REACTIVE POWER SOLUTIONS

# Power analyzer

# MCA PLUS II - ITF


# INSTRUCTION MANUAL

CE

## SAFETY PRECAUTIONS

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

| | |
|---|---|
|  | **DANGER**<br>Warns of a risk, which could result in personal injury or material damage. |

| | |
|---|---|
|  | **ATTENTION**<br>Indicates that special attention should be paid to a specific point. |

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

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

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

## DISCLAIMER

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

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

www.lifasa.com

## CONTENTS

## REVISION LOG

**Table 1: Revision log.**

| Date | Revision | Description |
|---|---|---|
| 04/14 | M001B01-03-14A | Initial Version |
| 06/14 | M001B01-03-14B | Changes in the following sections: 3.4 - 4.9 - 4.10 - 5 |
| 06/14 | M001B01-03-14C | Changes in the following sections: 4.9.5 - 4.9.6 - 4.10.2.1 |
| 11/14 | M001B01-03-14D | Changes in the following sections: 4.9.21 - 4.9.23 - 4.10.2 - 4.10.3 - 5 |
| 11/14 | M001B01-03-14E | Changes in the following sections: 3.3.2 - 3.4.2 - 3.4.8 - 4.5 - 4.9 - 4.10.3.1 |

## 1.- VERIFICATION UPON RECEPTION

Check the following points when you receive the unit:

a) The unit meets the specifications described in your order.
b) The unit has not suffered any damage during transport.
c) Perform an external visual inspection of the unit prior to switching it on.
d) Check that it has been delivered with the following:
   - An installation guide,
   - 2 Retainers used to attach the unit,
   - 5 connectors.

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

## 2.- PRODUCT DESCRIPTION

The **MCA PLUS II** unit measures, calculates and displays the main electrical parameters of the following networks: single-phase, two-phase, with and without neutral, balanced three-phase, with ARON measurements or unbalanced. The measurement will be taken in RMS with the three AC voltage inputs and three current inputs.


The unit features:

- **3 keys** that allow you to browse between the various screens and program the unit.
- **3 indicator LEDs**: CPU, ALARM and KEY.
- **LCD display**, displays all parameters,
- **2 digital inputs**, used to select the tariff or detect the logic state of external signals.
- **2 digital outputs**, fully programmable.
- **2 alarm relays**, fully programmable.
- **RS-485** Communications, MODBUS RTU©.

# 3.- UNIT INSTALLATION

## 3.1.- PRIOR RECOMMENDATIONS

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

The **MCA PLUS II** unit must be installed by authorised and qualified staff.

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

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

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

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

Inspect the work area before taking any measurements. Do not take measurements in dangerous areas or where there is a risk of explosion.

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

## 3.2.- INSTALLATION

The unit will be installed on a panel ($92^{+0.8}$ x $92^{+0.8}$ mm panel drill hole, in compliance with DIN 43700). All connections are located inside the electric panel.

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

The unit must be connected to a power circuit that is protected with gl (IEC 269) or M type fuses with a rating of 0.5 to 2 A. It must be fitted with a circuit breaker or equivalent device, in order to be able to disconnect the unit from the power supply network.
The power and voltage measuring circuit must be connected with cables that have a minimum cross-section of $1mm^2$.

The secondary line of the current transformer will have a minimum cross-section of 2.5 $mm^2$.

## 3.3.- UNIT TERMINALS

### 3.3.1.- List of terminals, MCA PLUS II model

**Table 2:List of terminals of the MCA PLUS II**

| Unit terminals | |
|---|---|
| **1 : A1** Auxiliary power supply. | **13: I2**, digital input 2 / tariff selection |
| **2: A2** Auxiliary power supply. | **14: $V_{L1,}$** Voltage input L1 |
| **3: Rc**, Common relay output | **15: $V_{L2,}$** Voltage input L2 |
| **4: R2**, Relay output 2 | **16: $V_{L3,}$**Voltage input L3 |
| **5: R1**, Relay output 1 | **17: N,** Neutral |
| **6: CT**, Common digital output. | **18: S1** , Current input L1 |
| **7: T2**, Digital output 2 | **19: S2,** Current input L1 |
| **8: T1**, Digital output 1 | **20: S1,** Current input L2 |
| **9: A(+)**, RS485 | **21: S2,** Current input L2 |
| **10: B(-)**, RS485 | **22: S1,** Current input L3 |
| **11: GND**, for RS485 and digital inputs | **23: $S_2$,** Current input L3 |
| **12: I1**, digital input 1 / tariff selection | |

