Residual current device and monitor

RDB



INSTRUCTION MANUAL

(M087BVM-03-23A)


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
05/24	M087BVM-03-23A	Initial version

SYMBOLS

Table 2: Symbols.

Symbol	Description
CE	In compliance with the relevant European directive.
	In accordance with the CMiM directive.
	The device complies with the 2012/19/EC European directive. Do not dispose of the device in a household waste container at the end of its useful life. Observe the local electronic device recycling regulations.
⎓	Direct current.
~	Alternating current.

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

1.- VERIFICATIONS UPON RECEPTION

The following must be checked upon reception of the device:

a) The device has been supplied according to the specifications in your order.
b) The device has not been damaged during transport.
c) Perform an external visual inspection of the device before connecting it.
d) Check that it has been supplied with the following:

- An installation guide.

> Immediately contact the carrier and/or **Vector's** after-sales service if you detect any problem in the device upon reception.

2.- DESCRIPTION OF THE PRODUCT

RDB is a electronic type B earth leakage current protection and monitoring relay. It has 2 programmables outputs relays: main trip relay and prealarm relay. It has one free voltage input for external TRIP/RESET.



Allows the setting and adjustment of all parameters required for complete protection and maintenance checking in the installation.

The **RDB** measures, calculates and displays the earth leakage current in three-phase, balanced or unbalanced industrial systems.

Measurements are in true effective value, via one earth leakage current input, from the **TDC-xx-TB** family external measuring toroid.

Under normal operating conditions the main values determining earth leakage protection in an installation are shown on the display. These include sensitivity, delay and instant current leakage.

Under normal operating conditions the backlit display is green. However, after any event causing a main relay to trip, the backlight is red, indicating the reason.

There are 1 models of the device:

✓ **RDB**, protective device (IEC 60947-2 M).

Main features:

- Measuring in true effective value (TRMS)
- Type B differential (IEC 60947-2 Annexed M)
- Insulation against transients (IEC 61008.1)
- High frequency filtering (IEC 61008.1)
- Trip setting between 80 and 100% IΔn
- Inverse curve (IEC 61008.1)
- Associated standard: IEC 61008.1, IEC755, IEC 60947-2 M
- 3 modules. DIN rail. In a panel using front accessory
- Displaying instant leakage values.
- Backlit LCD display.

3.- INSTALLING THE DEVICE

3.1.- PRELIMINARY RECOMMENDATIONS



The operators using and handling the device must follow the safety measures established in the country where the device will be used to guarantee its safe operation, using personal protective equipment if needed.

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

Disconnect the device from the mains and disconnect the measuring devices before handling, changing the connections of or replacing the device. Handling the device while it is connected is hazardous to people nearby.

The cables must be in perfect working order to prevent accidents or injuries to people and/or damage to the facilities/installations.

Limit the operation of the device to measuring the specified current or voltage values.

The manufacturer of the device shall not be held responsible for any damage resulting from the user or installation company failing to observe the warnings and/or recommendations indicated in this manual nor for any damage resulting from the use of non-original products or accessories or those from other brands.

Do not use the device to take measurements if you detect an anomaly or malfunction.

Check the environment in which the device is installed before taking a measurement. Do not use the device to take measurements in dangerous, explosive, wet or damp environments.



Disconnect the device from the mains and from the power supply (both the device and its measuring system) before performing any maintenance work, repairs or handling any of the connections of the device.
Contact the after-sales service if you detect that the device is not working properly.

3.2.- INSTALLATION

> While the device is connected, the terminals, opening the cover or removing elements can expose parts that are hazardous to the touch. The device must not be used until the installation process is complete.

The device is installed on a DIN rail or on a panel (drilled panel 67^{+1} x 67^{+1}mm, according to DIN 43 700 using accessory). All connections must remain inside the electrical board.

> It has an LED indicator that indicates the presence of voltage. Even if this LED is not on, the user must still verify that the unit is disconnected from all power supplies.

Through the core balance transformer must pass all live conductors supplyng electrical energy to loads or part of the installation which requires it to earth leakage protection with this device. In single-phase installation (phase and neutral, L and N), three phase - 3 wires (three phases, L1, L2 and L3) or three phases - 4 wires (L1, L2, L3 and N).

The device must be connected to a power supply circuit protected by fuses in line with the range and power consumption. In turn, the supply circuit must be provided with a circuit breaker or equivalent device to disconnect the device from the mains.

3.2.1.- INSTALLATION OF DEVICE IN PANEL

A 72x72 mm front adapter accessory is used to install the device on a panel. All connections must remain inside the electrical board.

The front adapter accessory has a base, a frame two tabs and three screws, **Figure 1**.



Figure 1:Adapter accessory.

The steps to follow to perform the installation of the adapter accessory are:

1.- The base is mounted on top of the device.

2.- The device is attached by screwing the holes in the device on the upper right corner and lower left corner on the front of device.

3.- The front frame is attached to cover the mounting points.

4.- Three green pressure tabs on the side runners of the base are attached.

5.- The device is mounted in the hole in the panel with the adapter.

6.- The tabs run towards the panel to obtain the mounting pressure.



Figure 2: Installation of adapter accessory.

3.3.- TERMINALS OF THE DEVICE

Table 3:Terminal description RDB.

