Protection and monitoring relay

RDB+ v2



INSTRUCTION MANUAL

(M430BVM-03-25A)

CE


22
PAP

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.

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

DISCLAIMER

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

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

www.vectorenergy.com

	**Vector,** recommends using the original cables and accessories that are supplied with the device.

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REVISION LOG

Table 1: Revision log.

Date	Revision	Description
02/24	M430BVM-03-24A	First Version
12/24	M430BVM-03-24B	Changes in the following sections: 2. - 9.2.
07/25	M430BVM-03-25A	Changes in the following sections: 2.- 3.4. - 4.6. - 8.3.1.

SYMBOLS

Table 2:Symbols.

Symbol	Description
CE	In accordance with the relevant European directive.
	Device covered by European Directive 2012/19/EC. At the end of its useful life, do not discard of the device in a household refuse bin. Follow local regulations on electronic equipment recycling.
⎓	Direct current.
~	Alternating current.

Note: *The images of the devices are for illustrative purposes only and may differ from the original device.*

1.- VERIFICATION UPON RECEPTION

Upon reception of the device check the following points:

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 **Vector**'s after-sales service.

2.- PRODUCT DESCRIPTION

The **RDB+** (v2) is a type-B earth leakage protection and monitoring device (IEC 60755), compatible with the earth leakage transformers in the **TDB** (v2) product range, and includes adjustable pre-alarm leakage sensitivity and integrated RS-485 communications.



The device features:

- **Display** for displaying the parameters.
- **3 keys** to browse through the different screens and program the device.
- **Digital output**, as a pre-alarm function.
- **Digital input** for external trigger or reset.
- **RS-485** communications.

The **TDB** (v2) are a range of electronic, type-B earth leakage protection and monitoring transformers (IEC 60755) to be used with **RDB+** (v2) and **CBS-400B** (v2) earth leakage protection and monitoring relays.

Vector has 4 models, depending on the maximum current of the monitored circuit (**In**):

- ✓ **TDB 35** (v2), for **In: 80 A**.
- ✓ **TDB 55** (v2), for **In: 160 A**.
- ✓ **TDB 80** (v2), for **In: 250 A**.
- ✓ **TDB 110** (v2), for **In: 400 A**.

The transformers have:

- **6 LEDs** providing information about the transformer's status.
- **2 RJ45** connection and power supply ports.

3.- INSTALLATION OF THE DEVICE

3.1.- PRELIMINARY RECOMMENDATIONS



In order to use the device safely, personnel operating it must follow the safety measures that comply with the standards of the country where it is to be installed; operators must wear the required personal protective equipment (rubber gloves, approved facial protection and flame-resistant clothing) to prevent injuries from electric shock or arcs caused by exposure to current-carrying conductors, and they must heed the various warnings indicated in this instruction manual.

The **RDB+** v2 device must be installed by authorised and qualified staff.

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

Cables must always be kept in perfect condition to avoid accidents or injury to personnel or installations.

Restrict the operation of the device to the specified measurement category, voltage or 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.

Do not use the device to take any measurements if an anomaly or malfunction is detected.

Check the surrounding environment before starting to take measurements. Do not take any measurements in hazardous or explosive environments.



Before carrying out maintenance, repair or handling of any of the device's connections, the device must be disconnected from all power sources, both from the device's own power supply and the measurement's.
Contact the after-sales service if you detect that the device is not working properly.

3.2.- INSTALLATION

> When the device is on, its terminals, opening covers or removing elements may expose the user to parts that are hazardous to touch. Do not use the device until it is fully installed.

The device must be installed inside a medium or low voltage electric panel or enclosure, with DIN rail mounting (IEC 60715).

> The device has a LED (**CPU**) that indicates voltage presence. Even in the case that the aforesaid LED is off, the user still needs to check the device is disconnected from any power supply.

The device must be connected to a power circuit protected by a fuse according to its power and consumption rating. It must be fitted with a circuit-breaker or equivalent device to disconnect the device from the power supply.

3.3.- PANEL ADAPTER 72 x 72 mm

Note: *The 72 x 72 mm panel adapter is a separately sold accessory.*

Vector has a panel adapter for **RDB+** (v2) devices so that it can be installed on 72 x 72 mm panels.

Figure 1 illustrates how the panel adapter is connected to an **RDB+** (v2).

> Before installing the adapter, the device must be disconnected from all power and measurement supplies.

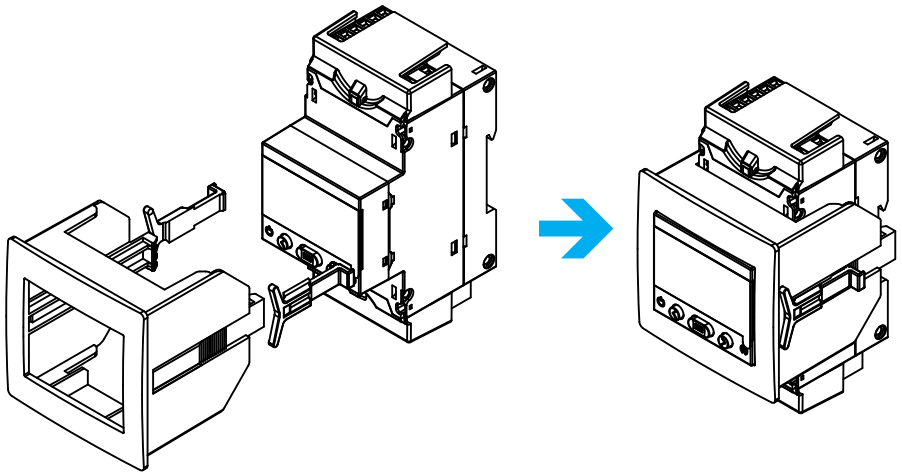


Figure 1: Installation of the panel adapter.

Table 3: Technical characteristics of the Panel Adapter.

Technical Specifications	
Protection degree	IP40
Enclosure	Self-extinguishing V0 plastic

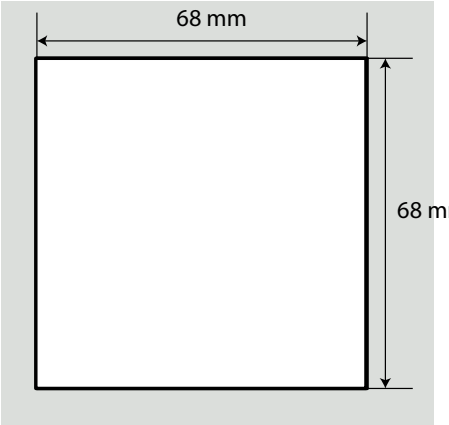


Figure 2: Cut in the panel.

3.4.- DEVICE TERMINALS

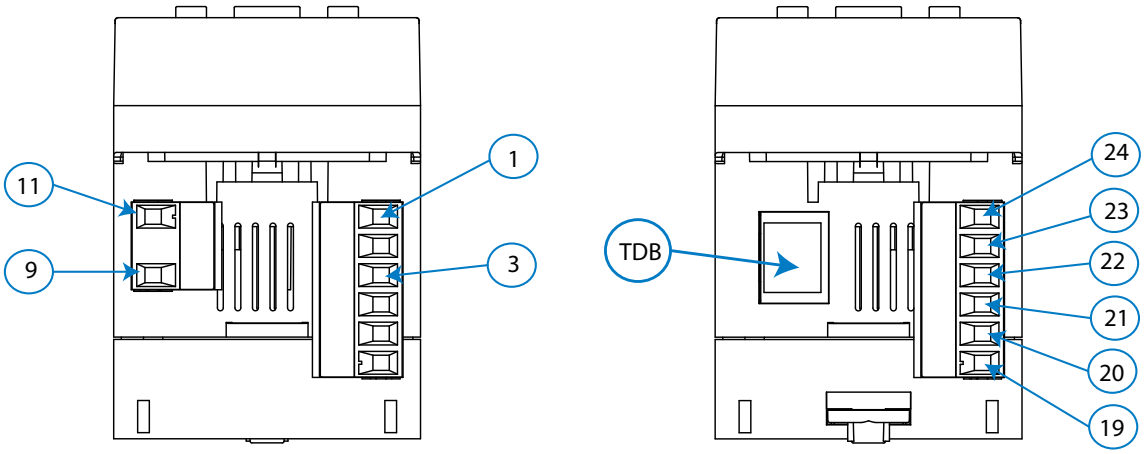


Figure 3: Terminals of the RDB+ (v2): Upper - Lower.

Table 4: List of RDB+ (v2) terminals.

Device terminals	
9: A1 +, Power supply	**21: TRIP/RESET,** Digital input for external trigger or reset.
11: A2 -, Power supply	**22: GND** for RS-485 and Digital input **TRIP/RESET**
1: R1, Output relay channel 1 (NO)	**23: B-**, RS-485
3: C1, Output relay channel 1 (Common)	**24: A+**, RS-485
19: Pre-alarm, Digital output (NO)	**TDB: TDB** transformer Connection (v2)
20: Pre-alarm, Digital output (Common)	

3.5.- TDB TRANSFORMERS (v2)

> When the device is on, its terminals, opening covers or removing elements may expose the user to parts that are hazardous to touch. Do not use the device until it is fully installed.

The transformer is designed for wall-mounting or DIN-rail assembly with an accessory for installation.

The **TDB** (v2) is a feed-thru busbar type transformer, where the conductor cables to be measured must pass through the inner hole or window of the transformer.

3.5.1. PANEL INSTALLATION

For panel installation, 4 clamping clips, are provided with the transformer, see **Figure 4**.

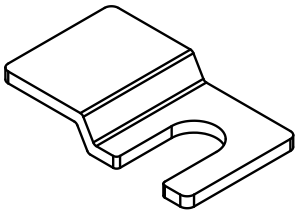


Figure 4: Clamping clip.

The clamping clips which must be installed on the **TDB** (v2) as shown in **Figure 5**.

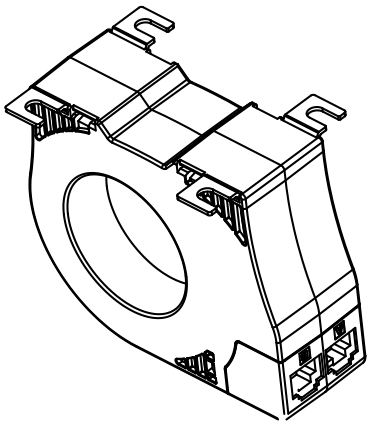


Figure 5: Position of the clamping clips.

3.5.2. INSTALLATION ON A DIN RAIL

For installation on a DIN rail, a support bracket is provided with the device, see **Figure 6**.

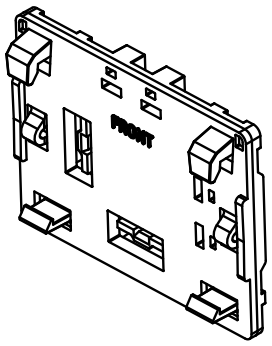


Figure 6: Support bracket.

The steps to ensure proper installation are:

1.- Attach the bracket to the DIN rail. Be sure the side marked FRONT is visible. The bracket can be installed in 2 ways, depending on how the **TDB** (v2) is to be positioned, **Figure 7**.

2.- Mount the **TDB** (v2) on the bracket, **Figure 7**.