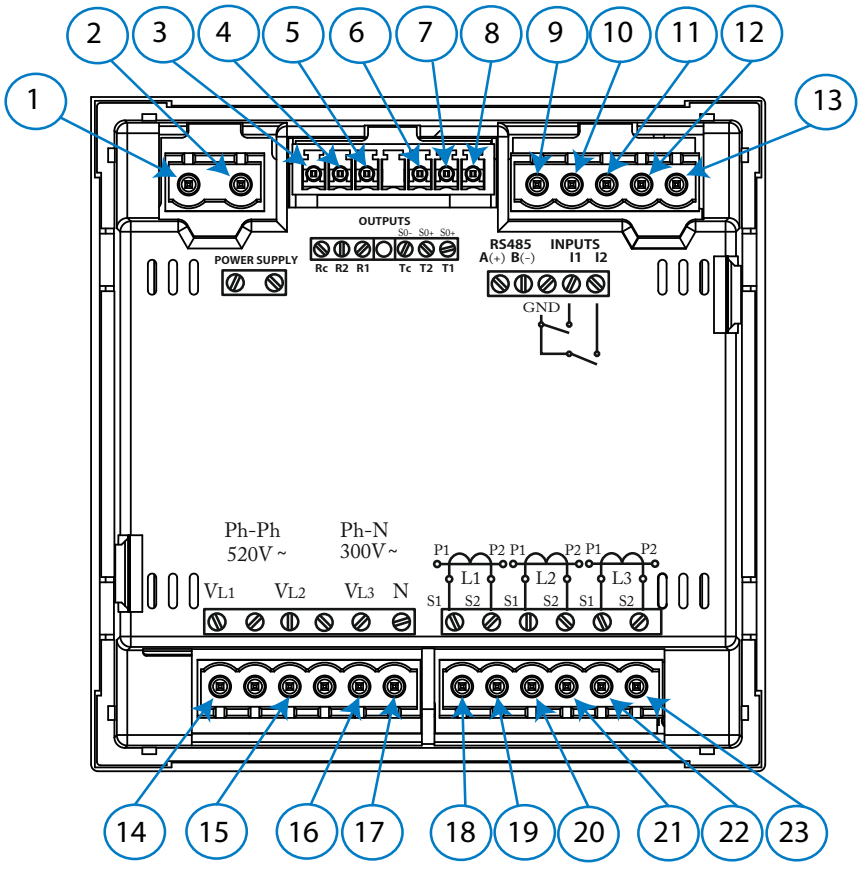



**Figure 1:Terminals of the MCA PLUS II**

## 3.4.- CONNECTION DIAGRAM

### 3.4.1.- Measuring Three-Phase Networks with a 4-wire connection, MCA PLUS II model.

Measurement system: 4-3Ph

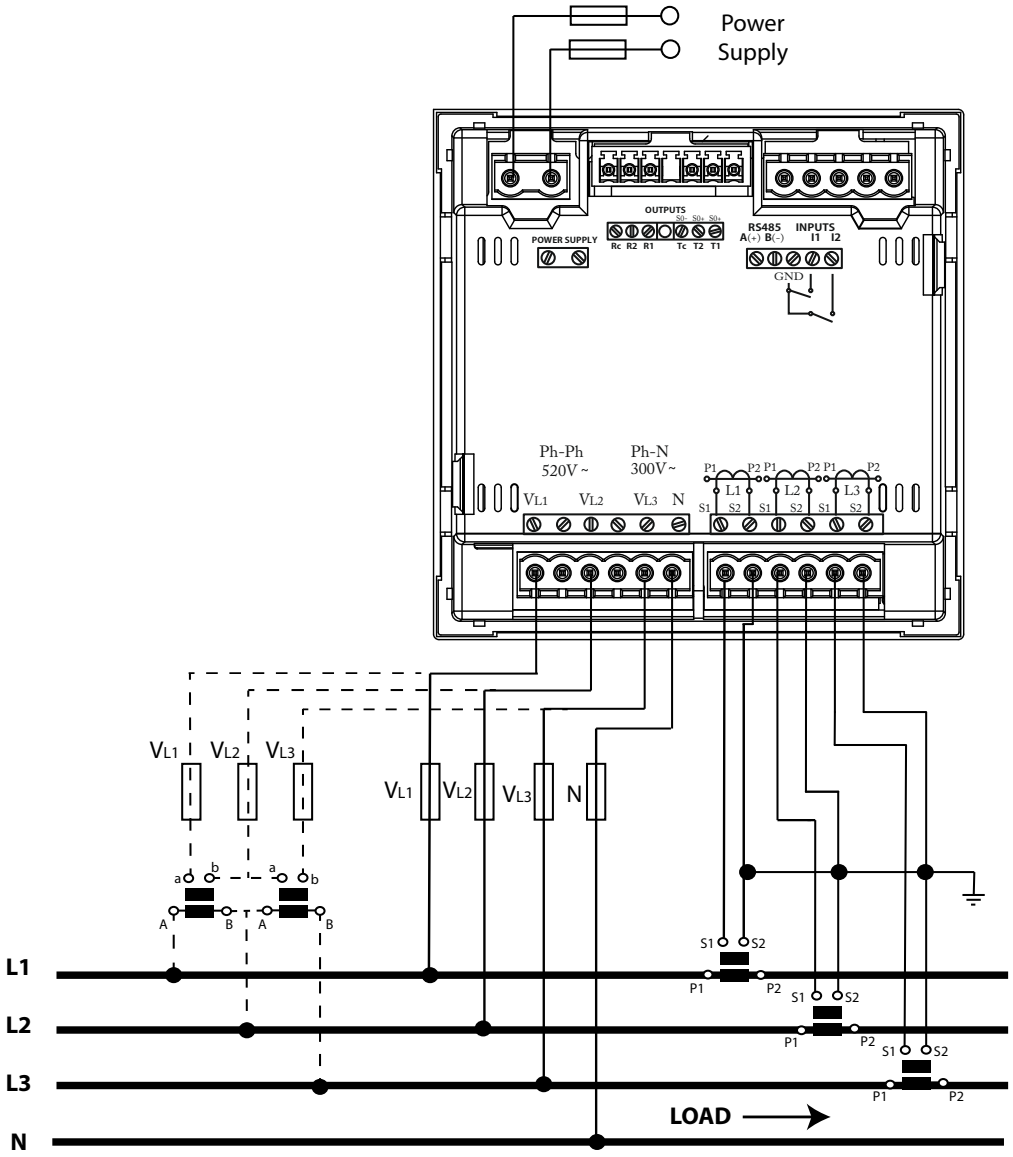



**Figure 2: Three-Phase measuring with a 4-wire connection, MCA PLUS II model.**

### 3.4.2.