Terminals of the device	
1: External input trip - Reclose	**9:** Transformer input 1S1
2: External input trip - Reclose	**10:** Power supply
4: Prealarm relay (Common)	**11:** Power supply
5: Prealarm relay (NC)	**13:** Tripping relay (NO)
6: Prealarm relay (NO)	**14:** Tripping relay (NC)
8: Transformer input 1S2	**15:** Tripping relay (Common)

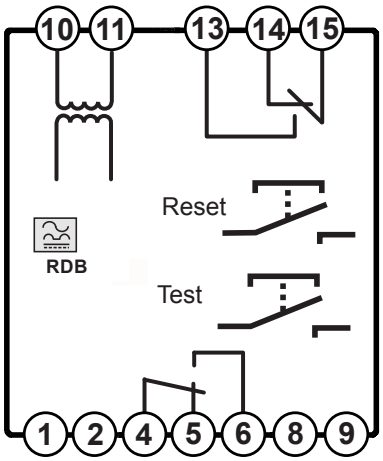


Figure 3:Terminals RDB.

3.4.- CONNECTION DIAGRAMS

Note: *It is recommended that meshed cable is used to connect the toroid over large distances.*

3.4.1.- RDB: TRIP BY SHUNT COIL

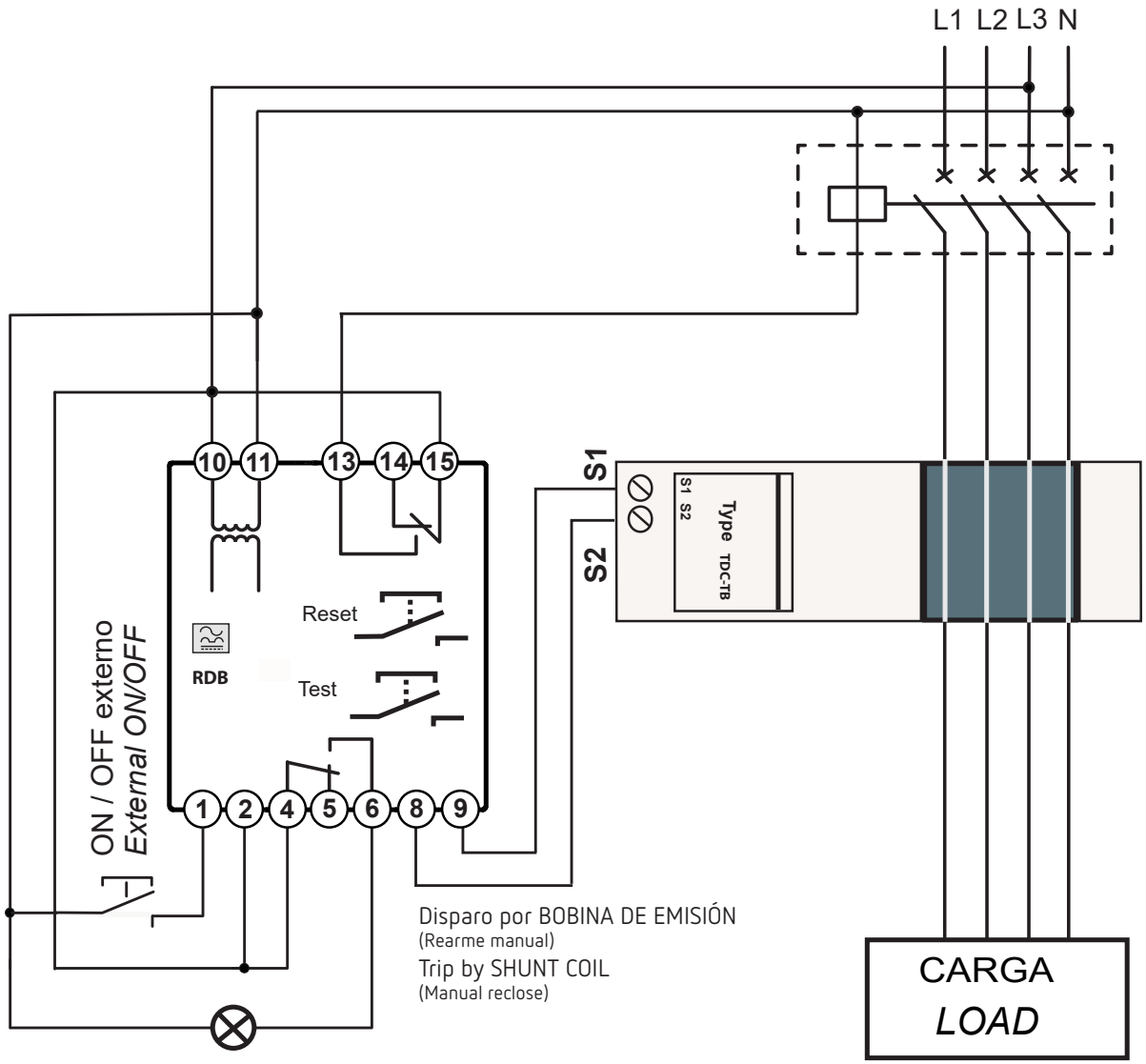


Figure 4: RDB: Trip by shunt coil.

