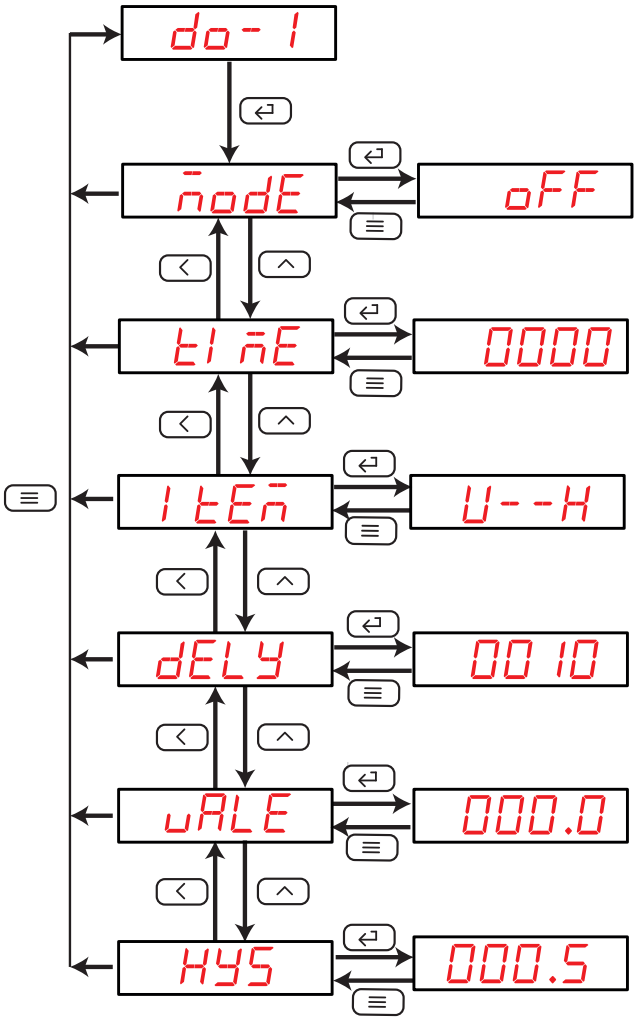
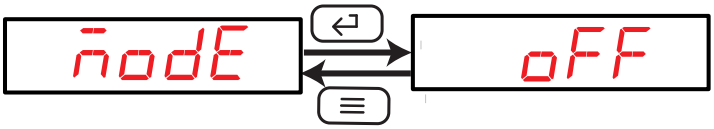


Figure 17:Configuration menu of relay output 1.

5.4.1.- RELAY MODE

This screen is used to configure the operating mode of relay 1.



Use the ^ key to browse the different options:

oFF, relay output 1 is disabled.
rEn, remote control output.
ALr, alarm output.

To validate the data, press the ↵ key.
Use the < and ^ keys to browse the configuration screens of the menu.

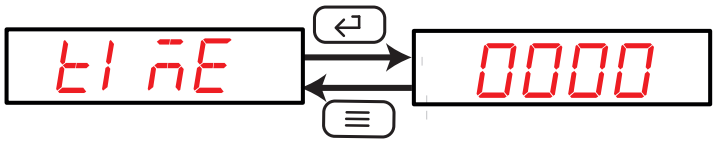
5.4.2.- RELAY PULSE DURATION

The alarm relay can behave in 2 different ways:

1.- The relay is activated when the alarm is triggered and is deactivated when the alarm is deactivated.

2.- The relay is activated when the alarm is triggered and is deactivated after a programmed period of time, even though the alarm condition has not been cancelled.

This screen is used to configure the programmed time, i.e., the relay pulse duration.
To make the relay operate in mode **no. 1**, program the value to **0**.



Use the ^, key to modify the value of the flashing digit
When the desired value is shown on the screen, press the < key to skip the digit.

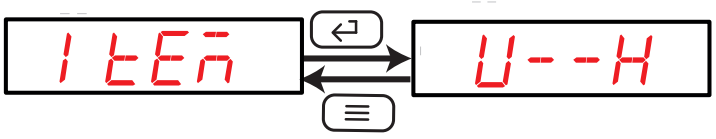
Minimum configuration value: 0 x 0.1 s
Maximum configuration value: 9999 x 0.1 s

Example: *Use program 0050 to configure a value of 5 s.*

To validate the data, press the ↵ key.
Use the < and ^ keys to browse the configuration screens of the menu.

5.4.3.- ALARM PARAMETER

This screen is used to configure the parameter that will be used to activate the alarm.



Use the ^ key to browse the different options:

U--H, Active alarm when the voltage is higher than the alarm value.

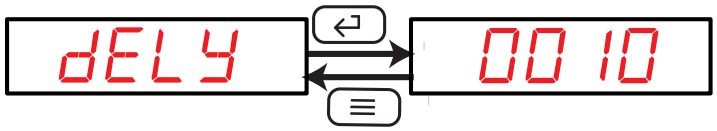
U--L , Active alarm when the voltage is less than the alarm value.
dI 1H, Active alarm when digital input 1 is connected.
dI 2H,Active alarm when digital input 2 is connected.
dI 1L , Active alarm when digital input 1 is disconnected.
dI 2L ,Active alarm when digital input 2 is disconnected.

To validate the data, press the ↵ key.

Use the < and ^ keys to browse the configuration screens of the menu.

5.4.4.- CONNECTION DELAY

This screen is used to configure the alarm connection delay.



Use the ^, key to modify the value of the flashing digit
When the desired value is shown on the screen, press the ^ key to skip the digit.

Minimum configuration value: 0 x 0.1 s
Maximum configuration value: 9999 x 0.1 s

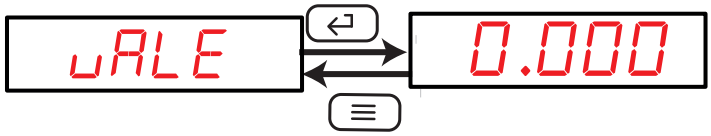
Example: *Use program 0050 to configure a value of 5 s.*

To validate the data, press the ↵ key.

Use the < and ^ keys to browse the configuration screens of the menu.

5.4.5.- ALARM VALUE

This screen configures the value of the measurement input from which the alarm will be activated.



Use the ^, key to modify the value of the flashing digit
When the desired value is shown on the screen, press the < key to skip the digit.

Minimum configuration value:
For model **DHC-96 HVdc:** 0000
For model **DHC-96 LVdc:** 00.00

For model **DHC-96 mVdc:**

00.00 For the voltage scales: 60.00 and 75.00.
000.0 For the voltage scales: 100.0, 150.0 and 200.0.

Maximum configuration value:

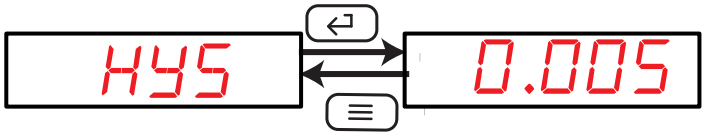
For model **DHC-96 HVdc:** 9999
For model **DHC-96 LVdc:** 99.99
For model **DHC-96 mVdc:**

99.99 For the voltage scales: 60.00 and 75.00.
999.9 For the voltage scales: 100.0, 150.0 and 200.0.

To validate the data, press the ↵ key.
Use the < and ^ keys to browse the configuration screens of the menu.

