REACTIVE ENERGY REGULATOR

Computer PV 12

INSTRUCTION MANUAL

(M505B01-03-26A)

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 device may result in injury to personnel as well as damage to the device. 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 device. Follow all installation and maintenance instructions throughout the device's working life. Pay special attention to the installation standards of the National Electrical Code.

Refer to the instruction manual before using the device

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 device and / or installations.

CIRCUTOR S.A.U. reserves the right to modify features or the product manual without prior notification.

DISCLAIMER

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

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

www.circutor.com

CIRCUTOR S.A.U. recommends using the original cables and accessories that are supplied with the device.

COMMITMENT TO TRANSPARENCY AND DATA ACCESS (Data Act)

Commitment to Transparency and Data Access (Data Act)

CIRCUTOR maintains a firm commitment to transparency and equitable access to the data generated by its connected electronic devices and related services. In compliance with **Regulation (EU) 2023/2854 (Data Act)**, the company makes available to its customers the relevant information regarding the data generated through the use of such products and services, under the terms established by the applicable regulations.

What data are generated?

CIRCUTOR's connected devices may collect and generate technical and operational data, such as:

- Operating and measurement parameters of the devices, including electrical quantities (energy, power, voltage, current, among others) and thermal variables;
- Device operating states;
- System events, including electrical events and power quality events;
- Device operation logs;
- Number of switching operations and device operating time.

These data do not generally include personal information, which is processed in accordance with the **General Data Protection Regulation** (**GDPR**) and **CIRCUTOR**'s Privacy Policy.

How to access and share these data?

Customers may directly access the generated data or request their download, provision, or transfer to authorised third parties through the following channels:

- Email: **data-act@circutor.com**
- Standard communication interfaces (such as REST APIs in different formats, industrial protocols, or messaging services);
- Download mechanisms via web platforms or interfaces integrated into the device itself;
- Remote communications through protocols such as OCPP, MQTT, or IEC 60870-5-102.

The available access and communication options will depend on the product. For detailed information on the supported protocols, interfaces, and access methods, please refer to the communications section of this manual.

For further information on formats, security measures, access conditions, and procedures, please consult:

https://circutor.com/en/company/commitment/eu-data-act/

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REVISION LOG

Table 1: Revision Log.

Date	Revision	Description
06/26	M505B01-03-26A	Initial version

SYMBOLS

Table 2: Symbols.

Symbol	Description
CE	Complies with the relevant European directive.
	Device subject to European Directive 2012/19/EU. At the end of its service life, do not dispose of the device with household waste. Comply with local regulations on the recycling of electronic devices.
⎓	Direct current.
~	Alternating current.
⧈	Double insulation.

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

1.- CHECKS ON RECEIPT

On receipt of the device, check the following:

a) The device matches the specifications stated in your order.
b) The device has not been damaged during transport.
c) Check that the specifications shown on the device label are suitable for the network to which it is to be connected (supply voltage and frequency, measurement range, etc.).
d) Carry out an external visual inspection of the device before connecting it.
e) Check that it is supplied with:
- An installation guide.
- 4 rear mounting clips.

If you identify any problem on receipt, immediately contact the carrier and/or **CIRCUTOR's** after-sales service.

2.- PRODUCT DESCRIPTION

The **Computer PV 12** is a reactive energy regulator designed for photovoltaic applications and for systems in which currents from different energy sources must be combined.
The device measures the grid cos φ and controls the connection and disconnection of capacitors to correct it. It also calculates and displays the main electrical parameters in single-phase and balanced three-phase networks. Measurements are taken as true RMS values using four AC voltage inputs, three independent current inputs and one leakage-current measurement input.

The **Computer PV 12** has twelve output relays.

The device features:

- **5 keys** for navigating between screens and programming the device.
- **4 indicator LEDs.**
- An **LCD for displaying** all parameters.
- **2 digital inputs** for selecting the target cos φ (4 target cos φ values).
- **2 digital outputs and 1 relay output**, all fully programmable for use as alarms.
- **1 relay output** specific for the fan.
- **12 output relays** for regulating cos φ by switching capacitors.
- **RS-485** communications using MODBUS RTU©.

3.- DEVICE INSTALLATION

3.1.- PRELIMINARY RECOMMENDATIONS

For safe use of the device, anyone handling it must comply with the safety regulations applicable in the country of use, wear the required personal protective equipment and observe all warnings in this instruction manual.

The **Computer PV 12** must be installed by authorised and qualified personnel.

Before handling the device, modifying its wiring or replacing it, disconnect the power supply and the measurement circuits. Handling the device while it is connected poses a risk to personnel.

The cables must be maintained in good condition to prevent accidents, personal injury or damage to the installation.

The manufacturer shall not be held liable for any damage resulting from failure by the user or installer to observe the warnings and/or recommendations in this manual, or from the use of non-original or third-party products or accessories.

If a fault or malfunction is detected, do not use the device for measurements.

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

Before carrying out any maintenance or repairs, or handling any of the device connections, disconnect the device from all power sources, including its own power supply and the measurement circuits.
If you suspect a malfunction of the device, contact the after-sales service.

3.2.- INSTALLATION

The **Computer PV 12** regulator is connected to devices containing capacitors that remain charged after the power supply has been disconnected. To avoid the risk of electric shock, **wait at least 5 minutes** after disconnecting the device before handling its internal components.
Handling or using the device in any way other than that specified by the manufacturer may compromise user safety.

Before connecting the devices, ensure that the earth connections have been made correctly. An incorrect earth connection may cause the device to malfunction and poses a risk of electric shock to the user or anyone handling it.

If the device is connected under no-load conditions, resonances may occur, causing voltage harmonics to be amplified and potentially damaging the compensation device and other devices connected to the network.

To ensure safe use of the **Computer PV 12**, anyone installing or handling it must follow the standard safety procedures for low voltage (LV) or medium voltage (MV) electrical installations, as applicable, and observe all warnings in this instruction manual.

The device is panel-mounted (panel cut-out: 138+1 x 138+1 mm, in accordance with DIN IEC 61554). All connections are located inside the electrical enclosure.

> When the device is connected, the terminals and any parts exposed by opening covers or removing components may be hazardous to touch. The device must not be used until installation is complete.

The device must be connected to a power supply circuit protected by gL-type fuses (IEC 60269) or class M fuses rated between 0.5 and 2 A. A circuit breaker or equivalent device must also be provided to disconnect the device from the mains supply.

For current measurement, the installation of 1, 2, or 3 external current transformers (CTs) is required. The transformation ratio of these CTs is normally **In/5 A** or **In/1 A**, where **In** must be at least 1.5 times the maximum total load current.

The current transformer for **ES1, ES2 or ES3** (Energy Source 1, 2 or 3) must be installed at a point in the supply line through which the total current drawn by the loads to be compensated and the capacitors flows. (**Figure 1**).

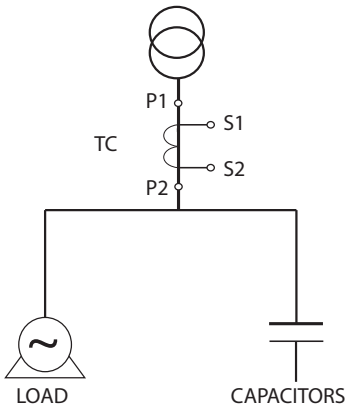
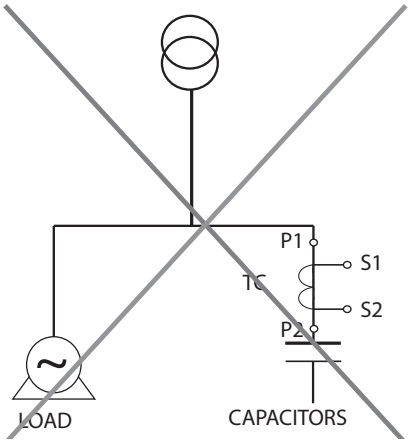
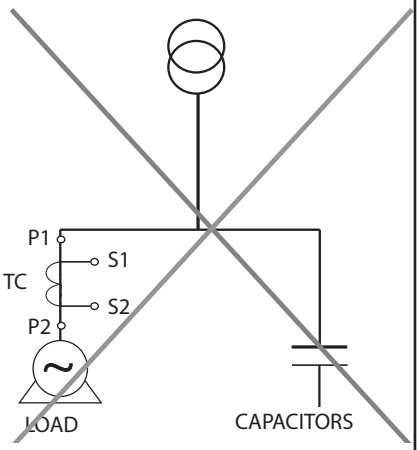
CORRECT	INCORRECT	
		
The current transformers of the **ES1** must measure the current together with the capacitors plus the loads. **If it does not work, check that the CTs are not short-circuited.**	If the CT is connected in this position, NONE OF THE CAPACITORS WILL BE CONNECTED, even if there are inductive loads. **The device does not compensate.**	If the CT is connected in this position ALL THE CAPACITORS WILL BE CONNECTED, but they will not be disconnected if the load drops. **Risk of over-compensation in the network with no load.**

Figure 1: Current transformer locations.

Only one CT is required per Energy Source for three-phase measurement.

The **Computer PV 12** may only be used in installations where the cos φ of the energy sources whose currents are to be summed is equal or close to unity (cos φ ≈ 1); see **Figure 2.**

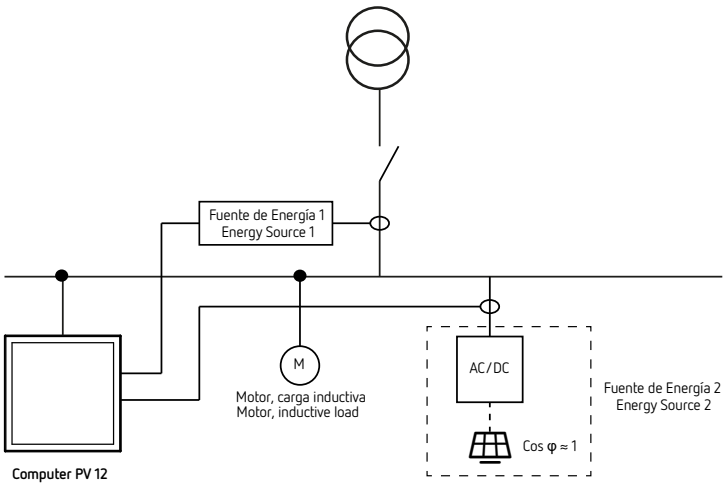


Figure 2: Computer PV 12 installation A.

In installations configured as shown in **Figure 3**, if the utility meter displays an incorrect reading even though the capacitor bank is operating correctly, the **Computer PV 12** cannot correct the issue. In this case, contact **CIRCUTOR**'s technical support team for assessment and technical assistance.

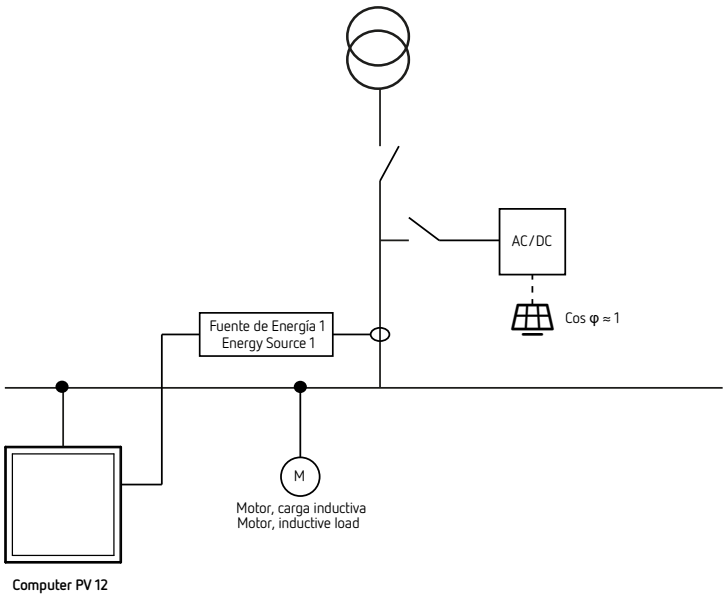


Figure 3: Computer PV 12 installation B.

3.3.- DEVICE TERMINALS

Table 3: Computer PV 12 terminal assignments.

Computer PV 12 terminal assignments	
1: A1, Power supply	**22: R7,** Relay Output 7
2: A2, Power supply	**23: R8,** Relay Output 8
3: $V_{L1,}$ Voltage Input L1	**24: R9,** Relay Output 9
4: $V_{L2,}$ Voltage Input L2	**25: R10,** Relay Output 10
5: $V_{L3,}$ Voltage Input L3	**26: R11,** Relay Output 11
6: $V_{LN,}$ Neutral voltage input	**27: R12,** Relay Output 12
7: S1, Input current from the **ES1** energy source	**28: A+**, RS-485 Communications
8: S2, Input current from the **ES1** energy source	**29: B-**, RS-485 Communications
9: S1, Input current from the **ES2** energy source	**30: S**, GND for communications RS-485
10: S2, Input current from the **ES2** energy source	**31: 1**, Digital input 1
11: S1, Input current from the **ES3** energy source	**32: 1**, Digital input 2
12: S2, Input current from the **ES3** energy source	**33: C**, Common of the digital inputs
13: S1, Leakage current input	**34: 1**, Digital output 1
14: S2, Leakage current input	**35: 2**, Digital output 2
15: COM, Common of relay outputs	**36: C,** Common of digital outputs
16: R1, Relay Output 1	**37:** Fan Relay Output (NO)
17: R2, Relay Output 2	**38:** Fan Relay Output (Common)
18: R3, Relay Output 3	**39: NC**, Alarm Relay Output (NC)
19: R4, Relay Output 4	**40: C**, Alarm Relay Output (Common)
20: R5, Relay Output 5	**41: NO**, Alarm Relay Output (NO)
21: R6, Relay Output 6	

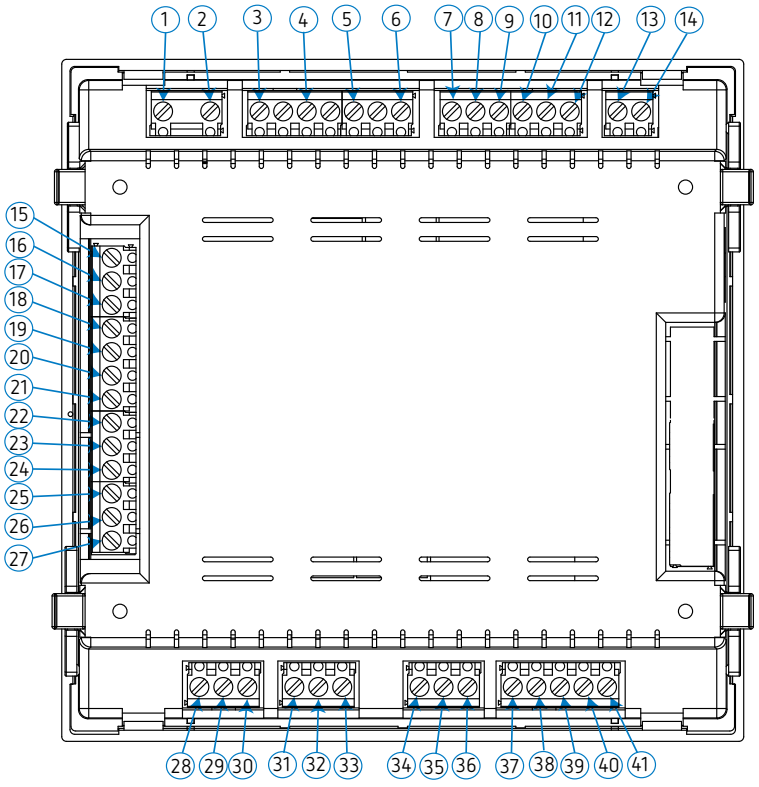


Figure 4: Terminals Computer PV 12.

3.4.- WIRING DIAGRAM

3.4.1.- 3 VOLTAGES + NEUTRAL AND 1, 2 OR 3 ENERGY SOURCES (ES)

Connection type: 3U.3C, 3U.2C and 3U. 1C

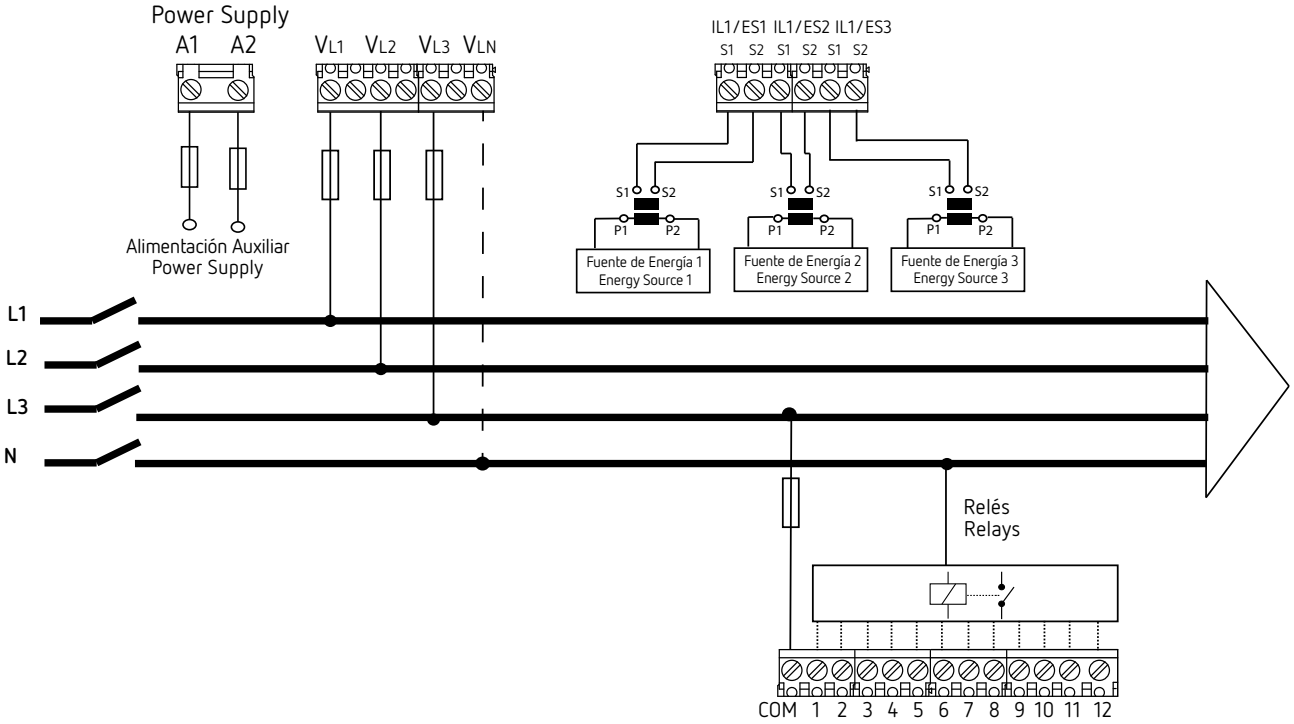


Figure 5: 3 voltages + neutral and 1, 2 or 3 energy sources (ES).

Note: *If the specified connection method is not followed, the phase must be adjusted using the procedure described in Section* ***"6.8.- PHASE CONNECTION"****.*

Note: *With this connection type, connection of the neutral conductor to* V_{LN} *is not required.*

Single-phase current measurements at different points in the installation must be taken on the same phase.

3.4.2.- 2 VOLTAGES AND 1, 2 OR 3 ENERGY SOURCES (ES)

Connection type: 2U.3C, 2U.2C and 2U. 1C

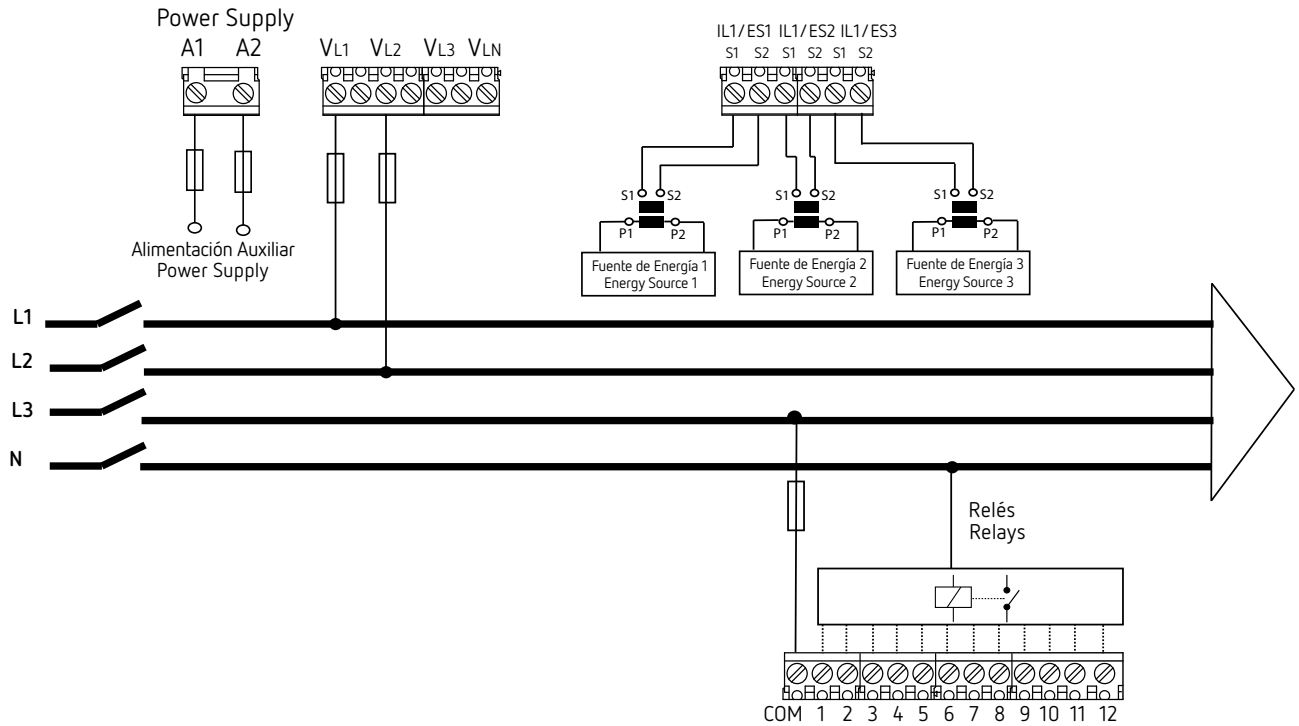


Figure 6: 2 voltages and 1, 2 or 3 energy sources (ES).

Note: *If the specified connection method is not followed, the phase must be adjusted using the procedure described in Section* ***"6.8.- PHASE CONNECTION"****.*

Note: *With this connection type, the neutral connection is not required.*

Single-phase current measurements at different points in the installation must be taken on the same phase.

3.4.3.- LEAKAGE CURRENT CONNECTION, I∆

A **WGS**-type differential transformer is required to measure the leakage current.
The leakage current transformer must be positioned so that it measures the current of the capacitor bank. This makes it possible to detect leakage current from any of the capacitors in the bank.

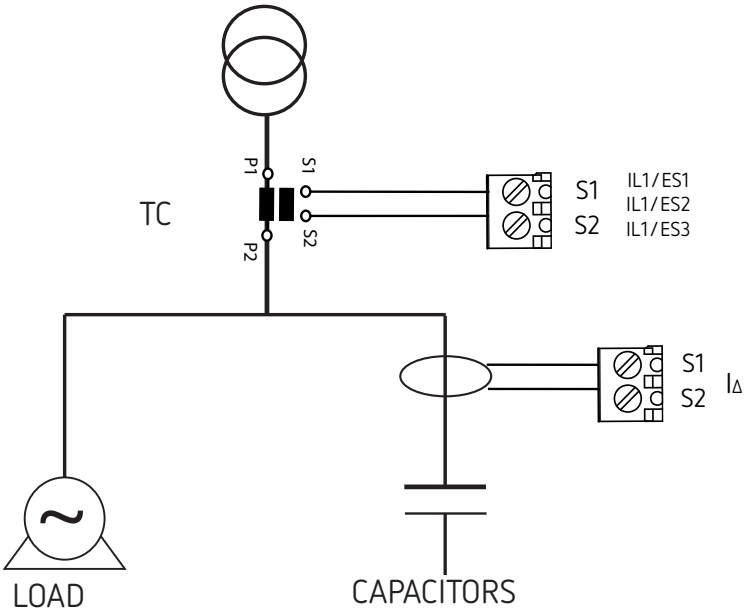


Figure 7: Connection of the leakage current transformer (I∆).

Note: *The differential transformer must have 500 turns. The maximum leakage current that the device can correctly measure is 1.5 A AC, although the maximum input current through the differential transformer is 5 A AC.*

Do not handle the leakage current transformer with the **Computer PV 12** powered on.

4.- OPERATION

4.1.- OPERATING PRINCIPLE

The **Computer PV 12** is a reactive energy regulator. It measures the grid cos φ and controls the connection and disconnection of capacitors via its relays to correct it.
The device provides four-quadrant regulator, as shown in **Figure 8**.

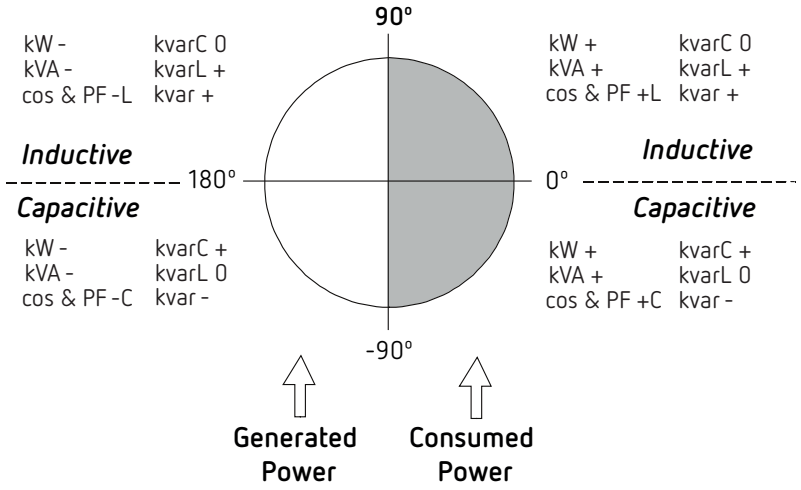


Figure 8: Measurement and compensation in all four quadrants.

In addition to the basic functions of a reactive energy regulator, the **Computer PV 12** provides the following features:

✓ Network analyser functions, including the measurement and display of multiple parameters.
✓ **Plug&Play** function for automatic device configuration.
✓ **AutoTest** and **Manual Test** functions for checking the condition of the capacitors in the battery.
✓ FCP system, which minimises the number of relay switching operations.
✓ Ability to force individual steps.
✓ Support for different connection types.
✓ Leakage current measurement, with the option to associate an alarm and locate and disconnect the faulty capacitor.
✓ Multiple alarms to warn of potential faults in both the capacitor bank and the installation.

4.2.- DEFINITIONS

This section provides some definitions that may be useful for understanding the operation of the device.

4.2.1.- FOUR-QUADRANT REGULATOR

This term means that the regulator can measure and regulate both when active power flows from the mains to the loads (the usual case in a consuming installation) and when it flows from the loads to the mains (in installations that include generators and therefore allow energy both to be consumed and exported or sold).

4.2.2.- STAGES AND STEPS

A distinction must be made between stages and steps. In this manual, a **stage** is each capacitor group into which a reactive power compensation device is divided. These stages may have different power ratings, normally in ratios of 1:1, 1:2, 1:2:4, etc.

A **step** is each increment of the total power, based on the power of the first step, that can be controlled using stages with different power ratings.

4.2.3.- FCP SYSTEM (FAST COMPUTERISED PROGRAM)

This system controls the stage connection sequence to achieve the required final power while minimising the number of switching operations and balancing the operating times of the different stages. For stages with the same power rating, the stage that has been disconnected for the longest time is connected when power is required, while the stage that has been connected for the longest time is disconnected when there is excess power.

4.2.4.- REGULATION PROGRAM

The power ratings of the different groups or stages usually follow certain patterns called "Programs".

The Program indicates the power ratio between the different stages. The most frequent Programs are:

Program 1.1.1.1. All stages have the same power rating. ***For example,*** *a 100 kvar device with 5 steps would comprise five identical 20 kvar stages and would be described as a (5 x 20) kvar device.*

Program 1.2.2.2. All stages from the second onwards have twice the power rating of the first stage. ***For example***, *a 180 kvar device with 5 stages would comprise one 20 kvar stage and four identical 40 kvar stages and would be described as a (20 + 4 x 40) kvar device.*

Program 1.2.4.4. The second stage has twice the power rating of the first, while all stages from the third onwards have four times the power rating of the first. ***For example***, *a 300 kvar device with 5 stages would comprise one 20 kvar stage, one 40 kvar stage and three identical 80 kvar stages and would be described as a (20 + 40 + 3 x 80) kvar device.*

Other Programs. Other Programs may be used, such as 1.2.2.4, 1.2.4.8 and 1.1.2.2. As can be deduced from the preceding examples, the numbers indicate the ratio between the power rating of the first stage, which is assigned a value of 1, and the ratings of the subsequent stages (2 indicates twice the power, 4 indicates four times the power, etc.).

The device supports Programs ranging from 1.1.1.1 to 1.9.9.9.

4.2.5.- PLUG&PLAY

When installing a reactive energy regulator, several parameters must be configured to ensure correct operation. Some of these parameters may be difficult to determine, such as the voltage phases, the correspondence between each measured current and its associated voltage, and the current transformer ratio. The **Computer PV 12** uses an automatic process to determine the required parameters, including:

- ✓***Connection type:*** detects which of the following connection types is in use: 3U.3C , 3U.2C , 3U. 1C

, 2U.3C , 2U.2C and 2U. 1C .

✓***Phase:*** identifies the correspondence between the connected voltages and currents, irrespective of the connection type detected previously.

✓***Number of stages installed and Program:*** sequentially connects all the stages to determine how many are installed and calculates the Program, i.e. the power ratio between the capacitor stages.

4.2.6.- CONNECTION TIME (Ton) AND RECONNECTION TIME (Trec)

The **connection time**,**Ton**, is the minimum interval between changes in the state of the stages, i.e. between connection and disconnection operations. This parameter directly affects the compensation speed and therefore the system's ability to track load changes. If the load changes rapidly, setting a shorter connection time will improve reactive energy compensation.

Conversely, a **Ton** value that is too short will increase the number of switching operations per unit of time and may shorten the service life of the associated components (contactors and capacitors). The **Computer PV 12** includes an individual operation counter for each stage.

The **reconnection time, Trec**, is the minimum interval between the disconnection of a stage and its reconnection. This interval allows the capacitor to discharge sufficiently to prevent overcurrents when it is reconnected.

4.2.7.- HARMONICS AND THD

Non-linear loads, such as rectifiers, inverters, variable-speed drives and furnaces, draw periodic non-sinusoidal currents from the grid. These currents comprise a fundamental frequency component of 50 or 60 Hz, plus a series of superimposed currents with frequencies that are multiples of the fundamental, known as harmonics. This distorts the current and consequently the voltage, resulting in adverse effects such as overloading of conductors, electrical machines and circuit breakers, phase imbalance, interference with electronic devices and tripping of residual current devices.

The harmonic content is usually quantified using total harmonic distortion (THD), which is the ratio, normally expressed as a percentage, between the RMS value of the harmonic content and the RMS value of the fundamental component.

4.3.- MEASUREMENT PARAMETERS

The device displays the following electrical parameters:

4.3.1.- CONNECTION TYPE: 3U.3C, 3U.2C AND 3U. 1C

Table 4: Measurement parameters (3U.3C, 3U.2C and 3U. 1C connection types).

Parameter	Units	Phases L1-L2-L3		III	Max(1)	Min(2)
Phase-to-neutral voltage	V	✓		✓	✓	✓
Phase-to-phase voltage	V	✓		✓	✓	✓
Frequency	Hz	✓(L1)			✓	✓
Voltage THD %	% THD V	✓			✓	
Voltage harmonic decomposition (up to 17th harmonic)	harm V	✓			✓	
Parameter	**Units**	**ES1-ES2-ES3**	**N**	**Total**	**Max(1)**	**Min(2)**
Current	A	✓			✓	✓
Leakage current	mA		✓		✓	✓
Active Power	M/kW	✓		✓	✓	✓
Apparent Power	M/kVA	✓		✓	✓	✓
Total Reactive Power	M/kvar			✓	✓	✓
Inductive Reactive Power	M/kvarL	✓		✓	✓	✓
Capacitive Reactive Power	M/kvarC	✓		✓	✓	✓
Power Factor	PF	✓		✓	✓	✓
cos φ	φ	✓		✓	✓	✓
Current THD %	% THD A	✓			✓	
Current harmonic decomposition (up to 17th harmonic)	harm A	✓			✓	
Active Energy	M/kWh			✓		
Inductive Reactive Energy	M/kvarLh			✓		
Capacitive Reactive Energy	M/kvarCh			✓		
Apparent Energy	M/kVAh			✓		
Temperature	°C			✓		
No. of operations	(x 1000)			✓		
Operating hours	h			✓		
Operating hours since last maintenance	h			✓		

(1) Display of the maximum value.

(2) Display of the minimum value.

4.3.2.- CONNECTION TYPE: 2U.3C, 2U.2C AND 2U. 1C

Table 5: Measurement parameters (Connection 2U.3C, 2U.2C and 2U. 1C connection types).