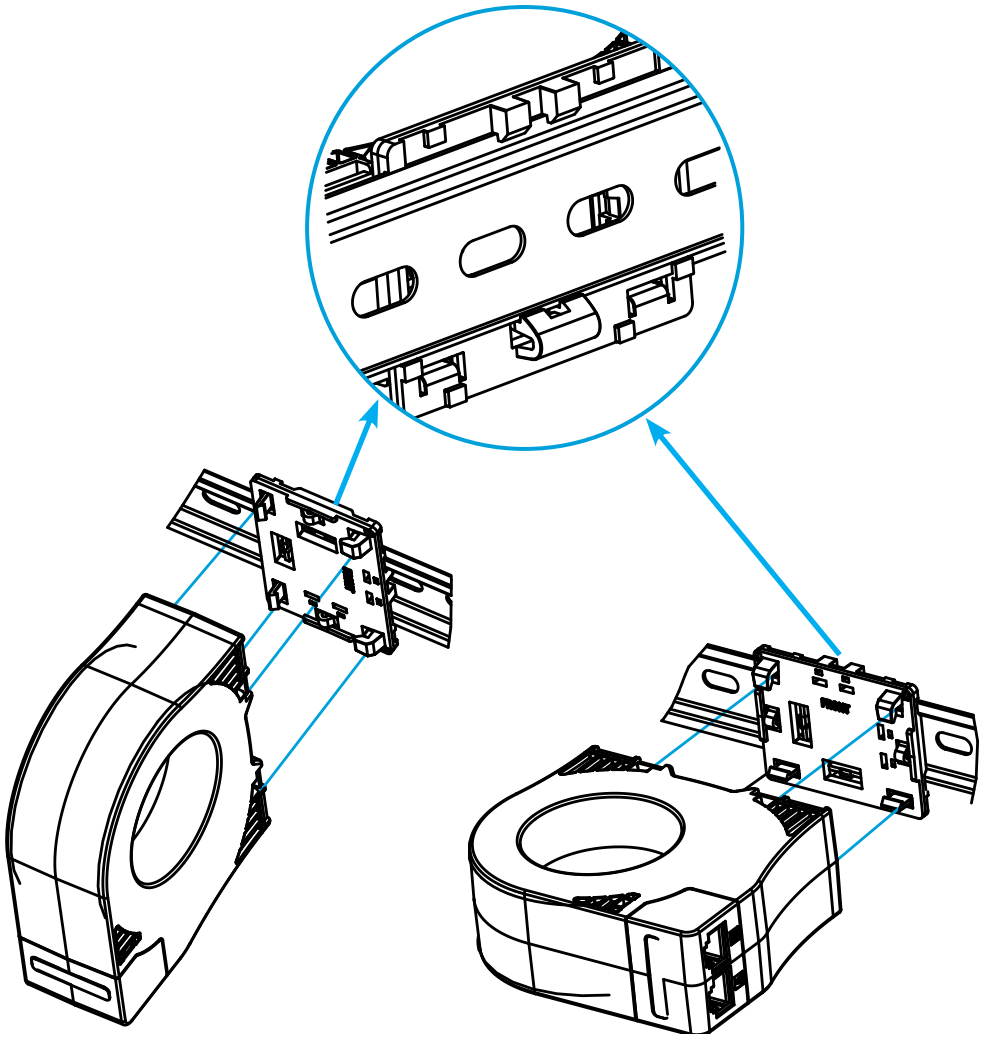


Figure 7: Installation on a DIN rail.

Note: *To remove the bracket from the DIN rail, use a screwdriver to pry it off,* **Figure 8**.

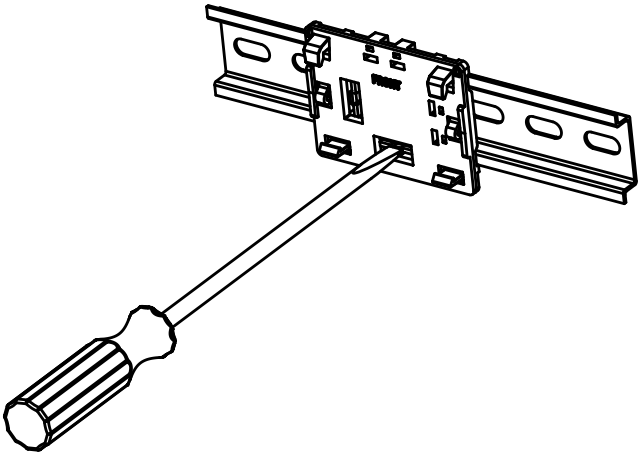


Figure 8: To remove the bracket use a screwdriver.

3.5.3.- TRANSFORMER TERMINALS

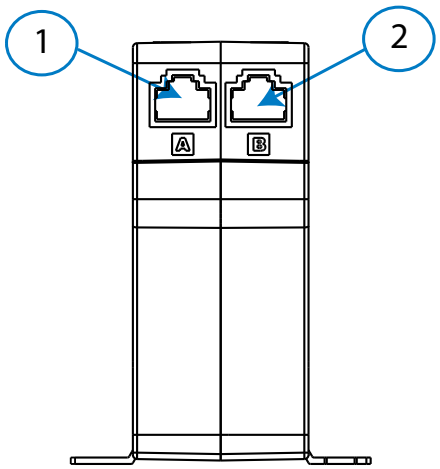


Figure 9: TDB v2 terminals.

Table 5: List of TDB v2 terminals.

Device terminals	
1, 2	Connection terminals to the **RDB+** v2

3.5.4.- TRANSFORMER LEDs

TDB v2 transformers have 6 indicating LEDs.

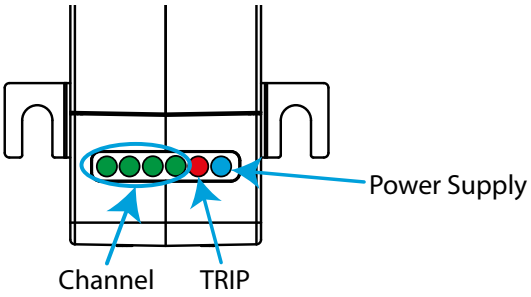


Figure 10: TDB v2 transformer LEDs

- **Power** (Blue color), indicates that the device is supplied power.

- **TRIP:** (Red color), indicates that a leakage current trip has occurred.
  (Red blinking), indicates that a pre-alarm has been generated.

- **Channel** (Green color), indicates the channel used for the **TDB** (v2).

Table 6: Channel LEDs.

LEDs	Description	
Channel		Channel 1

3.6.- CONNECTION DIAGRAMS

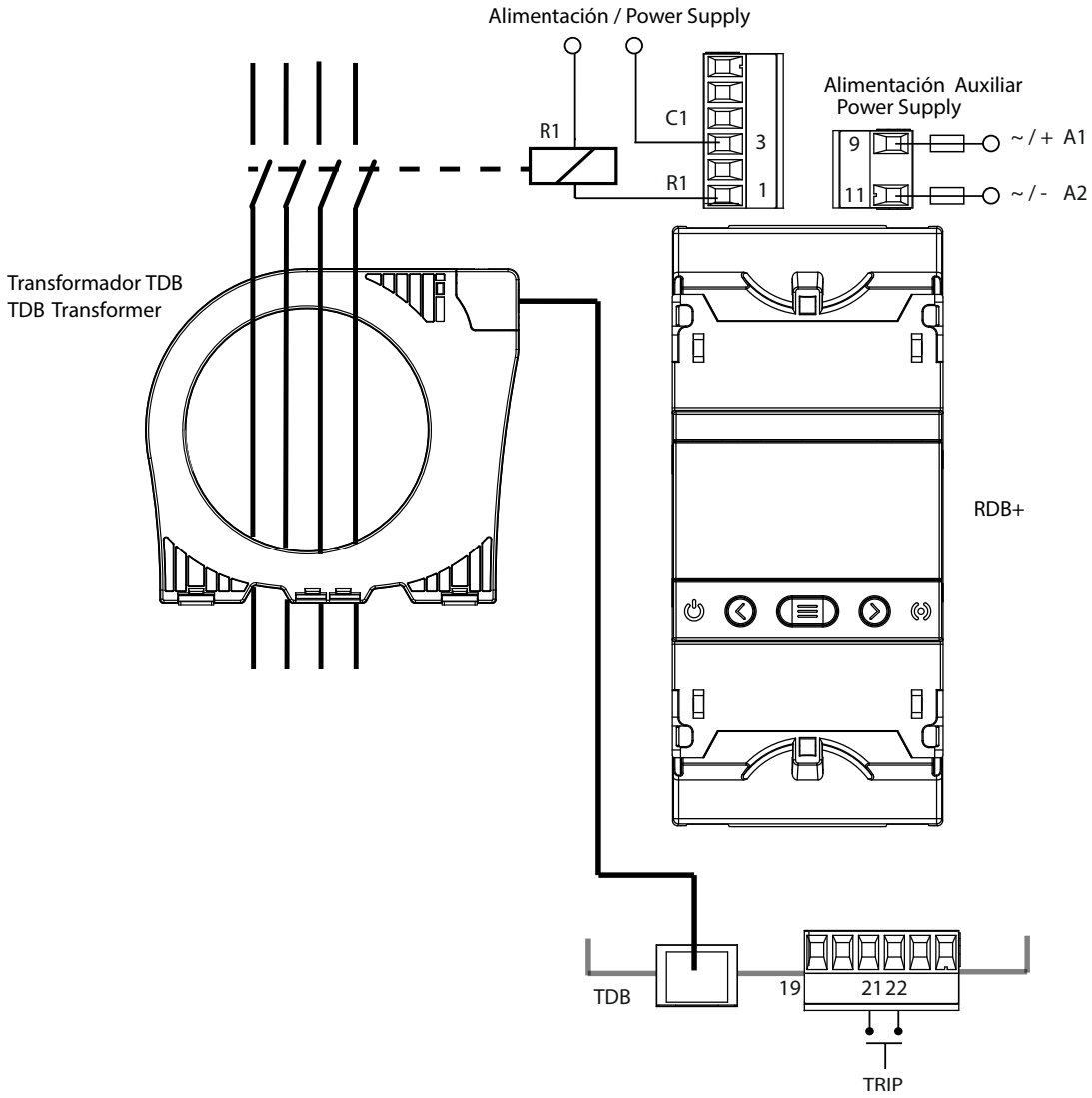


Figure 11: RDB+ (v2) Connection diagram.

3.7.- INSTALLATION CONNECTIONS

All active conductors that supply the loads or part of the installation where protection is required must pass through the associated **TDB** (v2) transformers.

Connect the **TDB** (v2) transformer to the **RDB+** (v2) using the RJ45 cable, **Figure 12**.

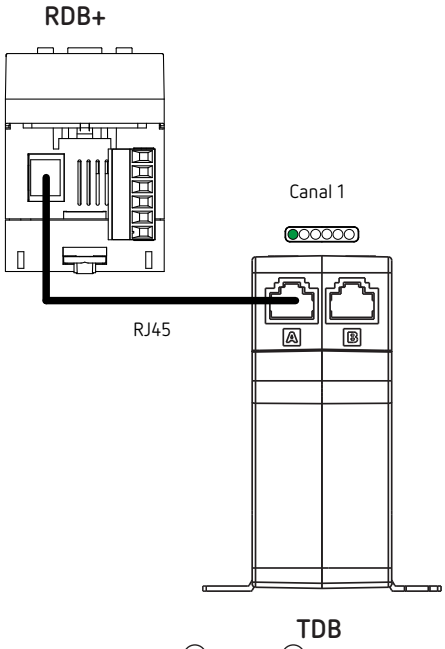


Figure 12: RDB+ (v2) - TDB (v2) connection.

Note: *If a RJ45 connection cable other than the one supplied with the* ***TDB*** (v2) *is used, it must have a cross-section of 4 x 2 x AWG24/7. The cable must be a maximum length of 9 metres.*

Connect the output relay of the **RDB+** (v2).

If the installation is modified and it involves new transformer, a replacement of the **TDB** (v2), the **RDB+** (v2) will detect this change and light the screens in yellow, see ***"5.1.- PROBLEMS OR CHANGES IN THE INSTALLATION"***.