- Measuring Three-Phase Networks with a 3-wire connection, MCA PLUS II model.

Measurement system: 3 - 3Ph

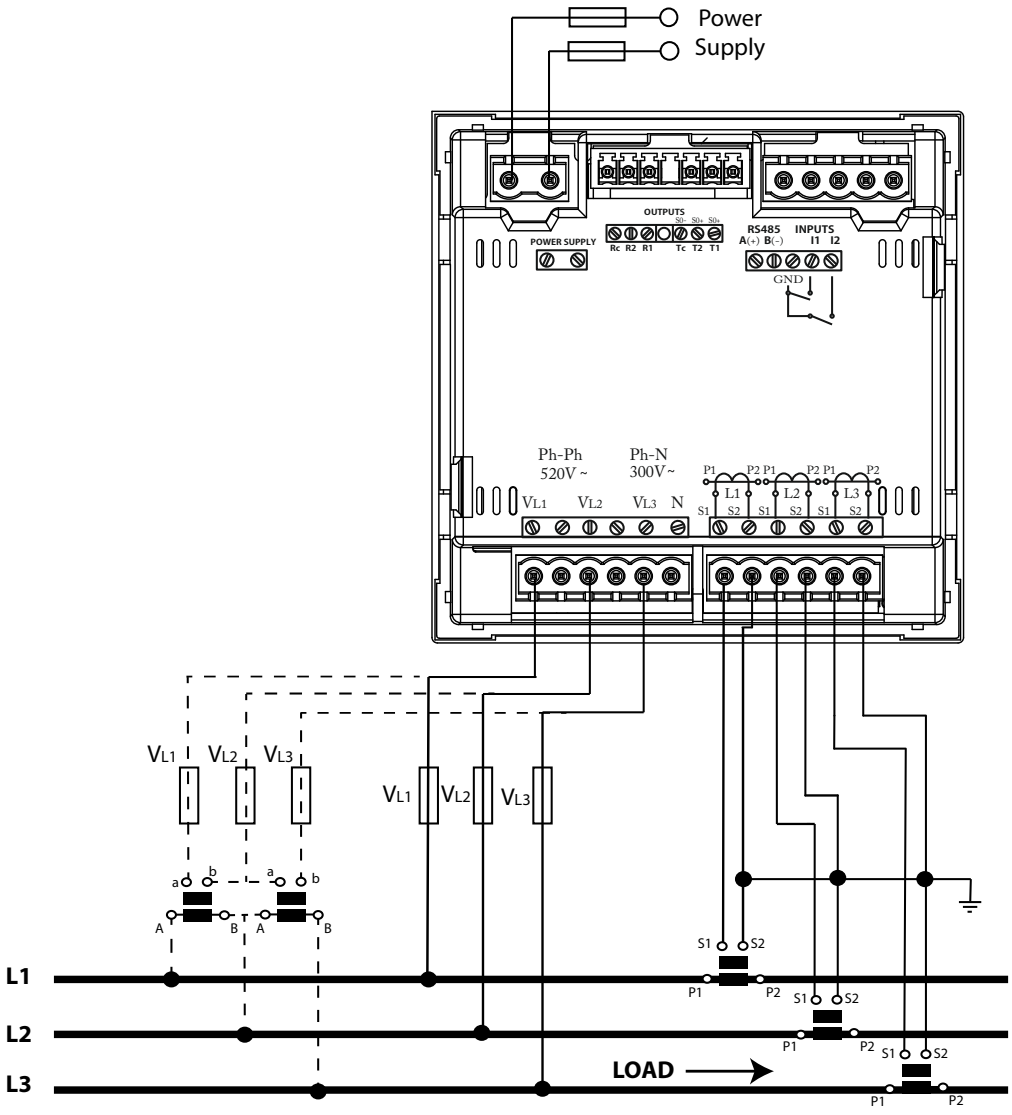



**Figure 3: Three-Phase measuring with a 3-wire connection, MCA PLUS II model.**

### 3.4.3.- Measuring Three-Phase Networks with a 3-wire connection and transformers with an ARON connection, MCA PLUS II model.