3.4.2.- RDB: TRIP BY UNDERVOLTAGE COIL

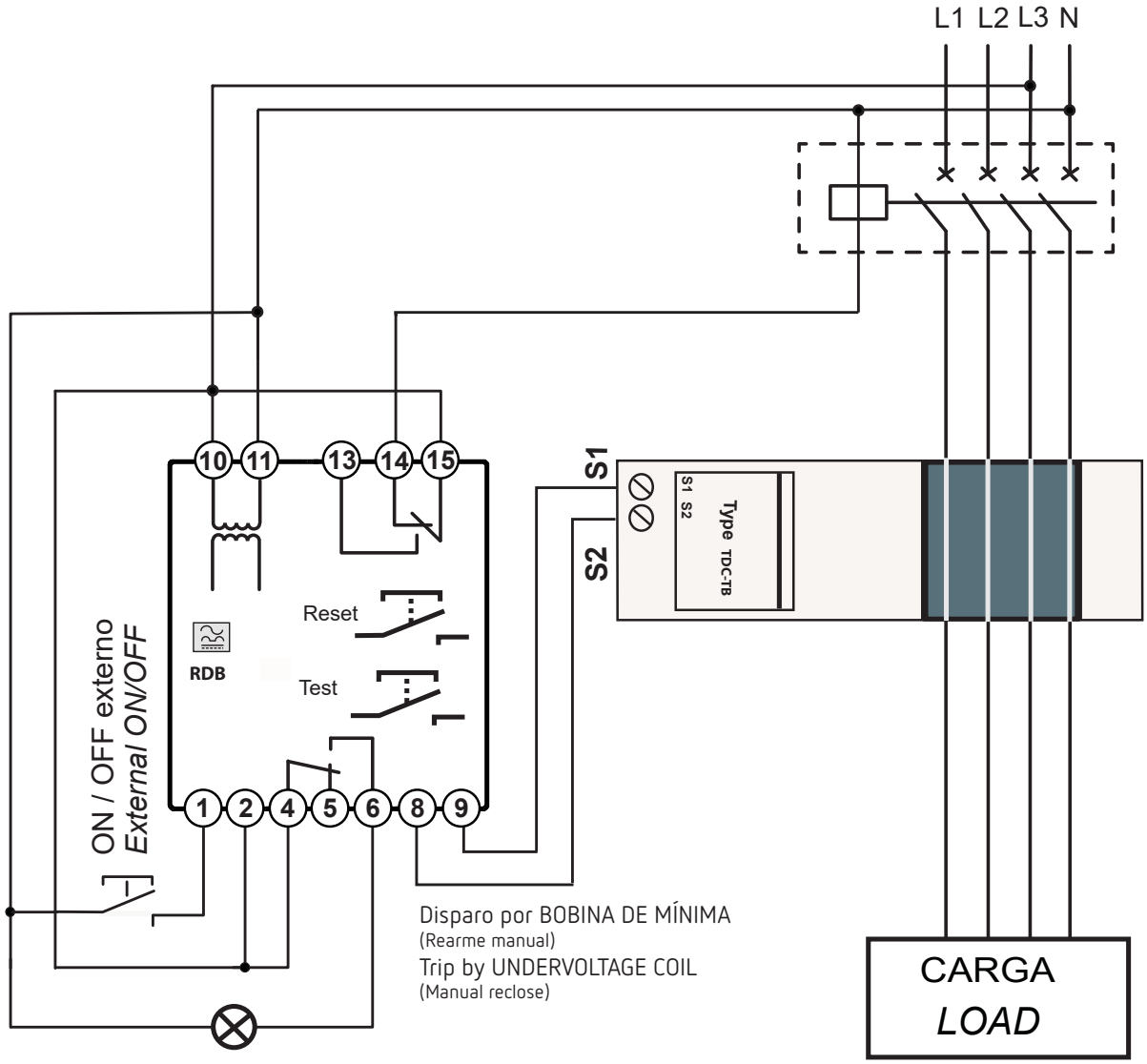


Figure 5: RDB: Trip by undervoltage coil.