Figure 13: Change in the installation.

4.- OPERATION

4.1.- LED INDICATORS

The **RDB+** (v2) device has 2 LEDs:

- **CPU**, white color, indicates that the device is on.

- **ALARM**,

Table 7: ALARM LED.

LED	Description
ALARM	**Red blinking:**
	Indicates that a pre-alarm has been generated.
	Red ON:
	Indicates that a trip has been generated.

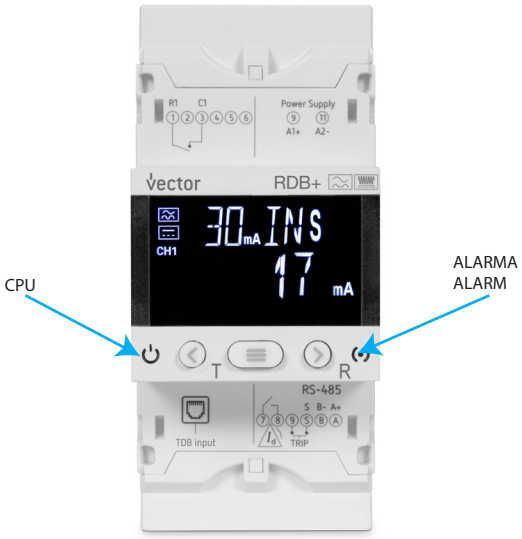


Figure 14: RDB+ (v2) LED indicators.

4.2.- DISPLAY

The device has a backlit LCD display that is split into two areas (**Figure 15**):

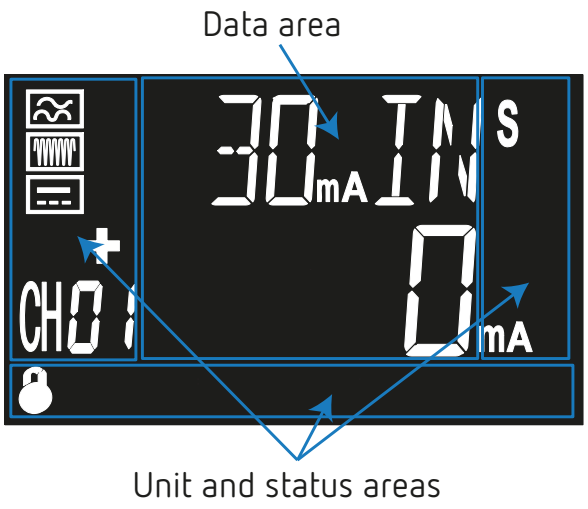


Figure 15: RDB+ (v2) display areas.

✓ The **data area**, which displays all the values measured by the device.

✓ The **unit and device status area,** which displays the different statuses, units and device information (**Table 8**).

Table 8: Display icons.

Icon	Description	Icon	Description
	Alternating current		Pre-alarm activated.
	Direct current	prog	Programming screen
	High frequency (Type F).	trip	A trip has been generated
	The relay works with positive polarity.	CH01	Channel : **CH01** channel 1
	Internal device error, contact **SAT.**		The device clock has not been set up
	The direct adjustments "*6.- DIRECT SETTINGS"* are locked. The setup menu *"7.- CONFIGURATION"* is locked and cannot be accessed. Go to the lock menu *"5.4.- LOCK"*, to change the option.		

The device's display can change color, indicating:



Blue color:
Adjustment or configuration screen.



Yellow color:
The installation has changed, see *"5.1.- PROBLEMS OR CHANGES IN THE INSTALLATION"*.



Red color:
The relay has tripped due to leakage current, see ***"5.3.- TRIP DISPLAY SCREENS"***.
An Individual test has been carried out, see ***"5.6.- TEST SCREEN"***.
An error was detected in the **TDB** (v2).

4.3.- KEYBOARD FUNCTIONS

The **RDB+** (v2) has 3 keys to browse through the different screens and program the device.

Function of the keys (**Tabla 9**):

Table 9: Function of the keys on display screens.

Key	Short keystroke	Long keystroke (3s)
< T	Previous screen	Tests the trip relay.
> R	Next screen	If there has been a trip, it resets the relay.
≡	Access to the lock/unlock menu, direct settings, configuration menu or events menu, depending on the screen being displayed.	Validate data and exit editing mode. Exit the configuration menu.

4.4.- DIGITAL OUTPUT

The device has a digital output (terminals 19 and 20 of **Figure 3**) that is activated when a pre-alarm is generated, see ***"7.2.- PRE-ALARM"***.

4.5.- RELAY

The **RDB+** (v2) has 1 output relay (terminals 1 and 3 of **Figure 3**) to carry out a trip on the channel. See ***"6.- DIRECT SETTINGS"*** to configure the trip parameters.

4.6.- DIGITAL INPUT

The device has a digital input, **TRIP/RESET**, (terminals 21 and 22 of **Figure 3**) for performing an external trip or reset.

5.- DISPLAY

When starting the device, the initial screen is displayed, showing the version of the device, **Figure 16**, y and after 13 seconds, the clock setup menu appears.

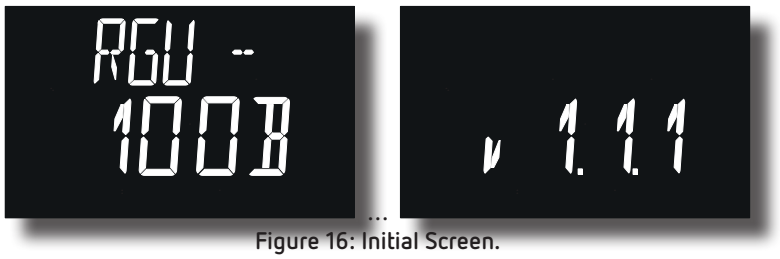


Figure 16: Initial Screen.

5.1.- PROBLEMS OR CHANGES IN THE INSTALLATION

If the device detects a problem in the installation at the end of startup, the screens turn yellow and one of the following screens is displayed:



The installation has changed and the device does not find the **TDB** (v2). The new installation has to be saved; this is carried out accessing the setup menu, see ***"7.5.- INSTALLATION"***.



The device has detected more **TDB** (v2) transformers than the installation can accept.



The device has detected **TDB** (v2) transformers that are not registered in the installation. The new installation has to be saved; this is carried out accessing the setup menu, see ***"7.5.- INSTALLATION"***.

5.2.- DISPLAY SCREENS

The display screen shows the leakage current and the trip current and delay values of the channel, **Figure 17**.

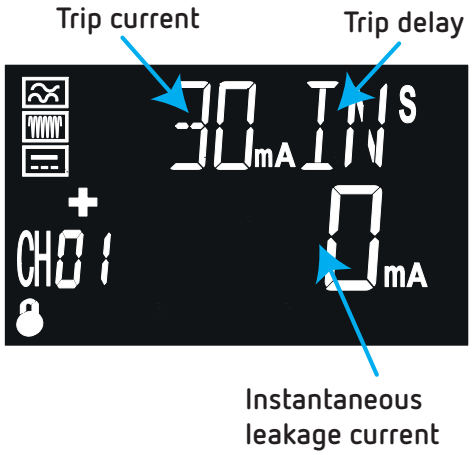
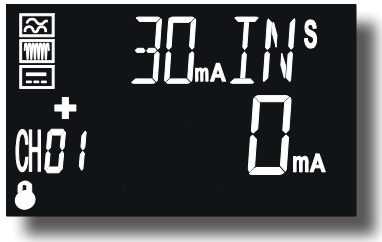


Figure 17: Main display screen.

Use keys (>) **R** and (<) **T** to browse through the different screens:



Channel 1:
Trip current (mA)
Trip delay
Total leakage current (alternating + direct), instantaneous (mA)

Access the Direct Settings menu by pressing the key ☰ for > 3s. (See *"6.- DIRECT SETTINGS").*

Note: *If the device is locked, 🔒, the menu cannot be accessed.*

(>)

(<)



Access the general setup menu by pressing the key ☰ (See *"7.- CONFIGURATION"*).

Note: *If the device is locked, 🔒, the configuration menu is accessed in read mode.*

Note: *If no key is pressed for 1 minute, the device goes to Channel 1's display screen.*

(>)

(<)



Access the lock menu by pressing the key ☰. (See *"5.4.- LOCK"*).

Note: *If no key is pressed for 1 minute, the device goes to Channel 1's display screen.*

(>)

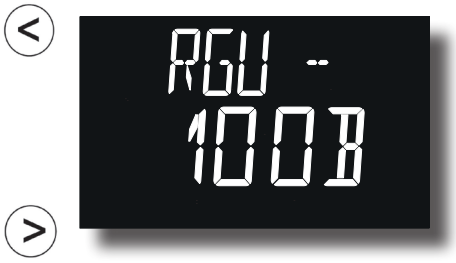
(<)



Access the event menu by pressing the key ☰ .(See *"5.5.- EVENT MENU"*)

Note: *If no key is pressed for 1 minute, the device goes to Channel 1's display screen.*

(>)

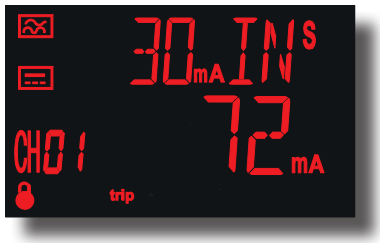


Screen with information on the device version. Press the key ☰ to see the version of the **RDB+** (v2).

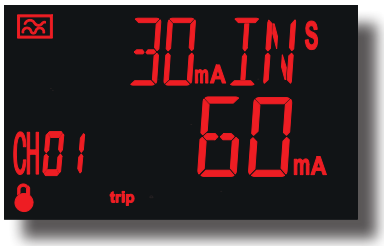
5.3.- TRIP DISPLAY SCREENS

If a trip has been generated in the channel, the display screen will be displayed in red, the **Alarm** LED will be lit in red and the last cycle current that tripped the relay will be displayed.

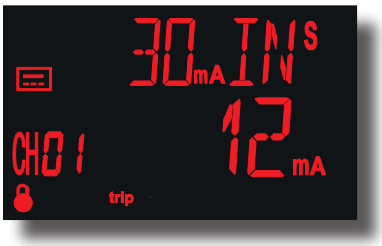
Use key ☰ to browse through the different trip information screens:



Trip current (mA)
Trip delay
Total leakage current (alternating + direct) that tripped the relay (mA)



Trip current (mA)
Trip delay
Alternating leakage current that tripped the relay (mA)



Trip current (mA)
Trip delay
Direct leakage current that tripped the relay (mA)

When pressing key > **R** for > 3s, the relay returns to its initial status and the principal screen is displayed in white.

5.4.- LOCK

To enter the lock menu, we must display the Lock screen and press the key ☰.



Figure 18: Lock menu.

The lock configuration screen is shown. If the device locks:

- The direct settings screens are locked ("***6.- DIRECT SETTINGS***") and the values cannot be modified.
- The configuration menu can only be accessed in read mode, no values can be modified ***("7.- CONFIGURATION")***.



Use keys > **R** and < **T** to skip through the different options.

✓ **Configuration values**

Table 10:Configuration values: Lock.

Lock	
Possible values	YES, the device is locked.
	NO, the lock on the device is deactivated.

Hold down the key ☰ for > 3s, to validate the data and exit the programming.

Note: *If no key is pressed for 1 minute, the device will lock automatically.*

5.5.- EVENT MENU

To enter the event menu, we must display the Events screen and press the key ☰.