5.4.6.- HYSTERESIS

This screen is used to configure the hysteresis value, i.e., the difference between the alarm connection and disconnection value.



Use the ^, key to modify the value of the flashing digit
When the desired value is shown on the screen, press the < key to skip the digit.

Minimum configuration value:
For model **DHC-96 HVdc:** 0000
For model **DHC-96 LVdc:** 00.00
For model **DHC-96 mVdc:**

00.00 For the voltage scales: 60.00 and 75.00.
000.0 For the voltage scales: 100.0, 150.0 and 200.0.

Maximum configuration value:
For model **DHC-96 HVdc:** 9999
For model **DHC-96 LVdc:** 99.99
For model **DHC-96 mVdc:**

99.99 For the voltage scales: 60.00 and 75.00.
999.9 For the voltage scales: 100.0, 150.0 and 200.0.

To validate the data, press the ↵ key.

Use the < and ^ keys to browse the configuration screens of the menu.

5.4.7.- SAVE CONFIGURATION

To save the configuration of the device, press the key until the main screen of the relay output 1 configuration menu is opened, **Figure 16**.

Press the key again to show the validation screen.

Use the key to browse the different options:

no ,exit the configuration without saving the changed values.

YES, save the changed configuration values.

Press the key to validate the data and exit the configuration menu.

5.5.- RELAY OUTPUT 2

Figure 18, shows the main screen of the configuration menu of relay output 2.

Figure 18:Configuration menu of relay output 2, main screen.

The configuration is the same as for alarm relay 1, see ***"5.4.- RELAY OUTPUT 1".***

5.6.- CONFIGURATION OF THE DISPLAY

Figure 19, shows the main screen of the configuration menu of the display.

Figure 19: Configuration menu of the display, main screen.

Press the ↵ key to open the configuration menu.

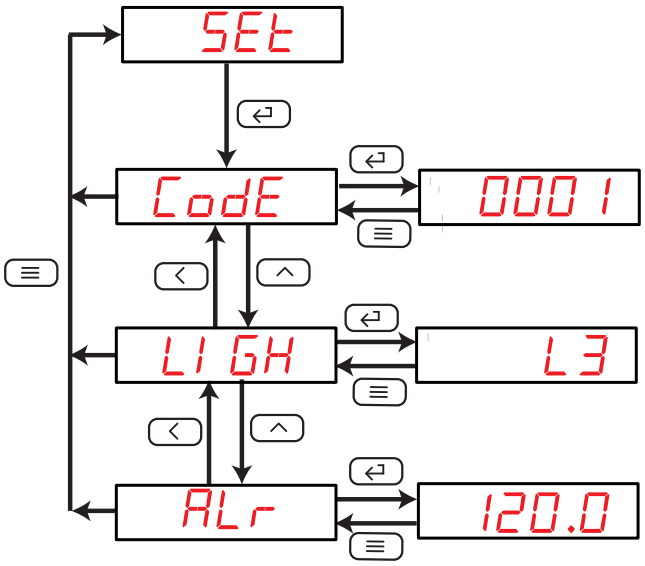
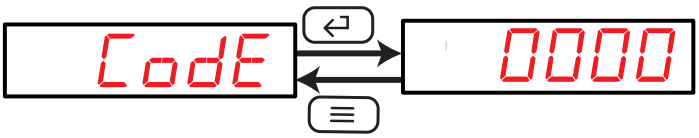


Figure 20:Configuration menu of the display.

5.6.1.- PASSWORD OFF ACCESS

This screen is used to configure the value of the password used to access the configuration menu in the **programming mode**.



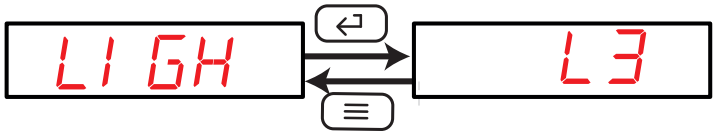
Use the ^, key to modify the value of the flashing digit
When the desired value is shown on the screen, press the < key to skip the digit.

Minimum configuration value: 0
Maximum configuration value: 9999

To validate the data, press the ↵ key.
Use the < and ^ keys to browse the configuration screens of the menu.

5.6.2.- BRIGHTNESS OF THE DISPLAY

The brightness of the display is configured on this screen.

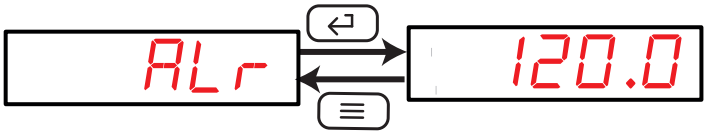


Use the , key to browse the different options: the display has 5 brightness levels, from L1 to L5.

To validate the data, press the key.
Use the and keys to browse the configuration screens of the menu.

5.6.3.- LIGHT ALARM

If the voltage value measured by the device is higher than a % of the nominal value, the device can make the digits on the display start flashing, in the form of a light alarm.



Use the , key to modify the value of the flashing digit.
When the desired value is shown on the screen, press the key to skip the digit.

Minimum configuration value: 30.0%
Maximum configuration value: 120.0%

Note: *If the a value of **0** is programmed, the light alarm will be deactivated.*

To validate the data, press the key.
Use the and keys to browse the configuration screens of the menu.

5.6.4.- SAVE CONFIGURATION

To save the configuration of the device, press the key until the main screen of the configuration menu of the display is opened, **Figure 19**.

Press the key again to show the validation screen.

Use the ,key to browse the different options:

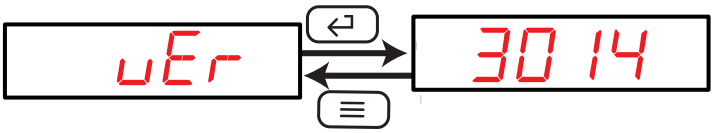
no, exit the configuration without saving the changed values.

YES, save the changed configuration values.

Press the key to validate the data and exit the configuration menu.

5.7.- SOFTWARE VERSION

The software version of the device is shown in the **display mode**.



6.- RS-485 COMMUNICATIONS

The **DHC-96** devices have one **RS-485** communications port,with communications protocols: **MODBUS RTU ®** .

6.1.- CONNECTIONS

The **RS-485** cable must be wired with twisted pair cable with mesh shield, with a maximum distance between the **DHC-96** and the master device of 1200 metres.
A maximum of 32 **DHC-96** devices can be connected to this bus.

Use an intelligent **RS-232** to **RS-485** network protocol converter to establish the communications with the master device.