Parameter	Units	Phases L1-L2		III	Max(3)	Min(4)
Phase-to-phase voltage	V	✓		✓	✓	✓
Frequency	Hz	✓(L1)			✓	✓
Voltage THD %	% THD V	✓			✓	
Voltage harmonic decomposition (up to 17th harmonic)	harm V	✓			✓	
Parameter	**Units**	**ES1-ES2-ES3**	**N**	**Total**	**Max(3)**	**Min(4)**
Current	A	✓			✓	✓
Leakage current	mA		✓		✓	✓
Active Power	M/kW	✓		✓	✓	✓
Apparent Power	M/kVA	✓		✓	✓	✓
Total Reactive Power	M/kvar			✓	✓	✓
Inductive Reactive Power	M/kvarL	✓		✓	✓	✓
Capacitive Reactive Power	M/kvarC	✓		✓	✓	✓
Power Factor	PF	✓		✓	✓	✓
cos φ	φ	✓		✓	✓	✓
Current THD %	% THD A	✓			✓	
Current harmonic decomposition (up to 17th harmonic)	harm A	✓			✓	
Active Energy	M/kWh			✓		
Inductive Reactive Energy	M/kvarLh			✓		
Capacitive Reactive Energy	M/kvarCh			✓		
Apparent Energy	M/kVAh			✓		
Temperature	°C			✓		
No. of operations	(x 1000)			✓		
Operating hours	h			✓		
Operating hours since last maintenance	h			✓		

(3) Display of the maximum value.

(4) Display of the minimum value.

4.4.- KEYBOARD FUNCTIONS

The **Computer PV 12** has five keys for navigating between screens and programming the device.

Key functions on the measurement screens are shown in **Table 6**:

Table 6: Key functions on the measurement screens.

Key	Short press	Long press (3 s)
^	Previous screen.	-
v	Next screen.	-
<	Display the minimum value.	Clear minimum values.
>	Display the maximum value.	Clear maximum values.
≡	Next parameter.	Enter the configuration menu.
^ v	**Very long press (10 s)** Access the Test screens.	

Key functions on the configuration and test screens are shown in **Table 7**:

Table 7: Key functions on the Configuration and Test screens.

Key	Short press	Long press (3 s)
^	Previous screen.	**Test:** Manually connect the selected capacitor.
v	Next screen.	**Test:** Manually disconnect the selected capacitor.
<	Previous parameter.	
>	Next parameter.	
≡	**Configuration:** Enter edit mode. **Test:** Start AutoTest.	**Configuration:** Exit the configuration menu. **Test:** Cancel the AutoTest process
^ v	**Very long press (10 s)** Exit the Test screens	

Note: *View "5.3.- **TEST:** TEST STATES" and "6.- CONFIGURATION" for more details.*

4.5.- DISPLAY

The device features a backlit LCD. The display is divided into four areas, as shown in **Figure 9**:

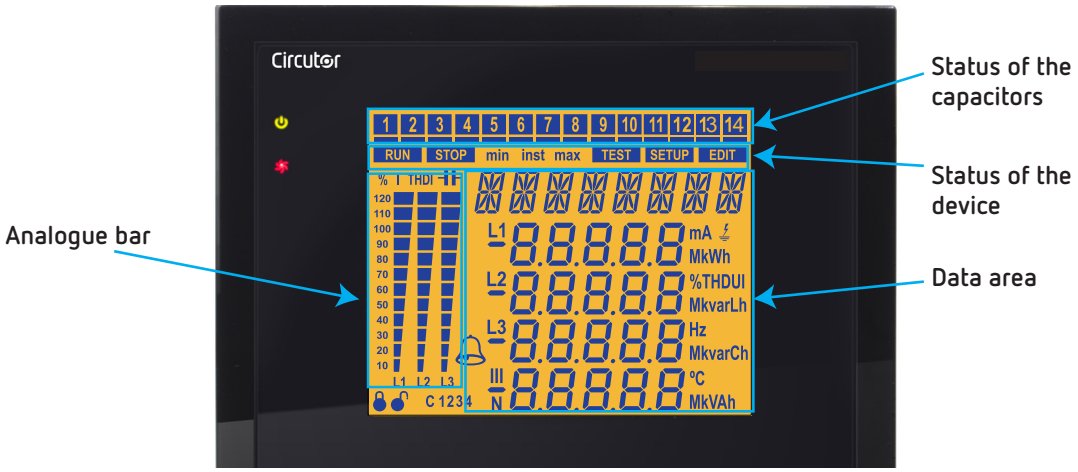


Figure 9: Display areas of the Computer PV 12.

✓ **Data area**, which displays the instantaneous, maximum and minimum values for each phase and energy source measured or calculated by the device.

✓**Capacitor status,** which displays the status of the device relays (see *"4.5.1.- CAPACITOR STATUS"*).

✓**Device status,** which displays the current device status (see *"4.5.2.- DEVICE STATUS"*).

✓**Analogue bar,** which displays the connected power of the capacitor bank (see *"4.5.3.- ANALOGUE BAR"*).

> In electrically noisy environments, the capacitive keypad may register unintended key presses. This does not indicate a device malfunction.

4.5.1.- CAPACITOR STATUS

Figure 10: Capacitor status.

This area displays the status of the device relays (stages) and therefore that of the connected capacitors.

The possible states are:

- ✓ No icon is displayed if the stage is disconnected and configured as AUTO.
- ✓ The icon is displayed 1 if the stage is connected and configured as AUTO.
- ✓ The icon is displayed 1, with a steady bottom bar if the stage is connected and configured as On.
- ✓The icon is displayed 1 ,with a flashing bottom bar if the stage is connected and configured as On nC.
- ✓Only a steady bottom bar is displayed if the stage is disconnected and configured as OFF.

✓Only a flashing bottom bar is displayed if the stage has been disabled by leakage current alarm, E 15.

The stage status is selected in the configuration menu (see ***"6.16.- STAGE STATUS"***). The available options are:

✓ AUtO, the stage status is determined by the switching operations performed by the device.
✓ On, the stage is forced ON and remains connected.
✓ OFF, the stage is forced OFF and remains disconnected.
✓ On nC, the stage is forced ON and remains connected, but the system does not take its connected power into account.

By default, all stages are configured as AUtO.

4.5.2.- DEVICE STATUS

This area uses the icons shown in **Table 8** to indicate the current device status.

Table 8: Device status Icons.

Icon	Description
RUN	The device is in measurement and regulation mode.
STOP	The device is not measuring or regulating.
SETUP	Indicates that the configuration menu is open.
TEST	Indicates that the test menu is open.
EDIT	Indicates that the editing mode is active within the configuration menu.
Inst	Indicates that the instantaneous value is being displayed.
max	Indicates that the maximum value is being displayed.
min	Indicates that the minimum value is being displayed.

4.5.3.- ANALOGUE BAR

The analogue bar shown in **Figure 11** appears on the measurement screens and indicates the connected power of the capacitor bank.

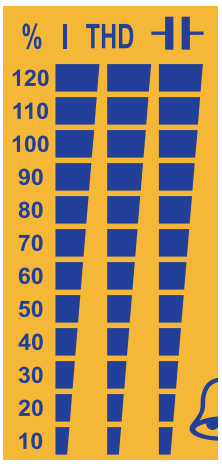


Figure 11: Analogue bar.

The capacitor load percentage is also displayed on the **TEST** results screen.

4.5.4.- OTHER DISPLAY SYMBOLS

The additional symbols shown on the display are listed in **Table 9**.

Table 9: Other Display Icons.

Icon	Description
🔔	**Alarm**, when the device detects an alarm, the display backlight flashes and the alarm icon 🔔 lights up. To identify the cause of the alarm, open the Active Alarms screen (see *"5.2.- **RUN** : MEASUREMENT STATE"*).
C 1234	**Target cos φ:** the icons indicate which of the four available target cos **φ** values is selected. (see *"6.5.- TARGET COS φ"*).
🔒 🔓	Editing locked/unlocked: editing of the configuration parameters is password protected. These icons indicate whether editing is locked or unlocked.

4.6.- LED INDICATORS

The **Computer PV 12** has the following LED indicators:

- ✓ The **CPU** LED flashes at 1-second intervals to indicate that the device is operating correctly.
- ✓ The **Alarm** LED indicates that an alarm is active.
- ✓ The **Fan** LED indicates that the fan is running.
- ✓ The **Key press** LED lights up when any of the five keys is pressed.

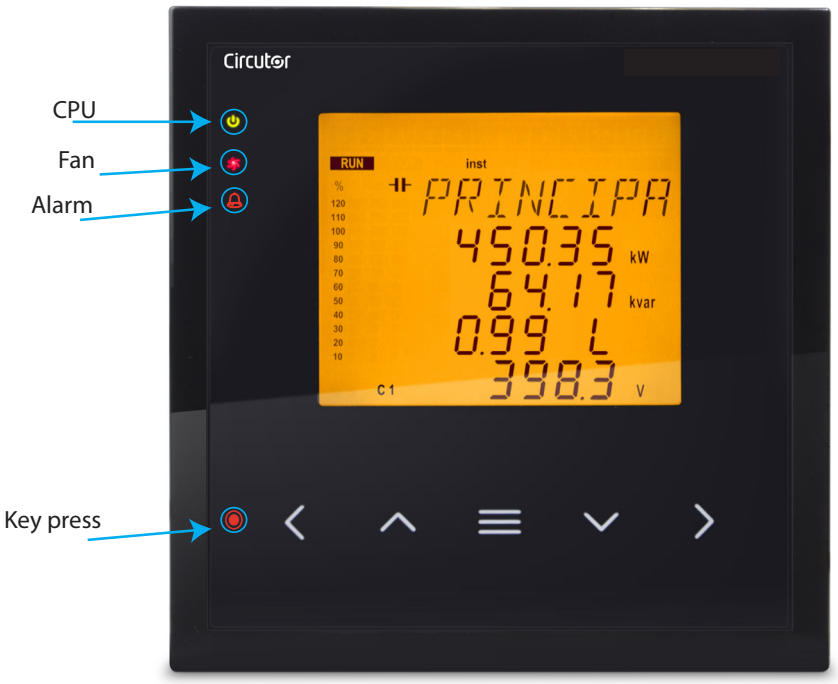


Figure 12: Computer PV 12 LED indicators.

4.7.- INPUTS

The **Computer PV 12** has two digital inputs (terminals 31 and 32 in **Figure 4**) for selecting one of the four **target cos φ** values that can be programmed in the device, i.e. the desired installation power factor. See "***6.5.- TARGET COS φ***"

Table 10: Target cos φ selection.

Digital input 2	Digital input 1	Target cos φ
0	0	1
0	1	2
1	0	3
1	1	4

On the display, the **C 1234** icon indicates which of the four target cos φ values is selected.

4.8.- OUTPUTS

The device features:

✓A relay (terminals 37 and 38 in **Figure 4**) dedicated to activating a fan when the programmable temperature threshold set in Section ***"6.18.- FAN"***, is exceeded. The **Fan** LED is associated with this relay.

✓A programmable alarm relay (terminals 39, 40 and 41 in **Figure 4**); see ***"6.22.- ALARM ENABLE".***

✓Two fully programmable digital outputs using opto-isolated NPN transistors (terminals 34, 35 and 36 in **Figure 4**); see ***"6.22.- ALARM ENABLE".***

✓Twelve output relays (terminals 15 ... 27 in **Figure 4**) for regulating cos φ by switching capacitors.

5.- DISPLAY SCREENS

5.1.- DEVICE INITIALISATION

When the **Computer PV 12** is powered on, the screen shown in **Figure 13** appears, displaying the device name, version and model.

Figure 13: Computer PV 12 initial screen.

After a few seconds, the main measurement screen shown in **Figure 14** appears.

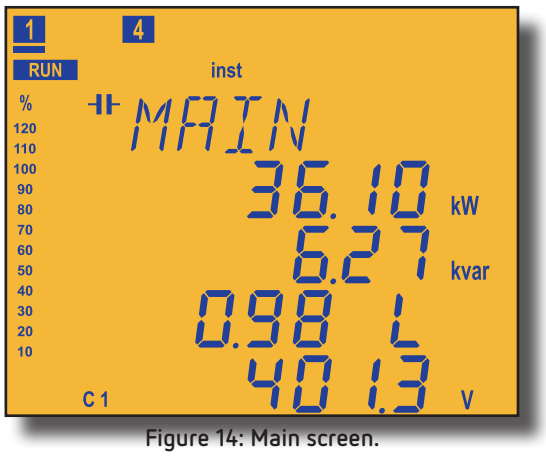


Figure 14: Main screen.

If no key is pressed for one minute, the display locks. When any key is pressed, the screen shown in **Figure 15** appears.

The unlock key sequence is ^ ☰ v ☰. It is fixed and cannot be changed.

Figure 15: Unlock screen.

The **Computer PV 12** has two operating states, with display screens corresponding to the selected state:

- ✓ Measurement state, **RUN** (see *"5.2.- RUN: MEASUREMENT STATE"*)
- ✓ Test state, **TEST** (see *"5.3.- TEST: TEST STATES"*)

5.2.- **RUN:** MEASUREMENT STATE

This state is identified by the symbol **RUN** on the display.
This is the normal operating state of the **Computer PV 12**. In this state, the device measures the different grid parameters and operates according to the configured settings, connecting or disconnecting the capacitors in the capacitor bank.

Use the ^ and ˇ keys to navigate between the different screens.

Note: *If the target cos φ hysteresis is enabled, the* ***RUN*** *symbol flashes every 5 seconds on the display screens.*

Maximum values:

Press the > key to display the maximum values. The **max** symbol appears on the display.

On the maximum values screen, press and hold the > key for more than 3 seconds to clear the maximum values.

Minimum values:

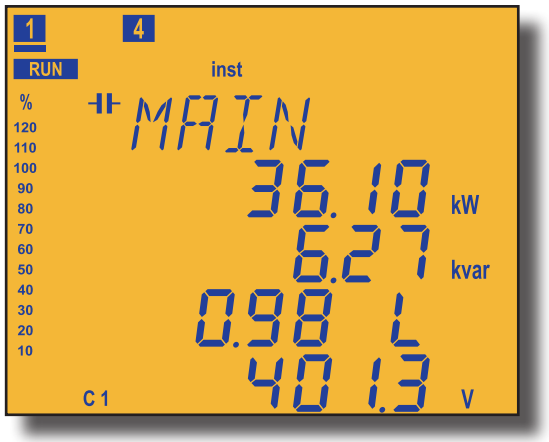
Press the < key to display the minimum values. The **min** symbol appears on the display.

On the minimum values screen, press and hold the < key for more than 3 seconds to clear the minimum values.

If no key is pressed for 5 minutes, the device switches to the main screen.

The available display screens depend on the connection type used in the installation.

5.2.1.- CONNECTION 3U.3C (3 VOLTAGES + NEUTRAL AND 3 ENERGY SOURCES)

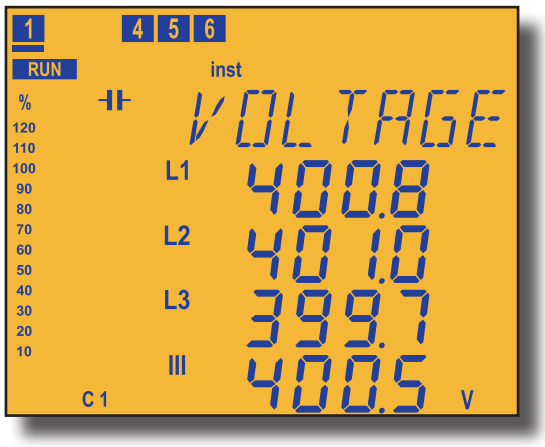


Total Active Power
Total Reactive Power
cos φ
L: Inductive / C: Capacitive
+: Consumed / - : Generated
Phase-to-phase voltage III

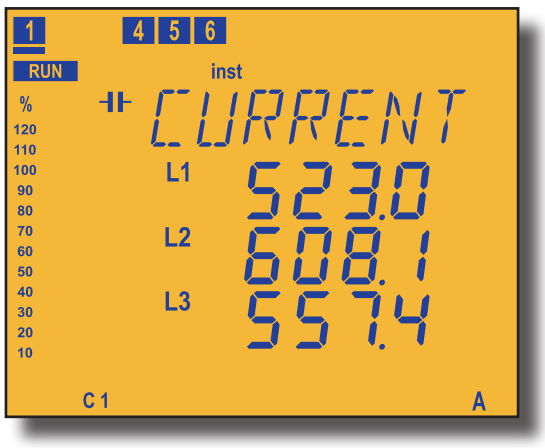
ˇ

≡ Press to switch to the **current** screens.

Phase-to-neutral voltage L1
Phase-to-neutral voltage L2
Phase-to-neutral voltage L3
Phase-to-neutral voltage III

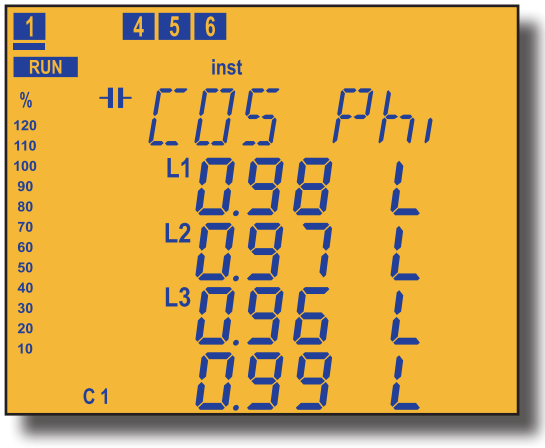


Phase-to-phase voltage L1
Phase-to-phase voltage L2
Phase-to-phase voltage L3
Phase-to-phase voltage III



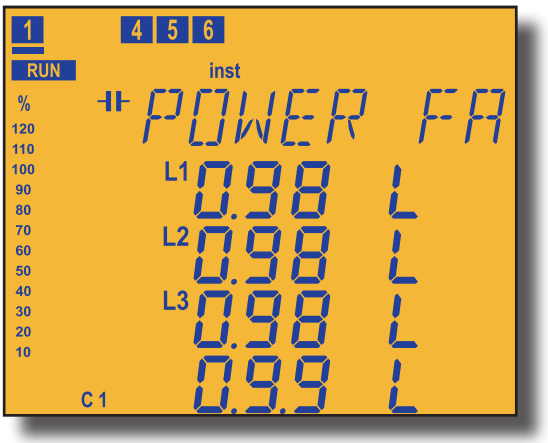
ES1 current
ES2 current
ES3 current

≡ Press to switch to the **cos φ** screen.

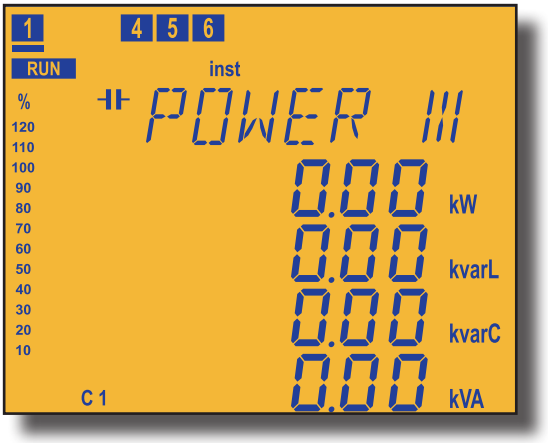


ES1 cos φ
ES2 cos φ
ES3 cos φ
Total cos φ
L: Inductive / C: Capacitive
+: Consumed / -: Generated

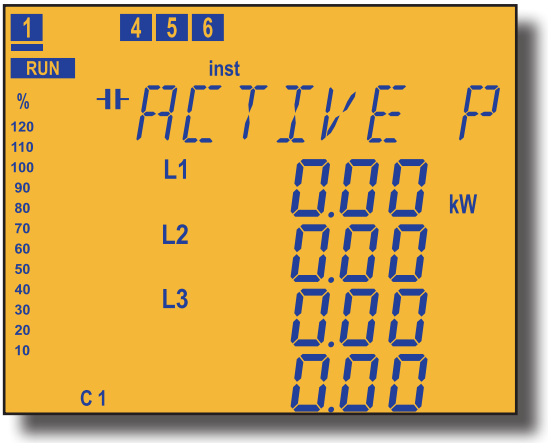
≡ Press to switch to the **consumed energy III** screen.



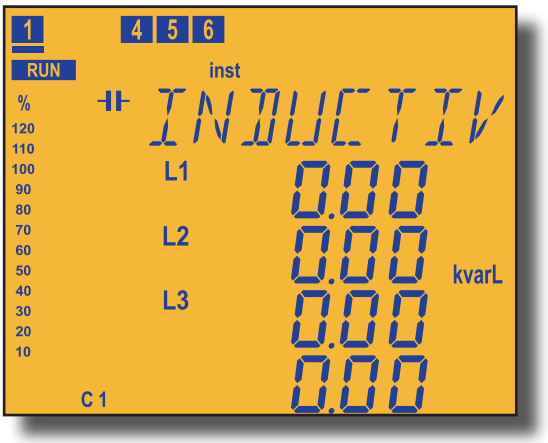
ES1 Power factor
ES2 Power factor
ES3 Power factor
Total Power factor
L: Inductive / C: Capacitive
+: Consumed / -: Generated



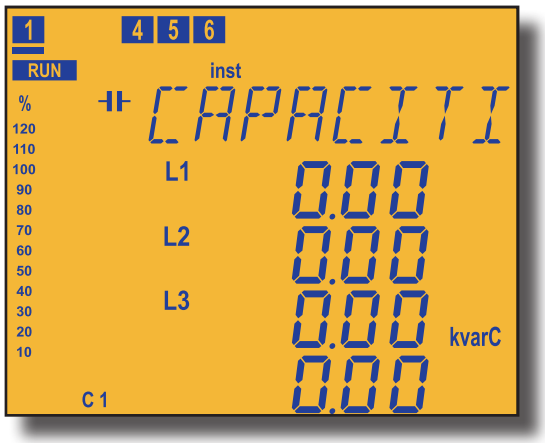
Total Active power
Total Inductive Reactive power
Total Capacitive Reactive power
Total Apparent power



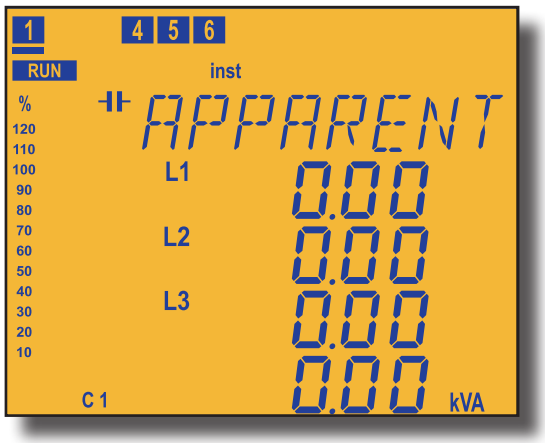
ES1 Active power
ES2 Active power
ES3 Active power
Total Active power



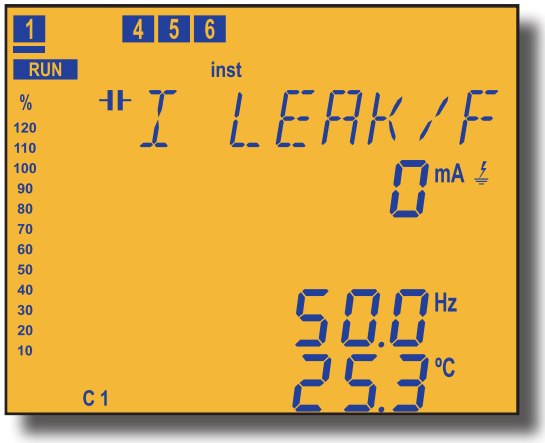
ES1 Inductive Reactive power
ES2 Inductive Reactive power
ES3 Inductive Reactive power
Total Inductive Reactive power



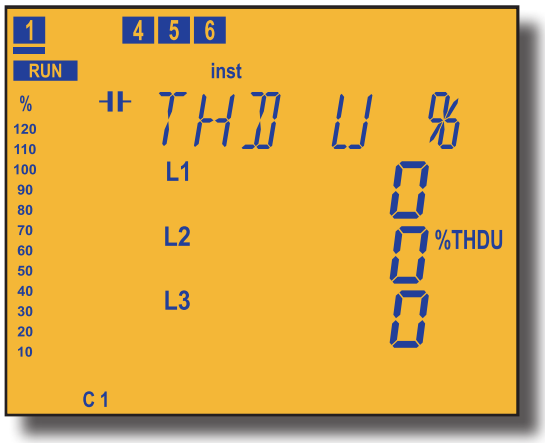
ES1 Capacitive Reactive power
ES2 Capacitive Reactive power
ES3 Capacitive Reactive power
Total Capacitive Reactive power



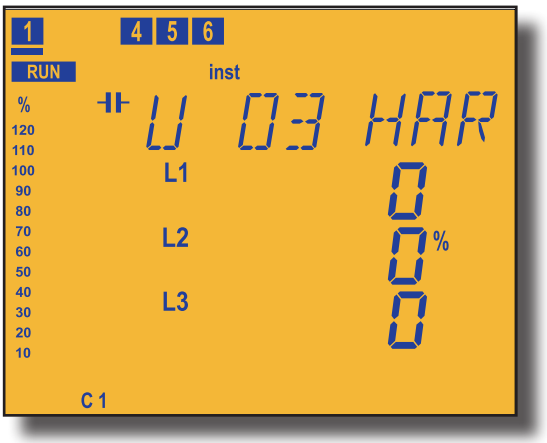
ES1 Apparent power
ES2 Apparent power
ES3 Apparent power
Total Apparent power



Leakage current
Frequency
Temperature



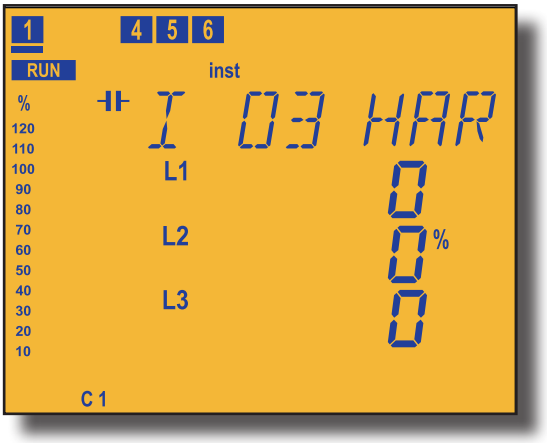
L1 Voltage THD
L2 Voltage THD
L3 Voltage THD



L1 Voltage harmonic
L2 Voltage harmonic
L3 Voltage harmonic

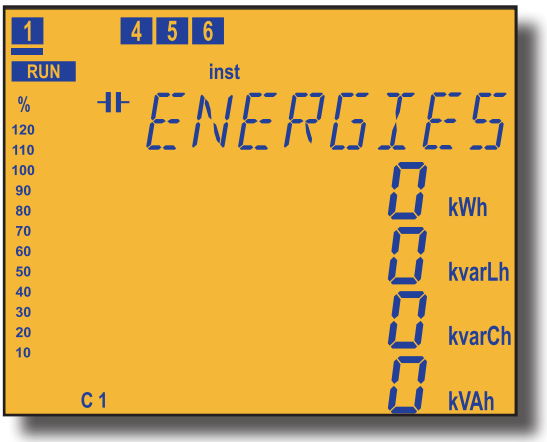
Press ≡ to select the harmonic order, from 3 to 17.

ES1 Current THD
ES2 Current THD
ES3 Current THD



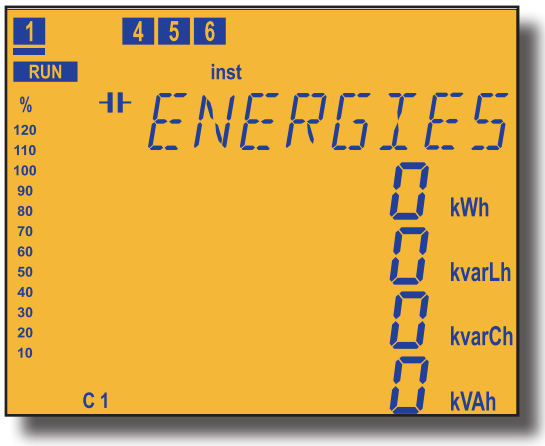
ES1 Current harmonic
ES2 Current harmonic
ES3 Current harmonic

Press ≡ to select the harmonic order, from 3 to 17.

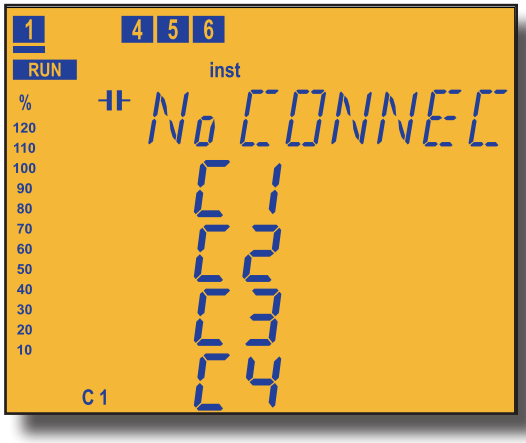


Total Active Energy consumed
Total Inductive Reactive Energy consumed
Total Capacitive Reactive Energy consumed
Total Apparent Energy consumed

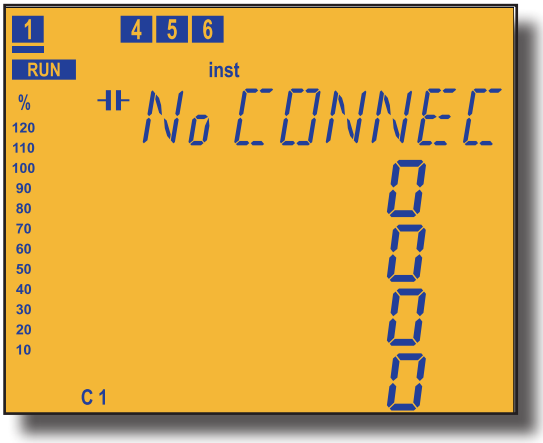
≡ Press to switch to the **Main** screen.



Total Active Energy generated
Total Inductive Reactive Energy generated
Total Capacitive Reactive Energy generated
Total Apparent Energy generated



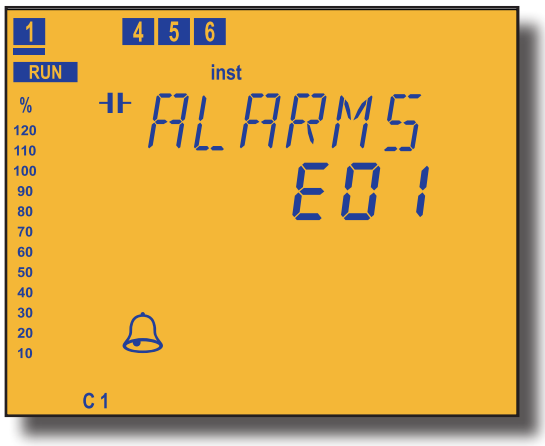
...



Number of switching operations for stages C1 to C12 [5]

The number of switching operations for the 12 available stages is shown across three screens.
Press and hold the › key for more than 3 seconds to clear the number of switching operations.

Device operating hours
Operating hours since the last maintenance [6]



Active alarms codes E01 to E18
(Table 11)

If more than four alarms are active, the corresponding information cycles on the display.

(5) An alarm should be associated with this parameter and configured to activate when the number of switching operations exceeds a specified value (e.g. 5000), indicating that the corresponding stage requires maintenance.
(6) When the operating hours since the last maintenance exceed 9000 hours, error code *E 18* and the alarm icon , 🔔, are displayed. See **Table 11**.

Table 11: Alarm codes.

Code	Description
E01	**No current detected.** The load current is below the minimum value or one of the current transformers (CTs) is not connected. The alarm is triggered when the CT secondary current is below 50 mA for any Energy Source (**ES1**, **ES2** or **ES3**). The device automatically disconnects the capacitors.
E02	**Overcompensation**. The device measures capacitive power while all stages are disconnected. This may be caused by an incorrect C/K parameter setting. To prevent false triggering, this alarm has a preset delay of 90 seconds.
E03	**Undercompensation**. The device measures inductive power while all stages are connected. This may be caused by an incorrect C/K parameter setting. To prevent false triggering, this alarm has a preset delay of 90 seconds.
E04	**Overcurrent**. The measured current exceeds the rated current by 20% for any Energy Source (**ES1**, **ES2** or **ES3**). The rated current is the CT primary current. To prevent false triggering, this alarm has a preset delay of 5 seconds.
E05	**Overvoltage**. The voltage measured in any of the phases exceeds the configured voltage (phase-to-phase voltage). The device automatically disconnects the capacitors. To avoid possible false operations, this alarm has a predefined delay of 5 seconds.
E06	**Low voltage**. The voltage in any of the phases is below the configured voltage (phase-to-phase voltage). The device automatically disconnects the capacitors. To avoid possible false operations, this alarm has a predefined delay of 5 seconds.
E07	**Inductive or capacitive cos φ alarm.** The total cos **φ** is outside the limits configured for either cos **φ** alarm (inductive or capacitive), and the measured currents exceed the configured threshold. To prevent false triggering, the alarm has a preset activation delay of 5 minutes and a deactivation delay of 30 seconds.
E08(7)	**Voltage THD alarm**. The voltage THD for one or more phases exceeds the threshold configured for the voltage THD alarm.
E09(7)	**Current THD alarm x I**. The THDI×I level for one or more Energy Sources (**ES1**, **ES2** or **ES3**) exceeds the threshold configured for the THDI×I alarm. THDI×I is the product of the current and its THDI value; see Section "***6.27.- CURRENT THD ALARM x I***".
E 10(7)	**Temperature Alarm**. The measured temperature exceeds the threshold configured for the temperature alarm.
E 11	**No connection state** due to *E08* , *E09* or *E 10*.
E 12	**Disconnection state** due to *E08* , *E09* or *E 10*.
E 13	**Leakage current alarm.** The leakage current exceeds the configured leakage-current alarm threshold.
E 14	**Repeated leakage alarm.** Repeated leakage events have been detected in the system, but they are not caused by a capacitor.
E 15	**Capacitor Leakage Alarm.** Leakage caused by one of the capacitors has been detected and the corresponding step is disabled. In addition to displaying message *E 13*, the disabled capacitors flash on the display. To re-enable them, refer to the Leakage Current Alarm settings.

Table 11 (Continuation): Alarm codes.