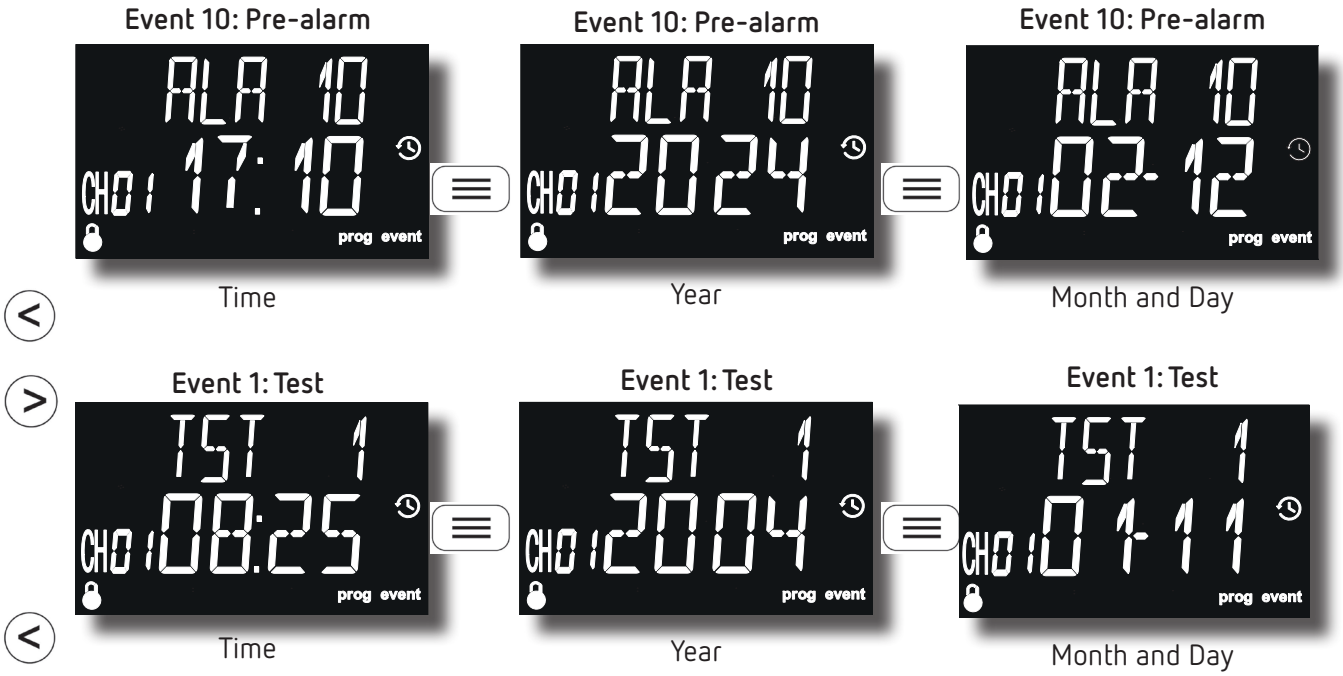
The device displays the last 20 events generated.

The **RDB+** (v2) saves 4 different types of events:

TRI, trip of a channel's relay.
ALA, pre-alarm activated.
TST, individual test
TRA, error in the transformer.

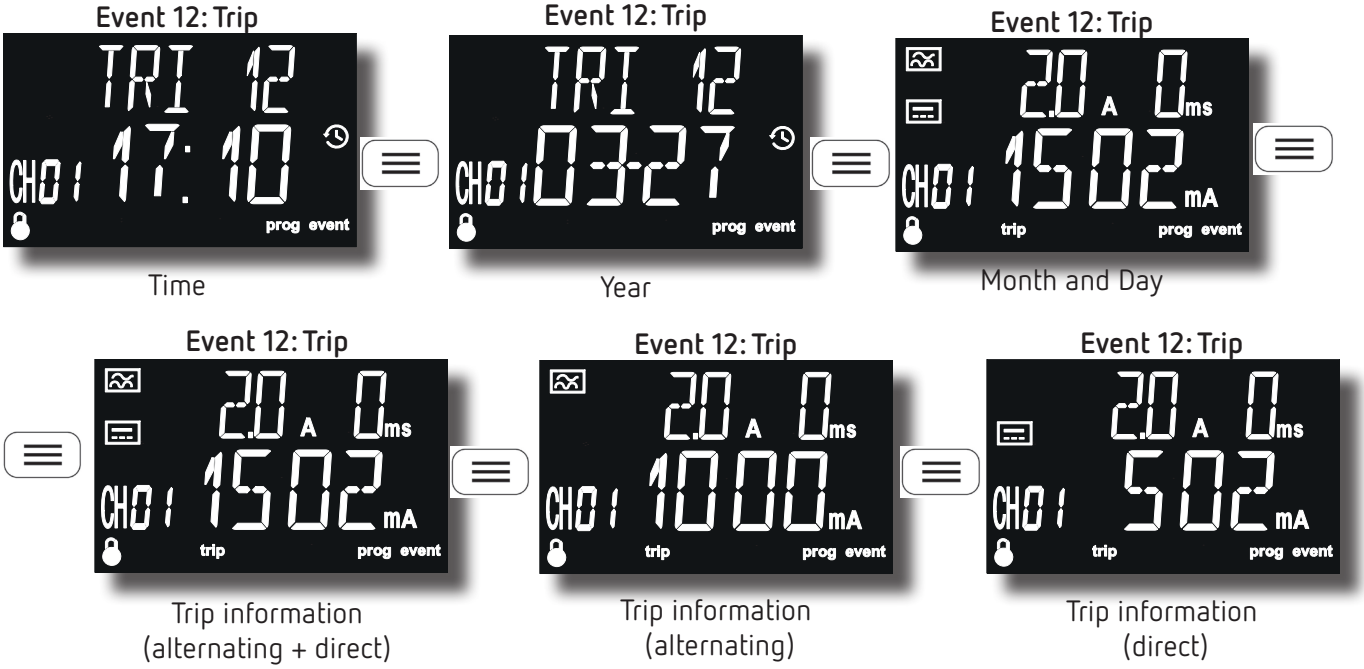
Use keys (>) **R** and (<) **T** to move from one event to another.
Press key ☰ for > 3s, to exit the event menu.

Three screens are displayed for **Pre-alarm, Test and Error in the transformer** events:





Six screens are displayed for **Trip** events:



The register of events can be reset by communications, see *"8.3.4.- EVENTS"*.

5.6.- TEST SCREEN

It is possible to carry out an individual test on the channel to verify the proper functioning of the relay.

To do this, press key < **T** for > 3s while channel 1's screen is being displayed.

If the relay has been tripped correctly, the screen in **Figure 19** is displayed. And the **Alarm** LED is lit in red.

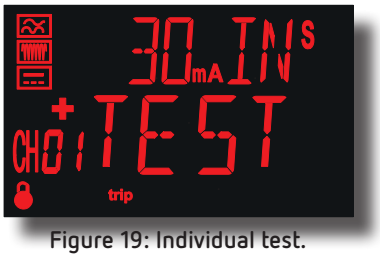


Figure 19: Individual test.

The relay is returned to its idle status by pressing the key > **R** for > 3s;

If the trip could not be carried out, the error screen (**Figure 20**) is displayed for 3s before returning to the channel display screen.

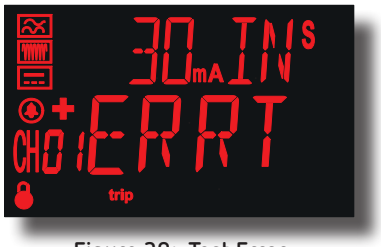
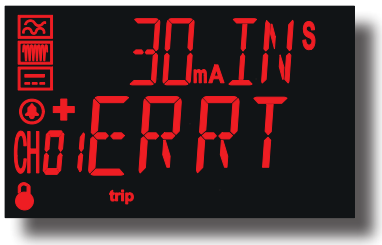


Figure 20: Test Error.

5.7.- ERROR SCREEN

If the device detects a problem with the transformer, the following screen is shown:



The device has detected an error in the transformer.

6.- DIRECT SETTINGS

From the channel's display screen, we can configure its trip current and delay. To do this, press key for > 3s.

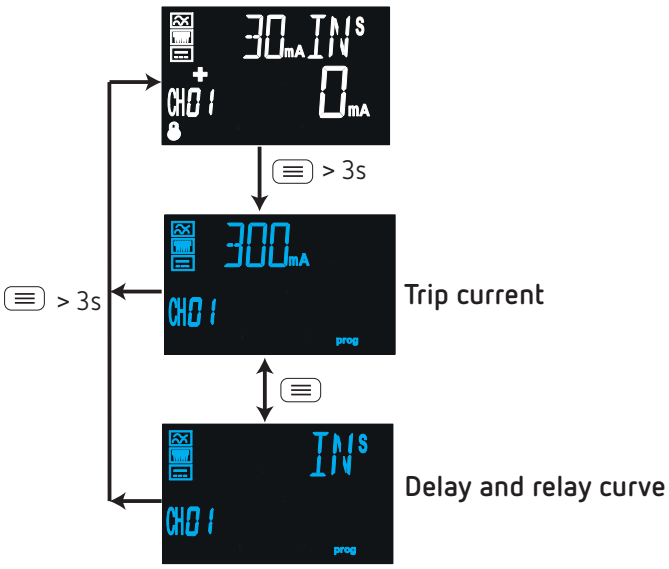


Figure 21: Direct settings.

Note: *If the device is locked, the direct settings cannot be modified and the screen shows the symbol . See (**"5.4.- LOCK"**), to modify the lock option.*

Note: *In **"ANNEX A.- DIRECT SETTINGS"** we can see the configuration tree.*

6.1.- TRIP CURRENT

The relay's trip current is configured in this screen.



Use keys > **R** and < **T** to skip through the different options.

✓ **Configuration values**

Table 11: Configuration values: Trip current.

Trip current			
Possible values	30 mA	100 mA	300 mA
	500 mA	1.0 A	3.0 A

To skip to the next programming point, press once the key .

Hold down the key for > 3s, to validate the data and exit the programming.

6.2.- DELAY AND RELAY CURVE

This screen is used to configure the delay of the relay trip or the type of trip curve.



Use keys (>) **R** and (<) **T** to skip through the different options.

✓ **Configuration values**

Table 12:Configuration values: Delay and Relay curve.

Delay and Relay curve						
Possible values	0.1 s	0.2 s	0.3 s	0.4 s	0.5 s	0.8 s
	1 s	3 s	5 s	**INS**, curve INS	**[S]**, curve SEL	

Note: *If the Trip current is* ***30 mA****, only the* ***INS*** *curve can be programmed.*
Note: *If the Trip current is* ***1.0 A*** *or* ***3.0 A****, the* ***INS*** *and* ***S*** *curves cannot be programmed.*

To return to the last programming point, press once the key ☰.

Hold down the key ☰ for > 3s, to validate the data and exit the programming.

7.- CONFIGURATION

To enter the configuration menu you must display the Setup screen and press the ☰ key.

If the device has been blocked, 🔒, the configuration menu is accessed in read mode and the screens are displayed in white.

The **RDB+** (v2) organises the device's configuration of the equipment into 5 menus, **Figure 22**.