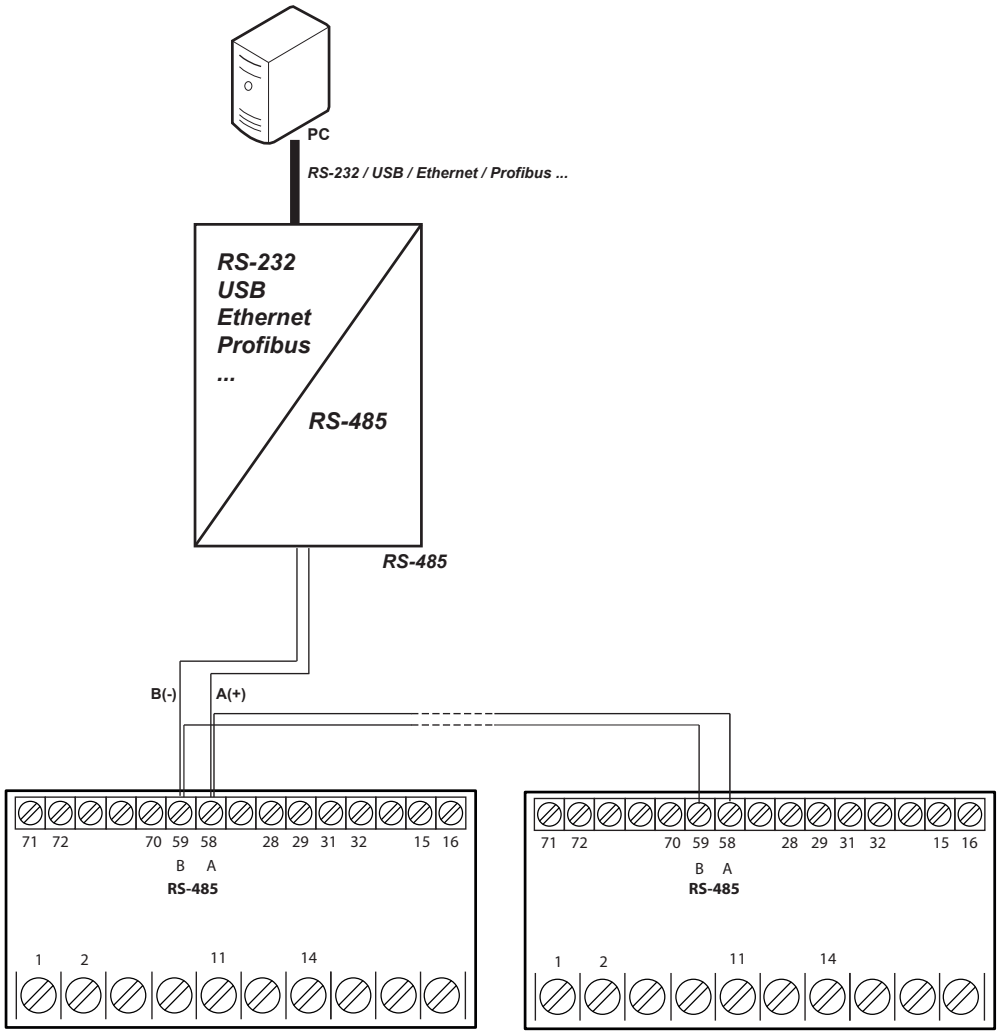


Figure 21: RS-485 Connection diagram.

Note:** Default values of the RS-485 communication : **19200 bps**, **No parity**, **8 data bits** and **1 stop bit.

6.2.- MODBUS PROTOCOL

In the Modbus protocol, the **DHC-96** device uses the RTU (Remote Terminal Unit) mode. The Modbus functions implemented in the device are as follows:

Function 0x01: Reading a relay.
Function 0x02: Reading input status.
Function 0x03 and 0x04: Reading integer registers.
Function 0x05: Writing a relay.
Function 0x0F: Writing multiples relays
Function 0x10: Writing multiples registers.

6.2.1. READING EXAMPLE : FUNCTION 0x01.

Question: Status of output relays

Address	Function	Initial Register	No. of Registers	CRC
01	01	0000	0002	BDCB

Address: 01, Peripheral number: 1 in decimal.
Function: 01, Read function.
Initial Register: 0000, on which the reading will start.
No. of Registers: 0002, number of registers read.
CRC: BDCB, CRC Character.

Response:

Address	Function	No. of Bytes	Register No. 1	CRC
01	01	01	03	1189

Address: 01, Responding peripheral number: 1 in decimal.
Function: 01, Read function.
No. of bytes: 01, No. of bytes received.
Registre: 03, in binary it is: 0000 0011, output relays 1 and 2 closed.
CRC:1189, CRC Character.

6.2.2. EXAMPLE OF OPERATION OF THE REMOTE CONTROL: FUNCTION 0X05.

Question: Activate the output of relay 1, programmed to work in remote control mode.

Address	Function	Initial Register	Relay action	CRC
01	05	0000	FF00	8C3A

Address: 01, Peripheral number: 1 in decimal.
Function: 05, Writing a relay
Initial Register: 0000, relay 1 address.
Relay action: FF00, We indicate that we want to close the relay.
CRC: 8C3A, CRC Character.

Response:

Address	Function	Initial Register	Relay action	CRC
01	05	0000	FF00	8C3A

6.3.- MODBUS COMMANDS

6.3.1.- MEASUREMENT VARIABLES AND DEVICE STATUS

All the addresses of Modbus memory are in Hexadecimal.
For these variables is implemented the **Function 0x03** and **0x04**.

Table 10: Modbus memory map (Table 1)

Parameter	Format	Address	Units
Voltage	float	06	V
Voltage	int	106	**DHC-96 HVdc**: V **DHC-96 LVdc**: 0.01 V **DHC-96 mVdc**: 0.01 mV - 0.1 mV (1)

(1) If has been programmed the measurement range of 60.00 mV, or 75.00 mV , the unit is 0.01 mV, for the rest of the values the units are 0.1 mV.

Table 11: Modbus memory map (Table 2)

Parameter	Format	Address	Value
Status of output relays bit [0] - bit [2]	bit [32]	100 - 101	**0:** open **1:** closed
Status of digital inputs bit [0] - bit [2]	bit [32]	102 - 103	**0:** open **1:** closed
Communications ID	int	104	**DHC-96 HVdc** : 502 **DHC-96 LVdc**: 501 **DHC-96 mVdc**:503

6.3.2.- OUTPUT RELAYS

All the addresses of Modbus memory are in Hexadecimal.
For these variables is implemented the **Function 0x01, 0x05** and **0x0F.**

Table 12: Modbus memory map (Table 3)

Parameter	Format	Address
Output relay	bit	0000

The format of the parameter is shown in T**able 13:**

Table 13: Format of the variables : Output relays.

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	**0**	**0**	**0**	**0**	**0**	**Relay 2** **1:** close **0:** open	**Relay 1** **1:** close **0:** Open

6.3.3.- DIGITAL INPUTS

All the addresses of Modbus memory are in Hexadecimal.
For these variables is implemented the **Function 0x02.**

Table 14: Modbus memory map (Table 4)

Parameter	Format	Address
Digital input	bit	0000

The format of the parameter is shown in **Table 15:**

Table 15:Format of the variables : Digital inputs.