4.- OPERATION

4.1.- GENERAL DESCRIPTION

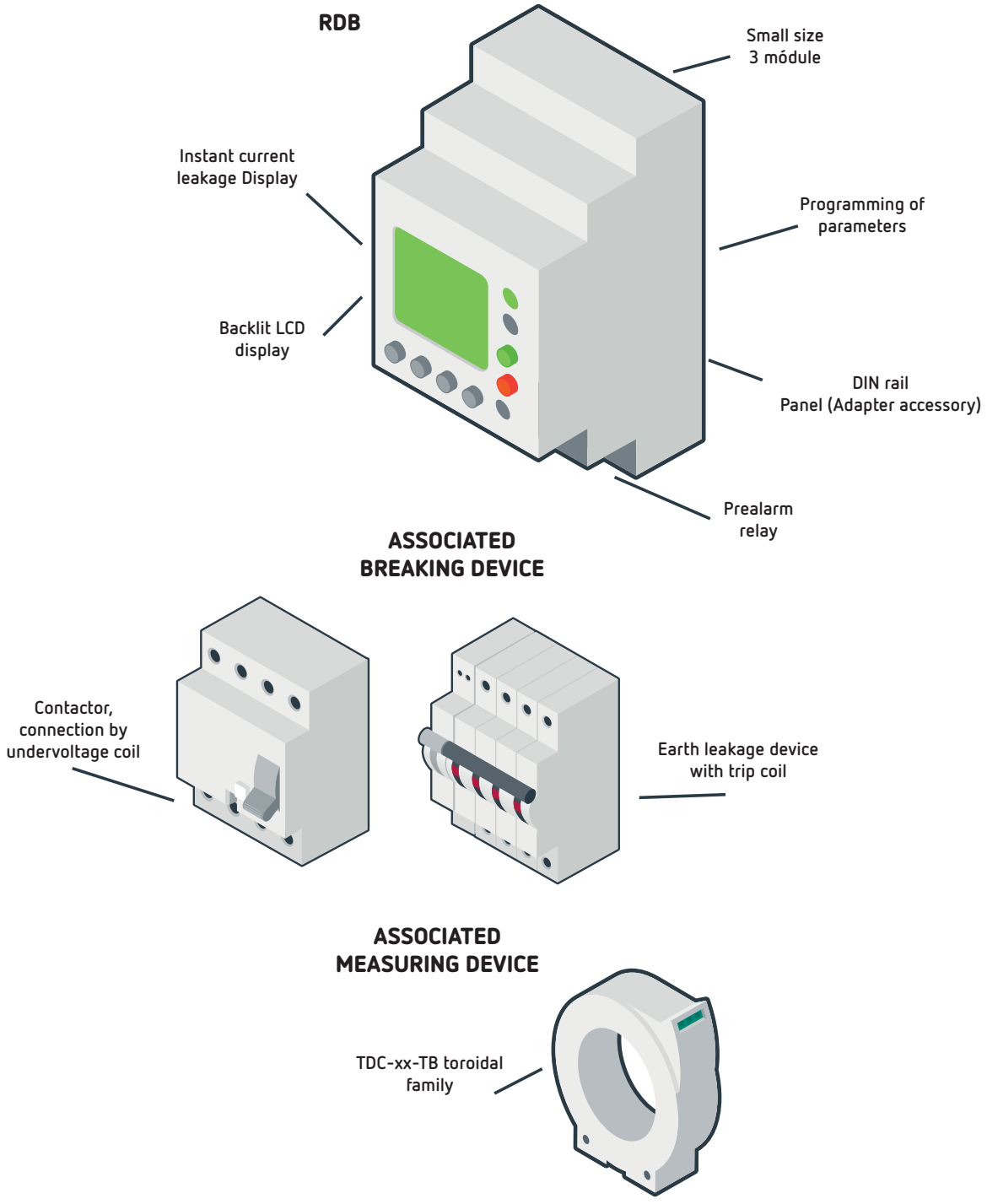


Figure 6: General description.

4.2.- DESCRIPTION OF THE DEVICE

The front of the equipment which is formed by the display, buttons and LEDs, is protected with a sealable plastic cover which has the appropriate holes to access the **RESET**, **TEST** and **PROG/PAG** keys.

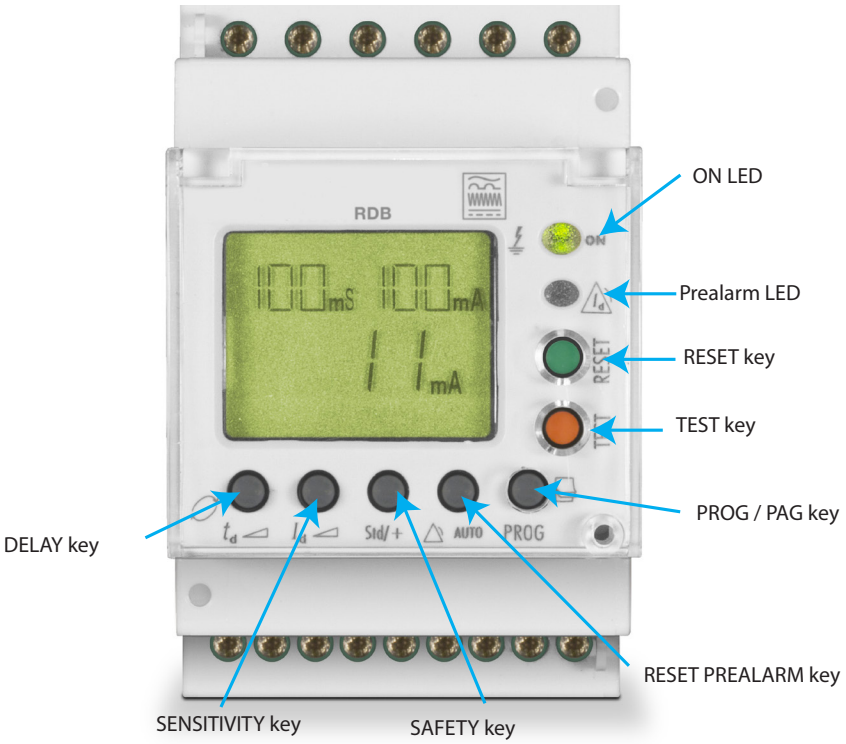


Figure 7: Description LEDs and button.

4.3.- LEDs INDICATORS

The device has 2 indicators LEDs, **Figure 7**.

Table 4: LEDs description: ON LED.