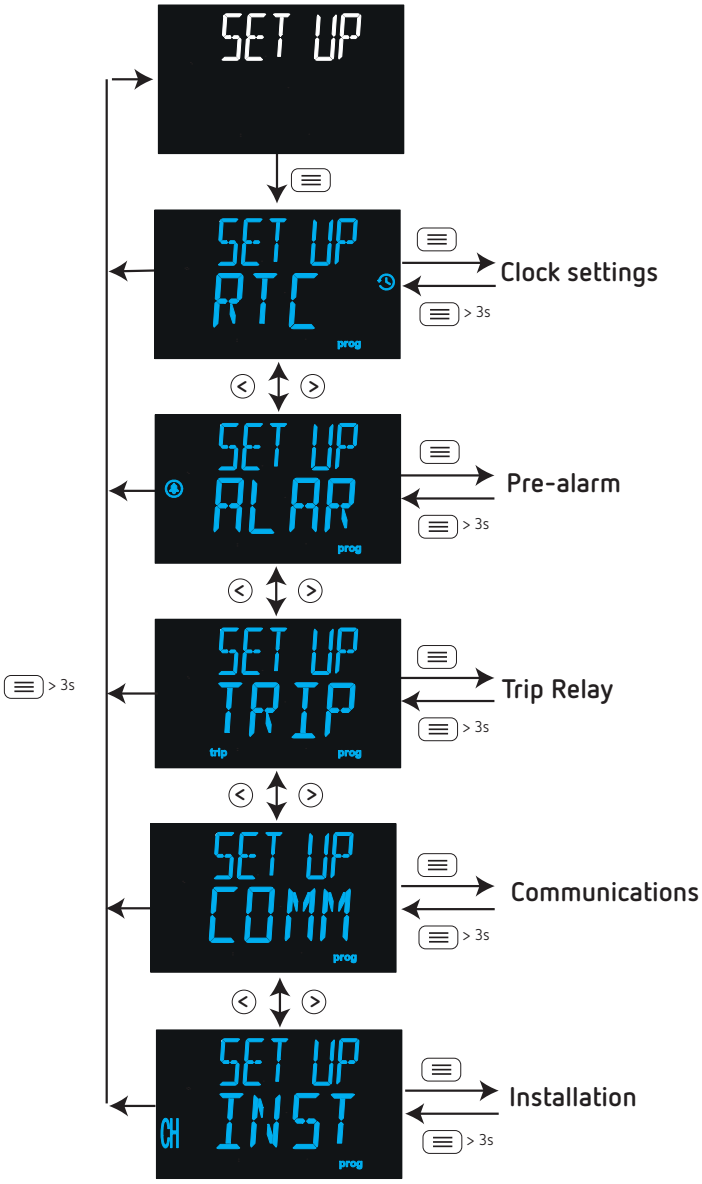


Figure 22: Configuration menu.

Note: *In **"ANNEX B.- SETUP MENU"** we can see the configuration tree.*

7.1.- CLOCK SETUP

Figure 23 shows the initial screen of the clock configuration menu. Press the ☰ to access the menu.



Figure 23: Clock setup menu.

Figure 24 shows the clock configuration menu.

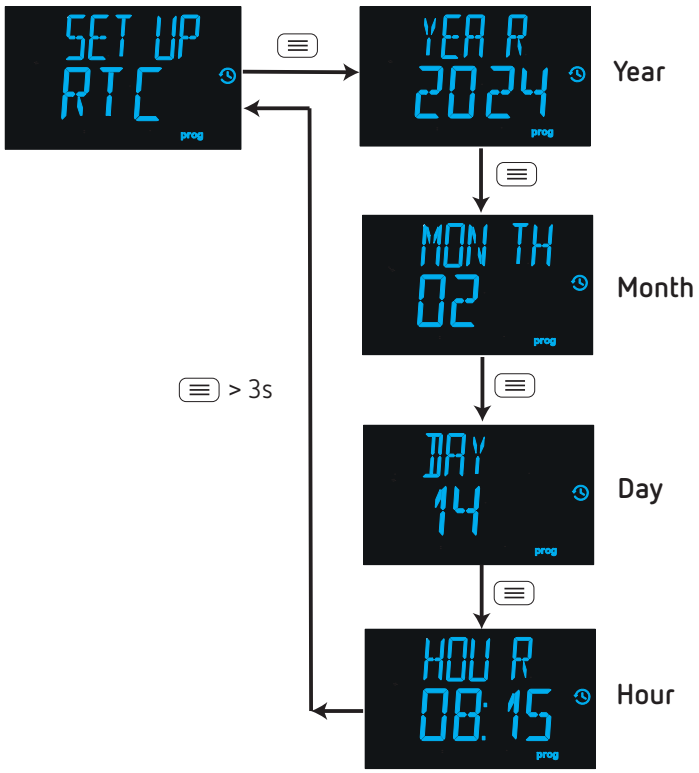


Figure 24: Clock setup menu.

7.1.1.- YEAR

In this section the year is configured.



Press key > **R** to increase the year value, and key < **T** to reduce it.

Press the ☰ key to validate the data and jump to the next programming point.

7.1.2.- MONTH

In this section the month is configured.



Press key > R to increase the month value, and key < T to reduce it.
Press the ≡ key to validate the data and jump to the next programming point.

7.1.3.- DAY

In this section the day is configured.



Press key > R to increase the day value, and key < T to reduce it.
Press the ≡ key to validate the data and jump to the next programming point.

7.1.4.- HOUR

In this section the hour is configured.



Press key > R to increase the hour value, and key < T to reduce it. Press key ≡ to confirm the value and configure the minutes, pressing the keys > R and < T.

Press the ≡ key to validate the data and jump to the initial screen of the clock configuration menu.

7.2.- PRE-ALARM

Figure 25 shows the initial screen of the pre-alarm menu. Press the key ☰ to access the menu.



Figure 25: Pre-alarm menu.

Figure 26 shows the pre-alarm configuration menu.

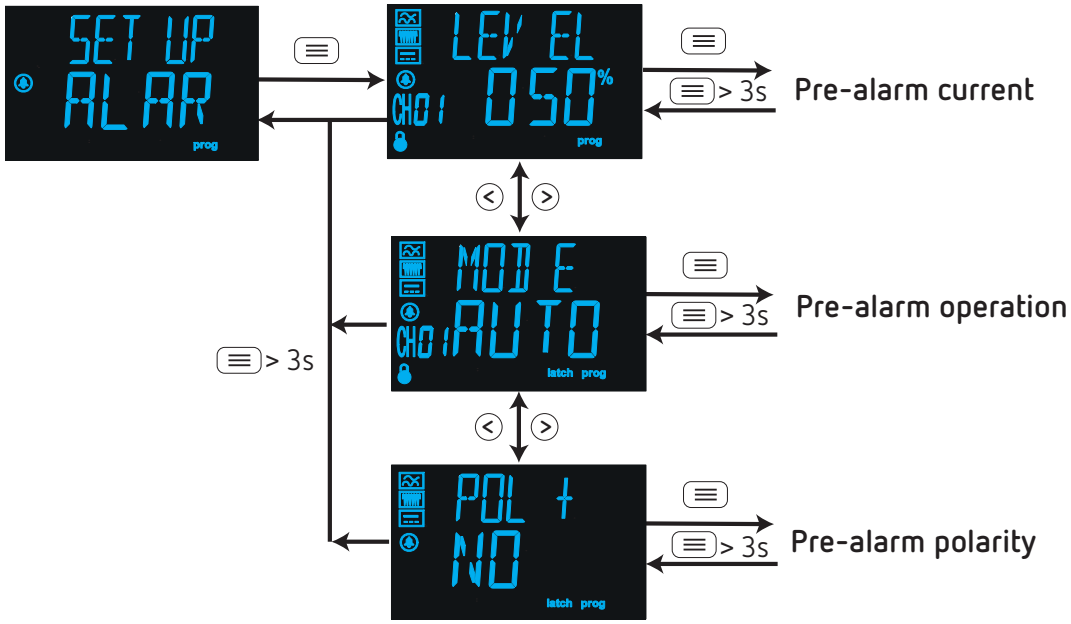


Figure 26: Pre-alarm configuration menu.

7.2.1.- PRE-ALARM CURRENT

This screen is used to configure the current at which the pre-alarm will be activated according to the % of the relay's trip current.



Press the key ☰ to enter edit mode, the programming value flashes.

Use keys > **R** and < **T** to modify the value.

✓ **Configuration values**

Table 13:Configuration values: Pre-alarm current.

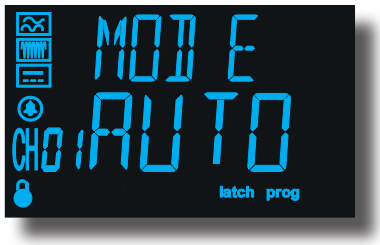
Pre-alarm current	
Minimum value	25 %
Maximum value	100 %

Hold down the key ☰ for > 3s to validate the data and exit edit mode.

To skip to the next programming point, press once the key > **R**.

7.2.2.- PRE-ALARM OPERATION

This screen is used to configure the pre-alarm's operation.



Press the key ☰ to enter edit mode, the programming value flashes.

Use keys > **R** and < **T** to skip through the different options.

✓ **Configuration values**

Table 14:Configuration values: Pre-alarm operation.

Pre-alarm operation	
Possible values	*DISA*, pre-alarm deactivated.
	AUTO, pre-alarm activated with latch deactivated; if the condition for the pre-alarm disappears, the pre-alarm is disconnected.
	MANU, pre-alarm activated with latch activated; the pre-alarm disappears when resetting via the keyboard or communications (see ***"8.3.3.- TRIPPING DUE TO TEST OR COMMUNICATIONS"***).

Hold down the key ☰ for > 3s to validate the data and exit edit mode.

To skip to the next programming point, press once the key > **R**.

7.2.3.- POLARITY

In this section the polarity of the pre-alarm is configured.



Press the key ☰ to enter edit mode, the programming value flashes.

Use keys >R and <T to skip through the different options.

✓ **Configuration values**

Table 15:Configuration values: Polarity.

Polarity	
Possible values	YES, The pre-alarm works with positive polarity (the polarity of the contacts is reversed with respect to the standard polarity).
	NO, the pre-alarm relay works with standard polarity.

Hold down the key ☰ for > 3s to validate the data and exit edit mode.

To jump to the home screen of the pre-alarm menu, press the key ☰ for > 3s.

7.3.- TRIP RELAY

Figure 27 shows the home screen of the trip relay configuration menu. Press the key ☰ to access the menu.

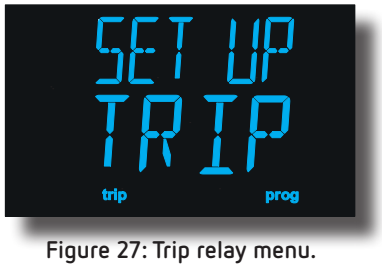


Figure 27: Trip relay menu.

Figure 28 shows the configuration menu of the trip relay.

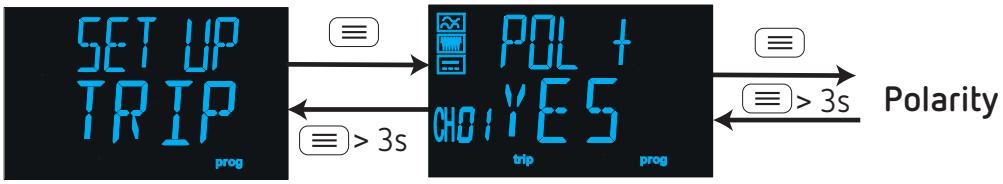


Figure 28: Configuration menu of the trip relay.

7.3.1.- POLARITY

The polarity of the trip relay is configured in this section.



Press the key ☰ to enter edit mode, the programming value flashes.

Use keys >R and <T to skip through the different options.

✓ Configuration values

Table 16:Configuration values: Polarity.

Polarity	
Possible values	YES, The trip relay works with positive polarity. The + icon is shown on the display.
	NO, the trip relay works with standard polarity.

Hold down the key ☰ for > 3s to validate the data and exit edit mode.

To jump to the home screen of the trip relay menu, press the key ☰ for > 3s.

Note: *Polarity can be programmed in **TDB** (v2) transformers. If the device has a **TDB** of a previous version installed, the screen shown in **Figure 29**, is displayed, indicating that the polarity of the transformer cannot be programmed.*



Figure 29: Polarity programming error display.