Measurement system: 3-Ar-ON

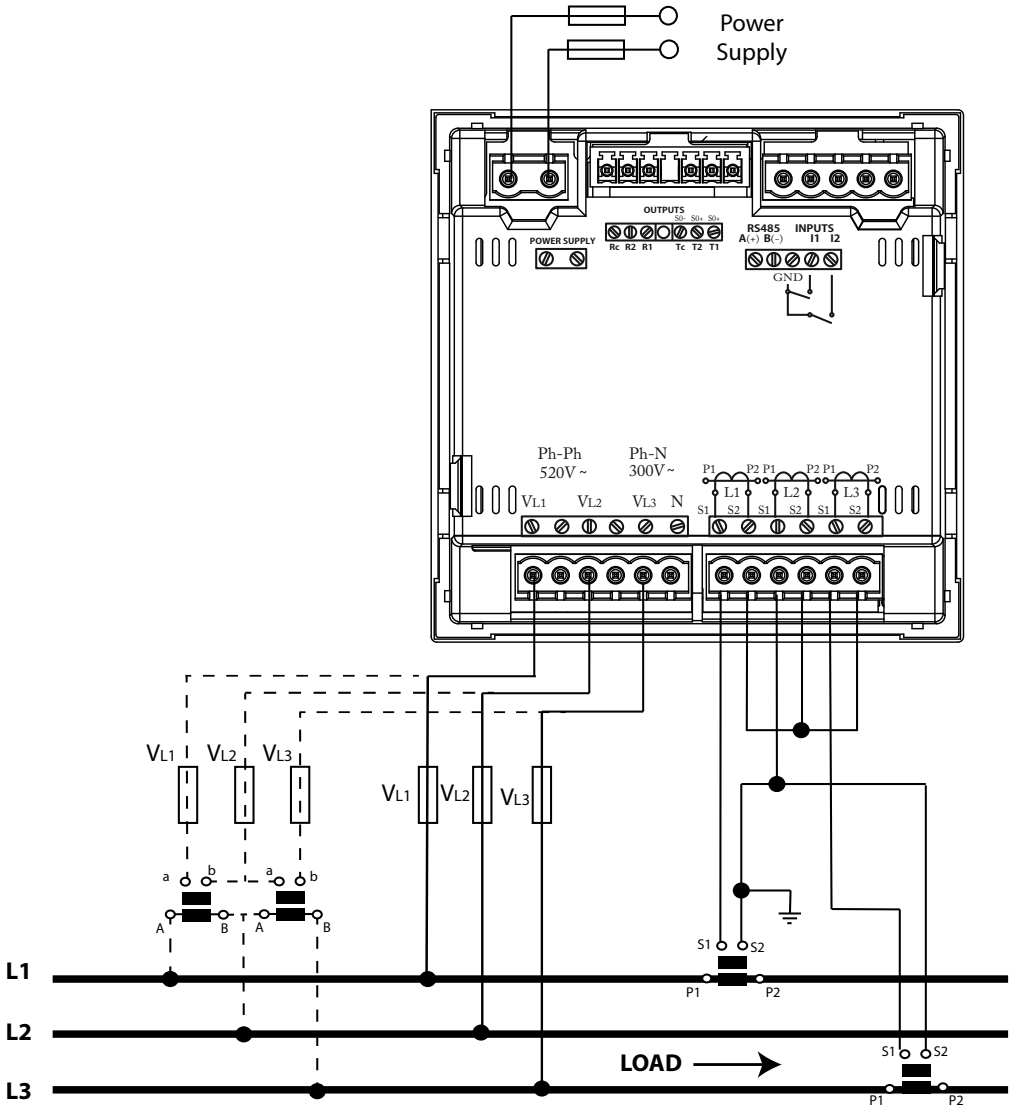



**Figure 4: Three-Phase measuring with a 3-wire connection and transformers with an ARON connection, MCA PLUS II**

| | |
|---|---|
| ⚠ | **MCA PLUS II** model:<br>The transformer secondary value must be 5A or 1A |