ON LED	
State	**Description**
Off	The device is not operating or is not receiving power supply voltage.
Green	The device is operating. It is receiving power supply voltage.
Red	The device has tripped.

Table 5: LEDs description: PREALARM LED.

PREALARM LED	
State	**Description**
Off	There is no pre-alarm trip.
On	Pre-alarm trip without reclosing.
On flashing	Pre-alarm trip in reclosing situation.

4.4.- KEYBOARD FUNCTIONS

The device has 7 keys, **Figure 7**.

1.- Keys accessible with sealed cover and tool

✓ **RESET**, Starts the device after a trip.

✓ **TEST**, Carries out a trip to check the proper operation of the relay.

✓ **PROG/PAG**, Access to prealarm programming.

2.- Access to prealarm programming

Keys with dual function. With a long press, the device is entered to set the values. With a short press, the option within a series of values defined in the device is selected.

✓ **SENSITIVITY (Id)**, It allows to choose between the values of 100, 300, 500 mA , 1 and 3 A

✓ **DELAY (td)**, It allows to choose between the values of 100, 200, 300, 400, 500, 750 ms and 1 s.

3.- Keys accessible with sealed cover and tool

Flush buttons.

✓ **SAFETY (Std/+)**, This allows the output contacts polarity to be set for both the main relay and the prealarm.
- With normal safety (Std) the relay is activated with a fault, the status is NO.
- With positive safety (+) the relay is activated on supplying the device and is deactivated with the fault, the status is NC.

✓**RESET PREALARM (AUTO)**,This allows the automatic re-establishment of the prealarm signal to be enabled.
- In Automatic Mode (REC), if the detected leakage current is below the preset prealarm threshold, the relay becomes de-activated.
- In manual mode, the device has to be RESET from the alarm screen in order to re-establish the prealarm system.

4.5.- DISPLAY

The device has a backlit display with **green** or **red** light, depending on the state of the device.

The background to the screen in normal mode is **green**. The parameters required for earth leakage protection, sensitivity and delay in its associated units are displayed. It also displays the current leakage current.

If the device trips through any event, the screen's background changes to **red** and the reason for the trip is displayed.

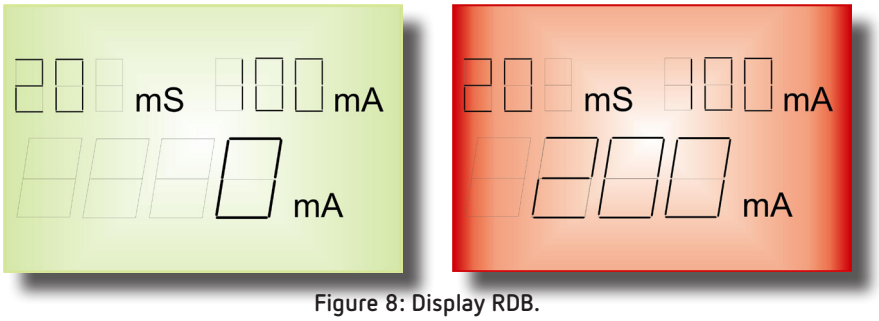


Figure 8: Display RDB.

Display messages by device trip, **Table 6**.

Table 6: Display messages by device trip.

Message	Cause of trip
TESt	Test
EXT	Remote signal ON/OFF
ALAR	Trip of a leakage current

Other display messages, **Table 7**.

Table 7: Other display messages.

Message	Description
SAVE	Validate configuration values
EXIT	Exits programming mode
ERRt	Poor toroid connection
OVR	Current leakage reading off scale

4.6.- OPERATION

When the device is powered at its rated voltage, the green LED **ON** the front is on, the backlit LCD is green indicating the software and hardware version. After a short while, the version disappears and the default display values appear on the display.

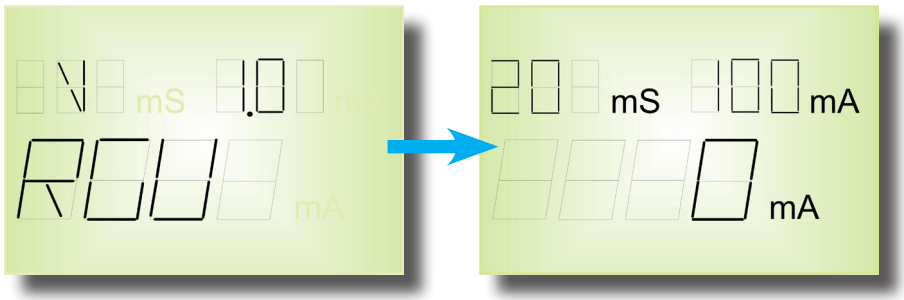


Figure 9:Initial screens.

The display shows the delay and sensitivity settings as well as the instant leakage current reading.

While the device is operating, the display shows the following symbols while the device is being programmed and set, **Figure 10**.