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	**0**	**0**	**0**	**0**	**0**	**Digital input 2** **1:** closed **0:** open	**Digital input 1** **1:** closed **0:** open

6.3.4.- REMOTE CONTROL OUTPUT (Relay output)

All the addresses of Modbus memory are in Hexadecimal.
For these variables is implemented the **Function 0x05:**

Table 16:Modbus memory map (Table 5)

Parameter	Format	Address	Value
Remote control, Output relay 1	bit	0000	**0000:** open **FF00:** closed
Remote control, Output relay 2	bit	0001	**0000:** open **FF00:** closed

Function 0x0F, multiple relay control:

Table 17: Modbus memory map (Table 6)

Parameter	Format	Address
Remote control	bit	0000

The format of the parameter is shown in **Table 18:**

Table 18:Format of the variables: Remote control.

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	**0**	**0**	**0**	**0**	**0**	**Relay 2** **1:** Closed **0:** Open	**Relay 1** **1:** Closed **0:** Open

6.3.5.- DEVICE CONFIGURATION VARIABLES

All the addresses of Modbus memory are in Hexadecimal.
For these variables is implemented the **Function 0x10.**

6.3.5.1. Configuration of the input

Table 19:Modbus memory map : Configuration of the input

Configuration of the input			
Variable	**Format**	**Address**	**Valid data margin**
Display value	int	807	1 ... 9999
Decimal point of the display value	int	808	**0:** xxxx - **1:** xxx.x - **2:** xx.xx - **3:** x.xxx
Units of the display value	int	806	**0:** V - **1:** kV
Measurement range	int	80B	**DHC-96 mVdc**: **0:** 60.00 mV - **1:** 75.00 mV **2:** 100.0 mV - **3:** 150.0 mV **4:** 200.0 mV **DHC-96 LVdc**: **0:** 10.00 V **DHC-96 HVdc**: **0:** 1500 V

6.3.5.2. RS-485 communications

Table 20:Modbus memory map : RS-485 communications

RS-485 communications			
Variable	**Format**	**Address**	**Valid data margin**
Modbus address	int	802	1 ... 247
Baud rate	int	803	**0:** 2400 bps - **1:** 4800 bps - **2:** 9600 bps - **3:** 19200 bps
Data format	int	804	**0:** n,8,1 : no parity, 8 data bits, 1 stop bit **1:** o,8,1 : odd parity, 8 data bits, 1 stop bit **2:** e,8,1 : even parity, 8 data bits, 1 stop bit **3:** n,8,2 : no parity, 8 data bits, 2 stop bit

6.3.5.3. Analog output

Table 21:Modbus memory map : Analog output

Analog output			
Variable	**Format**	**Address**	**Valid data margin**
Reading for the end of the analog output (**fs**)	int	815	0.5 x **A**[(2)] ≤ **fs** ≤ 1.2 x **A**[(2)]
Reading for the start of the analog output (**ds**)	int	816	0 ≤ **ds** ≤ 0.5 x **A**[(2)]
Type of output	int	817	**0:** 4 ... 20 mA **1:** 0 ... 20 mA **2:** 4 ...12 ... 20 mA

[(2)] **A**: *In the **DHC-96 HVdc** model the variable **A** has a value of 1500, in the **DHC-96 LVdc** model has a value of 1000. In the **DHC-96 mVdc** model, the value of variable **A** varies depending on the programmed **Measurement Range**, see **Table 9**.*

6.3.5.4. Relays outputs

Table 22:Modbus memory map : Relay outputs.

Relay outputs			
Variable	**Format**	**Address**	**Valid data margin**
Relay 1 mode	int	820	**0:** output is disabled. **1:** alarm output **2:** remote control output.
Relay 2 mode	int	826	
Relay 1 pulse duration	int	821	0 ... 9999 (x 0.1 s)
Relay 2 pulse duration	int	827	
Alarm parameter of relay 1	int	822	**0:** Upper voltage alarm (U--H) **12:** Alarm when Digital 1 input is connected (dI 1H) **13:** Alarm when Digital 2 input is connected (dI 2H) **16:** Lower voltage alarm (U--L) **28:** Alarm when Digital 1 input is disconnected (dI 1L) **29:** Alarm when Digital 2 input is disconnected (dI 2L)
Alarm parameter of relay 2	int	828	
Relay 1 connection delay	int	823	0 ... 9999 (x 0.1 s)
Relay 2 connection delay	int	829	
Relay 1 alarm value	int	824	0000 ... 9999 (3) 00.00 ... 99.99 (4) 000.0 ... 999.9 (5)
Relay 2 alarm value	int	82A	
Relay 1 hysteresis	int	825	0000 ... 9999 (3) 00.00 ... 99.99 (4) 000.0 ... 999.9 (5)
Relay 2 hysteresis	int	82B	

(3) **0000 ... 9999** For the model **DHC-96 HVdc**.

(4) **00.00 ... 99.99** For the model **DHC-96 LVdc**. For the **DHC-96 mVdc** model, on the voltage scales: 60.00 and 75.00.

(5) **000.0 ... 999.9** For the model **DHC-96 mVdc,** on the voltage scales: 100.0, 150.0 y 200.0.

6.3.5.5. Configuration of the display

Table 23:Modbus memory map : Configuration of the display

Configuration of the display			
Variable	**Format**	**Address**	**Valid data margin**
Password	int	800	0000 ... 9999
Brightness of the display	int	801	0 ... 4
Light alarm	int	805	300 ... 1200 (x 0.1%)

7.- TECHNICAL FEATURES

AC Power supply (6)	
Rated voltage	80 ... 270 V ~
Frequency	50 / 60 Hz
Consumption	3.1 ... 5.4 VA
Installation category	CAT III 300 V

DC Power supply (6)		
Rated voltage	80 ... 270 V ⎓	18 ... 36 V ⎓
Consumption	1.7 ...1.8 W	2.8 W
Installation category	CAT III 300 V	

(6) **Depending on model :**

DHC-96 HVdc			
Model	**Power supply**		
	80 ... 270 V ~	**80 ... 270 V ⎓**	**18 ... 36 V ⎓**
M22338	✓	✓	-
M223380030000	-	-	✓

DHC-96 LVdc			
Model	**Power supply**		
	80 ... 270 V ~	**80 ... 270 V ⎓**	**18 ... 36 V ⎓**
M22328	✓	✓	-
M223280030000	-	-	✓

DHC-96 mVdc			
Model	**Power supply**		
	80 ... 270 V ~	**80 ... 270 V ⎓**	**18 ... 36 V ⎓**
M22348	✓	✓	-
M223480030000	-	-	✓