Code	Description
E 16	**Leakage Current Transformer Detection Alarm.** The Leakage Current Alarm has been enabled, but the device does not detect the leakage current transformer connection.
E 17	**Number of Operations Alarm.** The configured number of operations has been exceeded for one or more capacitors.
E 18	**Maintenance Alarm.** More than 9,000 operating hours have elapsed since the last maintenance operation. Once device maintenance has been completed, open the screen showing the Operating hours since last maintenance and press and hold the ☰ › keys to reset the counter.

(7) Two levels can be configured for these alarms:

✓ Lo **value,** If the device exceeds this value for 30 minutes, the corresponding alarm is triggered. If alarm E 11 is enabled, the **Computer PV 12** enters the **No Connection** state and activates alarm E 11.

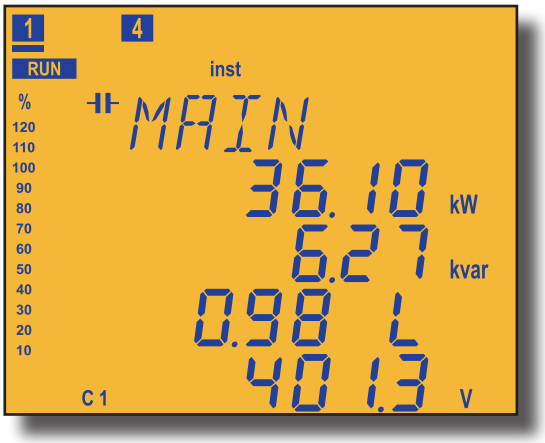
✓ HI **value, i**f the device exceeds this value for 30 seconds, the corresponding alarm is triggered. If alarm E 12 is enabled, the **Computer PV 12** enters the **Disconnection** state and activates alarm E 12.

If the device remains below the Lo value for 10 minutes, the alarms are deactivated and the device returns to its normal operating state.

In the **No Connection** state, the device does not connect any stage. However, it does not disconnect them either if required by the control operation.

In the Disconnection state, the device disconnects the stages and does not allow them to connect.

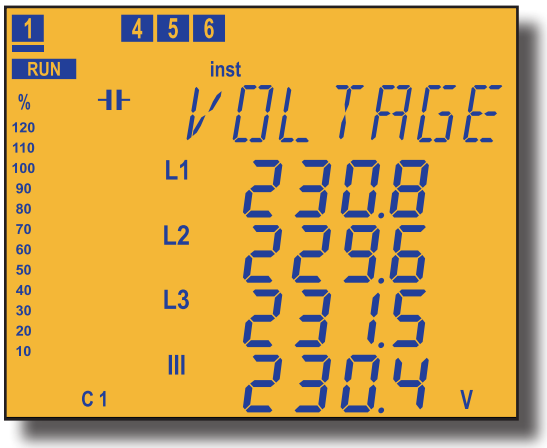
5.2.2.- CONNECTION 3U.2C (3 VOLTAGES + NEUTRAL AND 2 ENERGY SOURCES)



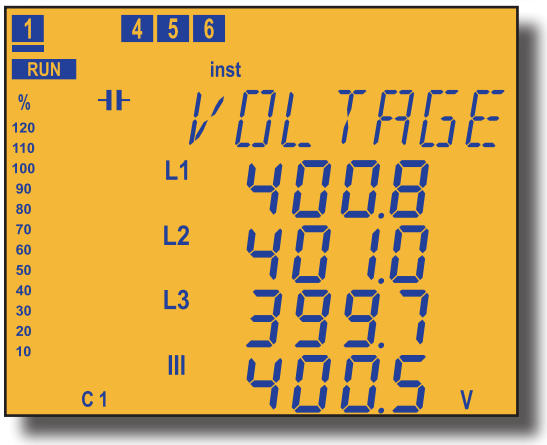
Total Active Power
Total Reactive Power
Cos φ
L: Inductive / C: Capacitive
+: Consumed / - : Generated
Phase-to-phase voltage III

⌄

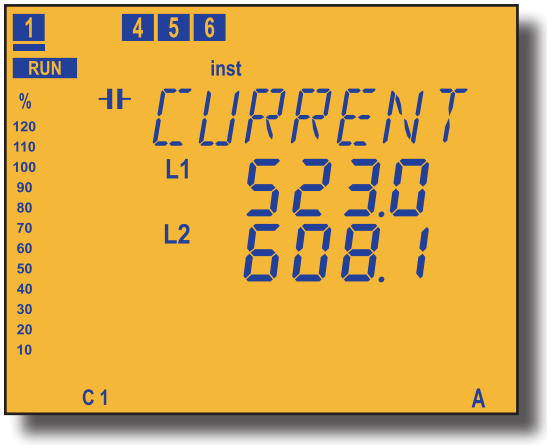
☰ Press to switch to the **current** screens.



Phase-to-neutral voltage L1
Phase-to-neutral voltage L2
Phase-to-neutral voltage L3
Phase-to-neutral voltage III

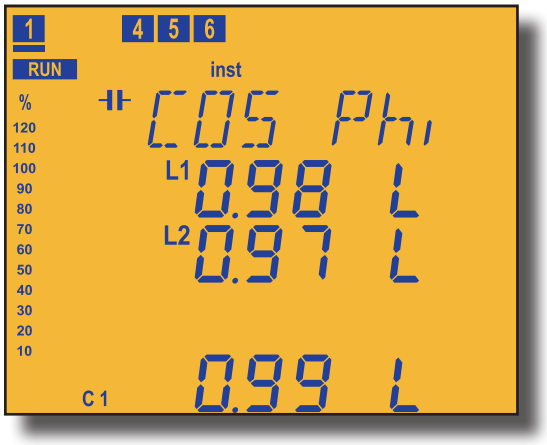


Phase-to-phase voltage L1
Phase-to-phase voltage L2
Phase-to-phase voltage L3
Phase-to-phase voltage III



ES1 current
ES2 current

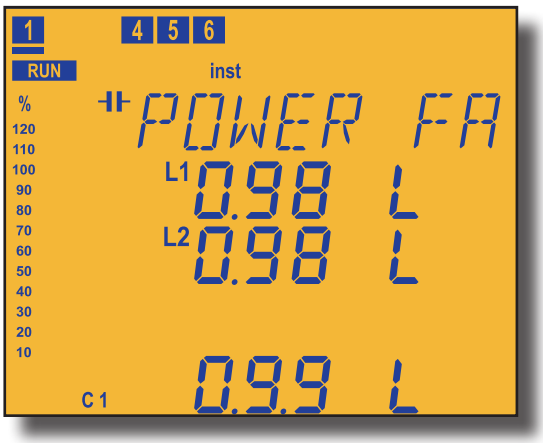
≡ Press to switch to the **cos φ** screen.



ES1 cos φ
ES2 cos φ

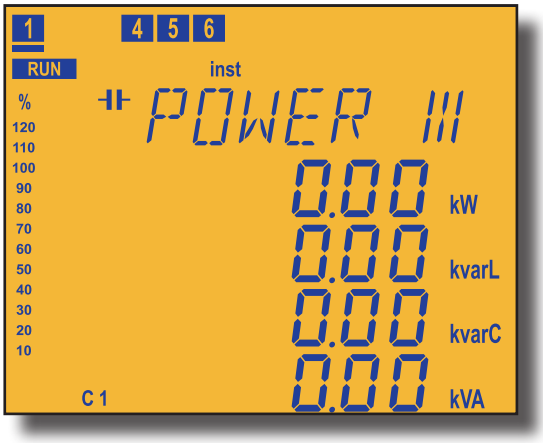
Total cos φ
L: Inductive / C: Capacitive
+: Consumed / -: Generated

≡ Press to switch to the **consumed energy III** screen.



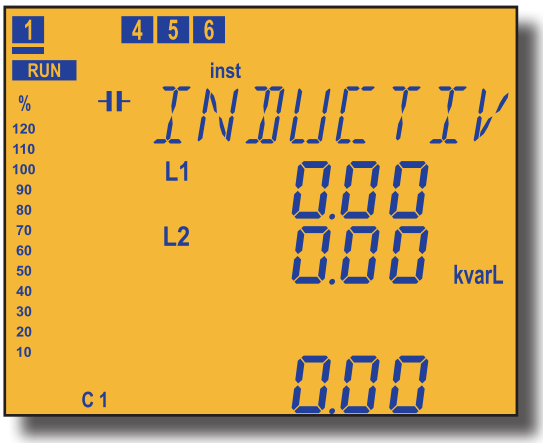
ES1 Power factor
ES2 Power factor

Total Power factor
L: Inductive / C: Capacitive
+: Consumed / -: Generated

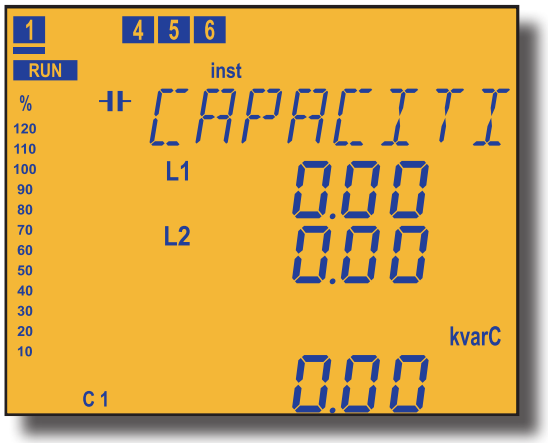


Total Active power
Total Inductive Reactive power
Total Capacitive Reactive power
Total Apparent power

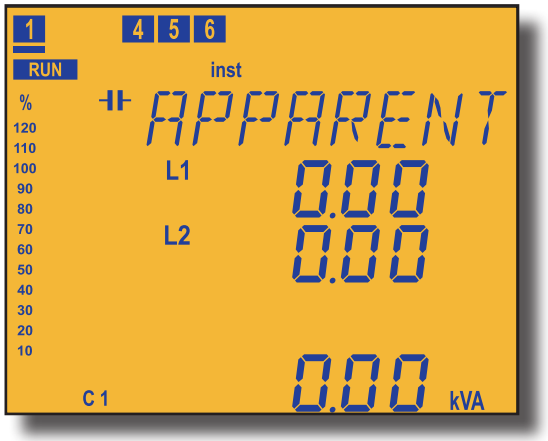
ES1 Active power
ES2 Active power
Total Active power



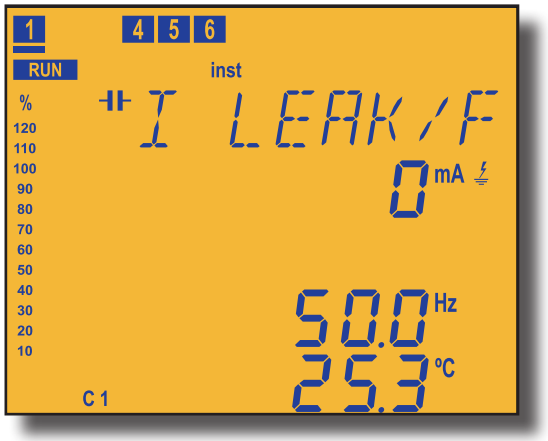
ES1 Inductive Reactive power
ES2 Inductive Reactive power
Total Inductive Reactive power



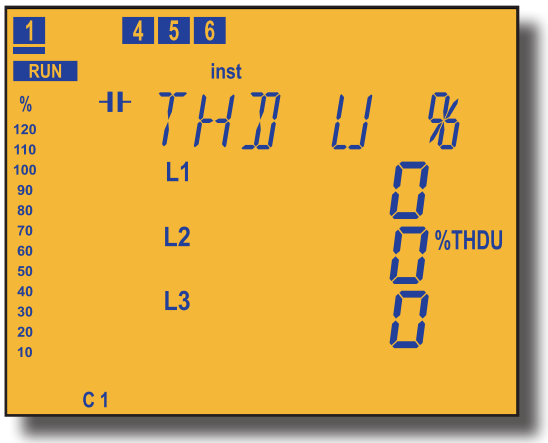
ES1 Capacitive Reactive power
ES2 Capacitive Reactive power
Total Capacitive Reactive power



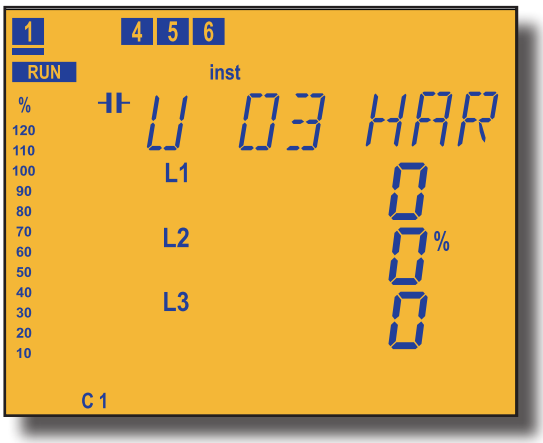
ES1 Apparent power
ES2 Apparent power
Total Apparent power



Leakage current
Frequency
Temperature

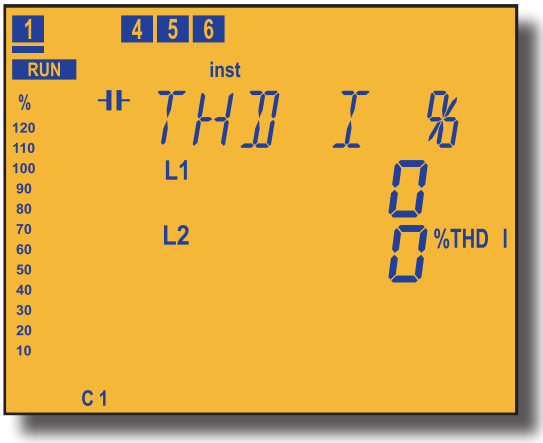


L1 Voltage THD
L2 Voltage THD
L3 Voltage THD

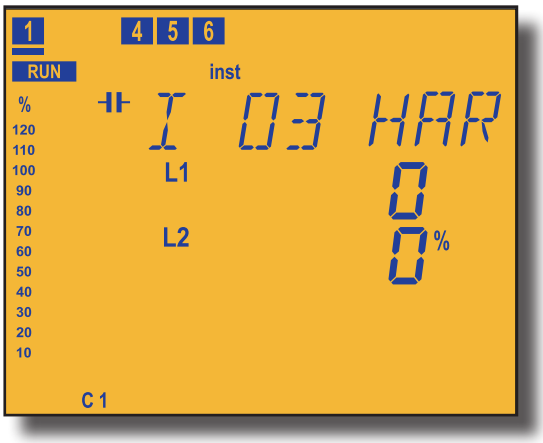


L1 Voltage harmonic
L2 Voltage harmonic
L3 Voltage harmonic

Press ☰ to select the harmonic order, from 3 to 17.

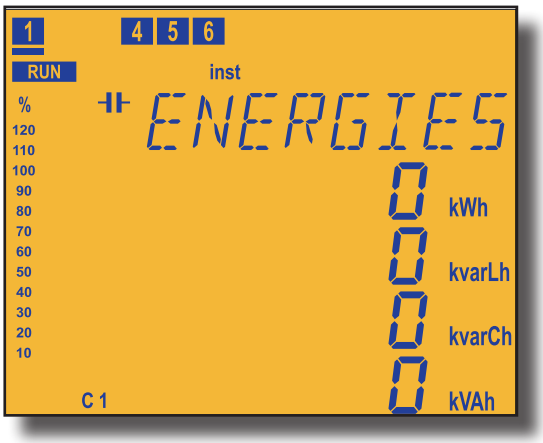


ES1 Current THD
ES2 Current THD



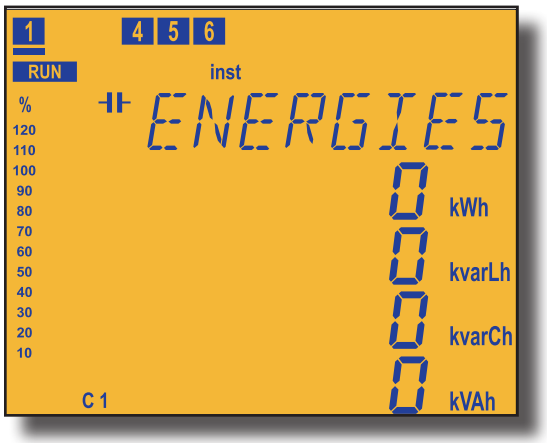
ES1 Current harmonic
ES2 Current harmonic

Press ☰ to select the harmonic order, from 3 to 17.

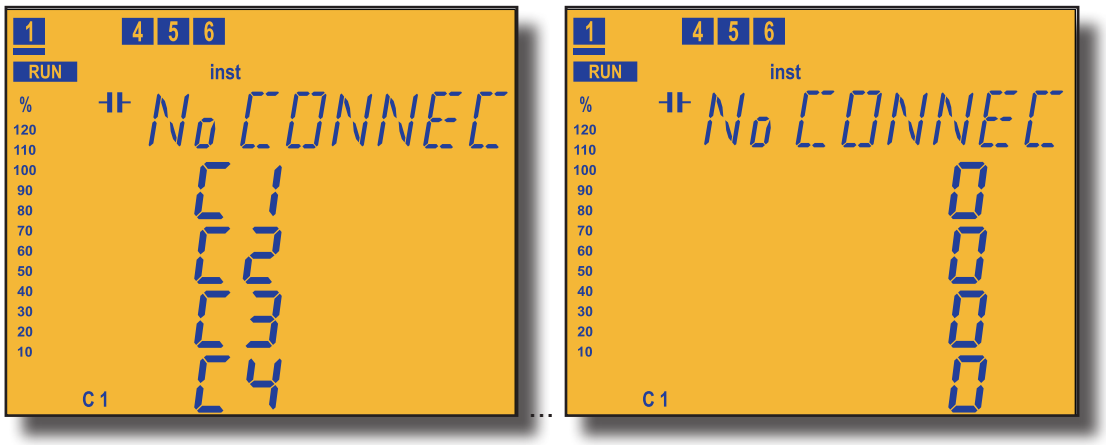


Total Active Energy consumed
Total Inductive Reactive Energy consumed
Total Capacitive Reactive Energy consumed
Total Apparent Energy consumed

☰ Press to switch to the **Main** screen.

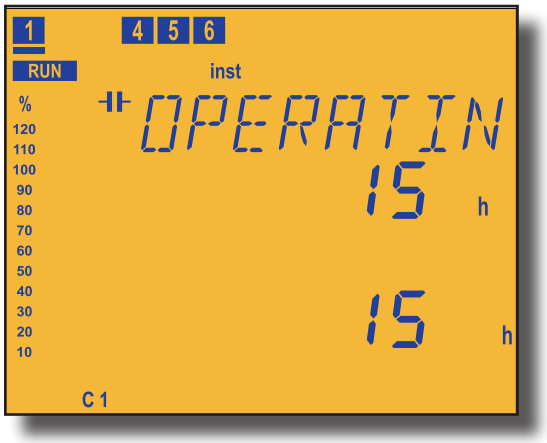


Total Active Energy generated
Total Inductive Reactive Energy generated
Total Capacitive Reactive Energy generated
Total Apparent Energy generated

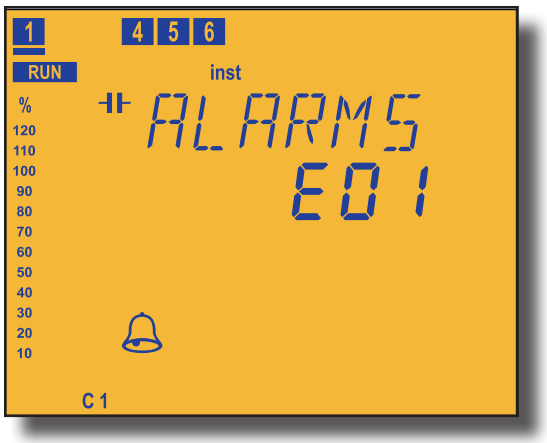


Number of switching operations for stages C1 to C12 (8)

The number of switching operations for the 12 available stages is shown across three screens.
Press and hold the › key for more than 3 seconds to clear the number of switching operations.



Device operating hours
Operating hours since the last maintenance (9)

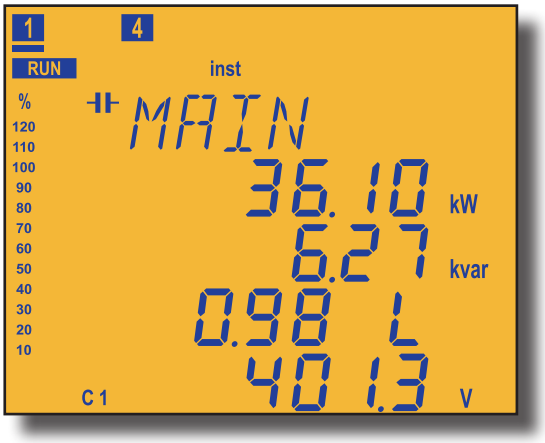


Active alarms codes E01 to E18
(Table 11)

If more than four alarms are active, the corresponding information cycles on the display.

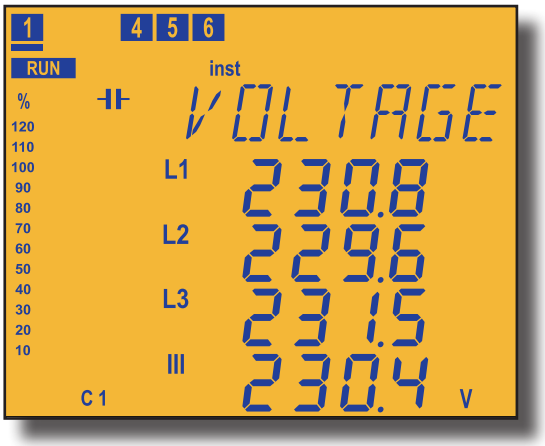
(8) An alarm should be associated with this parameter and configured to activate when the number of switching operations exceeds a specified value (e.g. 5000), indicating that the corresponding stage requires maintenance.
(9) When the operating hours since the last maintenance exceed 9000 hours, error code *E 18* and the alarm icon , , are displayed. See **Table 11**.

5.2.3.- CONNECTION *3U. 1C* (3 VOLTAGES + NEUTRAL AND 1 ENERGY SOURCES)

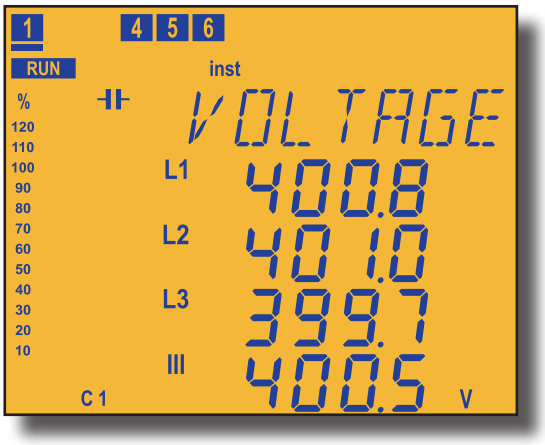


Total Active Power
Total Reactive Power
cos φ
L: Inductive / C: Capacitive
+: Consumed / - : Generated
Phase-to-phase voltage III

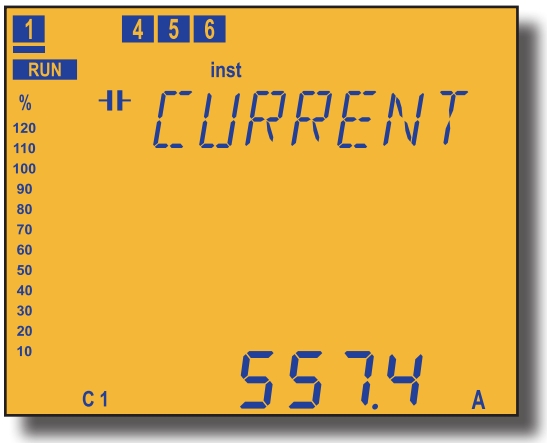
Press to switch to the **Current** screens.



Phase-to-neutral voltage L1
Phase-to-neutral voltage L2
Phase-to-neutral voltage L3
Phase-to-neutral voltage III

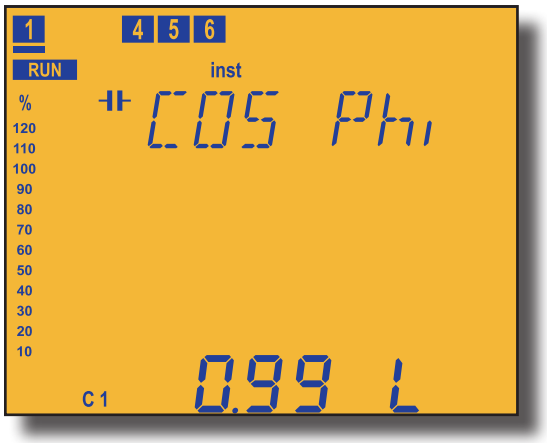


Phase-to-phase voltage L1
Phase-to-phase voltage L2
Phase-to-phase voltage L3
Phase-to-phase voltage III



ES1 current

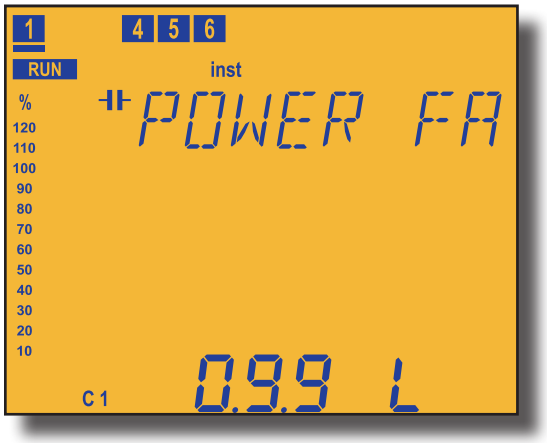
Press to switch to the **Cosine φ** screen.



ES1 cos φ

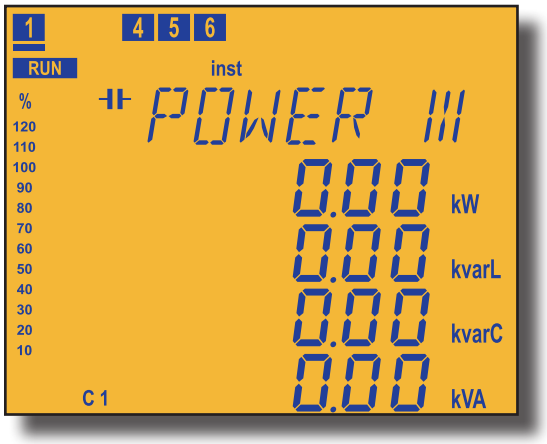
L: Inductive / C: Capacitive
+: Consumed / -: Generated

Press to switch to the **consumed energy III** screen.

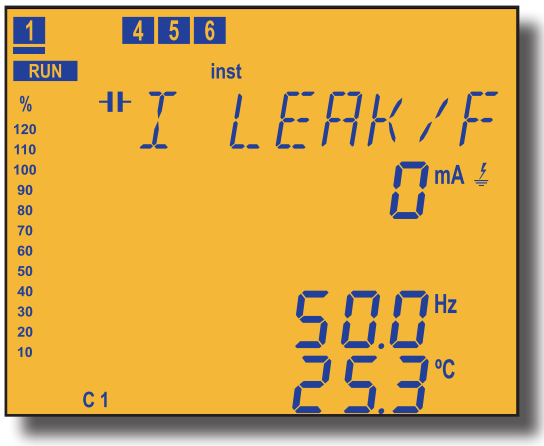


ES1 Power factor

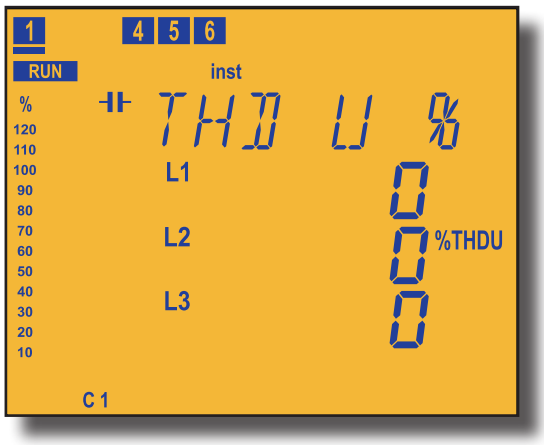
L: Inductive / C: Capacitive
+: Consumed / -: Generated



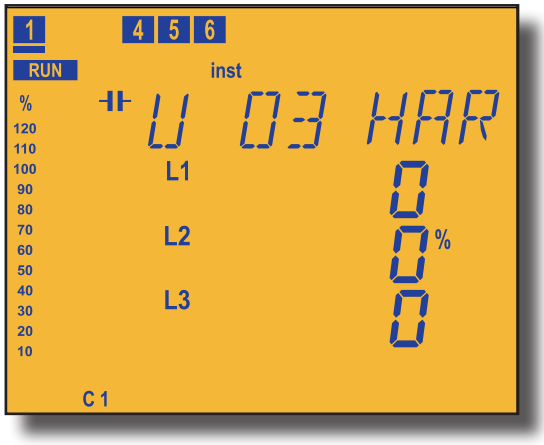
Total Active power
Total Inductive Reactive power
Total Capacitive Reactive power
Total Apparent power



Leakage current
Frequency
Temperature

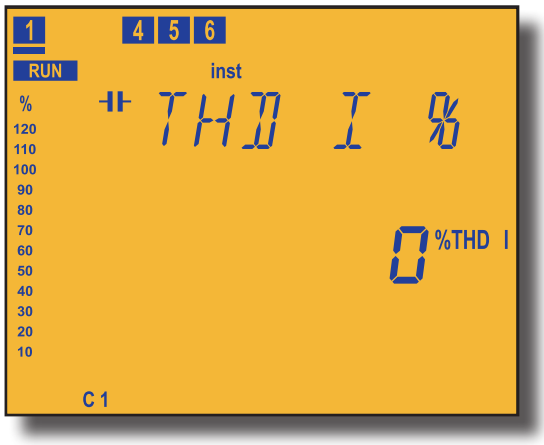


L1 Voltage THD
L2 Voltage THD
L3 Voltage THD

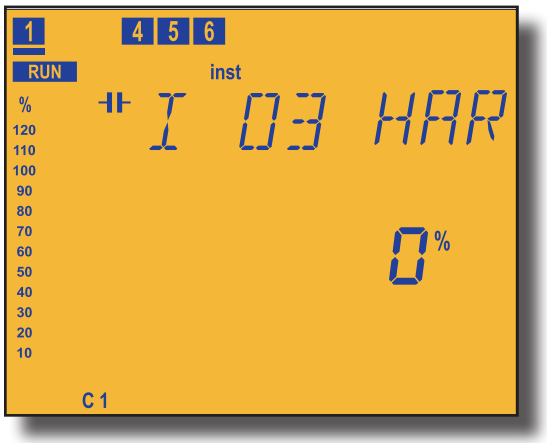


L1 Voltage harmonic
L2 Voltage harmonic
L3 Voltage harmonic

Press ☰ to select the harmonic order, from 3 to 17

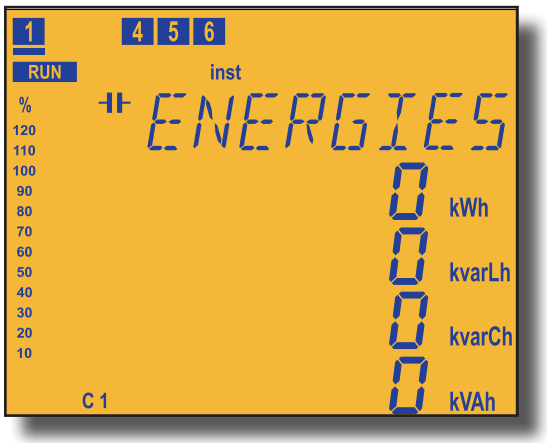


ES1 Current THD



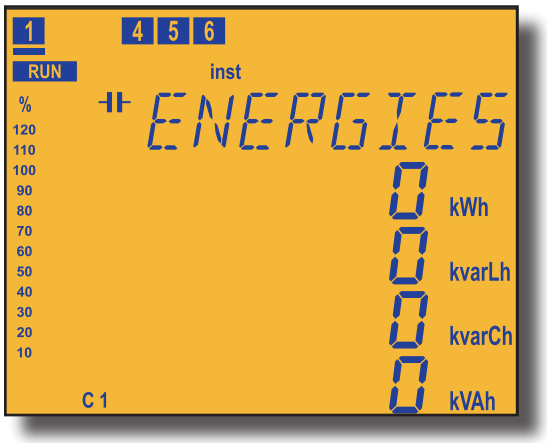
ES1 Current harmonic

Press ☰ to select the harmonic order, from 3 to 17.

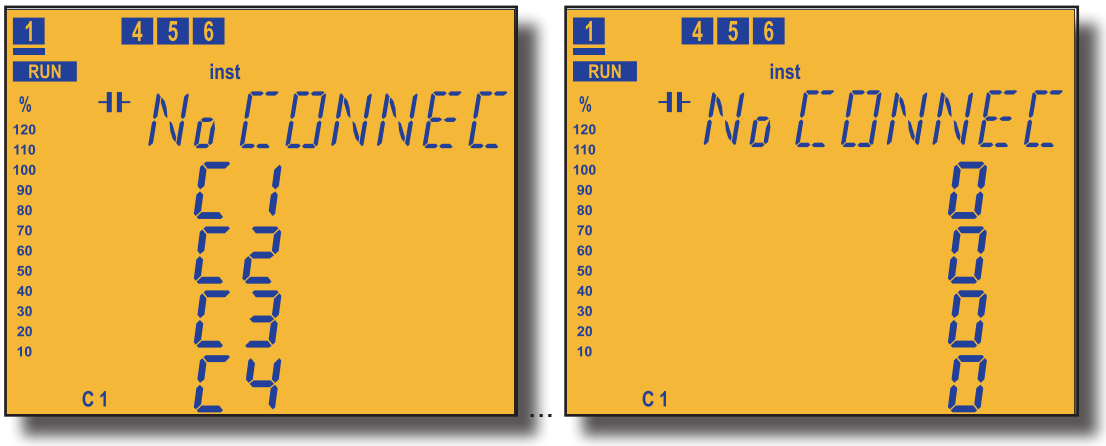


Total Active Energy consumed
Total Inductive Reactive Energy consumed
Total Capacitive Reactive Energy consumed
Total Apparent Energy consumed

☰ Press to switch to the **Main** screen.