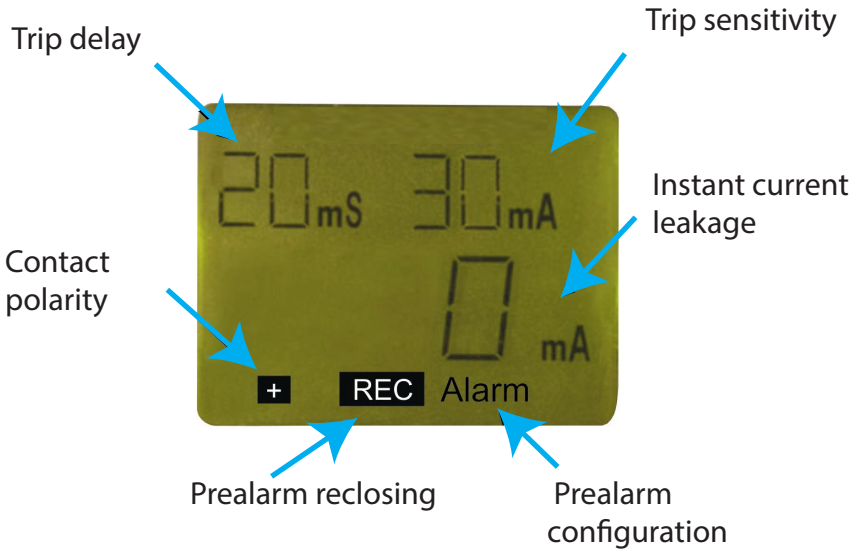


Figure 10: Descripción display.

In normal operating status the display shows the following parameters associated with the earth leakage protection, **Table 8.**

Table 8: Parameters visible by display.

Parameter	Units
Instant current leakage	mA / A
Programmed trip delay, td	ms / s
Programmed sensitivity of trip, Id = IΔN	mA / A
Contact status: Tripping relay	+ (contact 13-15 NO) / nothing (contact 13 - 15 NC) + (contact 14-15 NC) / nothing (contact 16 - 15 NO)

The **RDB** allow the display and setting of all required parameters to complete the earth leakage protection adjustment with prealarm, **Table 9**.

Table 9: Adjustment parameters.

Parameter	Units
Programmed prealarm trip delay	ms / s
Sensitivity of pre-alarm in % IΔN	%
Contact status: Prealarm relay	+ (contact 4-6 NO) / nothing (contact 4 - 6 NC) + (contact 4-5 NC) / nothing (contact 4 - 5 NO)
Operating frequency	Hz

4.7.- TROUBLESHOOTING OR REASONS FOR TRIPPING

4.7.1.- POOR TOROID CONNECTION ALARM

After a certain time the device will carry out a test to detect the presence of the sensor or associated earth leakage transformer.
Also the "**ERRt"** error message will permanently appear on the **RDB** display.

A short-circuit in the transformer secondary will also be detected as an error.

When this error is detected, the correct connection with the earth leakage transformer has to be ensured and a **RESET** made to re-establish proper working. If the transformer is detected again, normal status is returned and the error message disappears.

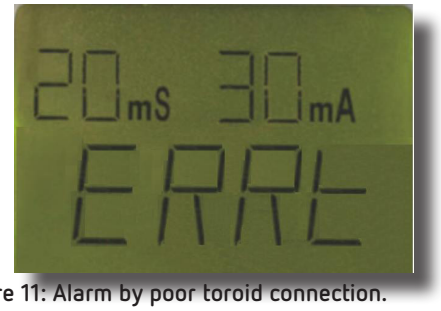


Figure 11: Alarm by poor toroid connection.

4.7.2.- PREALARM TRIP

In the event of the defaults current exceeding the programmed prealarm threshold, the yellow LED will come on, the green backlit LCD will show the leakage level and the prealarm output relay will be activated.
In automatic mode (**REC**) when the prealarm situation is removed, normal status is resumed (LED and signal relay).
In manual mode, the device has to be **RESET** to unblock the prealarm.

4.7.3.- TRIP BY LEAKAGE CURRENT

When the leakage current exceeds the value programmed in the trip relay, the red and yellow LEDs remain on and the LCD backlit in red with the message ALARM. To reconnect press **RESET** to return to the initial status.

4.7.4.- REMOTE TRIP

When a trip is forced (input terminals **1-2**, by applying **230 Vac**) the device is tripped and disabled and an "**EXT**" message is shown on the display in red and also the LED is on. It has to remain permanently in this situation until the change in status no longer exists. It is not possible to manually reset or reset using communications.

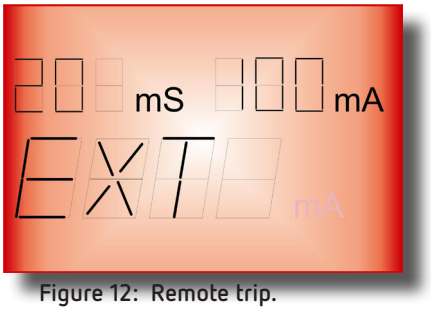


Figure 12: Remote trip.

When it is remotely reset (input terminals **1-2**, removing the **230 Vac**) the device is reconnected with the display backlit in green, LED **ON** in green as in normal status.

5.- CONFIGURATION

5.1.- ADIRECT SETTING

By pressing for a long time on any of the direct setting buttons, **Configuration** mode is entered and the relay's setting may be changed.
While in **Configuration** mode if any other direct function is used (**Id, td, Std/+** y **Auto**), the parameter for the displayed relay can also be set.

Configuration mode is exited if no buttons are pressed for a while with the last setting being "**SAVE**".

5.1.1.- SETTING THE SENSITIVITY TRIP

Pressing **Id** for more than one second, **Configuration** appears and a setting from the list is increased with every press. The current setting is seen in small figures and the new setting in the main figures.