Voltage measurement circuit		
Nominal voltage (Un)	**DHC-96 HVdc**	± 1500 V ⎓
	DHC-96 LVdc	± 10 V ⎓
	DHC-96 mVdc	60 mV / 75 mV / 100 mV / 150 mV / 200 mV ⎓
Overload	1.2 Un continuo, 2 Un Instantáneo (1 min)	
Consumption	< 0.1 VA	
Impedance	**DHC-96 HVdc**	> 5 MΩ
	DHC-96 LVdc	> 1 MΩ
	DHC-96 mVdc	> 1 MΩ
Installation category	CAT III 300V	

Measurement accuracy	
Voltage measurement	0.5%

Relays outputs	
Quantity	2
Contact capacity (resistive)	**CA:** 5A / 250 V~ , **CC:** 5A / 30 V ⎓
Max. voltage open contacts	277 V~
Maximum current	5 A ~
Maximum switching power	1385 VA
Electrical life (250 V~ / 5A)	$1x10^5$

(Continuation) Relays outputs	
Mechanical life	$5x10^6$

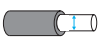
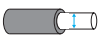
Digital inputs	
Quantity	2
Type	Potential free contact
Insulation	2000 V~
Maximum short-circuit current	3.3 mA ⎓
Maximum voltage in open circuit	17 V ⎓

Analog output	
Quantity	1
Maximum internal voltage	17 V ⎓
Linearity	0.5 %
Nominal output range	0-20 mA, 4-20 mA, 4-12-20 mA (Programmable)
Maximum load resistor	350 Ω

RS-485 communications	
Communications protocol	Modbus RTU
Baud rate	2400 - 4800 - 9600 - 19200 bps
Data bits	8
Stop bits	1 - 2
Parity	without, even, odd

User interface	
Display	LED 5 digits
Keyboard	4 keys

Environmental features	
Operating temperature	-40ºC ... +70ºC
Storage temperature	-40ºC ... +85ºC
Relative humidity	≤ 95%
Maximum altitude	2000 m
Protection degree	Front : IP54, Rear case: IP20
Pollution degree	2

Mechanical features			
Power supply and Measurement			
Terminals : 1, 2, 11, 14	≤ 1 mm^2	≤ 0.5 Nm	PZ1
Analog output, Relay outputs, RS-485, Digital inputs			
Terminals : 15, 16, 28, 29, 31, 32, 58, 59, 70, 71, 72	≤ 2.5 mm^2	0.5 ... 0.6 Nm	PZ0
Dimensions	**Figure 22** (mm)		
Weight	231 g.		
Surround	pc + abs		

Standards	
Electromagnetic compatibility (EMC) -- Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test.	IEC 61000-4-2
Electromagnetic compatibility (EMC)- Part 4-3: Testing and measurement techniques- Radiated, radio-frequency, electromagnetic field immunity test	IEC 61000-4-3

(Continuation) Standards	
Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test	IEC 61000-4-4
Electromagnetic compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test	IEC 61000-4-5
Electromagnetic compatibility (EMC) - Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields	IEC 61000-4-6
Electromagnetic compatibility (EMC) -- Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test	IEC 61000-4-8
Electromagnetic compatibility (EMC) -- Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests	IEC 61000-4-11
Safety requirements for electrical equipment for measurement, control and laboratory use -- Part 1: General requirements	IEC 61010-1

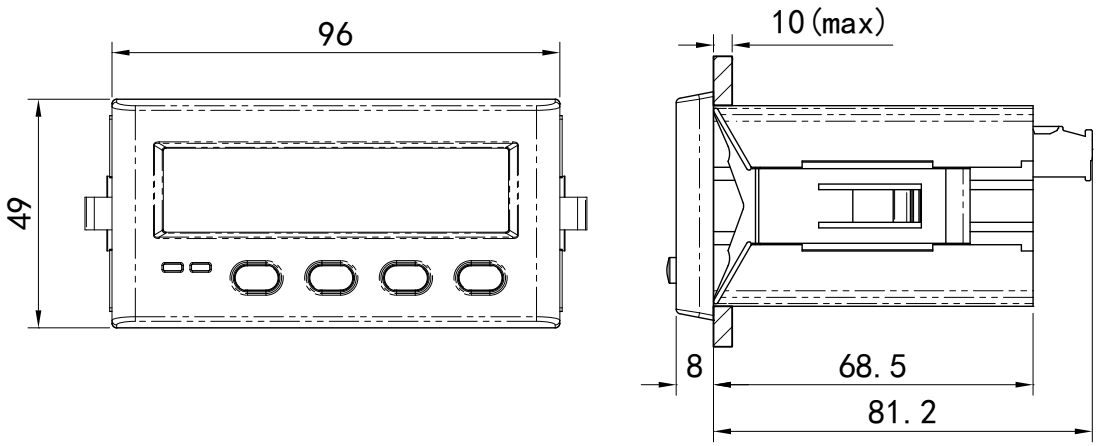


Figure 22: Dimensions of the DHC-96.

8.- MAINTENANCE AND TECHNICAL SERVICE

In the case of any query in relation to unit operation or malfunction, please contact the **CIRCUTOR, SA** Technical Support Service.

Technical Assistance Service
Vial Sant Jordi, s/n, 08232 - Viladecavalls (Barcelona)
Tel: 902 449 459 (España) / +34 937 452 919 (outside of Spain)
email: sat@circutor.es

9.- GUARANTEE

CIRCUTOR guarantees its products against any manufacturing defect for two years after the delivery of the units.

CIRCUTOR will repair or replace any defective factory product returned during the guarantee period.

• No returns will be accepted and no unit will be repaired or replaced if it is not accompanied by a report indicating the defect detected or the reason for the return.
•The guarantee will be void if the units has been improperly used or the storage, installation and maintenance instructions listed in this manual have not been followed. “Improper usage” is defined as any operating or storage condition contrary to the national electrical code or that surpasses the limits indicated in the technical and environmental features of this manual.
• **CIRCUTOR** accepts no liability due to the possible damage to the unit or other parts of the installation, nor will it cover any possible sanctions derived from a possible failure, improper installation or “improper usage” of the unit. Consequently, this guarantee does not apply to failures occurring in the following cases:
- Overvoltages and/or electrical disturbances in the supply;
- Water, if the product does not have the appropriate IP classification;
- Poor ventilation and/or excessive temperatures;
- Improper installation and/or lack of maintenance;
- Buyer repairs or modifications without the manufacturer’s authorisation.