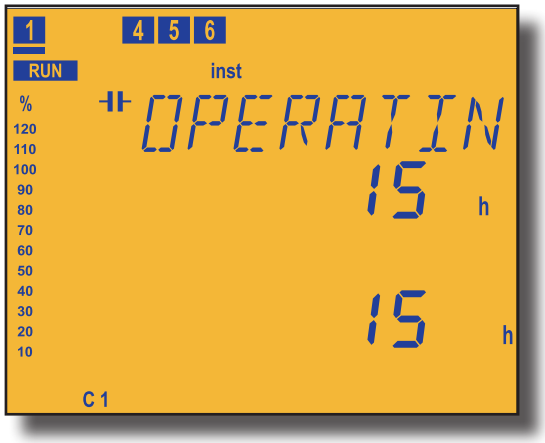


Total Active Energy generated
Total Inductive Reactive Energy generated
Total Capacitive Reactive Energy generated
Total Apparent Energy generated

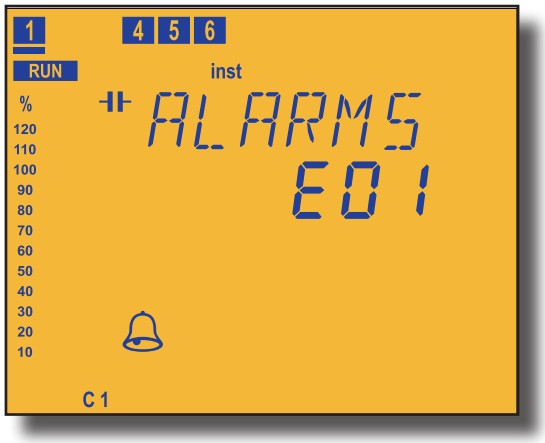


Number of switching operations for stages C1 to C12 [10]

The number of switching operations for the 12 available stages is shown across three screens. Press and hold the › key for more than 3 seconds to clear the number of switching operations.



Device operating hours
Operating hours since the last maintenance [11]



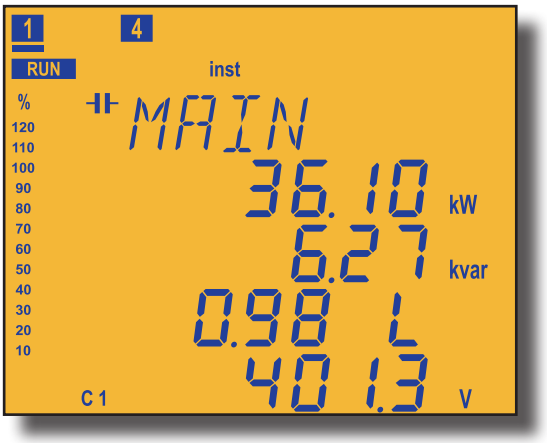
Active alarms codes E01 to E18 (Table 11)

If more than four alarms are active, the corresponding information cycles on the display.

[10] An alarm should be associated with this parameter and configured to activate when the number of switching operations exceeds a specified value (e.g. 5000), indicating that the corresponding stage requires maintenance.

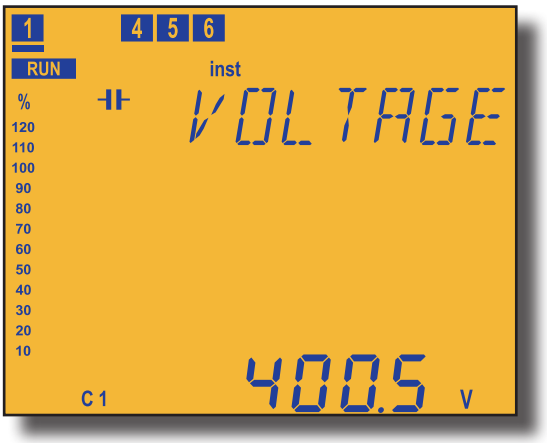
[11] When the operating hours since the last maintenance exceed 9000 hours, error code *E 18* and the alarm icon , 🔔 , are displayed. See **Table 11**.

5.2.4.- CONNECTION 2U.3C (2 VOLTAGES AND 3 ENERGY SOURCES)

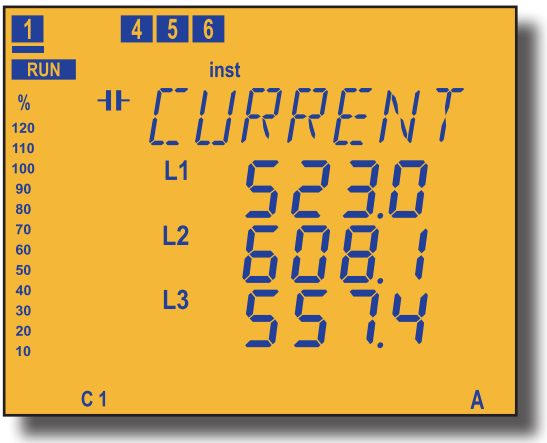


Total Active Power
Total Reactive Power
cos φ
L: Inductive / C: Capacitive
+: Consumed / - : Generated
Phase-to-phase voltage III

Press to switch to the **current** screens.

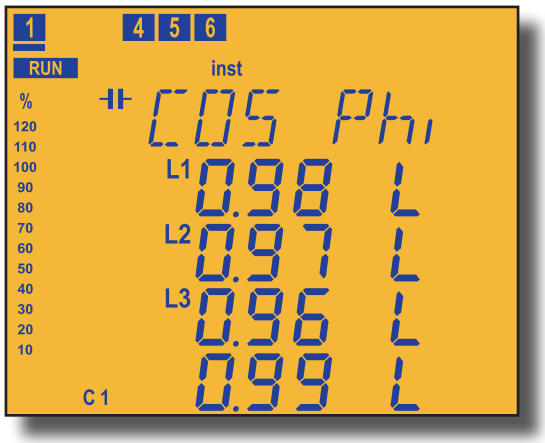


Phase-to-phase voltage



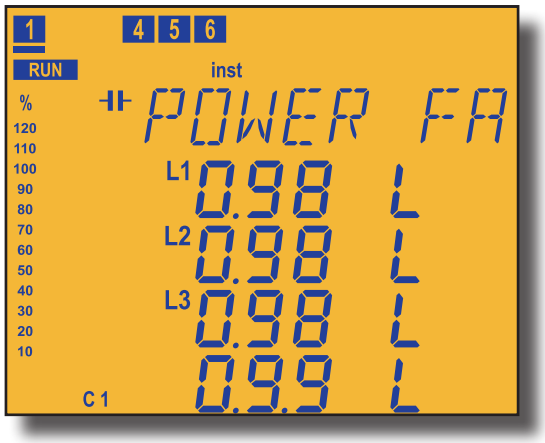
ES1 current
ES2 current
ES3 current

Press to switch to the **cos φ** screen.

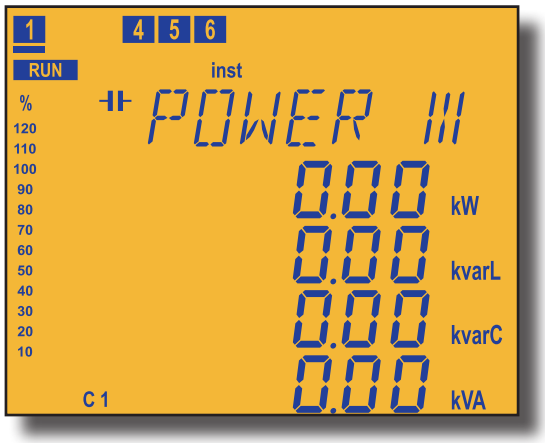


ES1 cos φ
ES2 cos φ
ES3 cos φ
Total cos φ
L: Inductive / C: Capacitive
+: Consumed / -: Generated

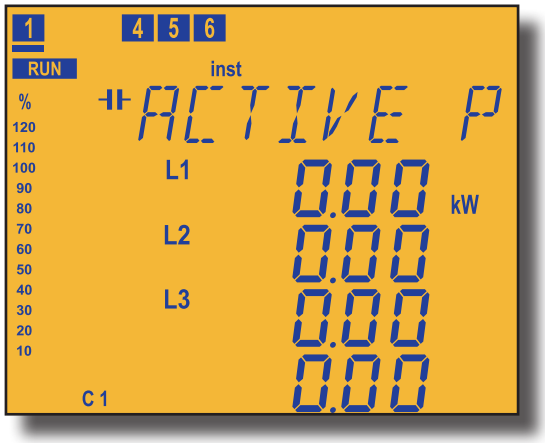
Press to switch to the **consumed energy III** screen.



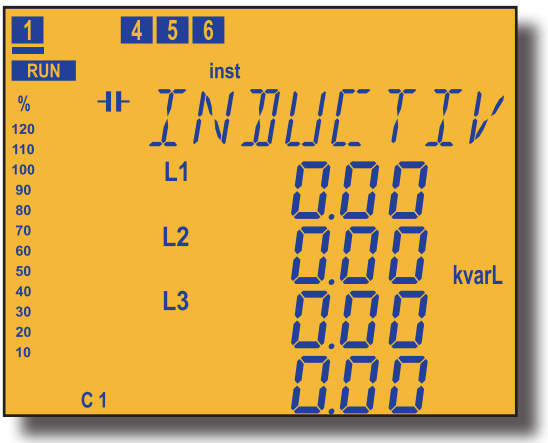
ES1 Power factor
ES2 Power factor
ES3 Power factor
Total Power factor
L: Inductive / C: Capacitive
+: Consumed / -: Generated



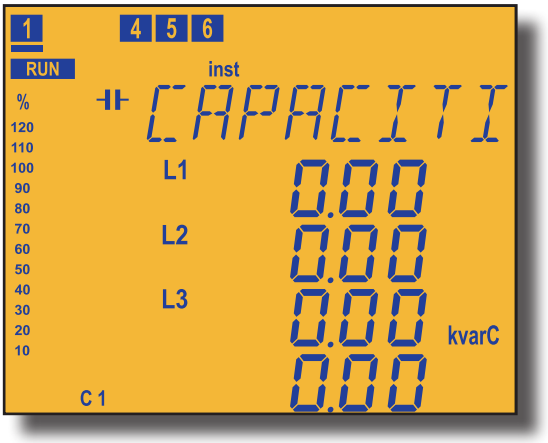
Total Active power
Total Inductive Reactive power
Total Capacitive Reactive power
Total Apparent power



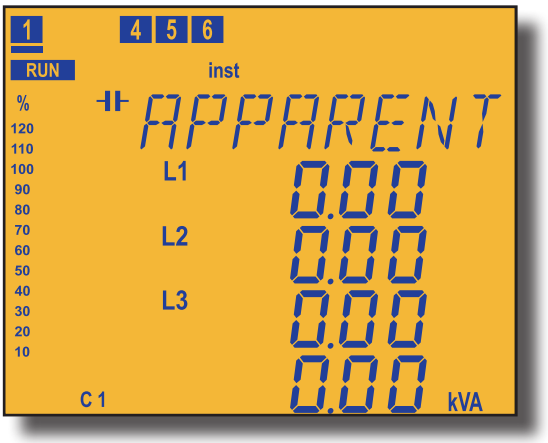
ES1 Active power
ES2 Active power
ES3 Active power
Total Active power



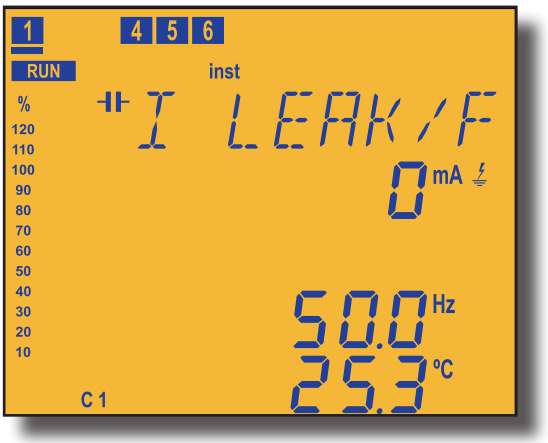
ES1 Inductive Reactive power
ES2 Inductive Reactive power
ES3 Inductive Reactive power
Total Inductive Reactive power



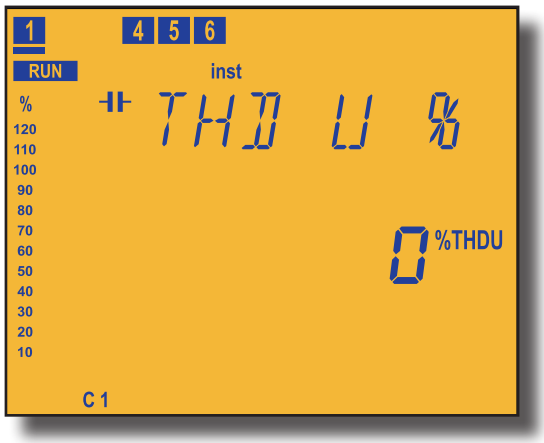
ES1 Capacitive Reactive power
ES2 Capacitive Reactive power
ES3 Capacitive Reactive power
Total Capacitive Reactive power



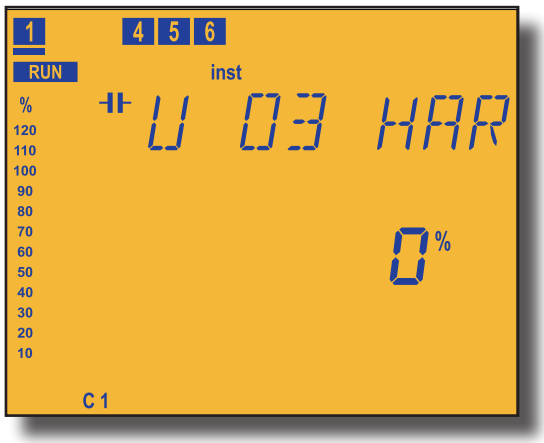
ES1 Apparent power
ES2 Apparent power
ES3 Apparent power
Total Apparent power



Leakage current
Frequency
Temperature

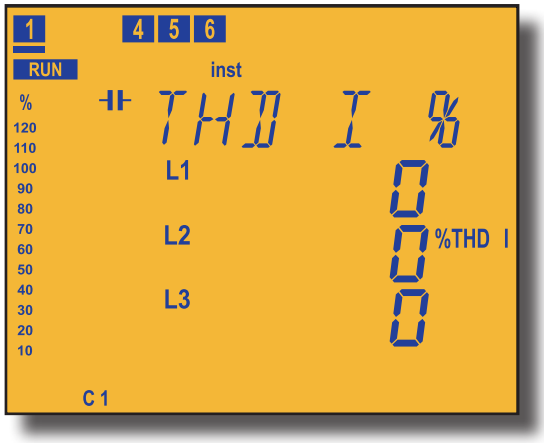


Voltage THD

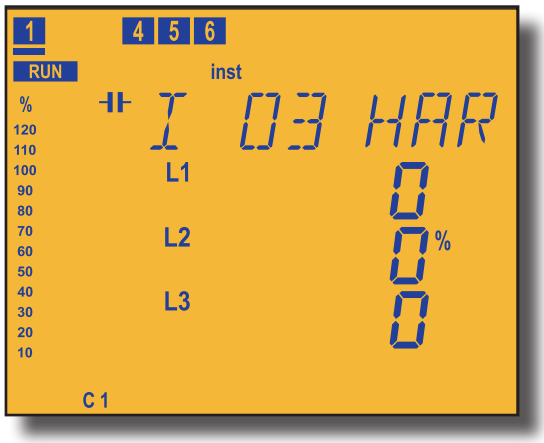


Voltage harmonic

Press ☰ to select the harmonic order, from 3 to 17.

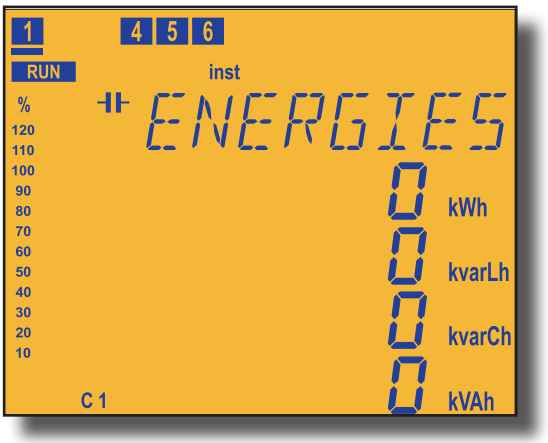


ES1 Current THD
ES2 Current THD
ES3 Current THD



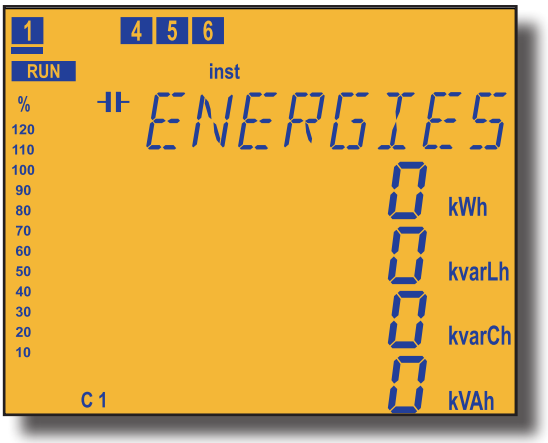
ES1 Current harmonic
ES2 Current harmonic
ES3 Current harmonic

Press ☰ to select the harmonic order, from 3 to 17.

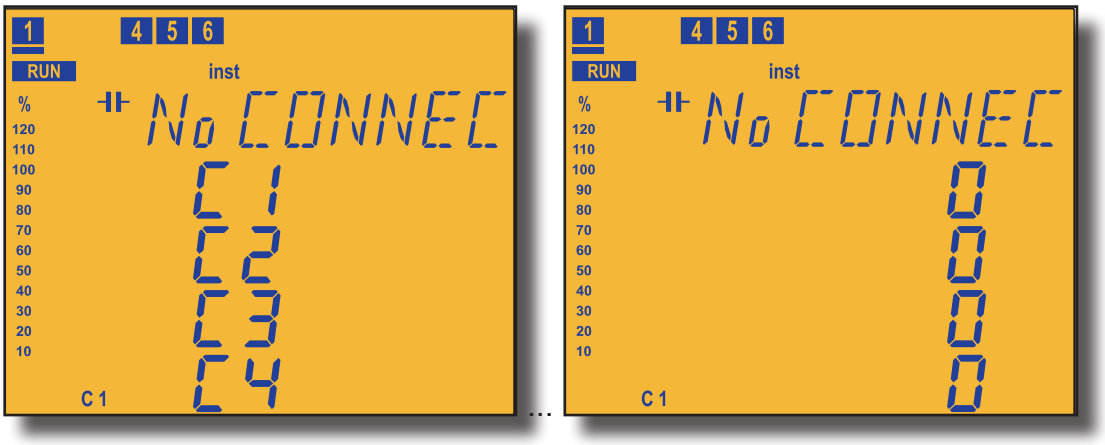


Total Active Energy consumed
Total Inductive Reactive Energy consumed
Total Capacitive Reactive Energy consumed
Total Apparent Energy consumed

Press to switch to the **Main** screen.

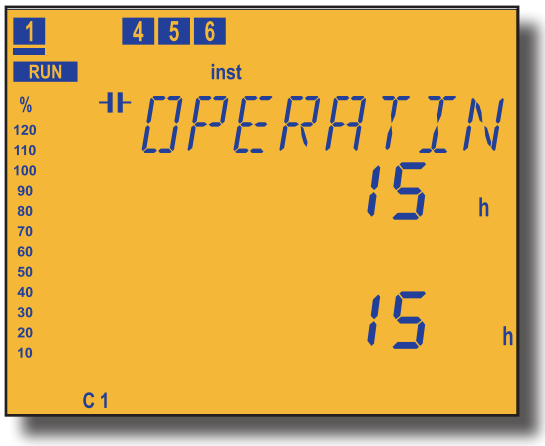


Total Active Energy generated
Total Inductive Reactive Energy generated
Total Capacitive Reactive Energy generated
Total Apparent Energy generated

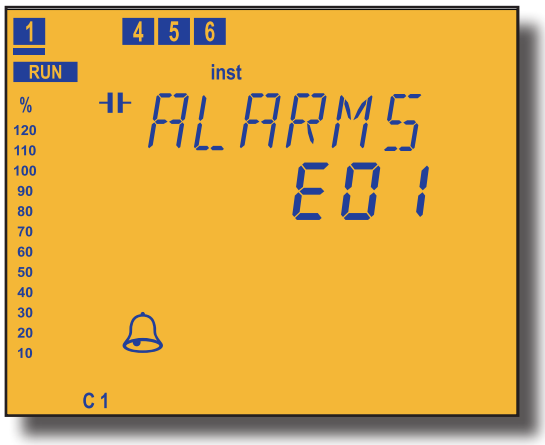


Number of switching operations for stages C1 to C12 [12]

The number of switching operations for the 12 available stages is shown across three screens.
Press and hold the › key for more than 3 seconds to clear the number of switching operations.



Device operating hours
Operating hours since the last maintenance[13]

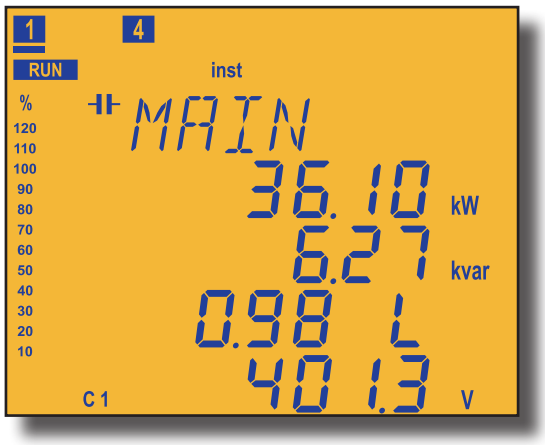


Active alarms codes E01 to E18 (Table 11)

If more than four alarms are active, the corresponding information cycles on the display.

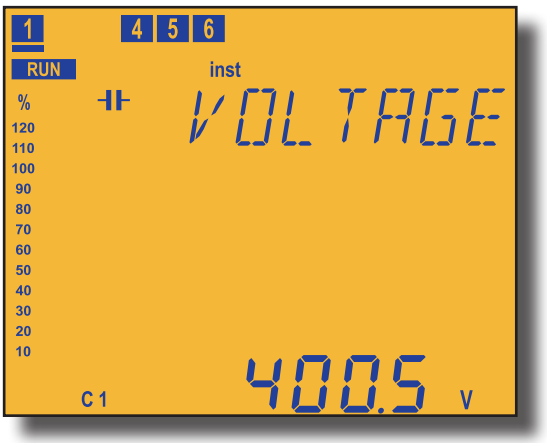
[12] An alarm should be associated with this parameter and configured to activate when the number of switching operations exceeds a specified value (e.g. 5000), indicating that the corresponding stage requires maintenance.
[13] When the operating hours since the last maintenance exceed 9000 hours, error code *E 18* and the alarm icon , , are displayed. See **Table 11**.

5.2.5.- CONNECTION *2U.2C* (2 VOLTAGES AND 2 ENERGY SOURCES)

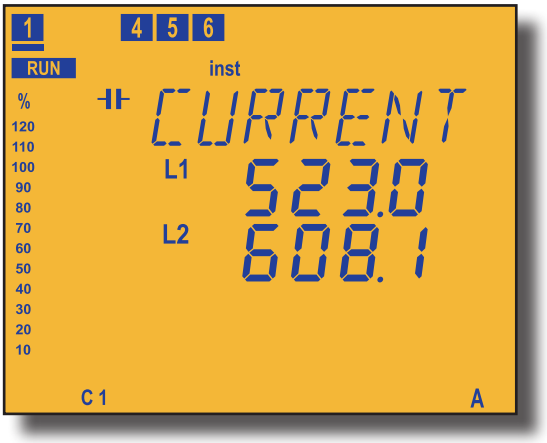


Total Active Power
Total Reactive Power
cos φ
L: Inductive / C: Capacitive
+: Consumed / - : Generated
Phase-to-phase Voltage III

≡ Press to switch to the **current** screens.

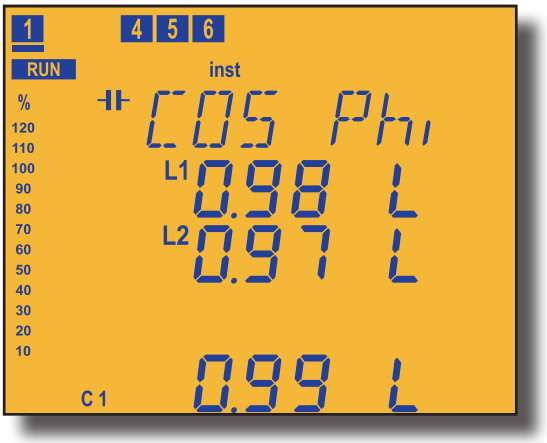


Phase-to-phase voltage



ES1 current
ES2 current

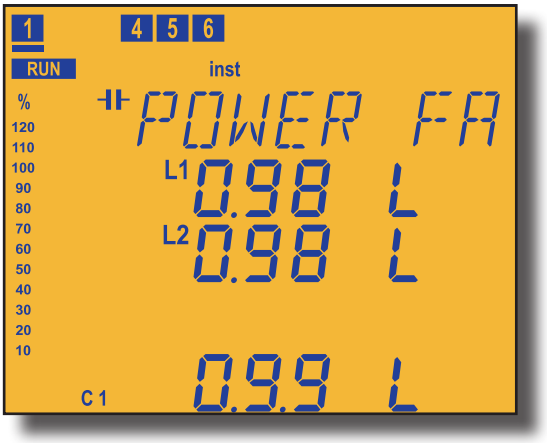
Press to switch to the **cos φ** screen.



ES1 cos φ
ES2 cos φ

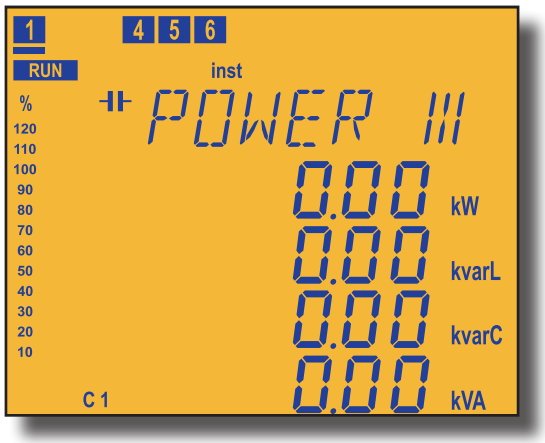
Total cos φ
L: Inductive / C: Capacitive
+: Consumed / -: Generated

Press to switch to the **consumed energy III** screen.

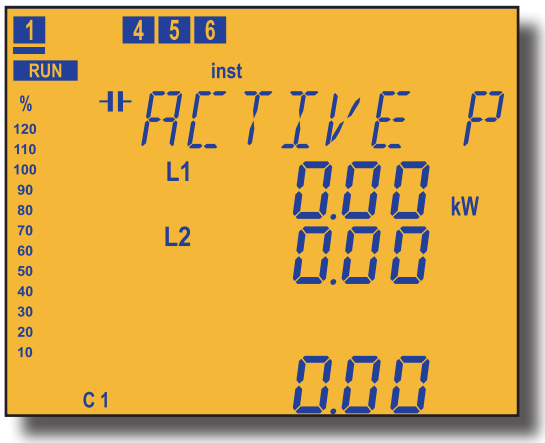


ES1 Power factor
ES2 Power factor

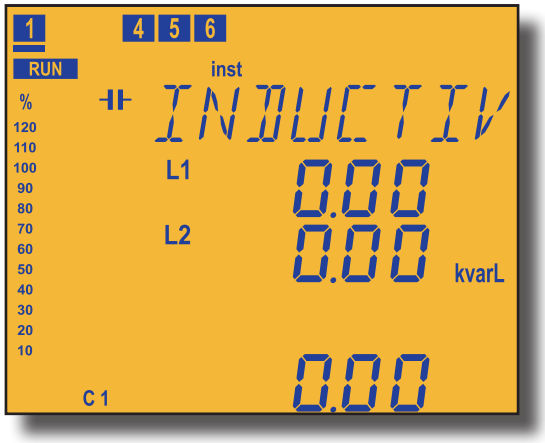
Total Power factor
L: Inductive / C: Capacitive
+: Consumed / -: Generated



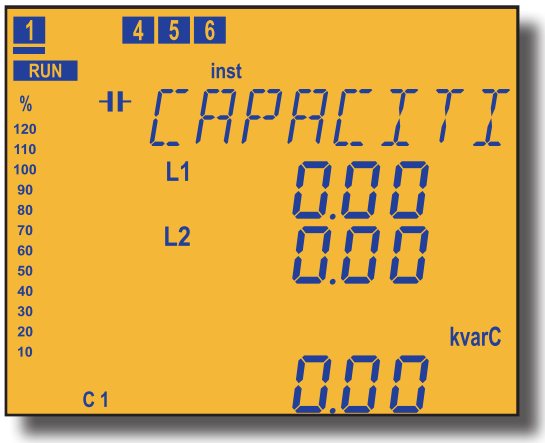
Total Active power
Total Inductive Reactive power
Total Capacitive Reactive power
Total Apparent power



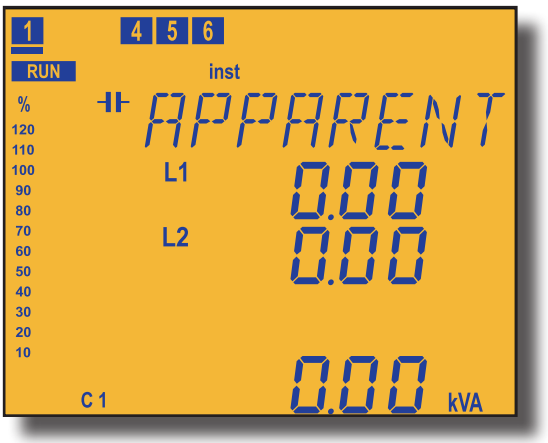
ES1 Active power
ES2 Active power
Total Active Power



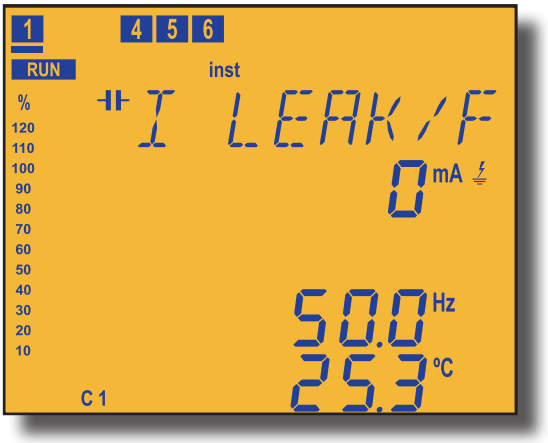
ES1 Inductive Reactive power
ES2 Inductive Reactive power
Total Inductive Reactive power



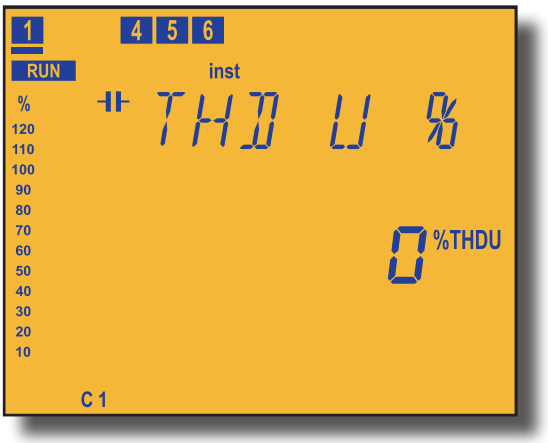
ES1 Capacitive Reactive power
ES2 Capacitive Reactive power
Total Capacitive Reactive power



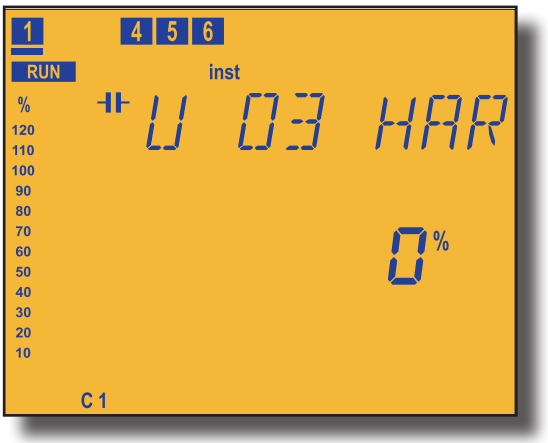
ES1 Apparent power
ES2 Apparent power
Total Apparent power



Leakage current
Frequency
Temperature

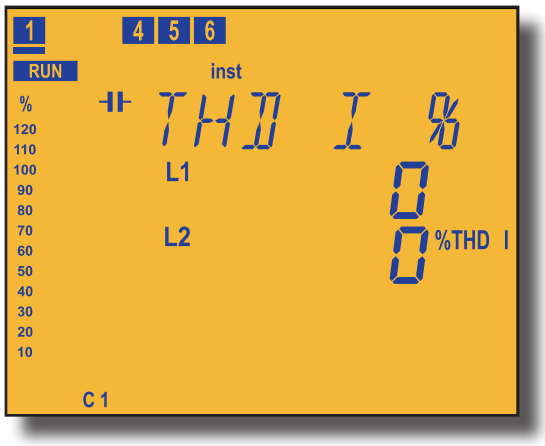


Voltage THD

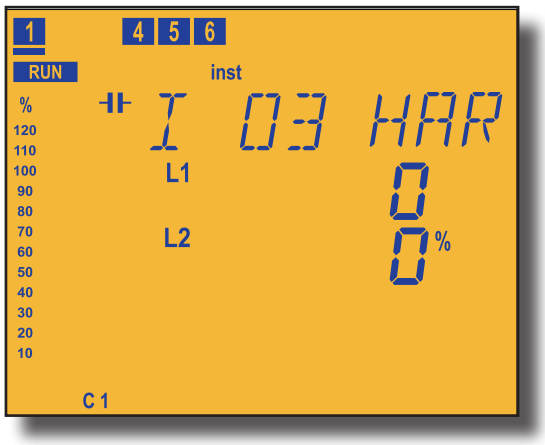


Voltage harmonic

Press ☰ to select the harmonic order, from 3 to 17.