### 3.4.4.- Measuring Two-Phase Networks with a 3-wire connection, MCA PLUS II.

Measurement system: 3-2Ph

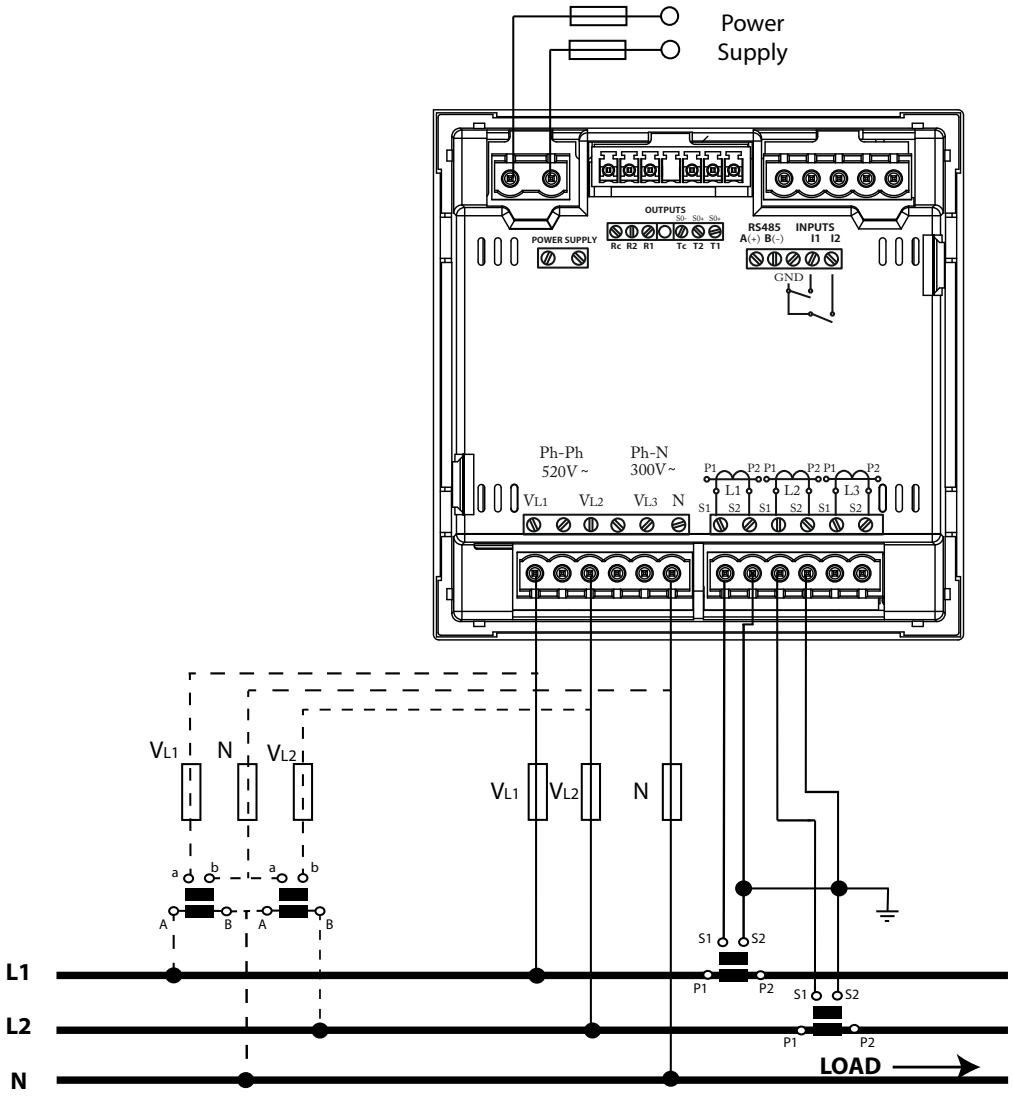



**Figure 5: Measuring Two-Phase Networks with a 3-wire connection, MCA PLUS II model**

| | |
|---|---|
| ⚠ | **MCA PLUS II** model:<br>The transformer secondary value must be 5A or 1A |

### 3.4.5.- Measuring Single-Phase Networks, phase to phase, with a 2-wire connection, MCA PLUS II model.

Measurement system: 2-2Ph

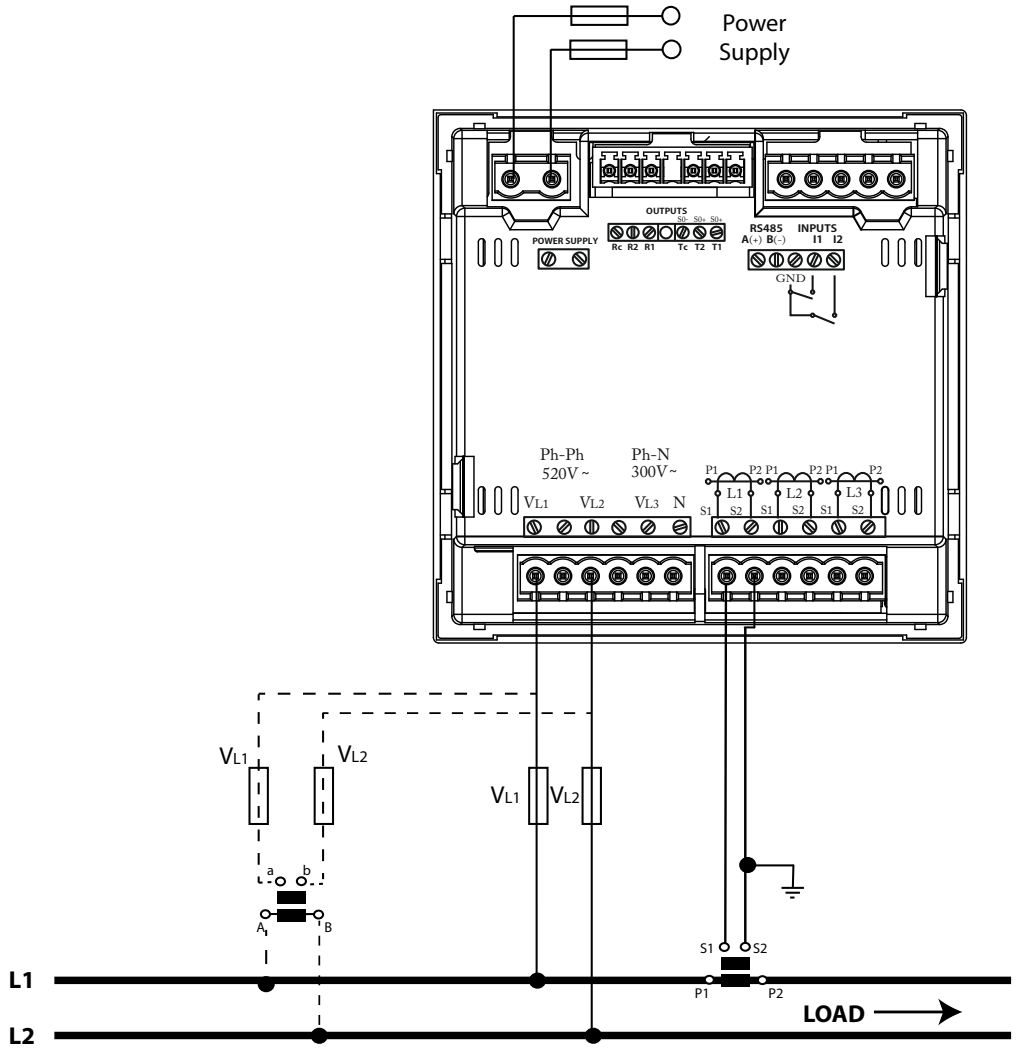



**Figure 6: Measuring Single-Phase Networks, phase to phase, with a 2-wire connection, MCA PLUS II model.**

| | |
|---|---|
| ⚠ | **MCA PLUS II** model:<br>The transformer secondary value must be 5A or 1A |