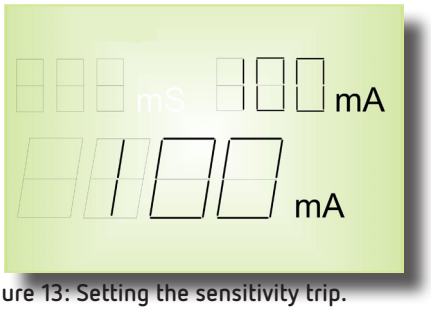


Figure 13: Setting the sensitivity trip.

Possible setting values are: **100 mA, 300 mA, 500 mA, 1 A, and 3 A**.

5.1.2.- DELAY SETTING AND MAIN RELAY CURVE

Pressing **td** for more than one second, **Configuration** appears and a setting from the list including curve types is increased with every press.
The current setting is seen in small figures and the new setting in the main figures.

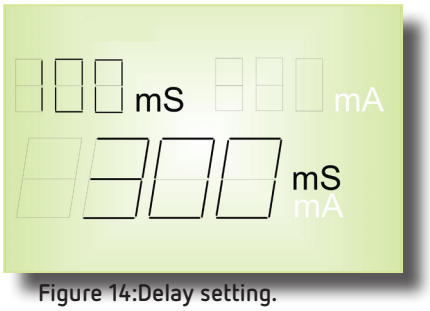


Figure 14:Delay setting.

Possible setting values are: **100, 200, 300, 400, 500, 750 ms, 1, 5** and **10 s.**

5.1.3.- POSITIVE SECURITY SETTING OF THE MAIN RELAY

"**Std"**, contacts are on standby, terminals 14 - 15 (NC) and 13 - 15 (NO).
"**+**", contacts change status on powering the device, the **+** sign is displayed. Terminals 14 -15 (NO) and 13 -15 (NC).

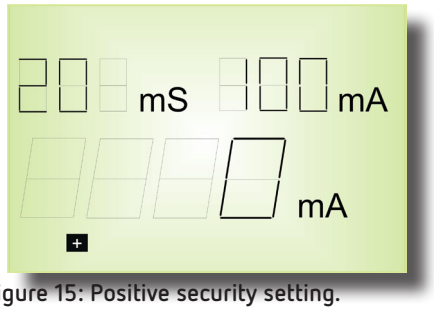


Figure 15: Positive security setting.

5.1.4.- SETTING THE PREALARM RELAY

The **PROG/PAG** key control the prealarm relay and main relay settings.

If the button is pressed for a short time the prealarm setting is entered. "**Alarm**" appears on the display. Also the prealarm threshold appears as a % of the sensitivity setting and the prealarm delay. To exit press **PROG**.

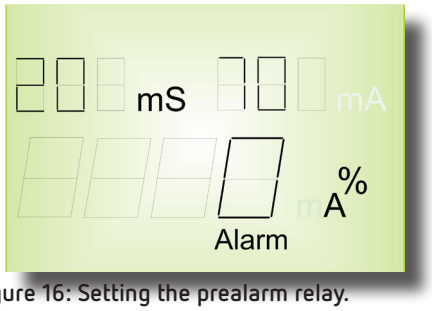


Figure 16: Setting the prealarm relay.

5.1.4.1.- Setting of the prealarm current

This is in terms of the program value in the main relay. Pressing **Id** enters to change the value. Relative values are shown as a % of the present trip current. Pressing **Id** changes the values: **OFF, 50, 60, 70, 80 a**nd **MAIN.**
Where:

OFF: prealarm disabled
MAIN: the prealarm continues to trip the main channel.

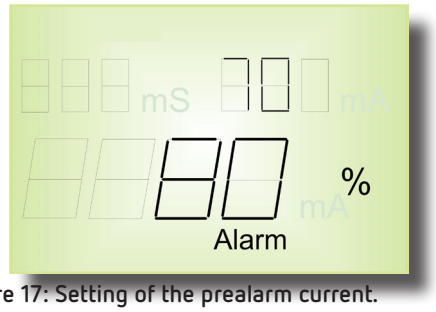


Figure 17: Setting of the prealarm current.

5.1.4.2.- Prealarm time setting

This is in terms of the program value in the main relay. Pressing **td** enters to change the values. Pressing **td** changes the values: **100, 200, 300, 400, 500, 750 ms, 1, 5** and **10 s.**

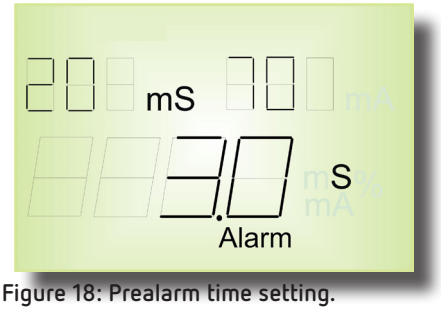


Figure 18: Prealarm time setting.

5.1.4.3.- Prealarm positive safety setting

"**Std**", contacts are on standby. Terminal: 4 - 5 (NC) and 4 - 6 (NO).
"**+**", contacts change status on powering the device, the **+** sign is displayed. Terminals: 4 – 5 (NO) and 4 – 6 (NC).