7.4.- RS-485 COMMUNICATIONS

Figure 30 shows the initial screen of the RS-485 communications menu. Press the key ☰ to access the menu.



Figure 30: Communications menu.

Figure 31 shows the configuration menu of the RS-485 communications.

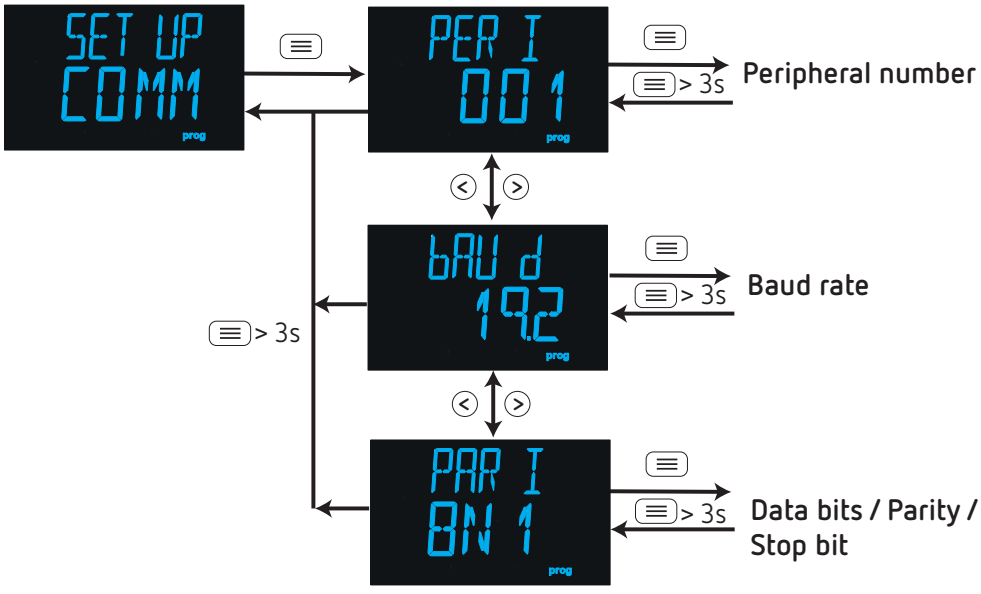


Figure 31: RS-485 communications configuration menu.

7.4.1.- PERIPHERAL NUMBER

In this section, the device's peripheral number for RS-485 communications is selected.



Press the key ☰ to enter edit mode, the programming value flashes.

Use keys > **R** and < **T** to skip through the different options.

✓ **Configuration values**

Table 17:Configuration values: Peripheral number.

Peripheral number	
Minimum value	1
Maximum value	247

Hold down the key ☰ for > 3s to validate the data and exit edit mode.

To skip to the next programming point, press once the key > **R**.

7.4.2.- BAUD RATE

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



Press the key ☰ to enter edit mode, the programming value flashes.

Use keys > **R** and < **T** to skip through the different options.

✓ **Configuration values**

Table 18:Configuration values: Baud rate.

Baud rate			
Possible values	4.8, 4800 bps	9.6, 9600 bps	19.2, 19200 bps
	38.4, 38400 bps	57.6, 57600 bps	115.2, 115200 bps

Hold down the key ☰ for > 3s to validate the data and exit edit mode.

To skip to the next programming point, press once the key > **R**.

7.4.3.- DATA BITS / PARITY / STOP BIT

In this section, the data and stop bits and the parity of the RS-485 communications are selected.



Press the key ☰ to enter edit mode, the programming value flashes.

Use keys > **R** and < **T** to skip through the different options.

✓ **Configuration values**

Table 19:Configuration values: Data bits / Parity / Stop bits.

Data bits / Parity / Stop bit	
Possible values	8N 1, 8 data bits, no parity, 1 stop bit.
	8E 1, 8 data bits, even parity, 1 stop bit.
	8O 1, 8 data bits, odd parity, 1 stop bit.
	8N2, 8 8 data bits, no parity, 2 stop bits.
	8E2, 8 data bits, even parity, 2 stop bits.
	8O2, 8 data bits, odd parity, 2 stop bits.

Hold down the key ☰ for > 3s to validate the data and exit edit mode.

To jump to the initial screen of the communications menu, press the key ☰ for > 3s.

7.5.- INSTALLATION

Figure 32 shows the initial screen of the installation menu. Press the key ☰ to access the menu.



Figure 32: Installation menu.

Figure 33 shows the installation configuration menu.



Figure 33: Installation configuration menu.

7.5.1.- SAVE INSTALLATION

This section saves the current installation of the device.



Press the key ☰ to enter edit mode, the programming value flashes.

Use keys (>)R and (<)T to skip through the different options.

✓ **Configuration values**

Table 20: Configuration values: Save installation.

Save installation	
Possible values	YES, The device installation is saved.
	NO, The device installation is not saved.

Hold down the key ☰ for > 3s to validate the data and exit edit mode.

To jump to the home screen of the installation menu, press the key ☰ for > 3s.

Press the ☰ key for > 3s to exit the configuration menu.

8.- RS-485 COMMUNICATIONS

The **RDB+** (v2) has an RS-485 communications port. The device is equipped with the **MODBUS RTU** communication protocol as standard.

8.1.- CONNECTIONS

The RS-485 cable must be wired using twisted pair cable with mesh shield (minimum 3 wires), with a maximum distance of 1200 meters between the **RDB+** (v2) and the master unit.
In this bus we can connect a maximum of 32 **RDB+** (v2).

For communication with the master unit, we must use a smart RS-232 to RS-485 network protocol converter.

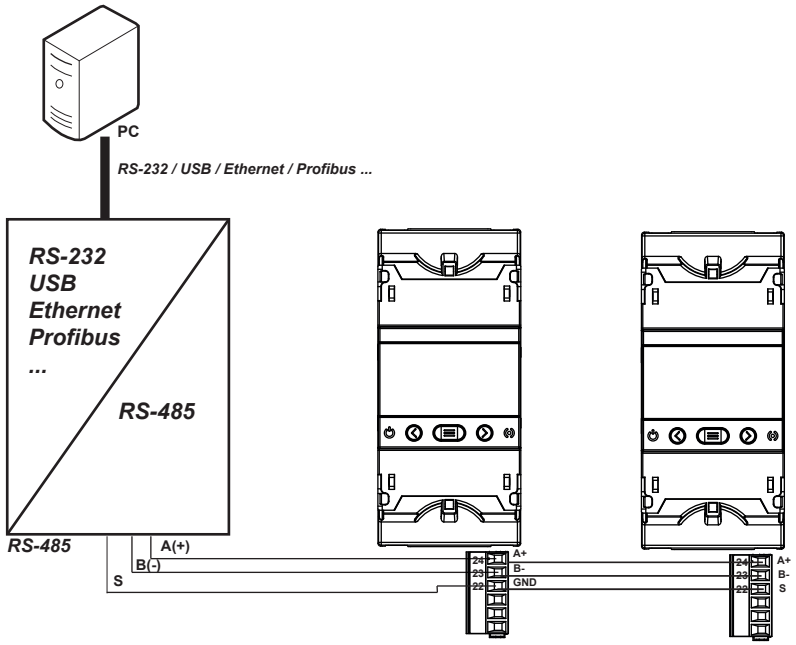


Figure 34: RS-485 connection diagram.

Note: *Default values of the RS-485 communication:* ***9600 bps, no parity, 8 data bits*** *and* **1 stop bit**.

8.2.- MODBUS PROTOCOL

Within the Modbus protocol, the **RDB+** (v2) 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.
Functions 0x03 and 0x04: Reading integer registers.
Function 0x05: Writing a relay.
Function 0x10: Writing multiple registers.

8.3.- MODBUS COMMANDS

All **MODBUS** map addresses are in Hexadecimal format.

8.3.1.- VARIABLES OF THE RDB+ (v2) AND INSTALLATION

Function 0x02 is used for these variables.
Functions 0x01 and **0x05** are used for the variable ***Save the new installation***.

Table 21: Modbus Memory Map: RDB+ (v2) - INSTALLATION (Table 1).

RDB+ (v2) - INSTALLATION			
Parameter	**Format**	**Address**	**Value**
Installation tripped due to **TRIP/RESET** input	bool	5DC	**0:** Not tripped - **1:** Tripped
The installation has changed	bool	7CE	**0:** Not changed - **1:** Changed
Internal error detected in the **RDB+** (v2)	bool	7CF	**0:** Not detected - **1:** Detected
Save the new installation	bool	F9F	**1:** Save the installation

Function 0x04 is used for these variables.

Table 22: Modbus Memory Map: RDB+ (v2) - INSTALLATION (Table 2).

RDB+ (v2) - INSTALLATION			
Parameter	**Format**	**Address**	**Value**
Date and time of the device	Unit [32]	283C - 283D	Device date (Epoch format)
Serial no. of the **TDB** (v2) registered in the installation's Channel	String	3458 ...345E	-
Installation status	Unit [16]	3583	**0 ... 5** (see **Table 23**)
Status of **RDB+** (v2)	Unit [16]	3584	**0 ... 2** (see **Table 24**)
ID no. of **RDB+** (v2)	Unit [32]	35E8 - 35E9	-
Serial no. of **RDB+** (v2)	Unit [16]	364C ... 3652	-

Possible installation statuses, **Table 23**:

Table 23: Installation statuses.

Possible installation statuses	
Value	**Description**
0	Correct installation
1	A new **TDB** (v2) has been detected and added to the installation
2	The **TDB** (v2) registered in the installation is not detected
3	A **TDB** (v2) not registered in the installation has been detected
4	More **TDB** (v2)'s than the installation can accept has been detected
5	There is no **TDB** (v2) registered in the installation

Possible statuses of **RDB+** (v2), **Table 24**:

Table 24: Status of RDB+ (v2).

Possible statuses of RDB+ (v2)	
Value	**Description**
0	Device in startup process
1	Device idle
2	Device tripped due to activation of the **TRIP/RESET** input

8.3.2.- CHANNEL VARIABLES

Function 0x04: reading of registers, is used for these variables.

Table 25: Modbus Memory Map: Channel variables.

Configuration variable	Format	Address	Units/Format
TDB (v2) model	String	FA0-FA1	-
Serial no. of **TDB** (v2)	String	FA2...FA8	-
Firmware version (part 1)	Unit [16]	FA9	-
Firmware version (part 2)	Unit [16]	FAA	-
Firmware version revision	Unit [16]	FAB	-
TDB (v2) status	Unit [16]	FAC	**0 ... 6** (see **Table 26**)
TDB (v2) channel	Unit [16]	FAD	**1:** channel 1
Programmed trip curve or delay	Unit [16]	FAE	ms
Programmed trip current	Unit [16]	FAF	mA
Instant total leakage current	Unit [16]	FB0	mA
Instant alternating leakage current	Unit [16]	FB1	mA
Instant direct leakage current	Unit [16]	FB2	mA
Total leakage current that tripped the relay	Unit [16]	FB3	mA
Alternating leakage current that tripped the relay	Unit [16]	FB4	mA
Direct leakage current that tripped the relay	Unit [16]	FB5	mA
Programmed pre-alarm current	Unit [16]	FB6	%
Pre-alarm Operation	Unit [16]	FB7	**0:** Deactivated **1:** Activated with deactivated latch **2:** Activated with activated latch

Possible statuses of **TDB** (v2), **Table 26**:

Table 26: TDB (v2) statuses.

Possible statuses of TDB (v2)	
Value	**Description**
0	**TDB** (v2) in startup process
1	**TDB** (v2) in idle status
2	**TDB** (v2) tripped due to detected leakage current
3	**TDB** (v2) tripped due to TEST with Test error result
4	**TDB** (v2) tripped due to TEST with Test successful result
5	**TDB** (v2) tripped due to communications
6	**TDB** (v2) tripped due to **TRIP input**

Function 0x02 is used for these variables.