CIRCUTOR, SA – Vial Sant Jordi, s/n
08232 Viladecavalls (Barcelona) Spain
(+34) 937 452 900 – info@circutor.com

(ES) DECLARACIÓN UE DE CONFORMIDAD

La presente declaración de conformidad se expide bajo la exclusiva responsabilidad de CIRCUTOR con dirección en **Vial Sant Jordi, s/n – 08232 Viladecavalls (Barcelona) España**

Producto:

Instrumentación digital

Serie:

DHC-96

Marca:

CIRCUTOR

EL objeto de la declaración es conforme con la legislación de armonización pertinente en la UE, siempre que sea instalado, mantenido y usado en la aplicación para la que ha sido fabricado, de acuerdo con las normas de instalación aplicables y las instrucciones del fabricante

2014/35/UE: Low Voltage Directive 2014/30/UE: Electromagnetic Compatibility Directive
2011/65/UE: RoHS2 Directive

Está en conformidad con la(s) siguiente(s) norma(s) u otro(s) documento(s) normativos(s):

IEC 61010-1:2010+AMD1:2016 CSV Ed 3.0 IEC 61000-6-2:2016 Ed 3.0
IEC 61000-6-4:2006+AMD1:2010 CSV Ed 2.1

Año de marcado "CE":

2019

(EN) EU DECLARATION OF CONFORMITY

This declaration of conformity is issued under the sole responsibility of CIRCUTOR with registered address at **Vial Sant Jordi, s/n – 08232 Viladecavalls (Barcelona) Spain**

Product:

Digital multimeter

Series:

DHC-96

Brand:

CIRCUTOR

The object of the declaration is in conformity with the relevant EU harmonisation legislation, provided that it is installed, maintained and used for the application for which it was manufactured, in accordance with the applicable installation standards and the manufacturer's instructions

2014/35/UE: Low Voltage Directive 2014/30/UE: Electromagnetic Compatibility Directive
2011/65/UE: RoHS2 Directive

It is in conformity with the following standard(s) or other regulatory document(s):

IEC 61010-1:2010+AMD1:2016 CSV Ed 3.0 IEC 61000-6-2:2016 Ed 3.0
IEC 61000-6-4:2006+AMD1:2010 CSV Ed 2.1

Year of CE mark:

2019

(FR) DÉCLARATION UE DE CONFORMITÉ

La présente déclaration de conformité est délivrée sous la responsabilité exclusive de CIRCUTOR dont l'adresse postale est **Vial Sant Jordi, s/n – 08232 Viladecavalls (Barcelone) Espagne**

Produit:

Instrumentation numérique

Série:

DHC-96

Marque:

CIRCUTOR

L'objet de la déclaration est conforme à la législation d'harmonisation pertinente dans l'UE, à condition d'avoir été installé, entretenu et utilisé dans l'application pour laquelle il a été fabriqué, conformément aux normes d'installation applicables et aux instructions du fabricant

2014/35/UE: Low Voltage Directive 2014/30/UE: Electromagnetic Compatibility Directive
2011/65/UE: RoHS2 Directive

Il est en conformité avec la(les) suivante (s) norme(s) ou autre(s) document(s) réglementaire (s):

IEC 61010-1:2010+AMD1:2016 CSV Ed 3.0 IEC 61000-6-2:2016 Ed 3.0
IEC 61000-6-4:2006+AMD1:2010 CSV Ed 2.1

Année de marquage « CE »:

2019

Viladecavalls (Spain), 10/01/2019
General Manager: Ferran Gil Torné

CIRCUTOR, S.A.
NIF. A-08513178
Vial Sant Jordi, s/n.
08232 VILADECAVALLS
(Barcelona) Spain
Tel.(+34) 93 745 29 00

CIRCUTOR, SA – Vial Sant Jordi, s/n
08232 Viladecavalls (Barcelona) Spain
(+34) 937 452 900 – info@circutor.com

(DE)

KONFORMITÄTSERKLÄRUNG UE

Vorliegende Konformitätserklärung wird unter alleiniger Verantwortung von CIRCUTOR mit der Anschrift, Vial Sant Jordi, s/n – 08232 Viladecavalls (Barcelona) Spanien, ausgestellt

Produkt:

Digitale Messgeräte

Serie:

DHC-96

Marke:

CIRCUTOR

Der Gegenstand der Konformitätserklärung ist konform mit der geltenden Gesetzgebung zur Harmonisierung der EU, sofern die Installation, Wartung undVerwendung der Anwendung seinem Verwendungszweck entsprechend gemäß den geltenden Installationsstandards und der Vorgaben des Herstellers erfolgt.

2014/35/UE: Low Voltage Directive 2014/30/UE: Electromagnetic Compatibility Directive
2011/65/UE: RoHS2 Directive

Es besteht Konformität mit der/den folgender/folgenden Norm/Normen oder sonstigem/sonstiger Regelwerk/Regelwerken

IEC 61010-1:2010+AMD1:2016 CSV Ed 3.0 IEC 61000-6-2:2016 Ed 3.0
IEC 61000-6-4:2006+AMD1:2010 CSV Ed 2.1

Jahr der CE-Kennzeichnung:

2019

(PT)

DECLARAÇÃO DA UE DE CONFORMIDADE

A presente declaração de conformidade é expedida sob a exclusiva responsabilidade da CIRCUTOR com morada em **Vial Sant Jordi, s/n – 08232 Viladecavalls (Barcelona) Espanha**

Producto:

Instrumentação digitais

Série:

DHC-96

Marca:

CIRCUTOR

O objeto da declaração está conforme a legislação de harmonização pertinente na UE, sempre que seja instalado, mantido e utilizado na aplicação para a qual foi fabricado, de acordo com as normas de instalação aplicáveis e as instruções do fabricante.

2014/35/UE: Low Voltage Directive 2014/30/UE: Electromagnetic Compatibility Directive
2011/65/UE: RoHS2 Directive

Está em conformidade com a(s) seguinte(s) norma(s) ou outro(s) documento(s) normativo(s):

IEC 61010-1:2010+AMD1:2016 CSV Ed 3.0 IEC 61000-6-2:2016 Ed 3.0
IEC 61000-6-4:2006+AMD1:2010 CSV Ed 2.1

Ano de marcação "CE":

2019

(IT)

DICHIARAZIONE DI CONFORMITÀ UE

La presente dichiarazione di conformità viene rilasciata sotto la responsabilità esclusiva di CIRCUTOR, con sede in **Vial Sant Jordi, s/n – 08232 Viladecavalls (Barcellona) Spagna**

prodotto:

Strumentazione digitale

Serie:

DHC-96

MARCHIO:

CIRCUTOR

L'oggetto della dichiarazione è conforme alla pertinente normativa di armonizzazione dell'Unione Europea, a condizione che venga installato, mantenuto e utilizzato nell'ambito dell'applicazione per cui è stato prodotto, secondo le norme di installazione applicabili e le istruzioni del produttore.