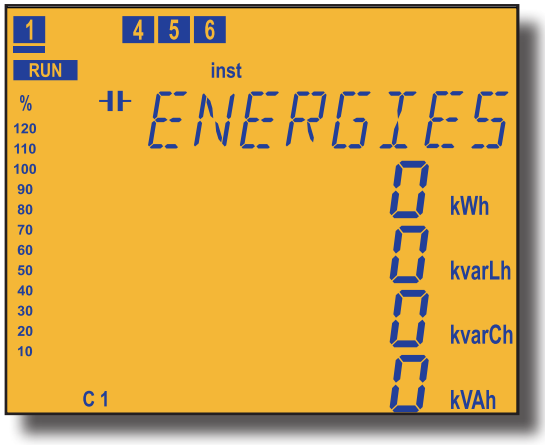


ES1 Current THD
ES2 Current THD



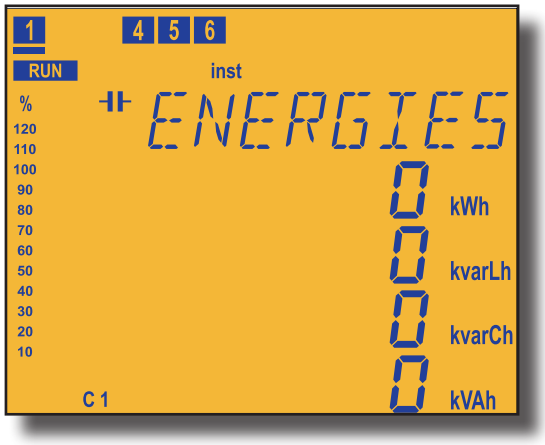
ES1 Current harmonic
ES2 Current harmonic

Press ≡ to select the harmonic order, from 3 to 17.

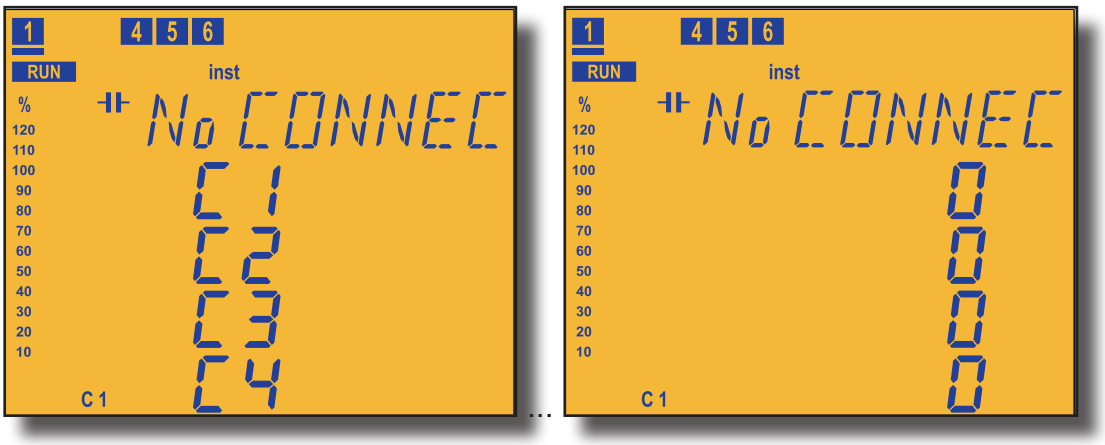


Total Active Energy consumed
Total Inductive Reactive Energy consumed
Total Capacitive Reactive Energy consumed
Total Apparent Energy consumed

≡ Press to switch to the **Main** screen.

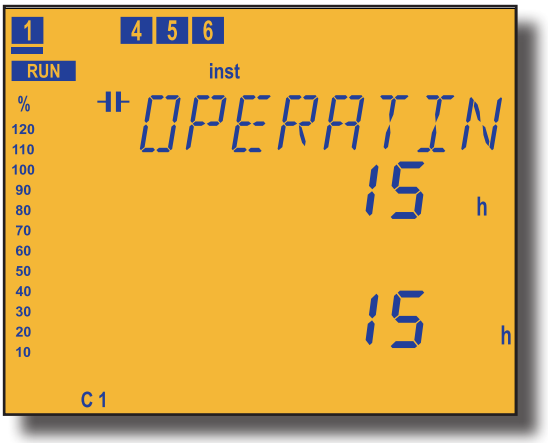


Total Active Energy generated
Total Inductive Reactive Energy generated
Total Capacitive Reactive Energy generated
Total Apparent Energy generated

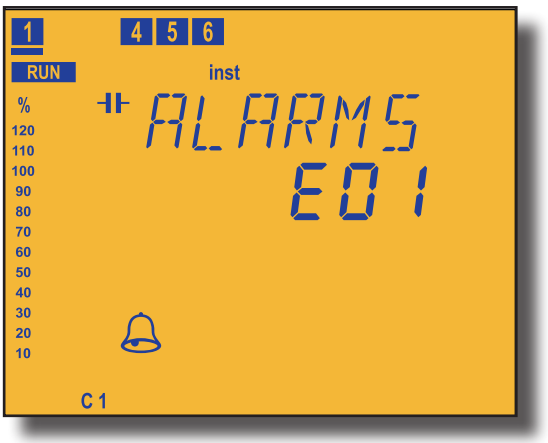


Number of switching operations for stages C1 to C12 (14)

The number of switching operations for the 12 available stages is shown across three screens.
Press and hold the › key for more than 3 seconds to clear the number of switching operations.



Device operating hours
Operating hours since the last maintenance (15)



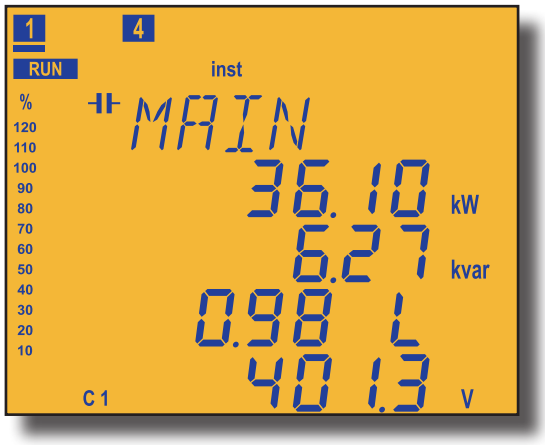
Active alarms codes E01 to E18 (Table 11)

If more than four alarms are active, the corresponding information cycles on the display.

(14) An alarm should be associated with this parameter and configured to activate when the number of switching operations exceeds a specified value (e.g. 5000), indicating that the corresponding stage requires maintenance.

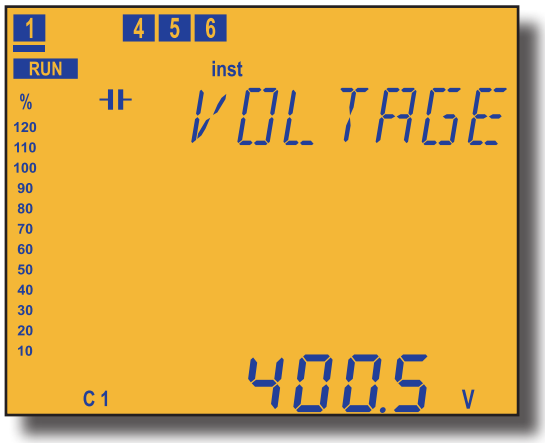
(15) When the operating hours since the last maintenance exceed 9000 hours, error code E 18 and the alarm icon , 🔔 , are displayed. See **Table 11**.

5.2.6.- CONNECTION 2U. 1C (2 VOLTAGES AND 1 ENERGY SOURCE)

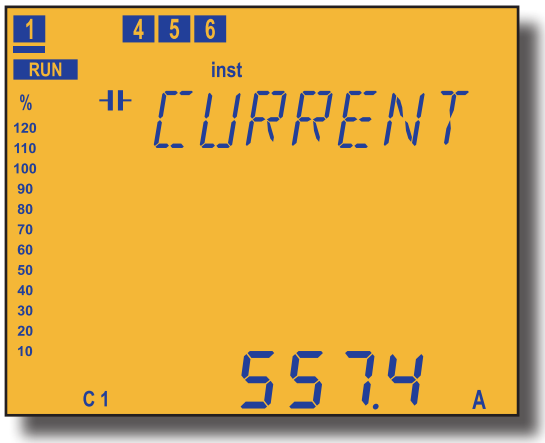


Total Active Power
Total Reactive Power
cos φ
L: Inductive / C: Capacitive
+: Consumed / - : Generated
Phase-to-phase voltage III

Press to switch to the **current** screens.

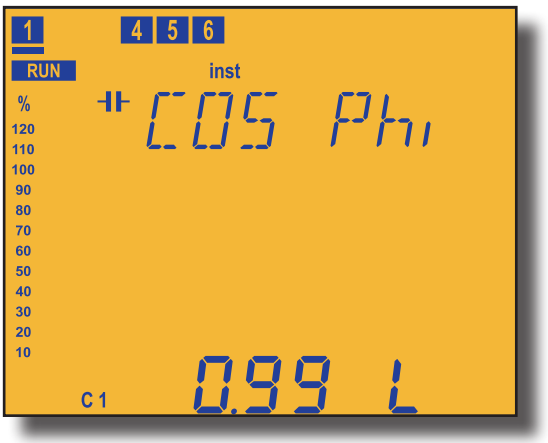


Phase-to-Phase voltage



ES1 current

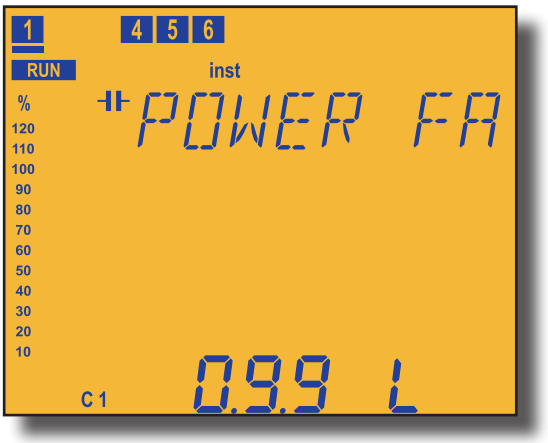
Press to switch to the **cos φ** screen.



ES1 cos φ

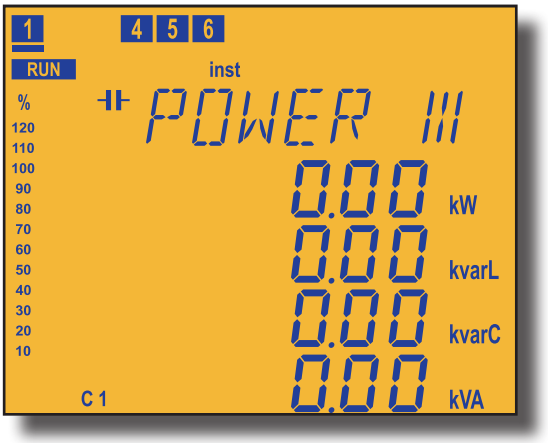
L: Inductive / C: Capacitive
+: Consumed / -: Generated

Press to switch to the **consumed energy III** screen.

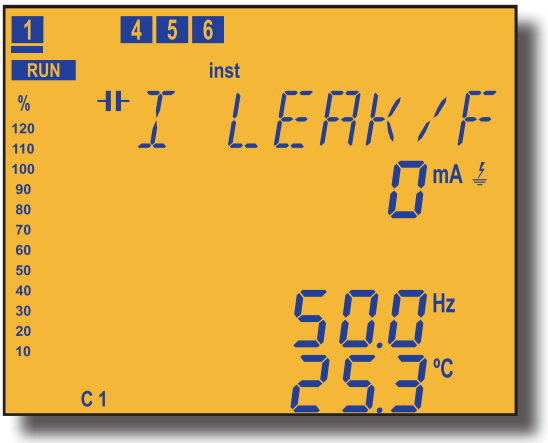


ES1 Power factor

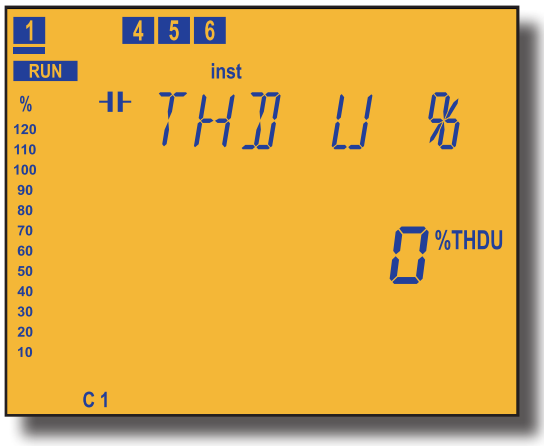
L: Inductive / C: Capacitive
+: Consumed / -: Generated



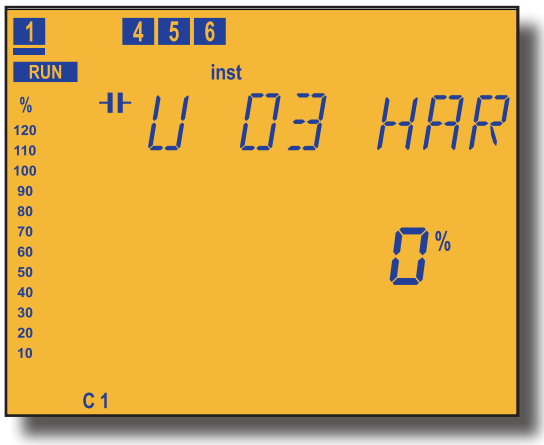
Total Active power
Total Inductive Reactive power
Total Capacitive Reactive power
Total Apparent power



Leakage current
Frequency
Temperature

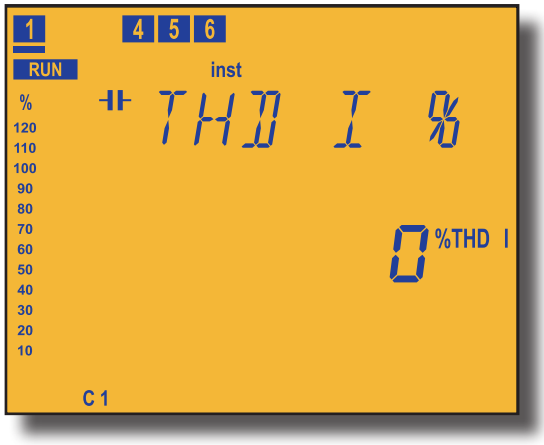


Voltage THD

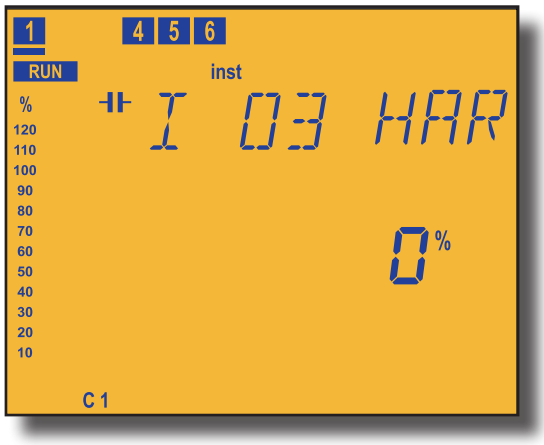


Voltage harmonic

Press ☰ to select the harmonic order, from 3 to 17.

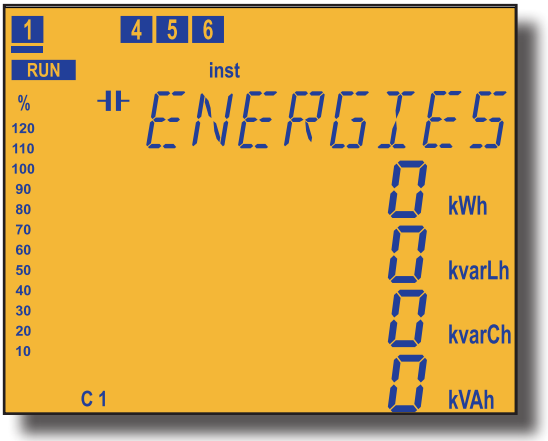


ES1 Current THD



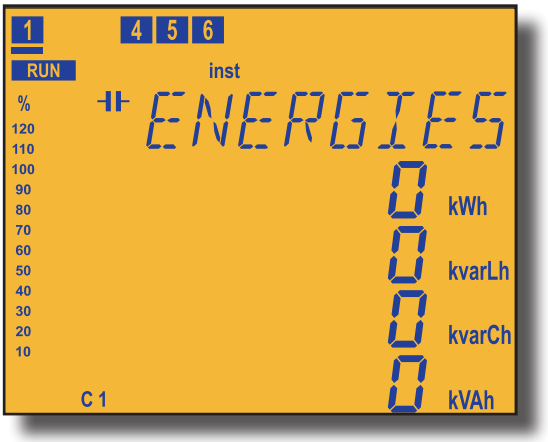
ES1 Current harmonic

Press ☰ to select the harmonic order, from 3 to 17.

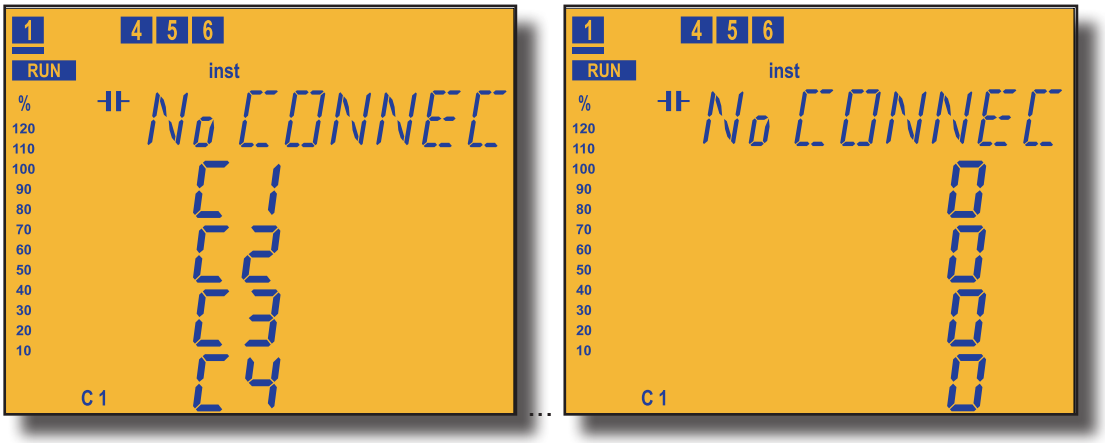


Total Active Energy consumed
Total Inductive Reactive Energy consumed
Total Capacitive Reactive Energy consumed
Total Apparent Energy consumed

Press to switch to the **Main** screen.



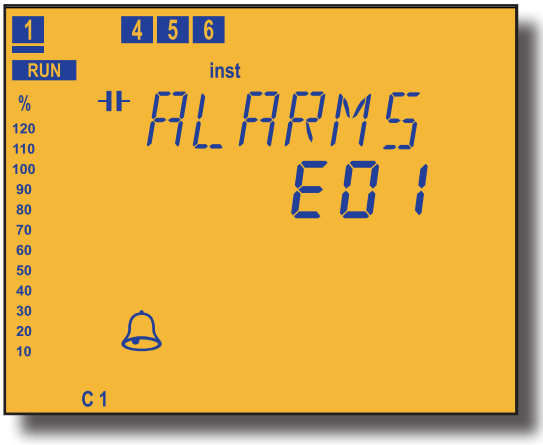
Total Active Energy generated
Total Inductive Reactive Energy generated
Total Capacitive Reactive Energy generated
Total Apparent Energy generated



Number of switching operations for stages C1 to C12 (16)

The number of switching operations for the 12 available stages is shown across three screens.
Press and hold the › key for more than 3 seconds to clear the number of switching operations.

Device operating hours
Operating hours since the last maintenance[17]



Active alarms codes E01 to E18 (Table 11)

If more than four alarms are active, the corresponding information cycles on the display.

[16] An alarm should be associated with this parameter and configured to activate when the number of switching operations exceeds a specified value (e.g. 5000), indicating that the corresponding stage requires maintenance.
[17] When the operating hours since the last maintenance exceed 9000 hours, error code *E 18* and the alarm icon , , are displayed. See **Table 11**.

5.3.- **TEST:** TEST STATES

This state is identified by the **TEST** symbol in the device status area of the display (**Figure 9**).

In this state, the stages can be manually connected and disconnected, and the measured parameters associated with each stage can be viewed. It also includes the **AutoTest** function, which performs a scan and calculation of all configured stages.

Press and hold the ⌄ ⌃ keys for more than 10 s from any measurement screen to enter the **TEST** state.

Press and hold the ⌄ ⌃ keys for more than 10 s from any **TEST** screen to return to the Measurement state.

Upon entering the **TEST** state, the disconnection screen shown in **Figure 16** is displayed. The device automatically disconnects all stages before entering the TEST state.
While this screen is displayed, the device does not respond to the keypad.

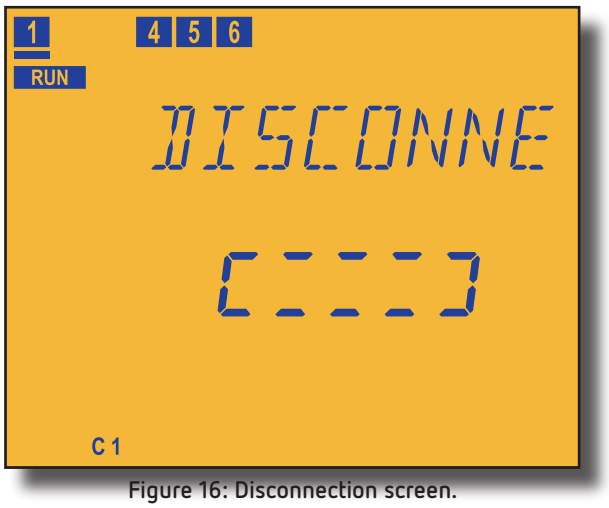


Figure 16: Disconnection screen.

The device automatically exits this screen. This may take some time.

To navigate through the different screens, use the keys ^ and ˇ.
If no key is pressed for 5 minutes, the device switches to the main screen.

5.3.1.- AUTOTEST

The **Figure 17** shows the initial **AutoTest** screen. The **AutoTest** scans and calculates all the device stages.

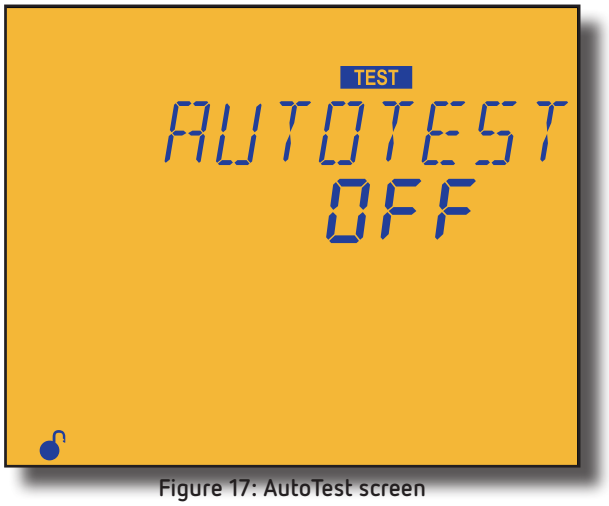


Figure 17: AutoTest screen

To start the **AutoTest**, press the ≡ key. The text OFF flashes.
Press the ^ key to change from OFF to StArt, then press the ≡ key to start the **AutoTest**.

Once the **AutoTest** has started, the results are displayed as the capacitors are connected and disconnected.
The **RUN** icon flashes during the **AutoTest**.

Leakage current
Capacitive Reactive Power
% Capacitive power of each capacitor as a percentage of the total estimated value.

Press and hold the ☰ key for more than 3 s to cancel the **AutoTest**.

When the **AutoTest** is complete, the device automatically switches to the **Individual Test** screen.

To navigate through the different test screens, use the keys ^ and ˇ .

5.3.2.- INDIVIDUAL TEST

The stages can be manually connected and disconnected using the **Individual Test** screens, and the measured parameters associated with each stage can be viewed.

Leakage current
Capacitive Reactive Power
% Capacitive power of each capacitor as a percentage of the total estimated value.

Press and hold the ^ key for more than 3 s to connect the displayed capacitor, subject to the programmed connection and reconnection times.

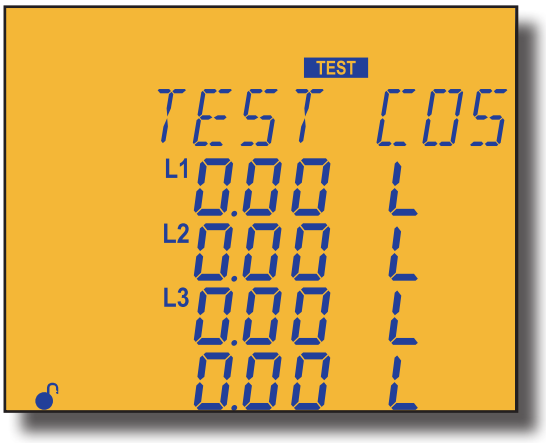
Press and hold the ˇ key for more than 3 s to disconnect the displayed capacitor, subject to the programmed connection and reconnection times.

Use the < and > keys to move between the different capacitors.

To navigate through the different test screens, use the keys ^ and ˇ .

5.3.3.- COS φ TEST

This screen displays the cos φ status.

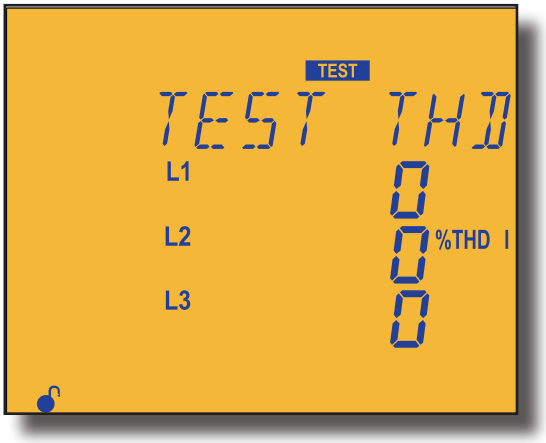


ES1 cos φ
ES2 cos φ
ES3 cos φ
Total cos φ
L: Inductive / C: Capacitive
+: Consumed / -: Generated

To navigate through the different test screens, use the keys ^ and ˇ .

5.3.4.- CURRENT THD TEST

This screen displays the current total harmonic distortion (THD).

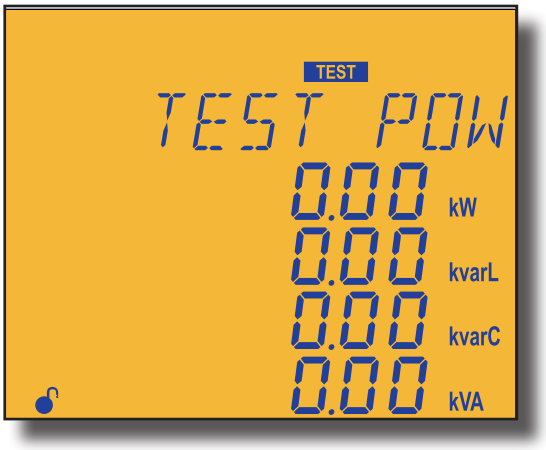


L1 current THD
L2 current THD
L3 current THD

To navigate through the different test screens, use the keys ^ and ˇ .

5.3.5.- POWER TEST

This screen displays the power measured by the device.



Total Active Power
Total Inductive Reactive Power
Total Capacitive Reactive Power
Total Apparent Power

To navigate through the different test screens, use the keys ^ and ˇ .

6.- CONFIGURATION

The configuration menu allows device parameters to be viewed and edited. The device keeps the capacitors disconnected at all times, except in **Plug&Play** mode.

This state is identified by the symbol **SETUP** in the device status area of the display.

To enter the configuration menu, press and hold the ≡ key for more than 3 s.

The password screen is shown on the display (**Figure 18**).

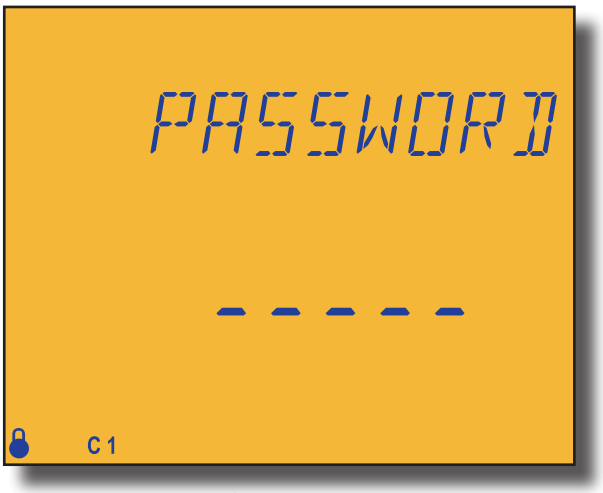


Figure 18: Password screen.

Table 12: Access password.

Access password	
Password	^ ≡ v ≡

Note: *The password is fixed and cannot be changed.*

If the password is entered incorrectly, the device returns to the measurement screen previously displayed.
If the password is entered correctly while one or more capacitors are connected, the disconnection screen appears (**Figure 19**).

The disconnection screen allows the device to disconnect all stages automatically before entering configuration mode.
While this screen is displayed, the device does not respond to keypad input.

Figure 19: Disconnection screen.

The device automatically exits this screen. This may take some time.

If no key is pressed for 5 minutes, the device exits the configuration menu and switches to the main measurement screen.

6.1.- PLUG&PLAY

Plug&Play assists with device configuration by automatically setting the basic parameters required for correct regulation.
To start the Plug&Play process, press the ☰ (**Figure 20**).
The device enters edit mode, indicated by the **EDIT** symbol and the flashing display digits.

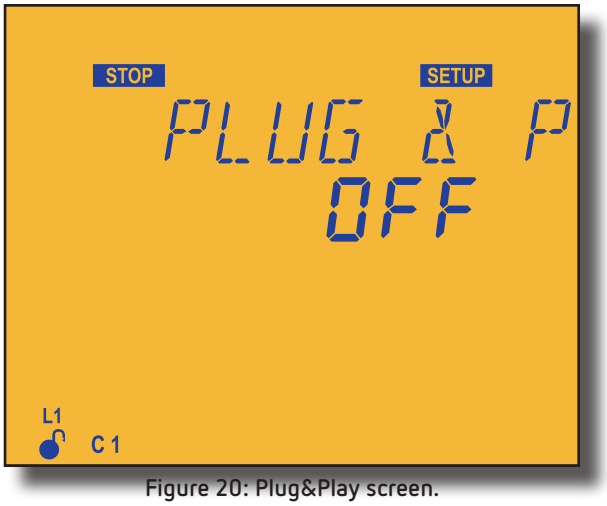


Figure 20: Plug&Play screen.

Press the ^ key to change from OFF to StArt
Press the ☰ key to start **Plug&Play.** Once started, the device connects and disconnects the capacitors, takes measurements and performs calculations to determine the following capacitor bank parameters:

- ✓ Connection type,
- ✓ Connection phase,
- ✓ Transformer direction,
- ✓ Number of steps detected,
- ✓ Program,

These parameters can also be configured manually in their corresponding setup screens.

When the device's **Plug&Play** process is active, the screen shown in **Figure 21** is displayed with the **RUN** symbol flashing. This process may take several minutes.

During the process, capacitors are connected and disconnected, and the corresponding information is shown on the display.

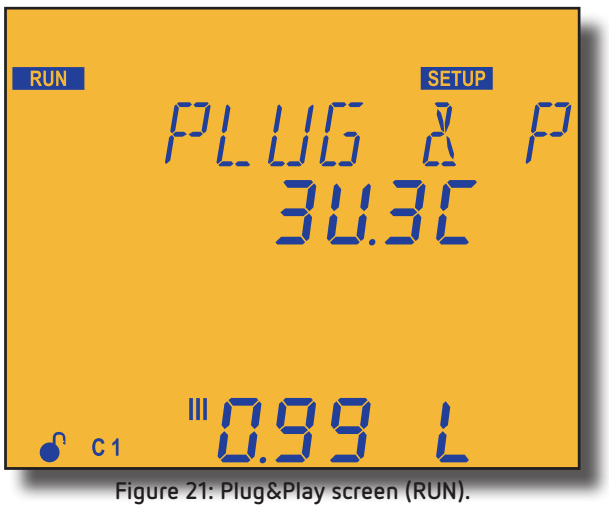
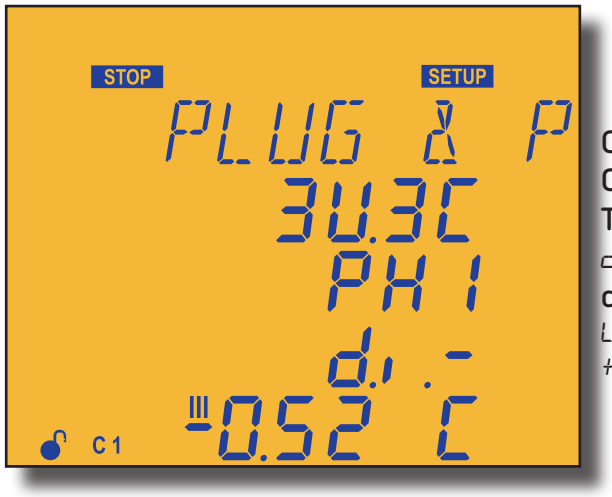


Figure 21: Plug&Play screen (RUN).