### 3.4.6.- Measuring Single-Phase Networks, phase to neutral, with a 2-wire connection, MCA PLUS II model.

Measurement system: 2 - 1Ph

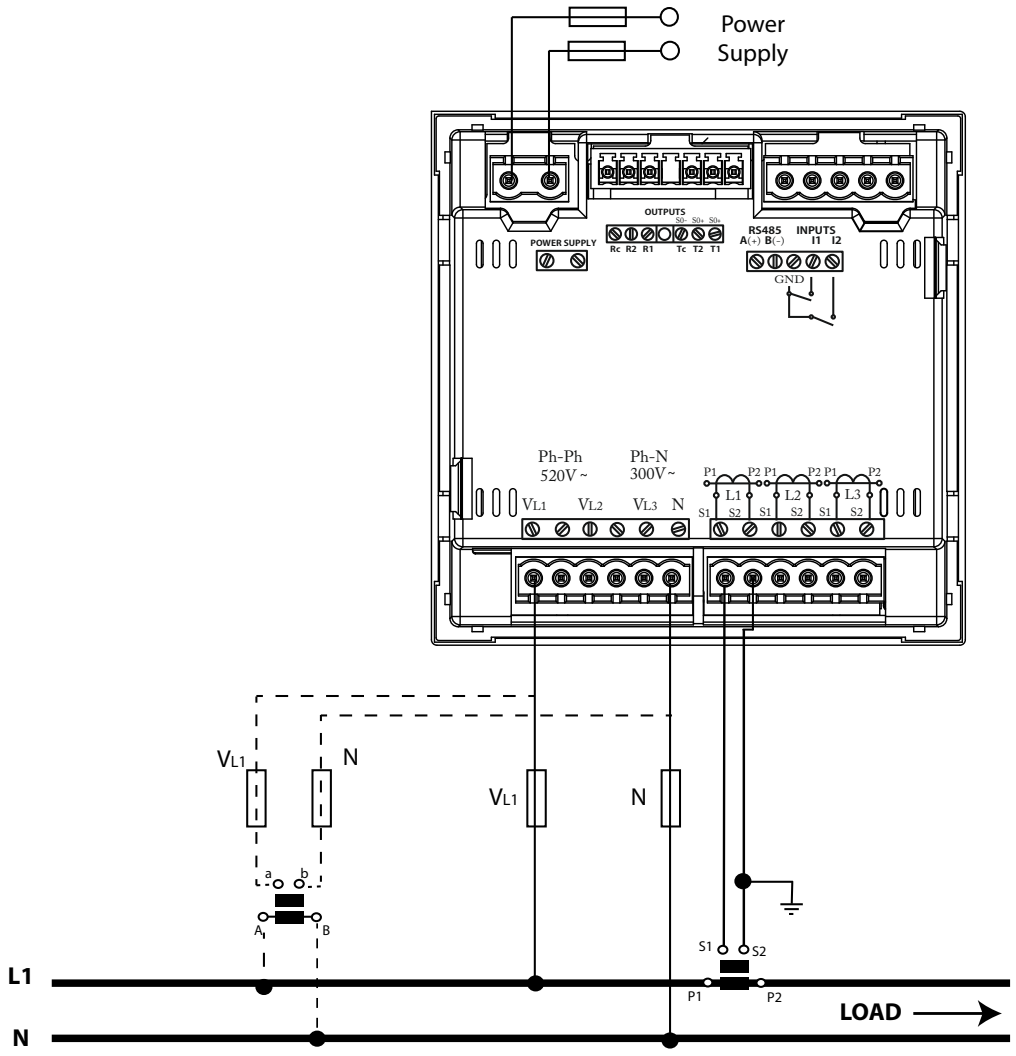



**Figure 7: Measuring Single-Phase Networks, phase to neutral, with a 2-wire connection, MCA PLUS II**

| | |
|---|---|
| ⚠ | **MCA PLUS II** model:<br>The transformer secondary value must be 5A or 1A |

## 4.- OPERATION

The **MCA PLUS II** is a four-quadrant power analyzer (consumption and generation).

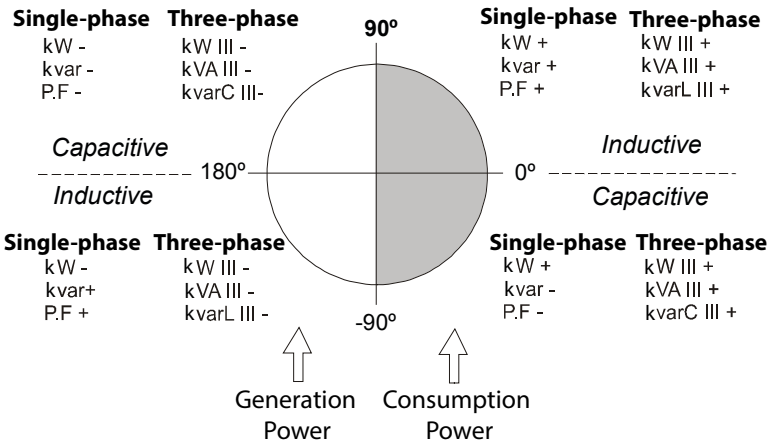



**Figure 8: Four quadrants of MCA PLUS II**

### 4.1.- MEASURING PARAMETERS

The unit displays the electrical parameters shown in **Table 4**.