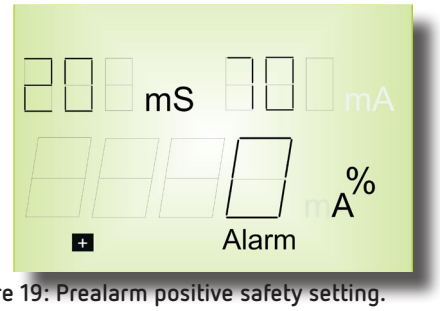


Figure 19: Prealarm positive safety setting.

5.1.4.4.- Reset prealarm setting

In the prealarm menu the **REC** function is shown as disabled or enabled. **REC** appears on the display when it is enabled.

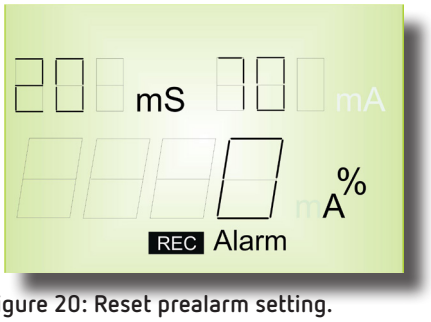


Figure 20: Reset prealarm setting.

6.- TECHNICAL FEATURES

Power supply AC [1]	
Rated voltage	230 V ~ ± 20%
Frequency	50 - 60 Hz
Consumption	6 VA
Installation category	CAT III 300 V

Power supply DC [1]	
Rated voltage	24 ... 125 V ± 20% ⎓
Consumption	4 W
CInstallation category	CAT III 300 V

[1] Depending on model

Monitoring features	
Sensitivity	0.1, 0.3, 0.5, 1, 3 A
Tripping delay	0.1, 0.2, 0.3, 0.4, 0.5, 0.75, 1, 5, 10 s

Relay output	
Quantity	2
Type	Electronic class B
Rated voltage	250 V ~
Maximum switching voltage	400 V ~
Rated current	10 A ~
Instantaneous maximum current	15 A ~
Rated load in AC1	2500 VA

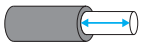
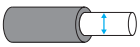
External trip / Reclose input	
Type	Optocoupled
Maximum voltage	230 V ± 20% ~
Maximum consumption	0.7 W

Type of transformer to use	
Sensitivity (IΔn)	Transformer
≥ 100 mA	TDC-20 TB, TDC-25 TB, TDC-35 TB
≥ 300 mA	TDC-55 TB
≥ 500 mA	TDC-80 TB, TDC-110 TB, TDC-140 TB, TDC-180 TB

Alarm range according to leakage current measured			
Current		Lower limit	Upper limit
Type AC (sine)		0.8 x **Idn**	1 x **Idn**
Type A	Sine half wave		1.4 x **Idn**
	Sin half wave phase controlled (90°- 135°)		
Type B	Smooth DC current		1.7 x **Idn**
	Sine current at 150 Hz		1 x **Idn**
	Sine current at 400 Hz		
	Sine current at 1000 Hz	1 x **Idn**	1.3 x **Idn**

User interface	
Display	LCD
Keyboard	7 keys
LED	2 LEDs

Environmental features	
Operating temperature	-10°C ... +50°C
Storage temperature	-20°C ... +55°C
Humidity (without condensation)	5 ... 95%
Maximum altitude	2000 m
Protection degree	Assembled device: IP41 (Front) Unmounted device: IP20 (Sides and back cover)

Mechanical features				
Dimensions		Figure 21		
Weight		168 g.		
Enclosure		V0 Polycarbonate plastic		
Fixing		DIN Rail - Panel by accessory		
Terminals				
	7 mm	0.127 ... 2.082 mm^2	0.5 ... 0.6 Nm	Bar 0.4x2.5x80 mm Length: 160 mm

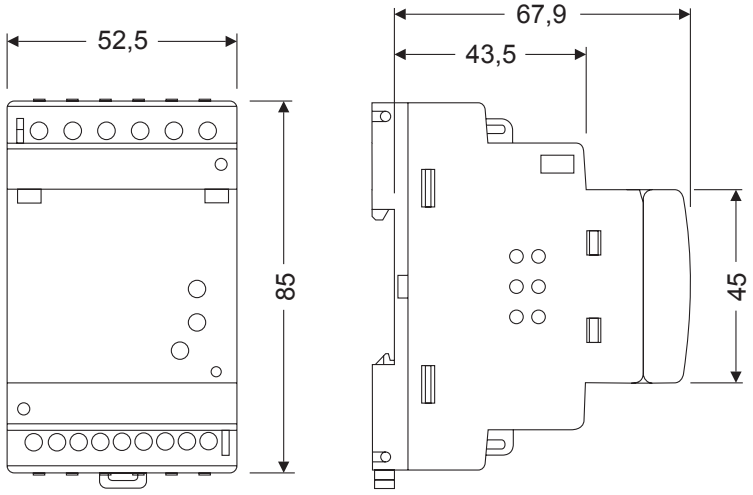


Figure 21: RDB Dimensions.

Standars	
Low-voltage switchgear and controlgear - Part 2: Circuit-breakers	UNE-EN 60947-2-M
General requirements for residual current operated protective devices	IEC 60755

7.- 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

8.- WARRANTY

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.

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