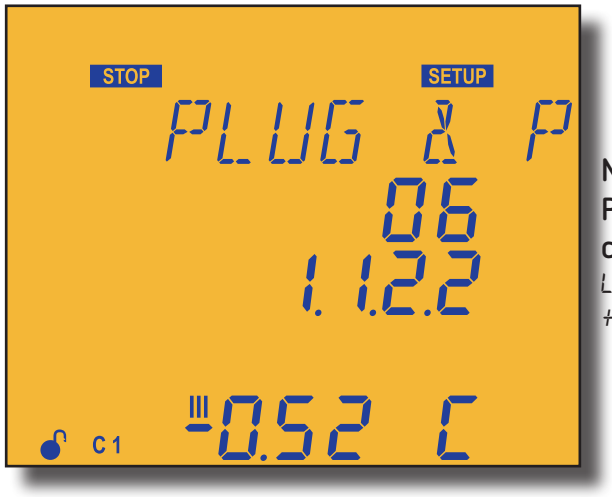
Once the device's **Plug&Play** process is complete, provided that no errors have occurred, the results are shown on two screens as follows:



Connection type
Connection phase
Transformer direction:
d: direct, i: inverse, -: no transformer
cos φ III
L: inductive, C: capacitive
+: consumed, - : generated

Press the ⌄ key to move to the next results screen.

Press the ⌃ key to exit the results screens.



No. of steps detected
Program
cos φ III
L: inductive, C: capacitive
+: consumed, - : generated

If an error occurs during the **Plug&Play** process, the process is aborted and the error is shown on the display (**Figure 22**).

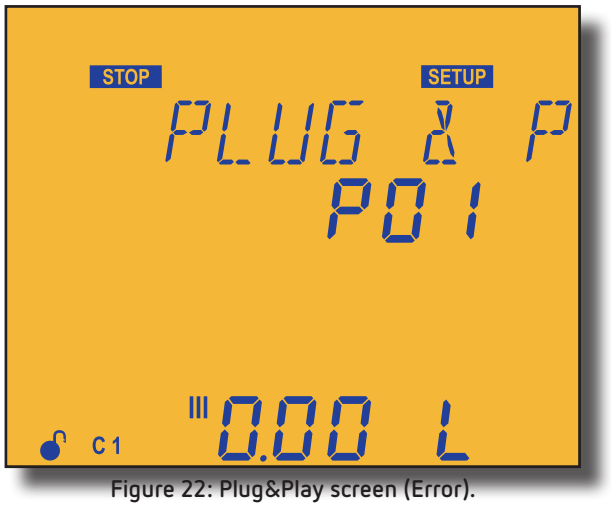


Figure 22: Plug&Play screen (Error).

If any parameter was successfully calculated before the error occurred, it is displayed on its assigned line. The errors that may occur during **Plug&Play** are listed in **Table 13**.

Table 13: Plug&Play error codes.

Code	Description
P00	The Plug&Play process cannot start for any of the following three reasons: - One or more stages have been disabled by the leakage current alarm. - One or more stages have been forced in ***"6.16.- STAGE STATUS".*** - The programmed reconnection time exceeds 280 s.
P01	Error while determining the connection type. See the connection diagrams.
P02	Phase not found. The cos φ outside the allowable range (0.62 to 0.99 inductive).
P03	Unstable measurement. Load changes during the process.
P04	Error in the measurement of the largest capacitor.
P05	No capacitor found.
P06	Incorrect measurement of the number of capacitors.
P07	Incorrect measurement of the first capacitor ratio.
P08	Possible error in the calculated program.

If error P00 occurs because one or more capacitors have been disabled by the leakage current alarm or forced through configuration, or because the reconnection time exceeds 280 s, **Plug&Play** cannot run until the issue is resolved.

Plug&Play is intended to assist with installation of the reactive energy compensation system, initial regulator configuration or system modifications (new regulator, new wiring, new stage, etc.). Before running **Plug&Play**, any problems caused by faulty capacitors must be resolved through maintenance or replacement, and all stages must be set to Auto mode, as configured by default.

Conditions for proper Plug&Play operation:

✓ The system must maintain an inductive cos φ between 0.62 and 0.99 throughout the process.
✓ The power in the system must be stable. There should be no significant load changes (>10% within 20 seconds) as this would result in incorrect calculation of capacitor power.
✓ There must be sufficient current in the system, above 100 mA AC at the regulator input.
✓ If the load is unbalanced, correct **Plug&Play** operation depends on the phase to which the current transformer is connected.

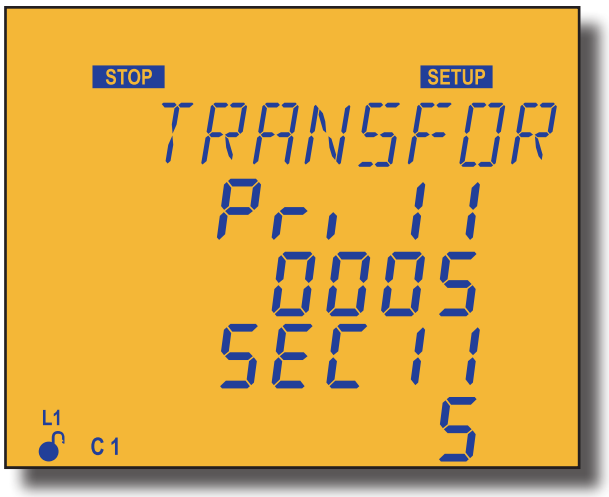
Once **Plug&Play** is complete, the current transformer primary must be configured to ensure that the device measures current and power correctly.

Press the ˅ key to proceed to the next configuration step.

To exit the configuration menu, press and hold the ≡ > key for more than 3 s. The ***"6.31.- SIMULATION SCREEN"*** is displayed.

6.2.- CURRENT TRANSFORMER RATIO (ENERGY SOURCE ES1)

This screen is used to configure the primary and secondary current transformer values for energy source **ES1**.
Press the ≡ key to enter edit mode, indicated by the **EDIT** symbol and the flashing digits.



The ^ key increases the digit value or displays the next option.
The ˅ key decreases the digit value or displays the previous option.
The < key moves to the previous digit, and the > key moves to the next digit.

- **ES1 primary current** (Pr.11)

Table 14: Configuration values: Primary current (ES1).

ES1 primary current	
Minimum value	1
Maximum value	9999

- **ES1 secondary current** (SEC 11)

Table 15: Configuration values: Secondary current (ES1).

ES1 secondary current	
Possible values	1
	5

Note: *The current transformer secondary value is common to all three energy sources. Changing it on one screen automatically updates it on the other screens.*

The maximum permissible current ratio is 2500.
Note: *The current ratio is the ratio between primary and secondary currents.*
The maximum value of: current ratio x voltage ratio: 65000.

To validate the data, press ☰ key. The **EDIT** symbol disappears from the display.

If the entered value is lower than the minimum value or higher than the maximum value, the display backlight flashes, and the entered value is replaced by the minimum or maximum value, or the last validated value.

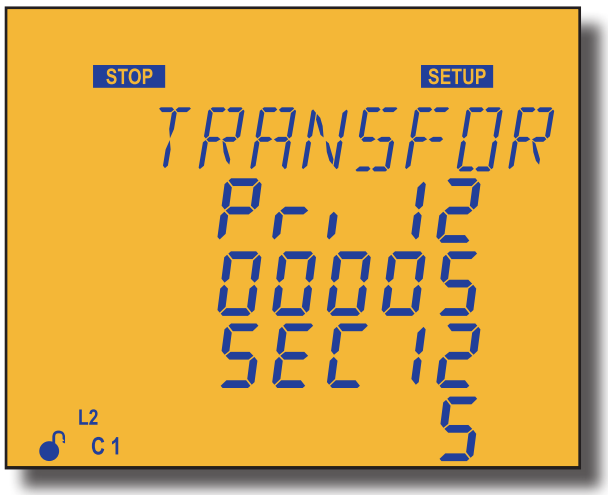
To proceed to the next programming step, press the ⌄ key.

To exit the configuration menu, press and hold the ☰ > key for more than 3 s. The ***"6.31.- SIMULATION SCREEN"*** is displayed.

6.3.- CURRENT TRANSFORMER RATIO (ENERGY SOURCE ES2)

Note: *This screen is available for the following connection types:* 3U.3C, 3U.2C, 2U.3C and 2U.2C.

This screen is used to configure the primary and secondary current transformer values for energy source **ES2**.
Press the ☰ key to enter edit mode, indicated by the **EDIT** symbol and the flashing digits.



The ⌃ key increases the digit value or displays the next option.

The ⌄ key decreases the digit value or displays the previous option.

The ‹ key moves to the previous digit, and the › key moves to the next digit.

- **ES2 primary current** (Pr i 2)

Table 16: Configuration values: Primary current (ES2).

ES2 primary current	
Minimum value	1
Maximum value	9999

- **ES2 secondary current** (SEC i 2)

Table 17: Configuration values: Secondary current (ES2).

ES2 secondary current	
Possible values	1
	5

Note: *The current transformer secondary value is common to all three energy sources. Changing it on one screen automatically updates it on the other screens.*

The maximum permissible current ratio is 2500.
Note: *The current ratio is the ratio between primary and secondary currents.*
The maximum value of: current ratio x voltage ratio: 65000.

To validate the data, press ☰ key. The **EDIT** symbol disappears from the display.

If the entered value is lower than the minimum value or higher than the maximum value, the display backlight flashes, and the entered value is replaced by the minimum or maximum value, or the last validated value.

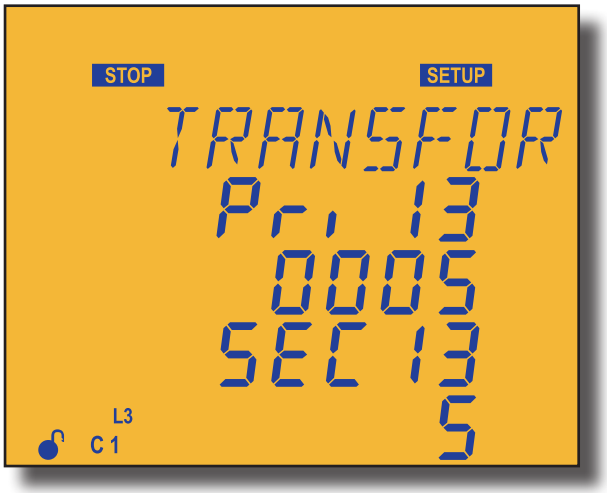
To proceed to the next programming step, press the ⌄ key.

To exit the configuration menu, press and hold the ☰ > key for more than 3 s. The ***"6.31.- SIMULATION SCREEN"*** is displayed.

6.4.- CURRENT TRANSFORMER RATIO (ENERGY SOURCE ES3)

Note: *This screen is available for the following connection types:* 3U.3C and 2U.3C.

This screen is used to configure the primary and secondary current transformer values for energy source **ES3**.
Press the ☰ key to enter edit mode, indicated by the **EDIT** symbol and the flashing digits.



The ^ key increases the digit value or displays the next option.

The ˅ key decreases the digit value or displays the previous option.

The < key moves to the previous digit, and the > key moves to the next digit.

- **ES3 primary current** (Pr 13)

Table 18: Configuration values: Primary current (ES3).

ES3 primary current	
Minimum value	1
Maximum value	9999

- **ES3 secondary current** (SEC 13)

Table 19: Configuration values: Secondary current (ES3).

ES3 secondary current	
Possible values	1
	5

Note: *The current transformer secondary value is common to all three energy sources. Changing it on one screen automatically updates it on the other screens.*

The maximum permissible current ratio is 2500.
Note: *The current ratio is the ratio between primary and secondary currents.*
The maximum value of: current ratio x voltage ratio: 65000.

To validate the data, press ☰ key. The **EDIT** symbol disappears from the display.

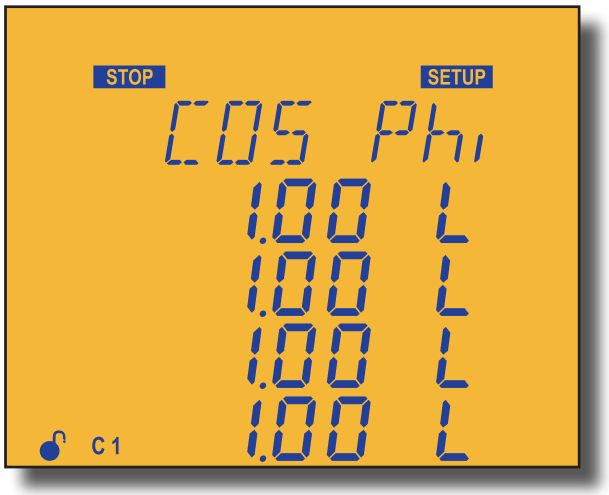
If the entered value is lower than the minimum value or higher than the maximum value, the display backlight flashes, and the entered value is replaced by the minimum or maximum value, or the last validated value.

To proceed to the next programming step, press the ˅ key.

To exit the configuration menu, press and hold the ≡ > key for more than 3 s. The ***"6.31.- SIMULATION SCREEN"*** is displayed.

6.5.- TARGET COS φ

The target cos φ setting defines the desired power factor for the installation. The **Computer PV** connects the required number of capacitors to bring the actual value as close as possible to the target value. Because regulation is performed in stages, no switching operation is carried out until the uncompensated demand reaches at least 70% of the power of the smallest stage or the overcompensation reaches 70% of the power of the smallest stage.



Four target cos φ values can be configured. Depending on the status of the digital inputs (see ***"4.7.- INPUTS"***), the device selects one of the four programmed values.

For each target cos φ, set the value and select whether it is inductive (L) or capacitive (C).

Press the ≡ key to enter edit mode, indicated by the **EDIT** symbol and the flashing digits.

The ˄ key increases the digit value or displays the next option.

The ˅ key decreases the digit value or displays the previous option.

The ˂ key moves to the previous digit, and the ˃ key moves to the next digit.

Table 20: Configuration values: cos φ.

cos φ			
Minimum value	0.50	**Possible values**	L, Inductive
Maximum value	1.00		C, Capacitive

To validate the data, press ≡ key. The **EDIT** symbol disappears from the display.

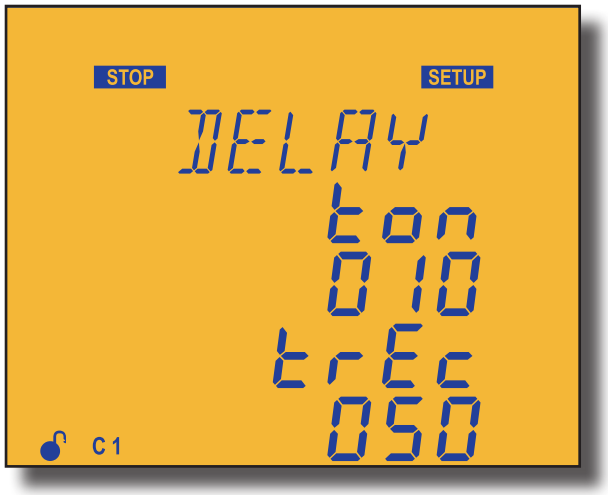
If the entered value is lower than the minimum value or higher than the maximum value, the display backlight flashes, and the entered value is replaced by the minimum or maximum value, or the last validated value.

To proceed to the next programming step, press the ⌄ key.

To exit the configuration menu, press and hold the ≡ > key for more than 3 s. The ***"6.31.- SIMULATION SCREEN"*** is displayed.

6.6.- CONNECTION AND RECONNECTION TIMES

This screen is used to configure the connection and reconnection times of the **Computer PV 12**.



Press the ≡ key to enter edit mode, identified by the symbol **EDIT** and the blinking of the digits to be modified.

The ^ key displays the next option.

The ⌄ key displays the previous option.

The < key moves to the previous digit, and the > key moves to the next digit.

- **Connection time** (ton): the minimum time between the connection and disconnection of the same stage.
- **Reconnection time** (trEC): the minimum time between disconnection and connection of the same stage. The trEC value must be greater than the ton value. A value five times greater is recommended.

Table 21: Configuration values: Connection and reconnection time.

Ton		trEC	
Minimum value	4 s	**Minimum value**	20 s
Maximum value	999 s	**Maximum value**	999 s

To validate the data, press ≡ key. The **EDIT** symbol disappears from the display.

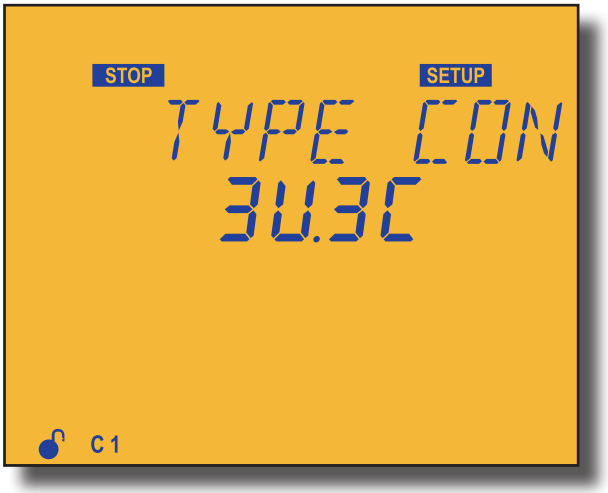
If the entered value is lower than the minimum value or higher than the maximum value, the display backlight flashes, and the entered value is replaced by the minimum or maximum value, or the last validated value.

To proceed to the next programming step, press the ⌄ key.

To exit the configuration menu, press and hold the ☰ > key for more than 3 s. The ***"6.31.- SIMULATION SCREEN"*** is displayed.

6.7.- CONNECTION TYPE

This screen is used to configure the installation connection type.



Press the ☰ key to enter edit mode, identified by the symbol **EDIT** and the blinking of the digits to be modified.

The ^ key displays the next option.

The ˇ key displays the previous option.

Table 22: Configuration values: Connection type.

Connection type		
Possible values	3U.3C	3 voltages and 3 energy sources (**ES1, ES2, ES3**)
	3U.2C	3 voltages and 2 energy sources (**ES1, ES2**)
	3U. 1C	3 voltages and 1 energy source (**ES1**)
	2U.3C	2 voltages and 3 energy sources (**ES1, ES2, ES3**)
	2U.2C	2 voltages and 2 energy sources (**ES1, ES2**)
	2U. 1C	2 voltages and 1 energy source (**ES1**)

To validate the data, press ☰ key. The **EDIT** symbol disappears from the display.

To proceed to the next programming step, press the ˇ key.

To exit the configuration menu, press and hold the ☰ > key for more than 3 s. The ***"6.31.- SIMULATION SCREEN"*** is displayed.

6.8.- PHASE CONNECTION

This parameter adapts the device to the different ways in which the power supply and measurement cables and the current transformers can be connected to the phases of the three-phase system.

The appropriate option must be selected while, at the time of adjustment, the installation is consuming inductive reactive power with an inductive cos φ between 0.6 and 1. Try the available options until the display shows a cos φ between 0.6 and 1. The displayed cos φ is provided for reference only and cannot be modified.

Press the ≡ key to enter edit mode, identified by the symbol **EDIT** and the blinking of the digits to be modified.

The ^ key displays the next option.

The ˇ key displays the previous option.

Table 23: Configuration values: Phase connection.

	Phases	V measurement phases	CT connection phase
Possible values	PH 1	L1-L2-L3	L1
	PH2	L1-L2-L3	L2
	PH3	L1-L2-L3	L3

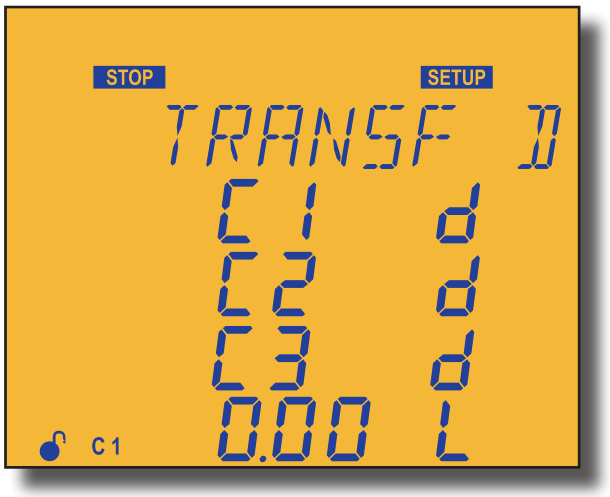
To validate the data, press ≡ key. The **EDIT** symbol disappears from the display.

To proceed to the next programming step, press the ˇ key.

To exit the configuration menu, press and hold the ≡ > key for more than 3 s. The ***"6.31.- SIMULATION SCREEN"*** is displayed.

6.9.- TRANSFORMER DIRECTION

This screen configures the current direction for each energy source (**ES**).



Press the ≡ key to enter edit mode, identified by the symbol **EDIT** and the blinking of the digits to be modified.

The ^ key displays the next option.

The ˇ key displays the previous option.

- **Transformer 1 direction** (C 1): Current transformer direction for **ES1**.
- **Transformer 2 direction** (C2): Current transformer direction for **ES2**.
- **Transformer 3 direction** (C3): Current transformer direction for **ES3**.

Table 24: Configuration values: Transformer direction.

	C1 (ES1)		C2 (ES2)		C3 (ES3)	
Possible values	d	direct	d	direct	d	direct
	ı	inverse	ı	inverse	ı	inverse

To validate the data, press ≡ key. The **EDIT** symbol disappears from the display.

To proceed to the next programming step, press the ˇ key.

To exit the configuration menu, press and hold the ≡ > key for more than 3 s. The ***"6.31.- SIMULATION SCREEN"*** is displayed.

6.10.- NUMBER OF STEPS

This screen is used to configure the number of steps, that is, the number of relay outputs that the device will have. The **Computer PV 12** can be configured with up to 12 relay outputs.

Press the ≡ key to enter edit mode, identified by the symbol **EDIT** and the blinking of the digits to be modified.

The ^ key displays the next option.

The ˇ key displays the previous option.

Table 25: Configuration values: No. of steps.

No. of steps	
Minimum value	0
Maximum value	12

To validate the data, press ≡ key. The **EDIT** symbol disappears from the display.

To proceed to the next programming step, press the ˇ key.

To exit the configuration menu, press and hold the ≡ > key for more than 3 s. The ***"6.31.- SIMULATION SCREEN"*** is displayed.

6.11.- PROGRAM

The device may be configured with stages of different power ratings. The power rating of the lowest-power stage is used as the base value (1), and the power ratings of the other stages are expressed relative to it.

Example:

Program 1.1.1.1, *all stages have the same power rating as the first stage.*

Program 1.2.4.4, *the second stage has twice the power rating of the first stage, and the subsequent stages have four times its power rating. See* ***"4.2.4.- REGULATION PROGRAM"****.*

When configuring the program, each stage value must be equal to or greater than the preceding stage value, and the first value must always be 1.

Press the ≡ key to enter edit mode, identified by the symbol **EDIT** and the blinking of the digits to be modified.

The ^ key displays the next option.

The ˇ key displays the previous option.

The < key moves to the previous digit, and the > key moves to the next digit.

Table 26: Configuration values: Program.

Program	
Minimum value	1.1.1.1
Maximum value	1.9.9.9

To validate the data, press ≡ key. The **EDIT** symbol disappears from the display.

To proceed to the next programming step, press the ˇ key.

To exit the configuration menu, press and hold the ≡ > key for more than 3 s. The ***"6.31.- SIMULATION SCREEN"*** is displayed.

6.12.- C/K FACTOR

The C/K factor is determined according to the reactive current supplied by the smallest stage, measured on the secondary side of the current transformer (CT). The required setting therefore depends on the power rating of the smallest stage, the CT ratio and the network voltage.

Table 27 and **Table 28** give the required C/K settings for a 400 V AC phase-to-phase network, for different CT ratios and smallest-stage power ratings.

Table 27: C/K factor (Table 1).

CT ratio (Ip / Is)	Power rating of the smallest stage at 400 V (kvar)													
	2.5	5.0	7.5	10.0	12.5	15.0	20.0	25.0	30.0	40.0	50.0	60.0	75.0	80.0
150/5	0.12	0.24	0.36	0.48	0.60	0.72	0.96							
200/5	0.09	0.18	0.27	0.36	0.45	0.54	0.72	0.90						
250/5	0.07	0.14	0.22	0.29	0.36	0.43	0.58	0.72	0.87					
300/5	0.06	0.12	0.18	0.24	0.30	0.36	0.48	0.60	0.72	0.96				
400/5	0.05	0.09	0.14	0.18	0.23	0.24	0.36	0.48	0.58	0.72	0.87			
500/5		0.07	0.11	0.14	0.18	0.22	0.29	0.36	0.45	0.54	0.72	0.87		
600/5		0.06	0.09	0.12	0.15	0.18	0.24	0.30	0.36	0.48	0.60	0.72	0.90	0.96
800/5			0.07	0.09	0.11	0.14	0.18	0.23	0.27	0.36	0.45	0.54	0.68	0.72
1000/5			0.05	0.07	0.09	0.11	0.14	0.18	0.22	0.29	0.36	0.43	0.54	0.57
1500/5				0.05	0.06	0.07	0.10	0.12	0.14	0.19	0.24	0.29	0.36	0.38
2000/5						0.05	0.07	0.09	0.11	0.14	0.18	0.22	0.27	0.28
2500/5							0.06	0.07	0.09	0.12	0.14	0.17	0.22	0.23
3000/5							0.05	0.06	0.07	0.10	0.12	0.14	0.18	0.19
4000/5									0.05	0.07	0.09	0.11	0.14	0.14

If the capacitor power rating at 440 V is used with a network voltage of 400 V, use **Table 28.**

Table 28: C/K factor (Table 2).

CT ratio (Ip / Is)	Power rating of the smallest stage at 440 V (kvar)													
	2.5	5.0	7.5	10.0	12.5	15.0	20.0	25.0	30.0	40.0	50.0	60.0	75.0	80.0
150/5	0.09	0.18	0.27	0.36	0.45	0.54	0.72	0.90						
200/5	0.07	0.14	0.20	0.27	0.34	0.41	0.54	0.68	0.81					
250/5	0.05	0.11	0.16	0.22	0.27	0.33	0.43	0.54	0.65	0.87				
300/5	0.05	0.09	0.14	0.18	0.23	0.27	0.36	0.45	0.54	0.72	0.90			
400/5		0.07	0.10	0.14	0.17	0.20	0.27	0.34	0.41	0.54	0.68	0.81		
500/5		0.05	0.08	0.11	0.14	0.16	0.22	0.27	0.33	0.43	0.54	0.65	0.81	0.87
600/5		0.05	0.07	0.09	0.11	0.14	0.18	0.23	0.27	0.36	0.45	0.54	0.68	0.72
800/5			0.05	0.07	0.08	0.10	0.14	0.17	0.20	0.27	0.34	0.41	0.51	0.54
1000/5			0.04	0.05	0.07	0.08	0.11	0.14	0.16	0.22	0.27	0.33	0.41	0.43
1500/5				0.04	0.05	0.05	0.07	0.09	0.11	0.14	0.18	0.22	0.27	0.29
2000/5						0.04	0.05	0.07	0.08	0.11	0.14	0.16	0.20	0.22
2500/5							0.04	0.05	0.07	0.09	0.11	0.13	0.16	0.17
3000/5							0.04	0.05	0.05	0.07	0.09	0.11	0.14	0.14
4000/5									0.04	0.05	0.07	0.08	0.10	0.11

For other voltages or conditions not included in the table, the C/K value can be obtained by a simple calculation.

✓ **C/K factor calculation**

The equation for calculating the C/K factor is:

$$C/K = \frac{I_C}{K}$$

where, **Ic**: is the current of the smallest capacitor.
K : is the current transformer ratio.
To calculate **Ic**, the reactive power **Q** of the smallest capacitor and the network voltage **V** must be known.

$$I_C = \frac{Q}{\sqrt{3}.V}$$

The transformation ratio K is calculated as:

$$K = \frac{IPrim_{ES1} + IPrim_{ES2} + IPrim_{ES3}}{Isec}$$

where,

IPrim ES1: is the rated primary current of the **ES1** transformer.
IPrim ES2: is the rated primary current of the **ES2** transformer.
IPrim ES3: is the rated primary current of the **ES3** transformer.
Isec: is the secondary current of the transformer.

Example: *In an installation with a single energy source (**ES1**) at 400 V, the smallest capacitor is rated at 60 kvar and the current transformer ratio is 500/5. The calculation is as follows:*

Current of the smallest capacitor, Ic: $I_C = \frac{60000}{\sqrt{3} \cdot 400}$

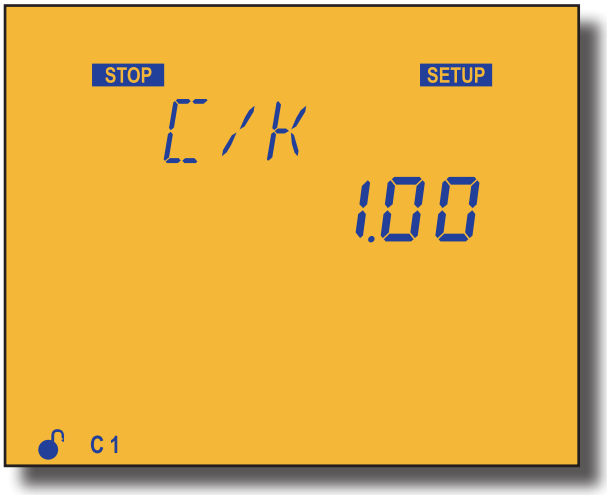
Factor K $K = 500/5 = 100$

*The C/K value is **0.866**.*

*If the 60 kvar power rating is specified at 440 V, it must be multiplied by V²/440², giving a C/K value of **0.72** for the previous example.*

⚠	If the C/K is set too low, there will be continuous connections and disconnections with minor load variations (The system performs more operations than necessary).
⚠	If the C/K is set too high, the regulator requires a higher reactive demand to switch and will perform fewer operations.

Press the ≡ key to enter edit mode, identified by the symbol **EDIT** and the blinking of the digits to be modified.



The ^ key increases the digit value.

The ˅ key decreases the digit value.

The ‹ key moves to the previous digit, and the › key moves to the next digit.

Table 29: Configuration values: C/K.

	C/K
Minimum value	0.02
Maximum value	1.0

To validate the data, press ☰ key. The **EDIT** symbol disappears from the display.

If the entered value is lower than the minimum value or higher than the maximum value, the display backlight flashes, and the entered value is replaced by the minimum or maximum value, or the last validated value.

To proceed to the next programming step, press the ˅ key.

To exit the configuration menu, press and hold the ☰ > key for more than 3 s. The ***"6.31.- SIMULATION SCREEN"*** is displayed.

6.13.- ADVANCED SETUP

This screen is used to select whether to access the advanced setup menu.

Press the ≡ key to enter edit mode, identified by the symbol **EDIT** and the blinking of the digits to be modified.

The ^ key displays the next option.

The ˇ key displays the previous option.

Table 30: Configuration values: Advanced setup.

Advanced setup		
Possible values	YES	The next programming step will be the voltage transformation ratio (***"6.14.- VOLTAGE TRANSFORMATION RATIO"***)
	no	The device returns to the Plug&Play configuration screen (***"6.1.- PLUG&PLAY"***)

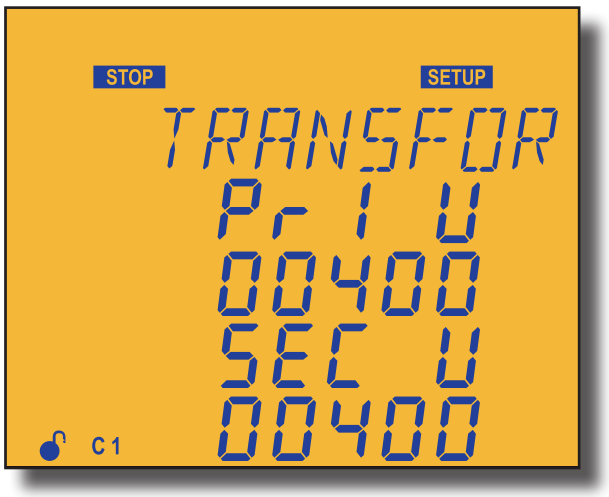
To validate the data, press ≡ key. The **EDIT** symbol disappears from the display.

To proceed to the next programming step, press the ˇ key.

To exit the configuration menu, press and hold the ≡ > key for more than 3 s. The ***"6.31.- SIMULATION SCREEN"*** is displayed.

6.14.- VOLTAGE TRANSFORMATION RATIO

This screen is used to configure the primary and secondary values of the voltage transformer.



Press the ≡ key to enter edit mode, identified by the symbol **EDIT** and the blinking of the digits to be modified.

The ^ key increases the digit value.

The ˇ key decreases the digit value.

The < key moves to the previous digit, and the > key moves to the next digit.

- **Primary voltage** (Pr I U): Primary value of the voltage transformer.
- **Secondary voltage** (SEC U): Secondary value of the voltage transformer.

Table 31: Configuration values: Transformation ratio.

	Primary voltage	Secondary voltage
Minimum value	1	1
Maximum value	99999	99999

The maximum permissible voltage ratio is 1000.
Note: *The voltage ratio is the ratio of the primary voltage to the secondary voltage.*
The maximum permissible value of the current ratio × voltage ratio is 65000.

To validate the data, press ☰ key. The **EDIT** symbol disappears from the display.

If the entered value is lower than the minimum value or higher than the maximum value, the display backlight flashes, and the entered value is replaced by the minimum or maximum value, or the last validated value.

To proceed to the next programming step, press the ⌄ key.