2014/35/UE: Low Voltage Directive 2014/30/UE: Electromagnetic Compatibility Directive
2011/65/UE: RoHS2 Directive

È conforme alle seguenti normative o altri documenti normativi:

IEC 61010-1:2010+AMD1:2016 CSV Ed 3.0 IEC 61000-6-2:2016 Ed 3.0
IEC 61000-6-4:2006+AMD1:2010 CSV Ed 2.1

Anno di marcatura "CE":

2019

Viladecavalls (Spain), 10/01/2019
General Manager: Ferran Gil Torné

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NIF. A-08513178
Vial Sant Jordi, s/n.
08232 VILADECAVALLS
(Barcelona) Spain
Tel.(+34) 93 745 29 00

CIRCUTOR, SA – Vial Sant Jordi, s/n
08232 Viladecavalls (Barcelona) Spain
(+34) 937 452 900 – info@circutor.com

(PL)

DEKLARACJA ZGODNOŚCI UE

Niniejsza deklaracja zgodności zostaje wydana na wyłączną odpowiedzialność firmy CIRCUTOR z siedzibą pod adresem: **Vial Sant Jordi, s/n – 08232 Viladecavalls (Barcelona) Hiszpania**

produk:

Przyrządy cyfrowe

Seria:

DHC-96

marka:

CIRCUTOR

Przedmiot deklaracji jest zgodny z odnośnymi wymaganiami prawodawstwa harmonizacyjnego w Unii Europejskiej pod warunkiem, że będzie instalowany, konserwowany i użytkowany zgodnie z przeznaczeniem, dla którego został wyprodukowany, zgodnie z mającymi zastosowanie normami dotyczącymi instalacji oraz instrukcjami producenta

2014/35/UE: Low Voltage Directive
2014/30/UE: Electromagnetic Compatibility Directive
2011/65/UE: RoHS2 Directive

Jest zgodny z następującą(ymi) normą(ami) lub innym(i) dokumentem(ami) normatywnym(i):

IEC 61010-1:2010+AMD1:2016 CSV Ed 3.0
IEC 61000-6-2:2016 Ed 3.0
IEC 61000-6-4:2006+AMD1:2010 CSV Ed 2.1

Rok oznakowania "CE":

2019

Viladecavalls (Spain), 10/01/2019
General Manager: Ferran Gil Torné

CIRCUTOR, S.A.
NIF. A-08513178
Vial Sant Jordi, s/n.
08232 VILADECAVALLS
(Barcelona) Spain
Tel.(+34) 93 745 29 00

ANNEX A.- CONFIGURATION MENU

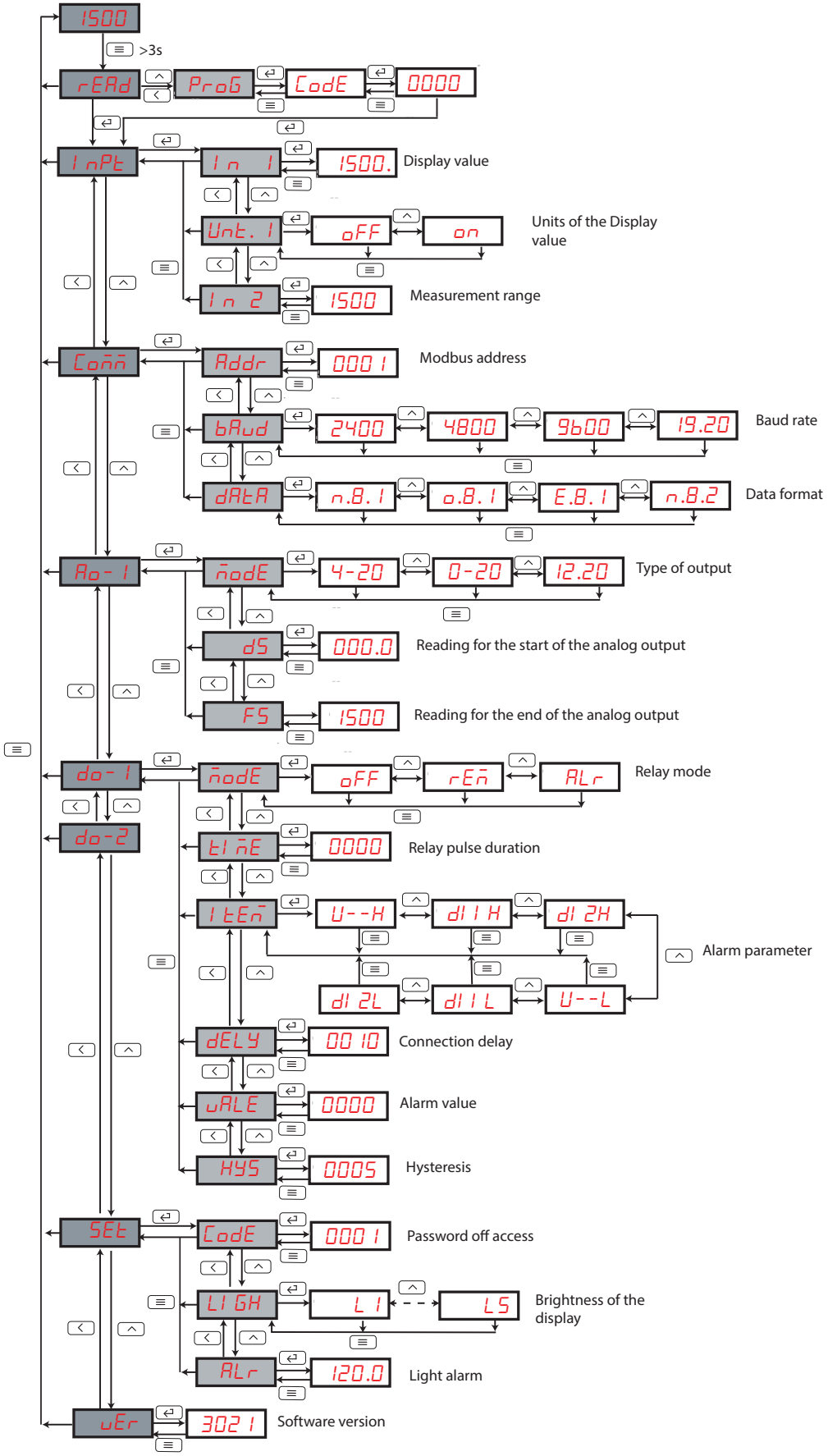

Figure 23:Configuration menu DHC-96 HVdc.