**Table 3: Measuring parameters of the MCA PLUS II.**

| Parameter | Units | Phases L1-L2-L3 | Total III | N |
|---|---|---|---|---|
| Phase-neutral voltage | Vph-N | ✓ | | |
| Phase-phase voltage | Vph-ph | ✓ | ✓ | |
| Current | A | ✓ | ✓ | ✓ |
| Frequency | Hz | ✓ | ✓ | |
| Active power | M/kW | ✓ | ✓ | |
| Apparent power | M/kVA | ✓ | ✓ | |
| Total Reactive Power | M/kvar | ✓ | ✓ | |
| Total Reactive Power - Consumption | M/kvar | ✓ | ✓ | |
| Total Reactive Power - Generation | M/kvar | ✓ | ✓ | |
| Total Inductive Reactive Power | M/kvarL | ✓ | ✓ | |
| Inductive Reactive Power - Consumption | M/kvarL | ✓ | ✓ | |
| Inductive Reactive Power - Generation | M/kvarL | ✓ | ✓ | |
| Total Capacitive Reactive Power | M/kvarC | ✓ | ✓ | |
| Capacitive Reactive Power - Consumption | M/kvarC | ✓ | ✓ | |
| Capacitive Reactive Power - Generation | M/kvarC | ✓ | ✓ | |
| Power factor | PF | ✓ | ✓ | |
| Cos φ | φ | ✓ | ✓ | |
| THD % Voltage | % THD V | ✓ | | |
| THD % Current | % THD A | ✓ | | |
| Harmonic Breakdown - Voltage (up to the 31st order harmonic) | harm V | ✓ | | |

| Parameter | Units | Phases L1-L2-L3 | Total III | N |
|---|---|---|---|---|
| Harmonic Breakdown - Current (up to the 31st order harmonic) | harm V | ✓ | | |
| Total Active Energy | M/kWh | ✓ | ✓ | |
| Total Inductive Reactive Energy | M/kvarLh | ✓ | ✓ | |
| Capacitive Reactive Energy | M/kvarCh | ✓ | ✓ | |
| Total Reactive Energy | M/kvarh | ✓ | ✓ | |
| Total Apparent Energy | M/kVAh | ✓ | ✓ | |
| Active Energy Tariff 1 | M/kWh | ✓ | ✓ | |
| Inductive Reactive Energy Tariff 1 | M/kvarLh | ✓ | ✓ | |
| Active Energy Tariff 2 | M/kWh | ✓ | ✓ | |
| Inductive Reactive Energy Tariff 2 | M/kvarLh | ✓ | ✓ | |
| Active Energy Tariff 3 | M/kWh | ✓ | ✓ | |
| Inductive Reactive Energy Tariff 3 | M/kvarLh | ✓ | ✓ | |
| Maximum Current Demand | A | ✓ | ✓ | |
| Maximum Demand of Active power | M/kW | ✓ | ✓ | |
| Maximum Demand of Apparent Power | M/kVA | ✓ | ✓ | |
| **Parameter** | **Units** | **Tariff: T1-T2-T3** | | **Total** |
| No. of hours | hours | ✓ | | ✓ |
| Cost | COST | ✓ | | ✓ |
| $CO_2$ Emissions | $kgCO_2$ | ✓ | | ✓ |

## 4.2.- KEYBOARD FUNCTIONS

The **MCA PLUS II** has 3 keys that allow you to browse between the various screens and program the unit.

Key functions on measuring screens (**Table 5**):

**Table 4: Key functions on measuring screens.**

| Key | Short keystroke | Long keystroke (2 s) |
|---|---|---|
|  | Previous screen | Display of minimum value |
|  | Next screen | Display of maximum value |
|  | Browsing the different profiles (analyzer, user, e3) | Accessing the programming menu |
|  | | Display of the Maximum Demand |
|  | | Active alarm information |
|  | | Unlocks the active alarm |

Key functions on harmonics screens (**Table 6**):

**Table 5: Key functions on harmonics screens.**

| Key | Short keystroke | Long keystroke (2 s) |
|---|---|---|
|  | Output of the harmonics screens | |
|  | Next screen | |
|  | Browsing the different types of harmonics | Accessing the programming menu |

Key functions on the programming menu, query mode (**Table 7**):

**Table 6: Key functions on the programming menu, query mode.**

| Key | Short keystroke | Long keystroke (2 s) |
|---|---|---|
|  | Previous screen | Programming output |
|  | Next screen | Programming output |
|  | | Opening the programming menu in the edit mode |

Key functions on the programming menu, edit mode (**Table 8**):

**Table 7: Key functions on the programming menu, edit mode.**

| Key | Keystroke |
|---|---|
|  | Next page |
|  | Increases the digits (0-9) or rotates between the different options. |
|  | Moves an editable digit (flashing) |

## 4.3.- DISPLAY

The unit has a backlit LCD display showing all the parameters listed in **Table 3**.