To exit the configuration menu, press and hold the ☰ > key for more than 3 s. The ***"6.31.- SIMULATION SCREEN"*** is displayed.

6.15.- HYSTERESIS

This section is used to configure the inductive (L) and capacitive (C) hysteresis values for the target cos φ. While cos φ remains within this range, the device does not connect any step, although it may disconnect them.

The hysteresis settings apply to all four configured target cos φ values.

Note: *If hysteresis is active, the* ***RUN*** *symbol flashes every 5 seconds on the display screens.*

Press the ☰ key to enter edit mode, identified by the symbol **EDIT** and the blinking of the digits to be modified.

The ⌃ key increases the digit value.

The ⌄ key decreases the digit value.

The ‹ key moves to the previous digit, and the › key moves to the next digit.

- **Capacitive hysteresis** (HYS C): capacitive (C) hysteresis value for the target cos φ.
- **Inductive hysteresis** (HYS L): inductive (L) hysteresis value for the target cos φ.

Table 32: Configuration values: Hysteresis.

	Capacitive hysteresis	Inductive hysteresis
Minimum value	0.00	0.00
Maximum value	0.10	0.10

To validate the data, press ☰ key. The **EDIT** symbol disappears from the display.

If the entered value is lower than the minimum value or higher than the maximum value, the display backlight flashes, and the entered value is replaced by the minimum or maximum value, or the last validated value.

To proceed to the next programming step, press the ⌄ key.

To exit the configuration menu, press and hold the ☰ > key for more than 3 s. The ***"6.31.- SIMULATION SCREEN"*** is displayed.

6.16.- STAGE STATUS

This parameter is available for each of the 12 possible stages and allows its state to be forced independently of the switching operation commanded by the device.

The stage being configured is identified on the display as C 1, C2...

On the measurement screens, the forced stage states are indicated by activating the lower line of the capacitor status bar (see ***"4.5.1. CAPACITOR STATUS"***).

Press the ☰ key to enter edit mode, identified by the symbol **EDIT** and the blinking of the digits to be modified.

The ⌃ key displays the next option.

The ⌄ key displays the previous option.

Table 33: Configuration values: Stage status.

Stage status		
Possible values	AUtO	The stage status depends on the switching operation commanded by the device.
	On	Stage forced **ON**; always connected.
	OFF	Stage forced **OFF**; always disconnected.
	On nC	Stage forced **ON** and permanently connected, but its connected power is not taken into account by the system.

Note: *By default, all stages are configured as AUtO.*

To validate the data, press ☰ key. The **EDIT** symbol disappears from the display.

The ‹ key jumps to the previous step.

The › key jumps to the next step.

To proceed to the next programming step, press the ˅ key.

To exit the configuration menu, press and hold the ☰ > key for more than 3 s. The ***"6.31.- SIMULATION SCREEN"*** is displayed.

6.17.- DISPLAY

This screen is used to configure the display backlight setting and language.

Press the ☰ key to enter edit mode, identified by the symbol **EDIT** and the blinking of the digits to be modified.

The ^ key displays the next option.

The ˅ key displays the previous option.

The ‹ key moves to the previous parameter, and the › key moves to the next parameter.

• **Display lighting**: Display backlight setting.

Table 34: Configuration values: Display Lighting.

Display Lighting		
Possible values	AUtO	The lighting turns on when a key is pressed and turns off if no key is pressed for 5 minutes.
	On	Display backlight always on.
	OFF	Display backlight always off.

• **Brightness level**: Brightness level of the display in %.

Table 35: Configuration values: Brightness Level.

Brightness Level	
Minimum value	0 %
Maximum value	100 %

• **Language**: Display language.

Table 36: Configuration values: Language.

Language				
Possible values	ESP	Spanish	tr	Turkish
	EnG	English	Srb	Serbian
	FrA	French		

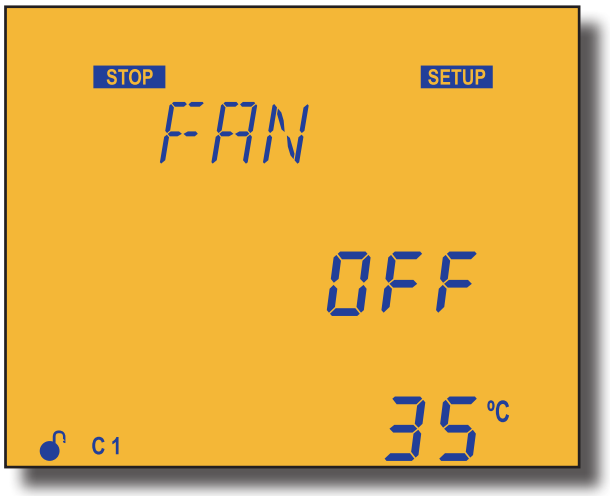
To validate the data, press ☰ key. The **EDIT** symbol disappears from the display.

To proceed to the next programming step, press the ⌄ key.

To exit the configuration menu, press and hold the ☰ > key for more than 3 s. The *"6.31.- SIMULATION SCREEN"* is displayed.

6.18.- FAN

At this point, the activation of the relay output associated with the fan is configured.
The device uses a hysteresis of 5 °C when switching off the fan to prevent frequent switching.



Press the ☰ key to enter edit mode, identified by the symbol **EDIT** and the blinking of the digits to be modified.

The ^ key increases the digit value or displays the next option.

The ˅ key decreases the digit value or displays the previous option.

The < key moves to the previous parameter, and the > key moves to the next parameter.

• **Fan**: Enables or disables the fan relay.

Table 37: Configuration values: Fan.

Fan		
Possible values	On	Fan relay enabled.
	OFF	Fan relay disabled.

• **Activation temperature**: Activation temperature of the fan relay.

Table 38: Configuration values: Activation temperature.

Activation temperature	
Minimum value	0 °C
Maximum value	80 °C

To validate the data, press ≡ key. The **EDIT** symbol disappears from the display.

If the entered value is lower than the minimum value or higher than the maximum value, the display backlight flashes, and the entered value is replaced by the minimum or maximum value, or the last validated value.

To proceed to the next programming step, press the ˅ key.

To exit the configuration menu, press and hold the ≡ > key for more than 3 s. The ***"6.31.- SIMULATION SCREEN"*** is displayed.

6.19.- UNDERVOLTAGE DISCONNECTION

This screen is used to configure the voltage threshold for undervoltage disconnection. This function disconnects all connected steps if any of the measured phase-to-phase voltages falls below the configured threshold. The steps are not reconnected until all the measured phase-to-phase voltages exceed the threshold.

Press the ≡ key to enter edit mode, identified by the symbol **EDIT** and the blinking of the digits to be modified.

The voltage threshold is set as a percentage of the configured primary voltage value ("*6.14.- VOLTAGE TRANSFORMATION RATIO*").

The ^ key increases the digit value.

The ˇ key decreases the digit value.

The < key moves to the previous digit, and the > key moves to the next digit.

Table 39: Configuration values: Undervoltage disconnection.

Undervoltage disconnection	
Minimum value	0 %
Maximum value	100 %

Note: *If 0% is set, the function is disabled.*
Note: *The value displayed in the fourth row (24 in the figure) cannot be edited and indicates the number of times the undervoltage disconnection function has been activated. This value is reset whenever the parameter is reconfigured.*

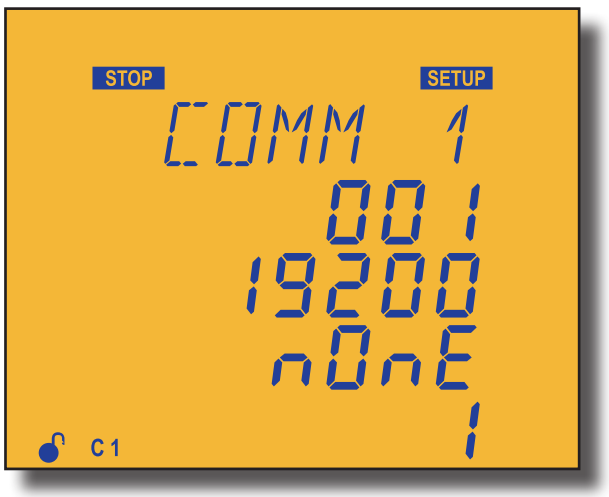
To validate the data, press ☰ key. The **EDIT** symbol disappears from the display.

To proceed to the next programming step, press the ˇ key.

To exit the configuration menu, press and hold the ☰ > key for more than 3 s. The *"6.31.- SIMULATION SCREEN"* is displayed.

6.20.- COMMUNICATIONS

This screen is used to configure the **RS-485** communication parameters.



Press the ☰ key to enter edit mode, identified by the symbol **EDIT** and the blinking of the digits to be modified.

The ^ key increases the digit value or displays the next option.

The ˇ key decreases the digit value or displays the previous option.

The < key moves to the previous digit or parameter.

The > key moves to the next digit or parameter.

- **Peripheral number**: Device number used for **RS-485** communications.

Table 40: Configuration values: Peripheral number.

Peripheral number	
Minimum value	1
Maximum value	254

- **Baud rate**: **RS-485** baud rate.

Table 41: Configuration values: Baud rate.

Baud rate	
Possible values	9600
	19200

- **Parity**: **RS-485** parity setting.

Table 42: Configuration values: Parity.

Parity		
Possible values	nonE	No parity
	EuEn	Even parity
	Odd	Odd parity

- **No. of stop bits**: Number of stop bits used for **RS-485** communications.

Table 43: Configuration values: No. of stop bits.

No. of stop bits	
Values possible	1
	2

To validate the data, press ☰ key. The **EDIT** symbol disappears from the display.

If the entered value is lower than the minimum value or higher than the maximum value, the display backlight flashes, and the entered value is replaced by the minimum or maximum value, or the last validated value.

To proceed to the next programming step, press the ⌄ key.

To exit the configuration menu, press and hold the ☰ > key for more than 3 s. The ***"6.31.- SIMULATION SCREEN"*** is displayed.

6.21.- CLEAR

This screen is used to select whether to reset the maximum and minimum values, energy values and number of stage connections.

Press the ≡ key to enter edit mode, identified by the symbol **EDIT** and the blinking of the digits to be modified.

The ^ key displays the next option.

The ˇ key displays the previous option.

The < key moves to the previous parameter, and the > key moves to the next parameter.

- **Maximums and minimums reset** (n): Resets the maximum and minimum values measured by the device.
- **Energy reset** (E): Resets the energy values.
- **Connection number reset** (C): Resets the number of stage connections.

Table 44: Configuration values: Clear.

	n (maximum and minimum)	E (energies)	C (number of stage connections)
Possible values	YES	YES	YES
	no	no	no

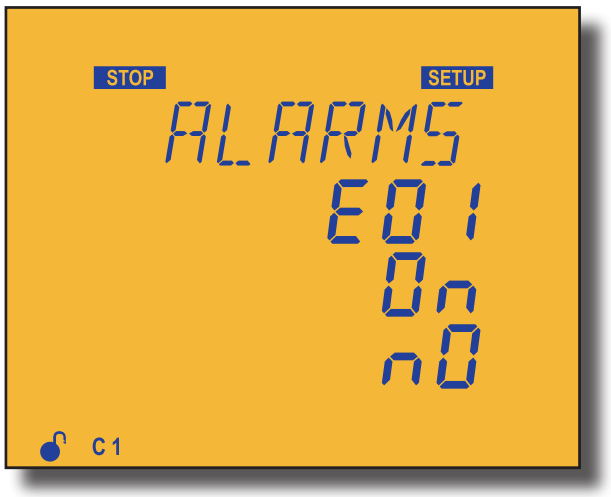
To validate the data, press ≡ key. The **EDIT** symbol disappears from the display.

To proceed to the next programming step, press the ˇ key.

To exit the configuration menu, press and hold the ≡ > key for more than 3 s. The ***"6.31.- SIMULATION SCREEN"*** is displayed.

6.22.- ALARM ENABLE

This screen is available for each error or alarm type (E01 to E17), see **Table 11.** It is used to enable or disable each error or alarm and assign it to the alarm relay or a digital output.



The ‹ key moves to the previous error.

The › key moves to the next error.

Press the ≡ key to enter edit mode, identified by the symbol **EDIT** and the blinking of the digits to be modified.

The ^ key displays the next option.

The ˇ key shows the previous option.

The ‹ key moves to the previous parameter, and the › key moves to the next parameter.

• **Alarm enable:** Enables or disables each device error or alarm.

Table 45: Configuration values: Alarm enable.

Alarm enable		
Possible values	On	Alarm enabled
	OFF	Alarm disabled

• **Association**: Assigns the alarm to the alarm relay or one of the digital outputs.

Table 46: Configuration values: Association with relay or digital output.

Association with relay or digital output		
Possible values	nO	Not associated with any digital output or the alarm relay.
	d2	Alarm activation associated with digital output 2.
	d1	Alarm activation associated with digital output 1.
	rELE	Alarm activation associated with the alarm relay.

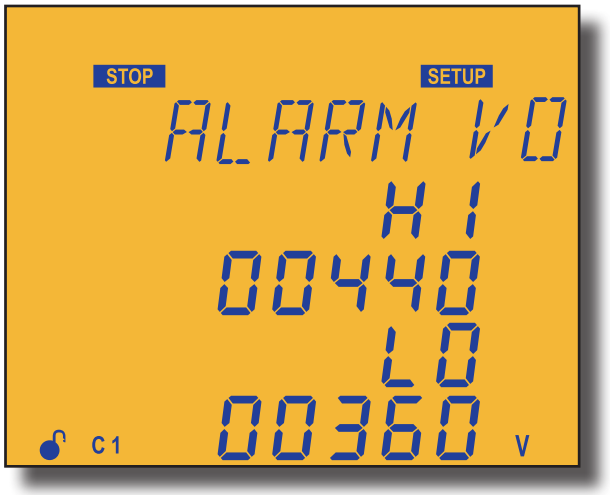
To validate the data, press ≡ key. The **EDIT** symbol disappears from the display.

To proceed to the next programming step, press the ˇ key.

To exit the configuration menu, press and hold the ☰ > key for more than 3 s. The ***"6.31.- SIMULATION SCREEN"*** is displayed.

6.23.- VOLTAGE ALARMS

This screen is used to configure the phase-to-phase voltage thresholds that trigger the overvoltage alarm (*E05*) and the undervoltage alarm (*E06*).
Note: *The alarm must be enabled (**"6.22.- ALARM ENABLE"**).*



Press the ☰ key to enter edit mode, identified by the symbol **EDIT** and the blinking of the digits to be modified.

The ^ key increases the digit value.

The ˇ key decreases the digit value.

The < key moves to the previous digit, and the > key moves to the next digit.

- **Overvoltage alarm** (*HI*): Phase-to-phase voltage threshold above which the overvoltage alarm (*E05*) is triggered.
- **Undervoltage alarm** (*Lo*): Phase-to-phase voltage threshold below which the undervoltage alarm (*E06*) is triggered.

Table 47: Configuration values: Voltage alarm.

	HI (Overvoltage alarm)	*Lo* (Undervoltage alarm)
Minimum value	0 V	0 V
Maximum value	99999 V	99999 V

Both alarms have a preset delay of 5 s to prevent false triggering.

When either alarm is triggered, the device enters the **Disconnection** state and disconnects all stages. The device does not return to normal operation until the cause of the alarm has been cleared.

To validate the data, press ☰ key. The **EDIT** symbol disappears from the display.

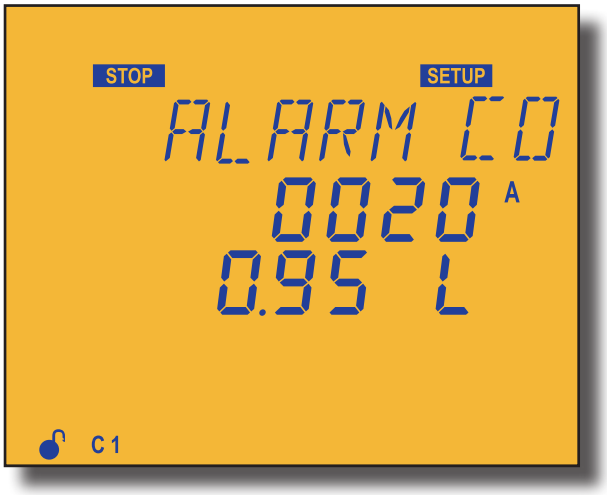
If the entered value is lower than the minimum value or higher than the maximum value, the display backlight flashes, and the entered value is replaced by the minimum or maximum value, or the last validated value.

To proceed to the next programming step, press the ⌄ key.

To exit the configuration menu, press and hold the ≡ > key for more than 3 s. The ***"6.31.- SIMULATION SCREEN"*** is displayed.

6.24.- INDUCTIVE COS φ ALARM

This screen is used to configure the lower operating threshold for the inductive cos φ alarm. The alarm is triggered when cos φ falls below the configured threshold and the current exceeds the programmed threshold.
Note: *The alarm must be enabled (**"6.22.- ALARM ENABLE"**).*



Press the ≡ key to enter edit mode, identified by the symbol **EDIT** and the blinking of the digits to be modified.

The ^ key increases the digit value.

The ⌄ key decreases the digit value.

The < key moves to the previous digit, and the > key moves to the next digit.

- **Current**: Current threshold above which the inductive cos φ alarm is triggered.
- **Cos φ**: cos φ threshold below which the inductive cos φ alarm is triggered.

Table 48: Configuration values: Inductive cos φ alarm.

	Current	Inductive cos φ (L)
Minimum value	0 A	0.50
Maximum value	9999 A	1.00

The alarm has a preset delay of 15 s to prevent false triggering.

To validate the data, press ≡ key. The **EDIT** symbol disappears from the display.

If the entered value is lower than the minimum value or higher than the maximum value, the display backlight flashes, and the entered value is replaced by the minimum or maximum value, or the last validated value.

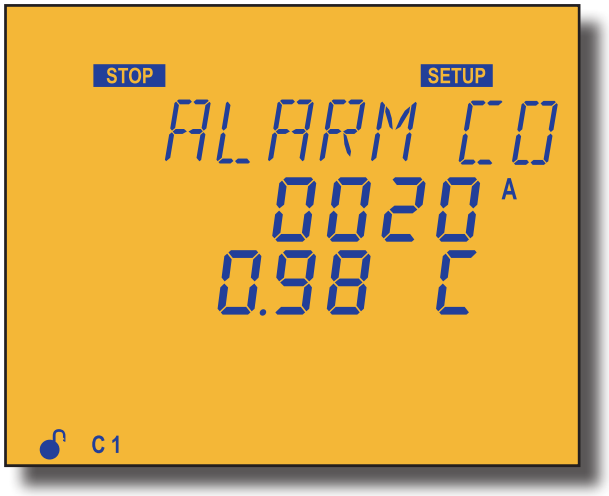
To proceed to the next programming step, press the ⌄ key.

To exit the configuration menu, press and hold the ≡ > key for more than 3 s. The ***"6.31.- SIMULATION SCREEN"*** is displayed.

6.25.- CAPACITIVE COS φ ALARM

This screen is used to configure the lower operating threshold for the capacitive cos φ alarm. The alarm is triggered when cos φ falls below the configured threshold and the current exceeds the programmed threshold.

Note: *The alarm must be enabled (**"6.22.- ALARM ENABLE"**).*



Press the ≡ key to enter edit mode, identified by the symbol **EDIT** and the blinking of the digits to be modified.

The ^ key increases the digit value.

The ˇ key decreases the digit value.

The < key moves to the previous digit, and the > key moves to the next digit.

- **Current**: Current threshold above which the capacitive cos φ alarm is triggered.
- **Cos φ**: cos φ threshold below which the capacitive cos φ alarm is triggered.

Table 49: Configuration values: Capacitive cos φ alarm.

	Current	Capacitive cos φ (C)
Minimum value	0 A	0.50
Maximum value	9999 A	1.00

The alarm has a preset delay of 15 s to prevent false triggering.

To validate the data, press ≡ key. The **EDIT** symbol disappears from the display.

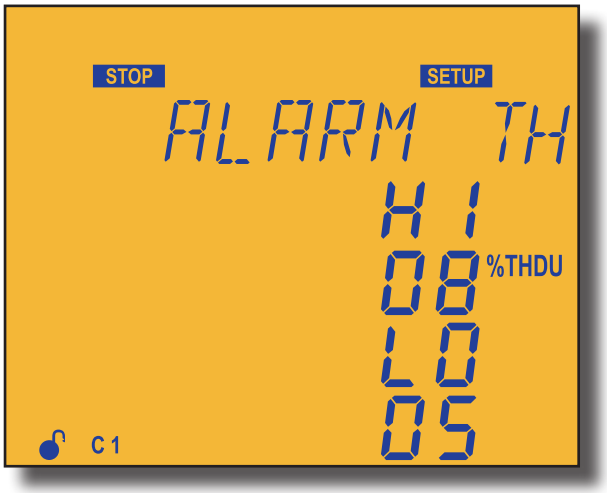
If the entered value is lower than the minimum value or higher than the maximum value, the display backlight flashes, and the entered value is replaced by the minimum or maximum value, or the last validated value.

To proceed to the next programming step, press the ˇ key.

To exit the configuration menu, press and hold the ≡ > key for more than 3 s. The ***"6.31.- SIMULATION SCREEN"*** is displayed.

6.26.- VOLTAGE THD ALARM

This screen is used to configure the thresholds that trigger the voltage THD alarm (*E08*). The programmed values apply to all three phases measured by the device.
Note: *The alarm must be enabled (**"6.22.- ALARM ENABLE"**).*



Press the ☰ key to enter edit mode, identified by the symbol **EDIT** and the blinking of the digits to be modified.

The ^ key increases the digit value.

The ˇ key decreases the digit value.

The < key moves to the previous digit, and the > key moves to the next digit.

•**Upper value** (*HI*)**:** If the device exceeds this value for 30 s, alarm *E08* is triggered. If alarm *E 12* is enabled, the **Computer PV 12** enters the **Disconnection** state and triggers alarm *E 12*.

Table 50: Configuration values: Voltage THD alarm (*HI*)

Voltage THD alarm (*HI*)	
Minimum value	1 %
Maximum value	99 %

•**Lower value** (*Lo*)**:** If the device exceeds this value for 30 min, alarm *E08* is triggered. If alarm *E 11* is enabled, the **Computer PV 12** enters the **No Connection** state and triggers alarm *E 11*.
If the device remains below the *Lo* value for 10 min, it clears the alarms and returns to normal operation.

Table 51: Configuration values: Voltage THD alarm (*Lo*)

Voltage THD alarm (*Lo*)	
Minimum value	1 %
Maximum value	99 %

In the **No Connection** state, the device does not connect any stages, nor does it disconnect them when required by the manoeuvre.
In the **Disconnection** state, the device disconnects all stages and prevents them from being reconnected.

To validate the data, press ☰ key. The **EDIT** symbol disappears from the display.

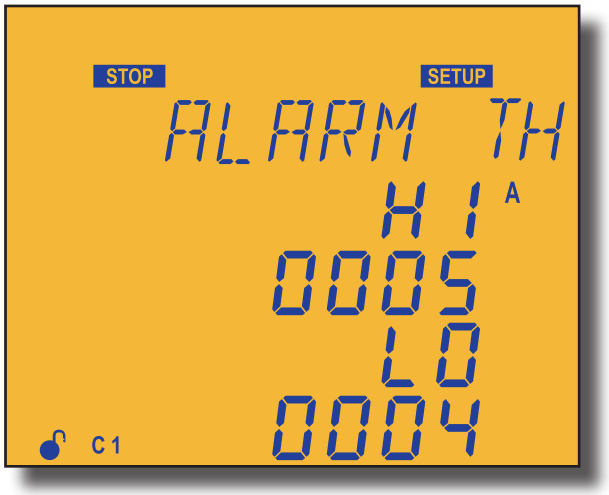
If the entered value is lower than the minimum value or higher than the maximum value, the display backlight flashes, and the entered value is replaced by the minimum or maximum value, or the last validated value.

To proceed to the next programming step, press the ⌄ key.

To exit the configuration menu, press and hold the ☰ > key for more than 3 s. The ***"6.31.- SIMULATION SCREEN"*** is displayed.

6.27.- CURRENT THD ALARM x I

This screen is used to configure the thresholds that trigger the current THDI x alarm (*E09*). The programmed values apply to all three energy sources (**ES1**, **ES2** and **ES3**) measured by the device.
Note: *The alarm must be enabled (**"6.22.- ALARM ENABLE"**).*



Press the ☰ key to enter edit mode, identified by the symbol **EDIT** and the blinking of the digits to be modified.

The ⌃ key increases the digit value.

The ⌄ key decreases the digit value.

The ‹ key moves to the previous digit, and the › key moves to the next digit.

The value programmed for this alarm corresponds directly to the total harmonic current setpoint.

For example: *to set the Lo threshold to 200 A of harmonic current measured by the regulator, enter 00200 directly in this field.*

•**Upper value** (*HI*)**:** If the device exceeds this value for 30 s, alarm *E09* is triggered. If alarm *E 12* is enabled, the **Computer PV 12** enters the **Disconnection** state and triggers alarm E12.

Table 52: Configuration values: Current THD alarm (*HI*)

Current THD alarm (*HI*)	
Minimum value	1 A
Maximum value	9999 A

• **Lower value** (Lo): If the device exceeds this value for 30 min, alarm E09 is triggered. If alarm E11 is enabled, the **Computer PV 12** enters the **No Connection** state and triggers alarm E11.
If the device remains below the Lo value for 10 min, it clears the alarms and returns to normal operation.

Table 53: Configuration values: Current THD alarm (Lo)

Current THD alarm (Lo)	
Minimum value	1 A
Maximum value	9999 A

In the **No Connection** state, the device does not connect any stages, nor does it disconnect them when required by the control logic.
In the **Disconnection** state, the device disconnects all stages and prevents them from being reconnected.

To validate the data, press ☰ key. The **EDIT** symbol disappears from the display.

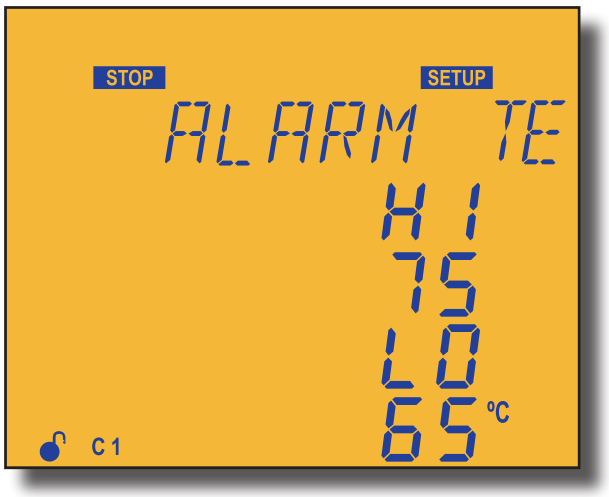
If the entered value is lower than the minimum value or higher than the maximum value, the display backlight flashes, and the entered value is replaced by the minimum or maximum value, or the last validated value.

To proceed to the next programming step, press the ⌄ key.

To exit the configuration menu, press and hold the ☰ > key for more than 3 s. The ***"6.31.- SIMULATION SCREEN"*** is displayed.

6.28.- TEMPERATURE ALARM

This screen is used to configure the thresholds that trigger the temperature alarm (*E 10*).
Note: *The alarm must be enabled (**"6.22.- ALARM ENABLE"**).*



Press the ≡ key to enter edit mode, identified by the symbol **EDIT** and the blinking of the digits to be modified.

The ^ key increases the digit value.

The ˇ key decreases the digit value.

The < key moves to the previous digit, and the > key moves to the next digit.

•**Upper value** (*HI*)**:** If the device exceeds this value for 30 s, alarm *E09* is triggered. If alarm *E 12* is enabled, the **Computer PV 12** enters the **Disconnection** state and triggers alarm *E 12*.

Table 54: Configuration values: Temperature alarm (*HI*)

Temperature alarm (*HI*)	
Minimum value	0 °C
Maximum value	80 °C

•**Lower value** (*Lo*)**:** If the device exceeds this value for 30 min, alarm *E09* is triggered. If alarm *E 11* is enabled, the **Computer PV 12** enters the **No Connection** state and triggers alarm E11.
If the device remains below the *Lo* value for 10 min, it clears the alarms and returns to normal operation.

Table 55: Configuration values: Temperature alarm (*Lo*)

Temperature alarm (*Lo*)	
Minimum value	0 °C
Maximum value	80 °C

In the **No Connection** state, the device does not connect any stages, nor does it disconnect them when required by the control logic.

In the **Disconnection** state, the device disconnects all stages and prevents them from being reconnected.

To validate the data, press ☰ key. The **EDIT** symbol disappears from the display.

If the entered value is lower than the minimum value or higher than the maximum value, the display backlight flashes, and the entered value is replaced by the minimum or maximum value, or the last validated value.

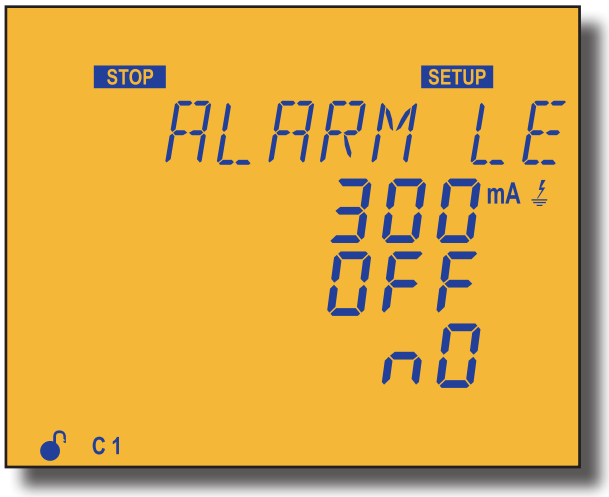
To proceed to the next programming step, press the ⌄ key.

To exit the configuration menu, press and hold the ☰ > key for more than 3 s. The ***"6.31.- SIMULATION SCREEN"*** is displayed.

6.29.- LEAKAGE CURRENT ALARM

This screen is used to configure the leakage current alarm parameters. There are four leakage current alarms: E 13, E 14, E 15 and E 16.

Note: *The alarm must be enabled (**"6.22.- ALARM ENABLE"**).*



Press the ☰ to enter edit mode, identified by the symbol **EDIT** and the blinking of the digits to be modified.

The ^ key increases the digit value or displays the next option.

The ⌄ key decreases the digit value or displays the previous option.

The < key moves to the previous digit, and the > key moves to the next digit.

• **Alarm value,** When the device exceeds this value, alarm E 13 is triggered.

Table 56: Configuration values: Alarm value.

Alarm value	
Minimum value	1 mA
Maximum value	999 mA

• **Responsible stage search,** If this parameter is set to On, the device connects and disconnects all stages to identify those responsible for the leakage. Once identified, they are disabled to prevent them from reconnecting. The device triggers alarms E 13 and E 15, and the disabled stages flash on the display.

Table 57: Configuration values: Responsible stage.

Responsible stage search		
Possible values	On	Search enabled
	OFF	Search disabled

•**Stage enabling:** This parameter re-enables the stages that have been disabled by this alarm (YES option).

Table 58: Configuration values: Stage enabling.

Stage enabling		
Possible values	YES	Enabling of the disabled stages.
	no	The disabled stages are not enabled.

To validate the data, press ☰ key. The **EDIT** symbol disappears from the display.

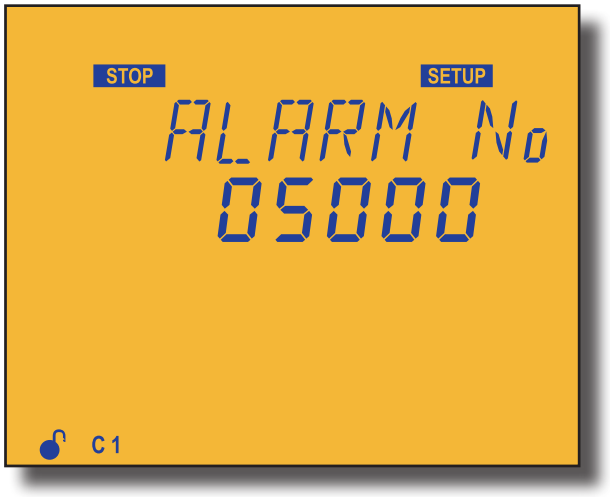
If the entered value is lower than the minimum value or higher than the maximum value, the display backlight flashes, and the entered value is replaced by the minimum or maximum value, or the last validated value.

To proceed to the next programming step, press the ˅ key.

To exit the configuration menu, press and hold the ☰ > key for more than 3 s. The ***"6.31.- SIMULATION SCREEN"*** is displayed.

6.30.- NUMBER OF OPERATIONS ALARM

This screen is used to configure the number of operations for any stage after which alarm E 17 is triggered.
Note: *The alarm must be enabled (**"6.22.- ALARM ENABLE"**).*



Press the ☰ key to enter edit mode, identified by the symbol **EDIT** and the blinking of the digits to be modified.

The ^ key increases the digit value.

The ˅ key decreases the digit value.

The < key moves to the previous digit, and the > key moves to the next digit.

Table 59: Configuration values: Number of operations alarm.

Number of operations alarm	
Minimum value	10
Maximum value	99999

To validate the data, press ☰ key. The **EDIT** symbol disappears from the display.

If the entered value is lower than the minimum value or higher than the maximum value, the display backlight flashes, and the entered value is replaced by the minimum or maximum value, or the last validated value.

To proceed to the next programming step, press the ˅ key.

To exit the configuration menu, press and hold the ☰ > key for more than 3 s. The ***"6.31.- SIMULATION SCREEN"*** is displayed.

6.31.- SIMULATION SCREEN

This screen is accessed by pressing and holding the ☰ key for more than 3 seconds when exiting configuration mode. It is an information-only screen and cannot be edited.

The simulation screen provides information that allows the user to enter measurement mode, **RUN**, by pressing and holding the ☰ key for 3 seconds or by not pressing any key for 5 minutes. To return to the configuration screens, press any of the other keys.