Table 27: Modbus Memory Map: Channel status.

Parámetro	Formato	Dirección	Valor
Internal error detected in the **TDB** v2	bool	0000	**0:** Not detected **1:** Detected
Pre-alarm activated	bool	0001	**0:** Deactivated **1:** Activated
Channel tripped	bool	0002	**0:** Not tripped **1:** Tripped
Channel tripped due to leakage current	bool	0003	
Channel tripped due to error in the **TDB** v2	bool	0004	
Channel tripped due to test	bool	0005	
Channel tripped due to **TRIP** input	bool	0006	
Channel tripped due to communications	bool	0007	
TDB v2 not connected	bool	0008	**0:** Not detected **1:** Detected
Error writing to **TDB** v2	bool	0009	
TDB v2 does not respond to requests	bool	000A	

8.3.3.- TRIPPING DUE TO TEST OR COMMUNICATIONS

The following functions are used for these variables: **0x01** and **0x05**.

Table 28: Modbus Memory Map: Configuration of the trip and pre-alarm.

Configuration of the Trip and Pre-alarm				
Configuration variable	Format	Address	Valid data range	Default value
Tripping due to **TEST** of channel	bool	07D0	**FF00:** Activate Test of channel **0000**: Finish TEST	0000
Tripping due to Communications of channel	bool	07D1	**FF00:** Tripping of channel **0000**: Channel reset	0000

8.3.4.- EVENTS

The following steps must be taken to read the events:

1.- Read the ***No. of events in the channel*** to consult.
2.- Write the channel number to consult in ***Channel selection***: 1.
3.- Write the event number to consult in ***Event selection***.
4.- Read the 8 ***Event*** registers simultaneously to consult the event's details.

Table 29: Modbus Memory Map: Events.

Parameter	Format	Address	Function	Value
No. of events in channel	Unit [16]	13BA	0x04	0 ... 100
Channel selection	Unit [16]	36BA	0x03 0x10	1
Event selection	Unit [16]	36BB		1 ... 10
Event	Array	1388-1389	0x04	Event date (Epoch format)
		138A		Type of event: **0:** Tripping of the channel's relay **1:** Pre-alarm activated **2:**Individual test **3:** Error in transformer
		138B		Channel where the event occurred
		138C		Programmed trip current
		138D (1)		Programmed trip or delay curve
		138E (1)		Total trip current (alternating + direct)
		138F (1)		Direct trip current
		1390 (1)		Alternating trip current
Delete Events	bool	0F9E	0x01 0x05	**1:** Deletes saved events

(1) Valid registers when the read event is a relay trip.

8.3.5.- DEVICE CONFIGURATION VARIABLES

The following functions are used for these variables:
Function 0x03: Reading of registers
Function 0x10:Writing multiple registers.

8.3.5.1.- Configuration of the trip and pre-alarm

Table 30: Modbus Memory Map: Configuration of the trip and pre-alarm.

Configuration of the Trip and Pre-alarm				
Configuration variable	Format	Address	Valid data range	Default value
Relay curve or delay (2)	Unit [16]	3714	**Table 31**	0
Trip current (2)	Unit [16]	3715	**Table 32**	30 mA
Pre-alarm current	Unit [16]	3716	1 ... 100 %	50 %
Pre-alarm Operation	Unit [16]	3717	**0:** Deactivated **1:** Activated with deactivated latch **2:** Activated with activated latch	1
Pre-alarm polarity	Unit [16]	36CE	**0:** Standard polarity **1:** Positive polarity	0
Trip relay polarity	Unit [16]	3718		

(2) To program the relay delay and the trip current it is necessary to first read the possible values of the **TDB** (v2); for them it is necessary to read **Table 31** and **Table 32**.

Table 31: Modbus Memory Map: Relay curve or delay table.

Relay curve or delay table.				
Parameter	Format	Function	Address	Value
Value 1	Unit [16]	0x04	1004	**1:** Curve INS - **0**[3]
Value 2	Unit [16]	0x04	1005	**2:** Curve SEL - **0**[3]
Value 3	Unit [16]	0x04	1006	**100** ms - **0**[3]
Value 4	Unit [16]	0x04	1007	**200** ms - **0**[3]
Value 5	Unit [16]	0x04	1008	**300** ms - **0**[3]
Value 6	Unit [16]	0x04	1009	**400** ms - **0**[3]
Value 7	Unit [16]	0x04	100A	**500** ms - **0**[3]
Value 8	Unit [16]	0x04	100B	**800** ms - **0**[3]
Value 9	Unit [16]	0x04	100C	**1000** ms - **0**[3]
Value 10	Unit [16]	0x04	100D	**3000** ms - **0**[3]
Value 11	Unit [16]	0x04	100E	**5000** ms - **0**[3]
Value 12	Unit [16]	0x04	100F	**0**[3]
Value 13	Unit [16]	0x04	1010	**0**[3]
Value 14	Unit [16]	0x04	1011	**0**[3]
Value 15	Unit [16]	0x04	1012	**0**[3]
Value 16	Unit [16]	0x04	1013	**0**[3]

[3] **0:** Indicates that the value is not available.

Table 32: Modbus Memory Map: Trip current table.

Trip current				
Parameter	Format	Function	Address	Value
Value 1	Unit [16]	0x04	1014	**30** mA - **0**[4]
Value 2	Unit [16]	0x04	1015	**100** mA - **0**[4]
Value 3	Unit [16]	0x04	1016	**300** mA - **0**[4]
Value 4	Unit [16]	0x04	1017	**500** mA - **0**[4]
Value 5	Unit [16]	0x04	1018	**1000** mA - **0**[4]
Value 6	Unit [16]	0x04	1019	**3000** mA - **0**[4]
Value 7	Unit [16]	0x04	101A	**0**[4]
Value 8	Unit [16]	0x04	101B	**0**[4]
Value 9	Unit [16]	0x04	101C	**0**[4]
Value 10	Unit [16]	0x04	101D	**0**[4]
Value 11	Unit [16]	0x04	101E	**0**[4]
Value 12	Unit [16]	0x04	101F	**0**[4]
Value 13	Unit [16]	0x04	1020	**0**[4]
Value 14	Unit [16]	0x04	1021	**0**[4]
Value 15	Unit [16]	0x04	1022	**0**[4]
Value 16	Unit [16]	0x04	1023	**0**[4]

[4] **0:** Indicates that the value is not available.

8.3.5.2.- RS-485 communications

Table 33: Modbus Memory Map: SR-485 Communications.

RS-485 Communications				
Configuration variable	**Format**	**Address**	**Valid data range**	**Default value**
Peripheral number	Unit [16]	36B0	1 ... 247	1
Baud rate	Unit [32]	36B1 - 36B2	4800, 9600, 19200, 38400, 57600, 115200	9600
Data format	Unit [16]	36B3	**0:** 8N1, **1:** 8E1, **2:** 801 **3:** 8N2, **4:** 8E2, **5:** 802	**0**

8.3.5.3.- Clock setup

Table 34: Modbus Memory Map: Clock setup.

Clock setup				
Configuration variable	**Format**	**Address**	**Valid data range**	**Default value**
Clock setup	Unit [32]	36C4 - 36C5	Date and time are given in Epoch format	

9.- TECHNICAL FEATURES

9.1.- RDB+ (v2)

AC Power supply	
Rated voltage	230 V ~ ± 15%
Frequency	50 ... 60 Hz
Consumption	9 VA
Installation category	CAT III 300V

Monitoring features	
Protection Type	Type B
Sensitivity (IΔn)	0.03 - 0.1 - 0.3 - 0.5 - 1 - 3 A
Adjustable trigger delay	INS - [S] - 0.1 - 0.2 - 0.3 - 0.4 - 0.5 - 0.8 - 1 - 3 - 5 s
Rated frequency of the monitored circuit	DC: 0 Hz - AC: 50 Hz - 1 kHz
Rated residual non-operating current	0.8 IΔn
Rated conditional short-circuit current (Icc)	Depends on the circuit breaker
Rated short-time withstand current (Icw)	
Uimp of the voltage source	4 kV (CAT III)
Compatible TDB transformers	TDB 35/55/80/110

Relay outputs	
Quantity	1
Maximum voltage open contacts	230 V ~
Maximum current	6 A
Maximum switching power	1500 VA
Electrical life (250V ~ / 5A)	$60x10^3$ Cycles
Mechanical life	$10x10^6$ Cycles

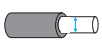
Digital output	
Type	Optoisolated
Maximum voltage	230 V ~
Maximum current	0.1 A

Digital input	
Type	Potential free contact
Insulation	5.3 kV
Input impedance	2 KΩ

RS-485 Communications	
Communications protocol	Modbus RTU
Baud rate	4800 -9600 - 19200 - 38400 - 57600 - 115200 bps
Data bits	8
Stop bits	1 - 2
Parity	without, even, odd

User interface	
Display	LCD custom (negative)
Keyboard	3 keys
LED	2 LED

Environmental features	
Operating temperature	-10°C ... +50°C
Storage temperature	-20°C ... +70°C
Relative humidity (without condensation)	5 ... 95%
Maximum altitude	2000 m
Protection degree IP	IP30, Front: IP40,
Pollution degree	2

Mechanical features			
			
Terminals: 1, 3, 9, 11, 19... 24	2.5 mm^2	≤ 0.4 Nm, M2.5	Flat
Dimensions	**Figure 35** (mm)		
Weight	188 g		
Enclosure	Self-extinguishing V0 plastic		

Standards	
Low-voltage switchgear. Part 2: Automatic switch protection	IEC 60947-2-M
General safety requirements for residual current operated protective devices	IEC 60755[5]
Environmental testing -- Part 2-1: Tests - Test A: Cold.	UNE-EN 60068-2-1
Environmental testing -- Part 2-2: Tests - Tests B: Dry heat	UNE-EN 60068-2-2
Environmental testing - Part 2-78: Tests - Test Cab: Damp heat, steady state	UNE-EN 60068-2-78

[5] Measurement conditions for Type B waveform specified in IEC 60755.

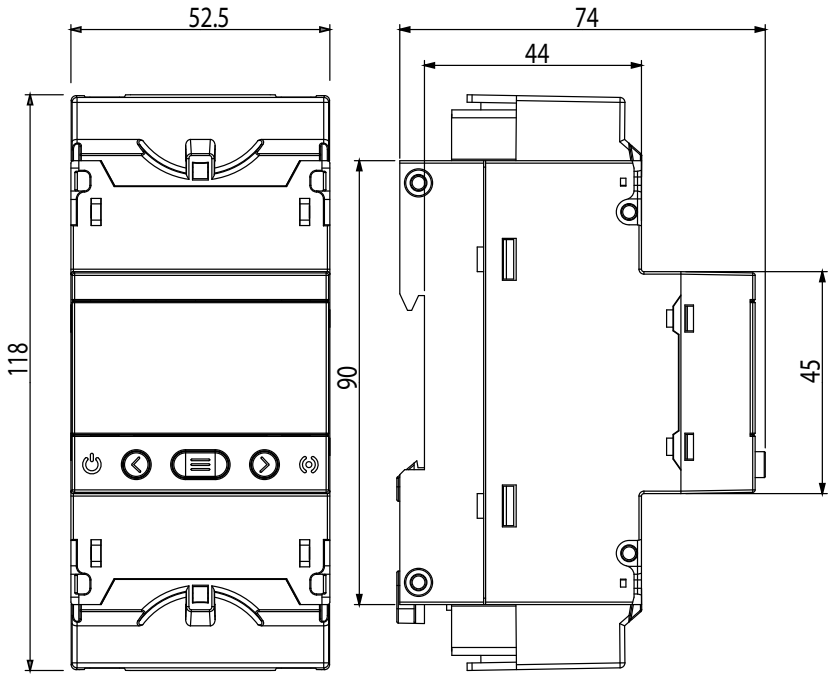


Figure 35: Dimensions of RDB+ (v2).