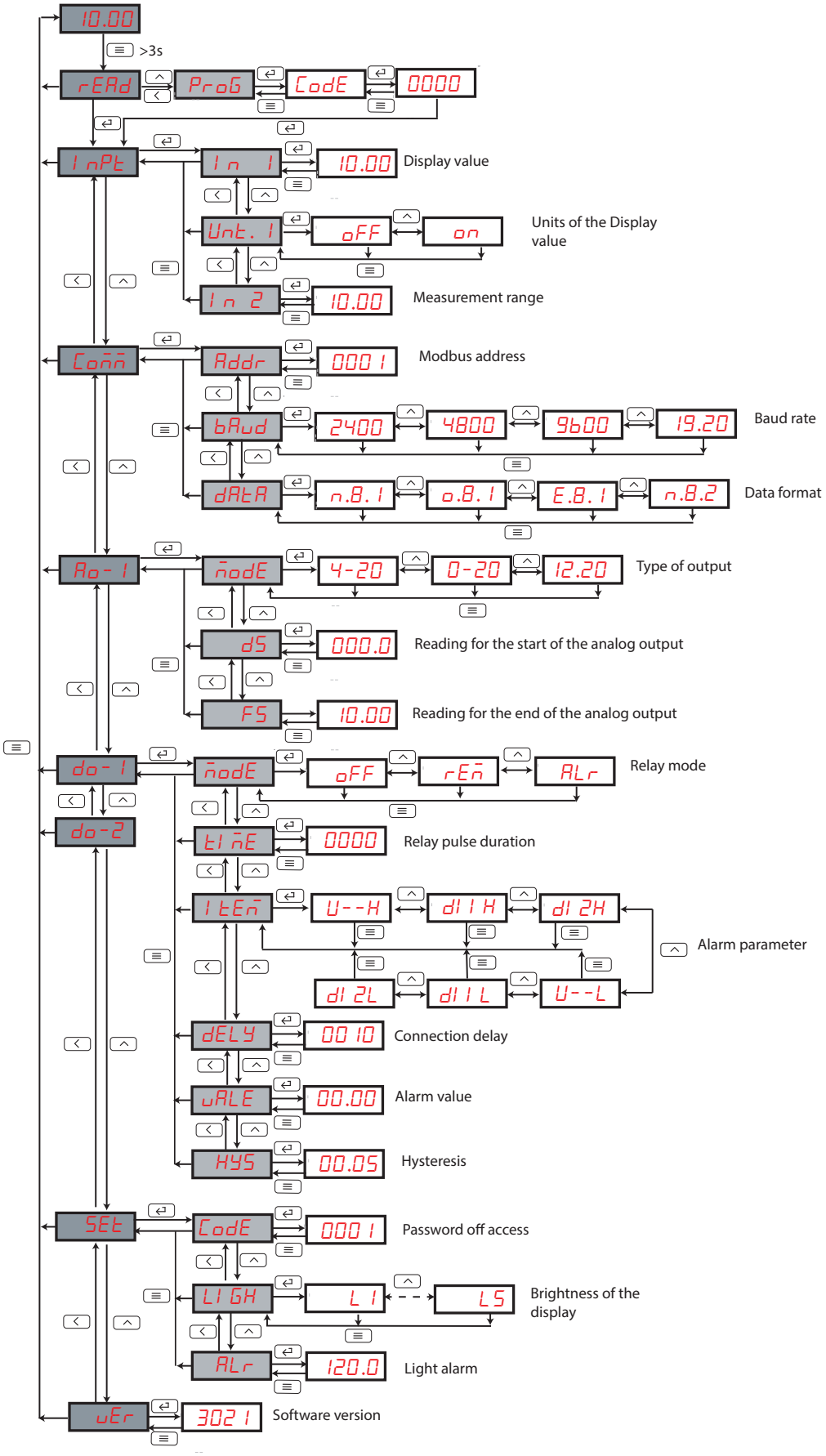

Figure 24:Configuration menu DHC-96 LVdc.

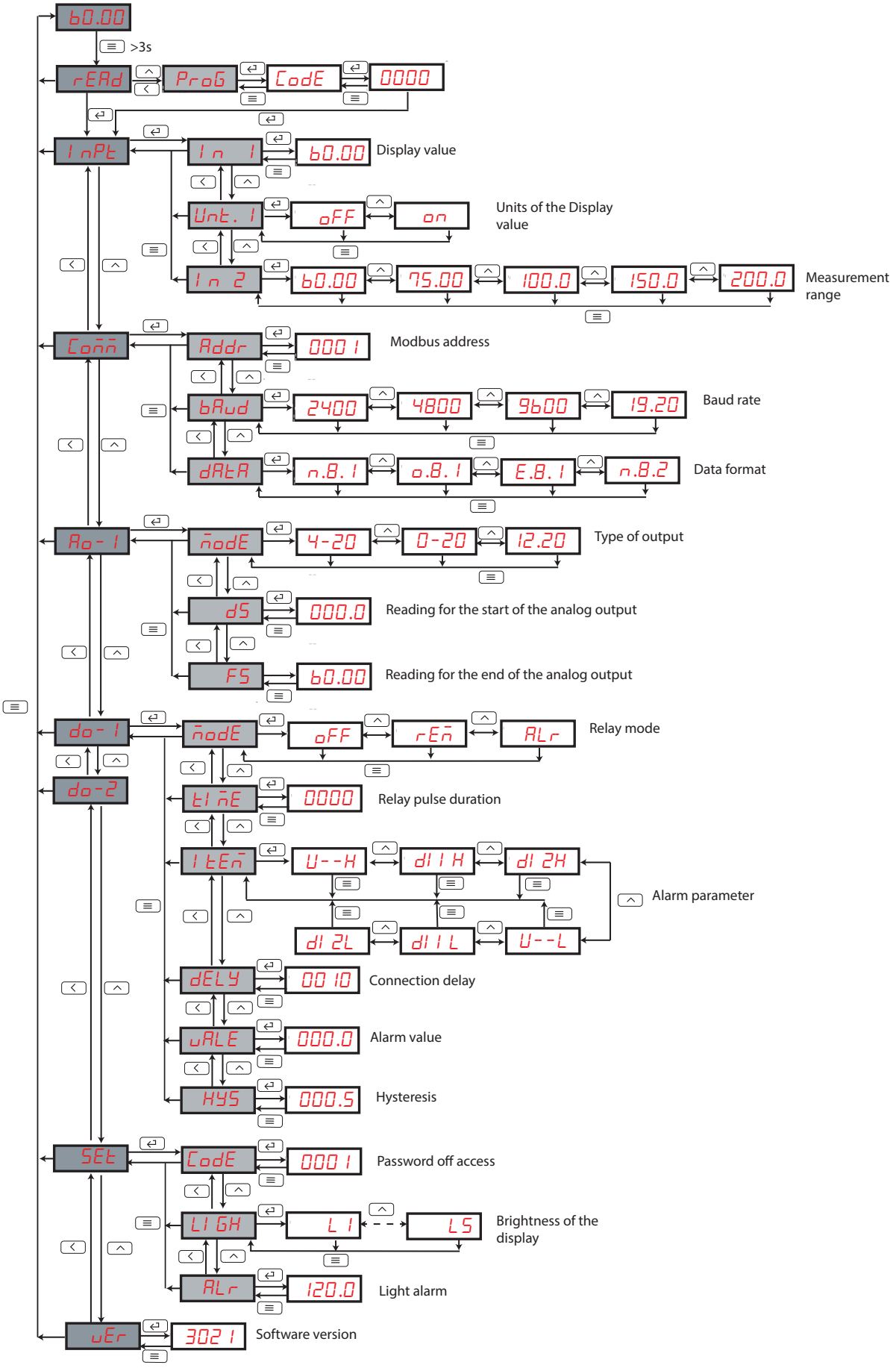

Figure 25:Configuration menu DHC-96 mVdc.

CIRCUTOR, SA
Vial Sant Jordi, s/n
08232 -Viladecavalls (Barcelona)
Tel.: (+34) 93 745 29 00 - Fax: (+34) 93 745 29 14
www.circutor.com central@circutor.com