The information displayed on the screen is:

- Measured cos **φ** value.
- Three-phase reactive power.
- The word StOP, indicating that the device is not yet in measurement mode.
- Simulation of the steps that would be connected upon entering measurement mode, together with the analogue bar.

7.- RS-485 COMMUNICATIONS

Computer PV 12 devices feature an **RS-485** serial communications output using the **Modbus RTU®** protocol.

7.1.- WIRING

The RS-485 cable must consist of a shielded twisted-pair cable with a minimum of three wires. The maximum distance between the **Computer PV 12** and the master unit is 1,200 metres.
A maximum of 32 **Computer PV 12** devices can be connected to this bus.

For communication with the master unit, the intelligent converter must be used.

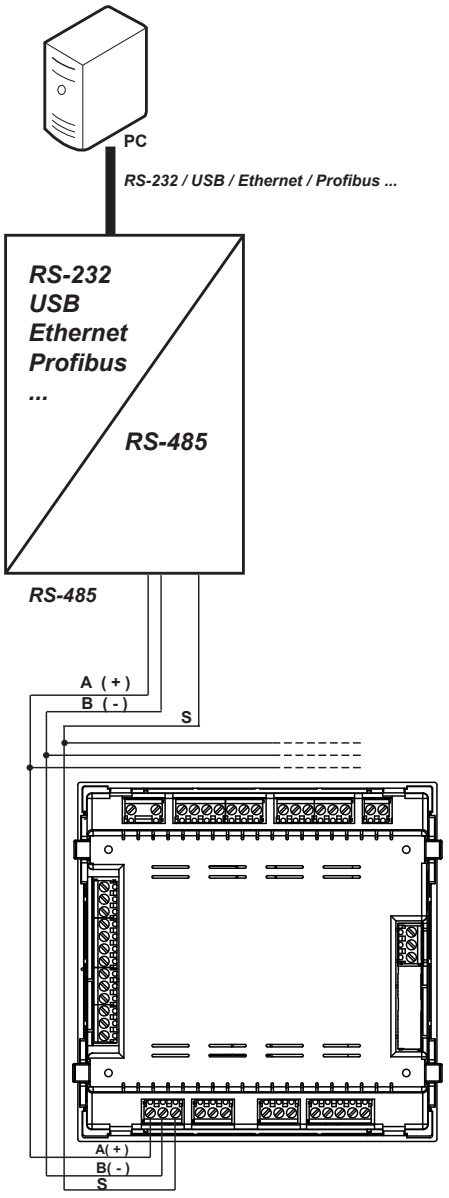


Figure 23: RS-485 wiring diagram.

7.2.- PROTOCOL

The Modbus protocol is an industrial communications standard that enables multiple devices to be connected in a network comprising one master and multiple slaves. It supports both individual master-slave communication and broadcast commands.
The **Computer PV 12** uses Modbus RTU mode (*Remote Terminal Unit*).

In RTU mode, the beginning and end of a message are detected by silent intervals of at least 3.5 character times. A 16-bit CRC is used for error detection.

The Modbus functions implemented in the device are:

Function 01: Read relay status.
Functions 03 and 04: Read registers.
Function 05: Write a relay.
Function 0F: Write multiple relays.
Function 10: Write multiple registers.

Exception codes

If the most significant bit of the function byte in the device response is 1, the next byte contains an exception code.

Table 60: Exception codes, Modbus communications

Exception code	Description
01	Invalid function. The function number is not implemented.
02	Invalid address or number of registers out of range.
03	Data error. A CRC error has occurred.
04	Peripheral error. An error occurred while accessing a peripheral (EEPROM, card, etc.).
06	Slave error or slave busy. Retry the transmission.

Example:

Address	Function	Exception code	CRC
0A	84	01	XXXX

Address: 0A, Peripheral number: 10 in decimal.
Function: 84, Read function 04 with bit 7 set to 1.
Exception code: 01, see **Table 60.**
CRC: 16-bit CRC.

For device operating safety, communication frames longer than 80 bytes are not permitted, whether sent or received.

7.2.1.- MODBUS REQUEST EXAMPLE

Request: Instantaneous L1 phase voltage

Address	Function	Starting register	No. of registers	CRC
0A	04	0000	0002	70B0

Address: 0A,peripheral number: 10 in decimal.
Function: 04, read function.
Starting Register: 0000, register at which reading is to begin.
No. of registers: 0002, number of registers to read.
CRC: 70B0, CRC character.

Response:

Address	Function	No. of Bytes	Register No. 1	Register No. 2	CRC
0A	04	04	0000	084D	8621

Address: 0A, peripheral number responding: 10 in decimal.
Function: 04, read function.
No. of bytes: 04, number of bytes received.
Register: 0000084D, L1 phase voltage value: VL1 × 10: 212.5 V.
CRC: 8621, CRC value.

7.3.- MODBUS MAP

7.3.1.- MEASUREMENT VARIABLES

Function 04 (read registers) is implemented for these variables.
The Modbus addresses of all tables are in hexadecimal.

Table 61: Modbus memory map: measurement variables (Table 1).

Parameter	Instantaneous	Maximum	Minimum	Units
L1 phase voltage	00-01	200-201	300-301	V/100
ES1 current	02-03	202-203	302-303	mA
ES1 active power	04-05	204-205	304-305	W
ES1 inductive reactive power	06-07	206-207	306-307	varL
ES1 capacitive reactive power	08-09	208-209	308-309	varC
ES1 reactive power	0A-0B	20A-20B	30A-30B	var
ES1 apparent power	0C-0D	20C-20D	30C-30D	VA
ES1 consumed reactive power	0E-0F	20E-20F	30E-30F	var
ES1 generated reactive power	10-11	210-211	310-311	var
ES1 power factor (18)	12-13	212-213	312-313	-
ES1 cos φ (18)	14-15	214-215	314-315	-
ES1 kW sign (18)	16-17	-	-	+1 or -1
ES1 kvar sign (18)	18-19	-	-	+1 or -1
L2 phase voltage	1A-1B	21A-21B	31A-31B	V/100
ES2 current	1C-1D	21C-21D	31C-31D	mA

Table 61 (Continued): Modbus memory map: measurement variables (Table 1).

Parameter	Instantaneous	Maximum	Minimum	Units
ES2 active power	1E-1F	21E-21F	31E-31F	W
ES2 inductive reactive power	20-21	220-221	320-321	varL
ES2 capacitive reactive power	22-23	222-223	322-323	varC
ES2 reactive power	24-25	224-225	324-325	var
ES2 apparent power	26-27	226-227	326-327	VA
ES2 consumed reactive power	28-29	228-229	328-329	var
ES2 generated reactive power	2A-2B	22A-22B	32A-32B	var
ES2 power Factor (18)	2C-2D	22C-22D	32C-32D	-
ES2 cos φ (18)	2E-2F	22E-22F	32E-32F	-
ES2 kW sign (18)	30-31	-	-	+1 or -1
ES2 kvar sign (18)	32-33	-	-	+1 or -1
L3 Phase Voltage	34-35	234-235	334-335	V/100
ES3 current	36-37	236-237	336-337	mA
ES3 active power	38-39	238-239	338-339	W
ES3 inductive reactive power	3A-3B	23A-23B	33A-33B	varL
ES3 capacitive reactive power	3C-3D	23C-23D	33C-33D	varC
ES3 reactive power	3E-3F	23E-23F	33E-33F	var
ES3 apparent power	40-41	240-241	340-341	VA
ES3 consumed reactive power	42-43	242-243	342-343	var
ES3 generated reactive power	44-45	244-245	344-345	var
ES3 power Factor (18)	46-47	246-247	346-347	-
ES3 cos φ (18)	48-49	248-249	348-349	-
ES3 kW sign (18)	4A-4B	-	-	+1 or -1
ES3 kvar sign (18)	4C-4D	-	-	+1 or -1
Three-phase voltage	4E-4F	24E-24F	34E-34F	V/100
Total current	50-51	250-251	350-351	mA
Total Active Power	52-53	252-253	352-353	W
Total inductive power	54-55	254-255	354-355	varL
Total capacitive power	56-57	256-257	356-357	varC
Total Reactive Power	58-59	258-259	358-359	var
Total apparent power	5A-5B	25A-25B	35A-35B	VA
Total consumed reactive power	5C-5D	25C-25D	35C-35D	var
Total generated reactive power	5E-5F	25E-25F	35E-35F	var
Total power factor(18)	60-61	260-261	360-361	-
Total cos φ (18)	62-63	262-263	362-363	-
Total kW sign (18)	64-65	-	-	-
Total kvar sign(18)	66-67	-	-	-
Frequency	68-69	268-269	368-369	Hz/10
L1-L2 voltage	6A-6B	26A-26B	36A-36B	V/100
L2-L3 voltage	6C-6D	26C-26D	36C-36D	V/100
L3-L1 voltage	6E-6F	26E-26F	36E-36F	V/100
Leakage Current	72-73	272-273	372-373	mA
Temperature	74-75	274-275	374-375	°C/10
L1 voltage THD %	7C-7D	27C-27D	-	%
L2 voltage THD %	7E-7F	27E-27F	-	%

Table 61 (Continued): Modbus memory map: measurement variables (Table 1).

Parameter	Instantaneous	Maximum	Minimum	Units
L3 voltage THD %	80-81	280-281	-	%
ES1 current THD %	82-83	282-283	-	%
ES2 current THD %	84-85	284-285	-	%
ES3 current THD %	86-87	286-287	-	%
Consumed active energy kWh	88-89	-	-	kWh
Consumed active energy Wh	8A-8B	-	-	Wh
Consumed inductive energy kvarLh	8C-8D	-	-	kvarLh
Consumed inductive energy varLh	8E-8F	-	-	varLh
Consumed capacitive energy kvarCh	90-91	-	-	kvarCh
Consumed capacitive energy varCh	92-93	-	-	varCh
Consumed apparent energy kVAh	94-95	-	-	kVAh
Consumed apparent energy VAh	96-97	-	-	VAh
Generated active energy kWh	98-99	--	-	kWh
Generated active energy Wh	9A-9B	-	-	Wh
Generated inductive energy kvarLh	9C-9D	-	-	kvarLh
Generated inductive energy varLh	9E-9F	-	-	varLh
Generated capacitive energy kvarCh	A0-A1	-	-	kvarCh
Generated capacitive energy varCh	A2-A3	-	-	varCh
Generated apparent energy kVAh	A4-A5	-	-	kVAh
Generated apparent energy VAh	A6-A7	-	-	VAh

(18) The **cos φ** and **power factor** parameters are accompanied by the **kW sign** and **kvar sign** parameters, which are used to determine the quadrant in which each phase is measured. See **Figure 8**.

Table 62: Modbus memory map: measurement variables (Table 2).

Parameter	Instantaneous	Maximum	Units
L1 fundamental voltage harmonic	400-401	484-485	V / 100
L1 voltage harmonics	402-415	486-499	% / 10
L2 fundamental voltage harmonic	416-417	49A-49B	V / 100
L2 voltage harmonics	418-42B	49C-4AF	% / 10
L3 fundamental voltage harmonic	42C-42D	4B0-4B1	V / 100
L3 voltage harmonics	42E-441	4B2-4C5	% / 10
ES1 fundamental current harmonic	442-443	4C6-4C7	mA
ES1 current harmonics	444-457	4C8-4DB	% / 10
ES2 fundamental current harmonic	458-459	4DC-4DD	mA
ES2 current harmonics	45A-46D	4DE-4F1	% / 10
ES3 fundamental current harmonic	46E-46F	4F2-4F3	mA
ES3 current harmonics	470-483	4F4-507	% / 10

Table 63: Modbus memory map: measurement variables (Table 3).

Parameter	Instantaneous
Relay variable (see **Table 64**)	600
Alarm variable (see **Table 65**)	605-606
Output status (see **Table 66**)	610
Digital input status (see **Table 67**)	615
Number of connections for each of the 12 relays	625-63E

✓ **Relay variable**

Displays the status of the 12 output relays. It is a 16-bit variable in which each bit indicates the status of a relay. See **Table 64**.

Table 64: Relay variable.

	Bit 15-14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Relay	-	14	13	12	11	10	9	8	7	6	5	4	3	2	1

Where **0**: relay disconnected (OFF).
1: relay connected (ON).

✓ **Alarm variable**

Displays the status of the 17 possible alarms. It is a 32-bit variable in which each bit indicates the status of an alarm. See **Table 65**.

Table 65: Alarm variable.

Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
E16	E15	E14	E13	E12	E11	E10	E09	E08	E07	E06	E05	E04	E03	E02	E01
Bit 31	**Bit 30**	**Bit 29**	**Bit 28**	**Bit 27**	**Bit 26**	**Bit 25**	**Bit 24**	**Bit 23**	**Bit 22**	**Bit 21**	**Bit 20**	**Bit 19**	**Bit 18**	**Bit 17**	**Bit 16**
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	E17

Where **0**: alarm inactive (OFF).
1: alarm active (ON).

✓ **Output status**

Displays the status of the four outputs: the fan relay, the alarm relay and the two digital outputs. It is a 16-bit variable in which each bit indicates the status of an output. See **Table 66**.

Table 66: Output status.

Bit 15... 4	Bit 3	Bit 2	Bit 1	Bit 0
-	Digital output 2	Digital output 1	Alarm relay	Fan relay
-	**1:** OFF **0:** ON	**1:** OFF **0:** ON	**1:** ON **0:** OFF	**1:** ON **0:** OFF

✓ **Digital input status**

Displays the status of the two digital inputs. It is a 16-bit variable in which each bit indicates the status of an input. See **Table 67**.

Table 67: Digital input status.

Bit 15... 2	Bit 1	Bit 0
-	Digital input 2	Digital input 1
-	**1:** ON **0:** OFF	**1:** ON **0:** OFF

7.3.2.- PARAMETER RESET

Parameters are reset using **Function 05** (write a relay).

Table 68: Modbus memory map: parameter reset.

Parameter reset		
Action	Address	Value to send
Reset maximum values	200	FF
Reset minimum values	210	FF
Reset maximum and minimum values	220	FF
Reset energy values	230	FF
Reset the stage search and stage enable values for the leakage current alarm	240	FF
Reset the number of operations for all relays	250	FF
Reset alarms E14 and E15	260	FF
Restore default configuration values	300	FF

7.3.3.- PROGRAMMING VARIABLES

For these variables, the following functions are implemented:

Function 04: Read registers.
Function 10: Write multiple registers.

7.3.3.1.- Device parameters

Table 69: Programming variables: Device parameters.

Device parameters	
Configuration variable	Address
Serial number[19]	1000-1003
Frame number [19]	1010-1013
Version [19]	1020-1021
Hardware register [19]	1030-1033

[19] Only **Function 04** is implemented for the device parameters.

7.3.3.2.- Communications

Table 70: Programming variables: Communications.

Communications			
Configuration variable	Address	Valid data range	Default value
Peripheral number	1071	1 ... 254	1
Baud rate	1072	**0:** 9600, **1:** 19200	1
Parity	1073	**0:** no parity, **1**:odd parity, **2:**even parity	0
Data bits	1074	**0:** 8 bits, **1:** 7 bits	0
Stop bits	1075	**0:** 1 bit, **1:** 2 bits	0

7.3.3.3.- Transformation Ratios

Table 71: Programming variables: Transformation Ratios.

Transformation Ratios			
Configuration variable	Address	Valid data range	Default value
ES1 primary current	11A0	1 ... 9999	5
ES2 primary current	11A1	1 ... 9999	5
ES3 primary current	11A2	1 ... 9999	5
ES1, ES2 and ES3 secondary current	11A3	**0:** 1A, **1:** 5A	1
Primary voltage	1095-1096	1 ... 99999	400
Secondary voltage	1097-1098	1 ... 99999	400

7.3.3.4.- Connection type

Table 72: Programming variables: Connection type.

Connection type			
Configuration variable	Address	Valid data range	Default value
Connection type	1100	**0:** 3U.1C, **1:** 3U.2C, **2:** 3U.3C, **3:** 2U.1C, **4:** 2U.2C, **5:** 2U.3C	**2**
Phase	1101	**1:** PH1, **2:** PH2, **3:** PH3 (**Table 23**)	**1**
Transformer 1 direction	1102	**0:** Direct, **1:** inverse	**0**
Transformer 2 direction	1103		
Transformer 3 direction	1104		

7.3.3.5.- Stage status

Table 73: Programming variables: Stage status.

Stage status			
Configuration variable	Address	Valid data range	Default value
C1	1110	**0:** AUtO, **1:** On, **2:** OFF, **3:** On nc (**Table 33**)	**0**
C2	1111		**0**
C3	1112		**0**
C4	1113		**0**
C5	1114		**0**
C6	1115		**0**
C7	1116		**0**
C8	1117		**0**
C9	1118		**0**
C10	1119		**0**
C11	111A		**0**
C12	111B		**0**

7.3.3.6.- Display

Table 74: Programming variables: Display.

Display			
Configuration variable	Address	Valid data range	Default value
Backlight	1125	**0:** Turns on when a key is pressed **1:** Always on **2:** Always off	**0**
Brightness level	1126	0 ... 10 (Value in % and /10)	7
Language	1127	**0:** Spanish, **1:** English, **2:** French, **3:** Turkish, **4:** Serbian	**0**
Advanced setup	1128	**0:** No, **1:** Yes	0

7.3.3.7.- Target cos φ

Table 75: Programming variables: Target cos φ.

Target cos φ			
Configuration variable	Address	Valid data range	Default value
Target cos φ 1	1130	50 ... 100 (Value x 100)	100
Target cos φ 2	1131		100
Target cos φ 3	1132		100
Target cos φ 4	1133		100
Target cos φ type 1	1134	**0:** capacitive **1:** inductive	1
Target cos φ type 2	1135		1
Target cos φ type 3	1136		1
Target cos φ type 4	1137		1

7.3.3.8.- Hysteresis

Table 76: Programming variables: Hysteresis.

Capacitive and inductive hysteresis			
Configuration variable	Address	Valid data range	Default value
Capacitive hysteresis	1185	0 ... 10 (Value x 100)	0
Inductive hysteresis	1186		

7.3.3.9.- C/K factor

Table 77: Programming variables: C/K factor.

C/K factor			
Configuration variable	Address	Valid data range	Default value
C/K factor	1138	0 ... 100 (Value x 100)	100

7.3.3.10.- Program

Table 78:Programming variables: Program

Program			
Configuration variable	Address	Valid data range	Default value
Program	1139	1111 ... 1999	1111

7.3.3.11.- Number of stages

Table 79: Programming variables: number of stages..

Number of stages			
Configuration variable	Address	Valid data range	Default value
Number of stages	113B	0 ... 12	12

7.3.3.12.- Connection and Reconnection time

Table 80:Programming Variables: Connection and Reconnection time.

Connection and Reconnection time			
Configuration variable	Address	Valid data range	Default value
Connection time	113C	4 ... 999 seconds	10
Reconnection Time	113D	20 ... 999 seconds	50

7.3.3.13.- Voltage THD alarm

Table 81:Programming Variables: Voltage THD alarm.

Voltage THD alarm			
Configuration variable	Address	Valid data range	Default value
Lower value (Lo)	1140	1-99 %	5
Upper value (Hi)	1141	1-99 %	8

7.3.3.14.- Current THD × I alarm

Table 82:Programming Variables: Current THD x I alarm.

Current THD x I alarm			
Configuration variable	Address	Valid data range	Default value
Lower value (Lo)	1142	1 ... 9999 A	4
Upper value (Hi)	1143	1 ... 9999 A	5

7.3.3.15.- Temperature alarm

Table 83:Programming Variables: Temperature alarm.

Temperature alarm			
Configuration variable	Address	Valid data range	Default value
Lower value (Lo)	1144	0 ... 80 °C	65 °C
Upper value (Hi)	1145	0 ... 80 °C	70 °C

7.3.3.16.- Leakage Current alarm

Table 84:Programming variables: Leakage current alarm.

Leakage Current alarm			
Configuration variable	Address	Valid data range	Default value
Responsible stage search	1146	**0:** Search disabled **1:** Search enabled	**0**
Alarm value	1147	1 ... 999 mA	300
Stage enabling	1148	**0:** No, **1:** Yes	**0**

7.3.3.17.- Inductive cos φ alarm

Table 85: Programming variables: inductive cos φ alarm.

Inductive cos φ alarm			
Configuration variable	Address	Valid data range	Default value
Inductive cos φ value	1149	50 ... 100 (Value x 100)	95
Current value	114A	0 ... 9999 A	20
cos φ type	114B	**1:** inductive	**1**

7.3.3.18.- Capacitive cos φ alarm

Table 86:Programming variables: capacitive cos φ alarm.

Capacitive cos φ alarm			
Configuration variable	Address	Valid data range	Default value
capacitive cos φ value	118A	50 ... 100 (Value x 100)	98
Current value	118B	0 ... 9999 A	20
cos φ type	118C	**0:** capacitive	**0**

7.3.3.19.- Fan alarm

Table 87:Programming variables: Fan alarm.

Fan Alarm			
Configuration variable	Address	Valid data range	Default value
Value	114C	0 ... 80 °C	35 °C
Enable	114D	**0:** Relay disabled **1:**Relay enabled	0

7.3.3.20.- Voltage alarm

Table 88:Programming variables: Voltage alarm.

Voltage alarm			
Configuration variable	Address	Valid data range	Default value
Overvoltage alarm	114E-114F	0 ... 99999 V	440 V
Undervoltage alarm	1150-1151	0 ... 99999 V	360 V

7.3.3.21.- Number of operations alarm

Table 89:Programming variables: number of operations alarm.

No. of operations			
Configuration variable	Address	Valid data range	Default value
No. of operations	1152-1153	10 ... 99999	5000

7.3.3.22.- Undervoltage trip

Table 90:Programming variables: Undervoltage trip.

Undervoltage tripping			
Configuration variable	Address	Valid data range	Default value
Trip voltage threshold	1190	0 ... 100 %	80 %

7.3.3.23.- Alarm enable

Table 91: Programming variables: Alarm enable.

Alarm enable			
Configuration variable	Address	Valid data range	Default value
Alarm E01 enable	1155	**0:** Alarm disabled. **1:** Alarm enabled.	1
Alarm E02 enable	1156		1
Alarm E03 enable	1157		1
Alarm E04 enable	1158		1
Alarm E05 enable	1159		0
Alarm E06 enable	115A		0
Alarm E07 enable	115B		0
Alarm E08 enable	115C		1
Alarm E09 enable	115D		0
Alarm E10 enable	115E		1
Alarm E11 enable	115F		1
Alarm E12 enable	1160		1
Alarm E13 enable	1161		0
Alarm E14 enable	1162		0
Alarm E15 enable	1163		0
Alarm E16 enable	1164		0
Alarm E17 enable	1165		0
Alarm E01 associated output	1170	**0:** Not associated with any output. **1:** Alarm associated with the alarm relay **2:** Alarm associated with digital output 1 **3:** Alarm associated with digital output 2	0
Alarm E02 associated output	1171		0
Alarm E03 associated output	1172		0
Alarm E04 associated output	1173		0
Alarm E05 associated output	1174		0
Alarm E06 associated output	1175		0
Alarm E07 associated output	1176		0
Alarm E08 associated output	1177		0
Alarm E09 associated output	1178		0
Alarm E10 associated output	1179		0
Alarm E11 associated output	117A		0
Alarm E12 associated output	117B		0
Alarm E13 associated output	117C		0
Alarm E14 associated output	117D		0
Alarm E15 associated output	117E		0
Alarm E16 associated output	117F		0
Alarm E17 associated output	1180		0

8.- TECHNICAL FEATURES

AC Power supply	
Rated voltage	100 ... 520 V ~
Frequency	50 ... 60 Hz
Maximum consumption	14.5 ... 16 VA
Installation category	CAT III 300V

Voltage measurement circuit		
	V Ph-N	V Ph-Ph
Rated voltage (Un)	230 V ~	400 V ~
Voltage measurement margin	20... 300 V ~	35...520 V ~
Frequency measurement margin	45 ... 65 Hz	
Input impedance	660 kΩ	
Min voltage measurement((Vstart)	20 V ~	35 V ~
Installation category	CAT III 300V	

Current measurement circuit	
Rated current (In)	.../5A
Current measurement margin	1...120% In
Min current measurement (Istart)	50 mA

Leakage current measurement circuit	
By differential transformer (500 turns)	
Secondary rated current	3 mA
Current measurement margin	10 mA ... 1.5A
Min current measurement (Istart)	10 mA

Measurement accuracy (UNE-EN 61557-12)	
Voltage measurement	0.5% ± 1 digit
Current measurement	0.5% ± 1 digit
Active power measurement	0.5% ± 2 digits
Reactive power measurement	1% ± 2 digits
Active energy measurement	Class 1
Reactive energy measurement	Class 2

Digital outputs	
Quantity	2
Type	NPN
Maximum voltage	24V ⎓
Maximum current	50 mA

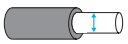
Relay outputs	
Quantity	14 (12 outputs, 1 fan, 1 alarm)
Dielectric strength	Between Coil and Contacts: 2500 V ~ (1 min.) Between open contacts: 1000 V ~ (1 min.)
Switching voltage	250 V ~
Maximum current	1 A
Maximum switching power	2500 VA
Electrical life	$30x10^3$ cycles
Mechanical life	$5x10^6$ cycles

Digital inputs	
Quantity	2
Type	Potential free contact
Insulation	Optoisolated

RS-485 communications	
Field bus	RS-485
Protocol	Modbus RTU
Baud rate	9600 - 19200
Stop bits	1 - 2
Parity	without - even - odd

User interface	
Display	LCD Custom COG
Keypad	Capacitive, 5 keys
LED	4 LED

Environmental features	
Operating temperature	-10°C ... +55°C
Storage temperature	-20°C ... +70°C
Relative humidity (non-condensing)	5 ... 95%
Maximum altitude	2000 m
Protection degree IP	IP30, **Front:** IP50
Protection degree IK	IK08
Pollution degree	2
Use	Interior

Mechanical features			
Terminals			
1 ... 6, 13 ... 41	≥ 1.5 mm^2	0.5 Nm	⊘
7 ... 12	≥ 2.5 $mm^{2(20)}$	0.5 Nm	⊘
Dimensions (Figure 24)	144 x 144 x 78 mm		
Weight	610 g		
Enclosure	Self-extinguishing V0 plastic		
Attachment	Panel		

(20) If the distance between the CTs and the device is over 25 m, this cross-section must be increased by 1 mm2 for every 10 m.

Standards	
Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement	UNE-EN 55022
Specification for radio disturbance and immunity measuring apparatus and methods - Part 2-1: Methods of measurement of disturbances and immunity - Conducted disturbance measurements	UNE-EN 55016-2-1
Electromagnetic compatibility (EMC). Part 4-2: Testing and measurement techniques. Electrostatic discharge immunity test.	UNE-EN 61000-4-2
Electromagnetic compatibility (EMC). Part 4-4: Testing and measurement techniques. Electrical fast transient/burst immunity test.	UNE-EN 61000-4-4
Electromagnetic compatibility (EMC). Part 4-5: Testing and measurement techniques. Surge immunity test.	UNE-EN 61000-4-5

(Continuation) Standards	
Electromagnetic compatibility (EMC). Part 4-6: Testing and measurement techniques. Immunity to conducted disturbances, induced by radio-frequency fields.	UNE-EN 61000-4-6
Electromagnetic compatibility (EMC). Part 4-8: Testing and measurement techniques. Power frequency magnetic field immunity test.	UNE-EN 61000-4-8
Electromagnetic compatibility (EMC) - Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests for equipment with input current up to 16 A per phase.	UNE-EN 61000-4-11
Electromagnetic compatibility (EMC). Part 4-20: Testing and measurement techniques. Emission and immunity testing in transverse electromagnetic (TEM) waveguides.	UNE-EN 61000-4-20
Safety requirements for electrical equipment for measurement, control, and laboratory use. Part 1: General requirements.	UNE-EN 61010-1
Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 2-030: Particular requirements for equipment having testing or measuring circuits	UNE-EN 61010-2-030

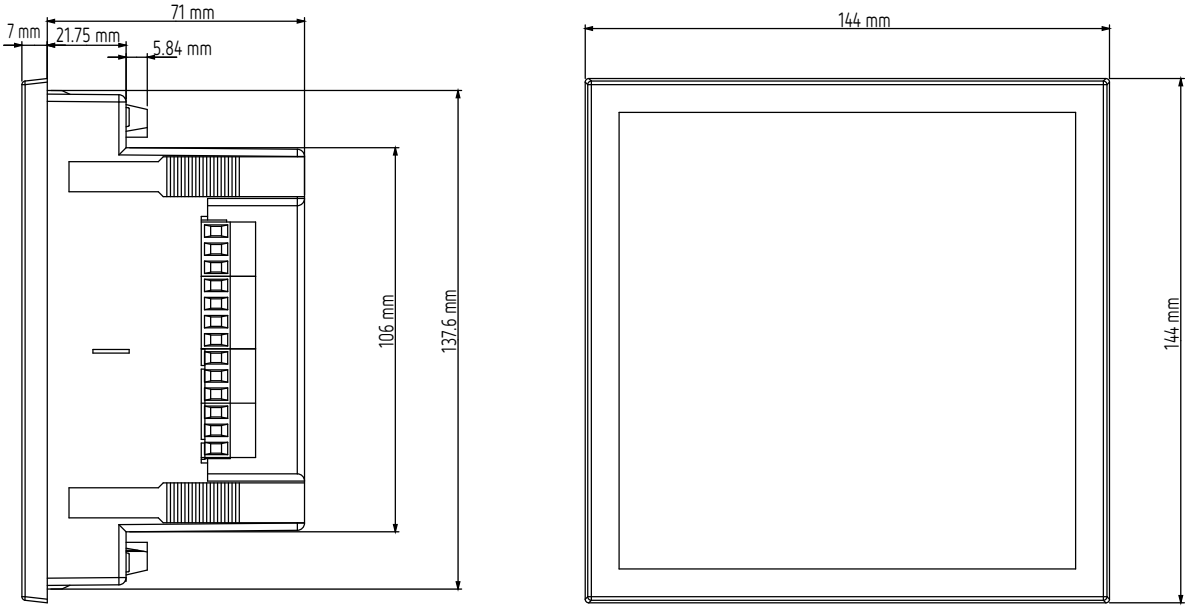


Figure 24: Dimensions of the Computer PV 12.

9.- MAINTENANCE AND TECHNICAL SERVICE

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

Technical Assistance Service
Vial Sant Jordi, s/n, 08232 - Viladecavalls (Barcelona)
Tel: +34 937 452 919
email: sat@circutor.com

10.- WARRANTY

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.

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(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:

Reguladores energía reactiva trifásico. regulación,medida, control de fugas y comunicaciones

Serie:

Computer PV 12

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/EU: Low Voltage Directive	2014/30/EU: EMC Directive
2011/65/EU: RoHS2 Directive	2015/863/EU: RoHS3 Directive

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

IEC 61010-1:2010+AMD1:2016	IEC 61010-2-030:2023
IEC 61326-1:2020	IEC 63000:2016 +AMD1:2022 CSV

(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:

Power Factor regulators. Regulation, measurement and protection all in one

Series:

Computer PV 12

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/EU: Low Voltage Directive	2014/30/EU: EMC Directive
2011/65/EU: RoHS2 Directive	2015/863/EU: RoHS3 Directive

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

IEC 61010-1:2010+AMD1:2016	IEC 61010-2-030:2023
IEC 61326-1:2020	IEC 63000:2016 +AMD1:2022 CSV

(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:

Régulateurs énergie réactive intelligents, mesure sur les 3 phases

Série:

Computer PV 12

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/EU: Low Voltage Directive	2014/30/EU: EMC Directive
2011/65/EU: RoHS2 Directive	2015/863/EU: RoHS3 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	IEC 61010-2-030:2023
IEC 61326-1:2020	IEC 63000:2016 +AMD1:2022 CSV

Viladecavalls (Spain), 4/5/2026
Chief Executive Officer: Joan Comellas Cabeza

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(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:

Dreiphasen-Blindleistungsregler. Regulierung, Messung, Ableitstrom- und Kommunikationsüberwachung

Serie:

Computer PV 12

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/EU: Low Voltage Directive	2014/30/EU: EMC Directive
2011/65/EU: RoHS2 Directive	2015/863/EU: RoHS3 Directive

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

IEC 61010-1:2010+AMD1:2016	IEC 61010-2-030:2023
IEC 61326-1:2020	IEC 63000:2016 +AMD1:2022 CSV

(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:

Reguladores de energia reativa. Medida e compensação sobre as 3 fases da instalação

Série:

Computer PV 12

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/EU: Low Voltage Directive	2014/30/EU: EMC Directive
2011/65/EU: RoHS2 Directive	2015/863/EU: RoHS3 Directive

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

IEC 61010-1:2010+AMD1:2016	IEC 61010-2-030:2023
IEC 61326-1:2020	IEC 63000:2016 +AMD1:2022 CSV

(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:

Regolatori energia reattiva trifase. regolazione, misurazione, controllo di fughe e comunicazioni

Serie:

Computer PV 12

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/EU: Low Voltage Directive	2014/30/EU: EMC Directive
2011/65/EU: RoHS2 Directive	2015/863/EU: RoHS3 Directive

È conforme alle seguenti normative o altri documenti normativi:

IEC 61010-1:2010+AMD1:2016	IEC 61010-2-030:2023
IEC 61326-1:2020	IEC 63000:2016 +AMD1:2022 CSV

Viladecavalls (Spain), 4/5/2026
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(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:

Regulator mocy biernej; regulacja, pomiar i ochrona w jednym

Seria:

Computer PV 12

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/EU: Low Voltage Directive	2014/30/EU: EMC Directive
2011/65/EU: RoHS2 Directive	2015/863/EU: RoHS3 Directive

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

IEC 61010-1:2010+AMD1:2016	IEC 61010-2-030:2023
IEC 61326-1:2020	IEC 63000:2016 +AMD1:2022 CSV

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