9.2.- TDB (v2)

Electrical features				
Models	TDB 35 (v2)	TDB 55 (v2)	TDB 80 (v2)	TDB 110 (v2)
Type	Bar			
Maximum rated current of the monitored circuit (In)	80 A	160 A	250 A	400 A
Frequency	50 ... 1 kHz			
Maximum operating voltage	≤ 720 V ~			
Accuracy	Tripping current			
	30 mA			± 2 mA
	100 mA			± 5 mA
	300 mA			± 20 mA
	500 mA			
	1.0 A			± 200 mA
	3.0 A			

User interface	
LED	6 LEDs

Environmental features	
Operating temperature	-10 °C ... +50 °C
Storage temperature	-20 °C ... +70 °C
Relative humidity (without condensation)	5... 95%
Maximum altitude	2000 m
Thermical class	150 °C

Mechanical features				
	TDB 35 (v2)	TDB 55 (v2)	TDB 80 (v2)	TDB 110 (v2)
Window size	Ø 35.5 mm	Ø 55.5 mm	Ø 80.5 mm	Ø 110.5 mm
Weight	235 g	355 g	555 g	710 g
Enclosure	Self-extinguishing V0 plastic			
Cable from TDB to RDB+				
Connector	RJ45 standard			
Cable cross-section	4 x 2 x AWG24/7			
Temperature range	- 20 °C ... +70 °C			
Length [6]	1.5 m			

[6] Length of the cable included with the **TDB** (v2).

Standards	
Low-voltage switchgear and controlgear - Part 2: Circuit-breakers	IEC 60947-2-M

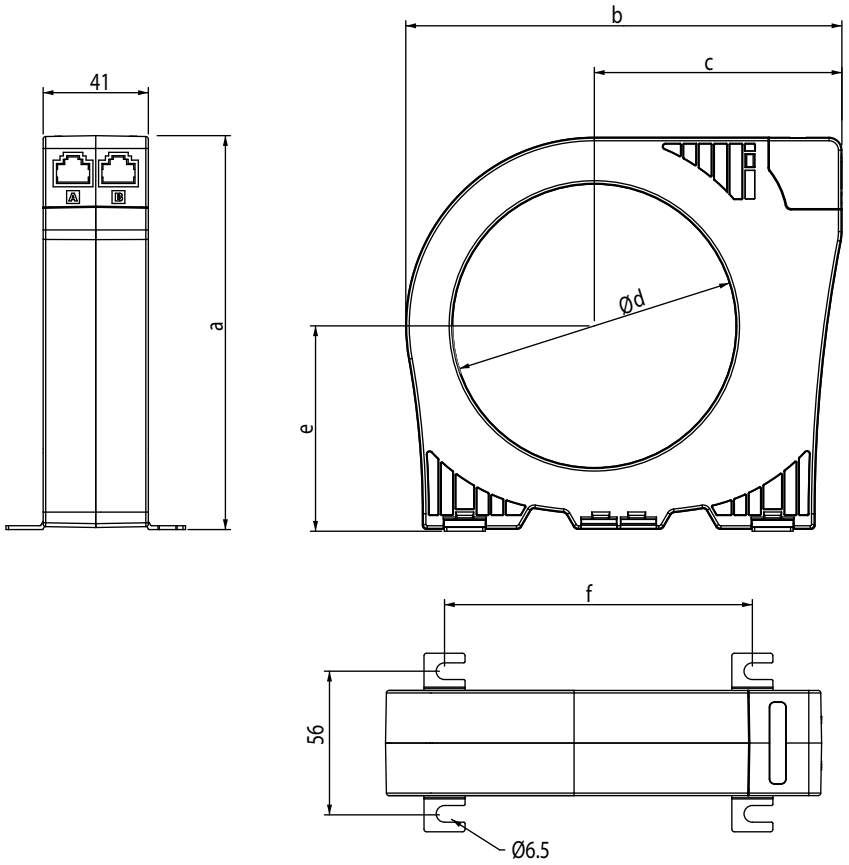


Figure 36: TDB v2 dimensions.

Figure 37: TDB v2 dimensions.

TDB v2 dimensions						
	a	b	c	d	e	f
TDB 35 v2	80	97	61.5	35.5	44.5	54
TDB 55 v2	98.5	118	72	55.5	52.5	81.5
TDB 80 v2	123.5	140	81.5	80.5	65	101.5
TDB 110 v2	153.5	170	96.5	110.5	80	120

10.- MAINTENANCE AND TECHNICAL SERVICE

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

Technical Assistance Service
C/ Montcada 7, Pol. Ind. Les Pereres
08130 - Santa Perpètua de Mogoda (Barcelona)
Tel: (+34) 935 748 206
email: info@vectorenergy.com

11.- GUARANTEE

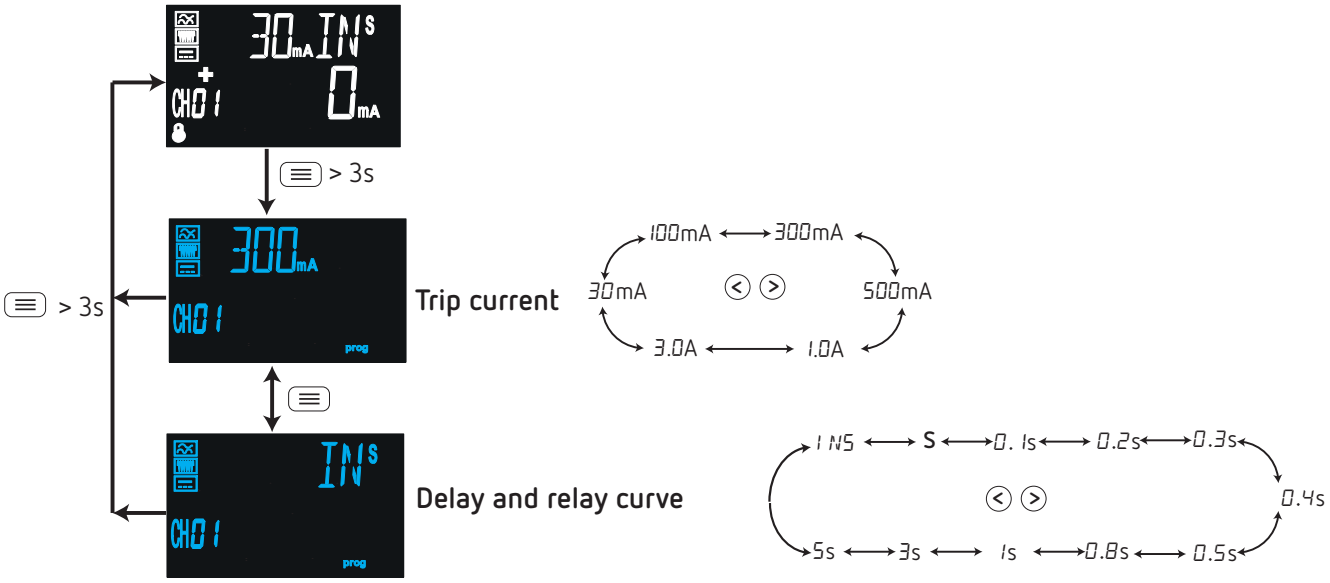
Vector guarantees its products against any manufacturing defect for two years after the delivery of the units.

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

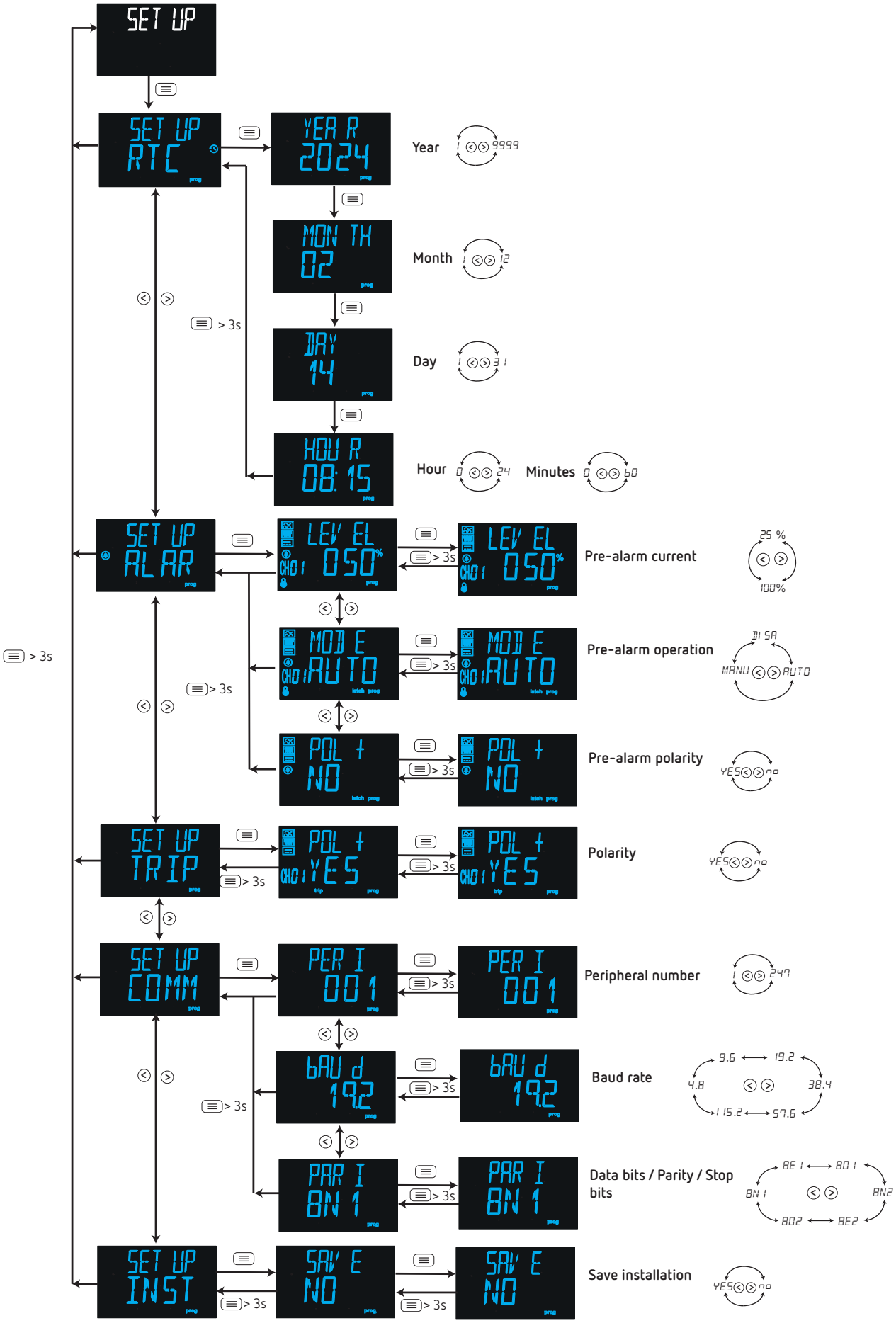


- No returns will be accepted and no unit will be repaired or replaced if it is not accompanied by a report indicating the defect detected or the reason for the return.
- The guarantee will be void if the units has been improperly used or the storage, installation and maintenance instructions listed 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.
- **Vector** 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.

ANNEX A.- DIRECT SETTINGS



ANNEX B.- SETUP MENU



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