The display is divided into four areas (**Figure 14**):


**Figure 9: MCA PLUS II Display areas**

✓ The area with **data per phase** displays the instantaneous, maximum and minimum values of each phase being measured or calculated by the unit.

✓The **total data** area displays the totals of the values being measured or calculated by the unit.

✓**Analogue bar,** displays the % of the current power of the installation.

✓**Cos φ - PF Bar,** displays the value of the system's Cos φ or power factor in real time.

### 4.3.1. COS φ - PF (POWER FACTOR) BAR


**Figure 10: Cos φ - PF Bar**

This bar displays the value of the installation's cos φ or power factor in real time.
The parameter that will be displayed is selected on the programming menu. ( ***"4.9.11. Selecting the Cos φ - PF bar on the display"***)

### 4.3.2. ANALOGUE BAR

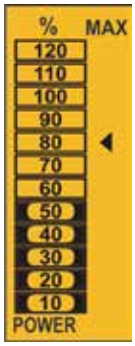



**Figure 11: Analogue Bar**

The analogue bar displays two parameters:

✓ **Current power of the installation in %**
This parameter is displayed in 12 divisions, each one represents 10%, into which the analogue bar is divided.
The unit calculates the current power of the installation using the formula:

$$P = V*I*\cos(\varphi)$$

Where the voltage and the cos(φ) are the installation's current values.
The current is referenced in its full scale. (100% is the full scale of the unit and a value above 100% indicates that it is out of range).

✓ **The maximum system demand reached**, i.e., the maximum power value reached since the unit was started, expressed as a percentage.
This value is displayed with the icon ◀.
The value and the maximum and minimum values are reset. ( ***"4.9.12. Deleting maximum and minimum values"***)

***Example:*** **Figure 16** shows that the installation performance is 50% and that the maximum demand of the system is 80%.

### 4.3.3. OTHER SYMBOLS ON THE DISPLAY

The following are also shown on the display:

✓ **Type of installation**
The type of installation to which the unit is connected can be selected on the programming menu, ( ***"4.9.8. Type of installation"***). The selected type is shown on the top left of the display.

✓ **State of digital inputs**
If the digital inputs have been activated, the top left of the display will show the icons I1 I2 that indicate that the digital input is active.

## 4.4.- LED INDICATORS

The **MCA PLUS II** unit has 3 LEDs:

- **CPU**, indicates that the unit is on, flashing each second.
- **ALARM**, indicates that an alarm has been activated if it is on
- **KEY**, LED that is lit when any key is pressed.


**Figure 12:LED Indicators of the MCA PLUS II.**

## 4.5.- OPERATION PROFILES

The **MCA PLUS II** has 3 operation profiles. The display screens will be opened for the corresponding profile:

- ✓ Analyzer profile, **analyzer**,
- ✓ Electrical energy efficiency profile, **e³**,
- ✓ User profile, **user**,

### 4.5.1. ANALYZER PROFILE

This profile is identified with the **analyzer** symbol on the bottom of the screen (**Figure 18**)

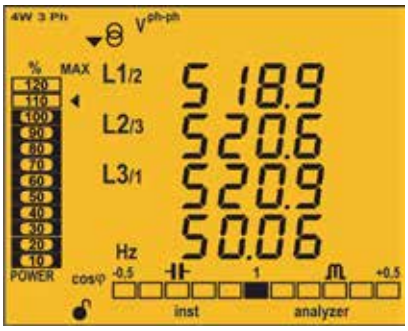
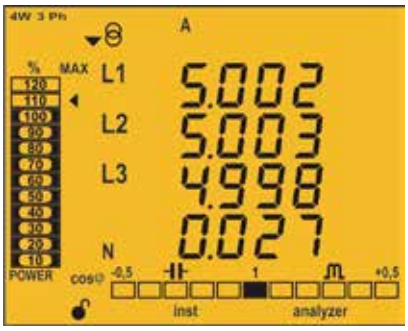
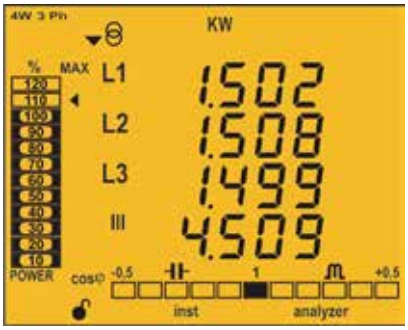

**Figure 13: MCA PLUS II screen with the analyzer profile.**

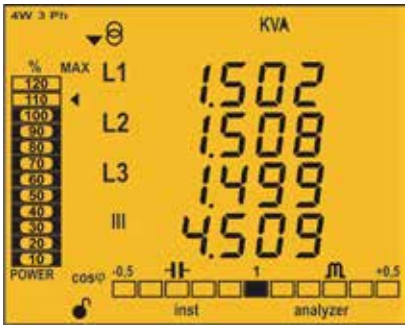
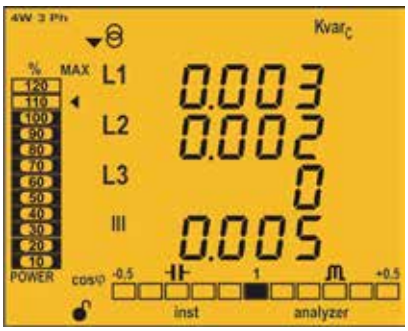
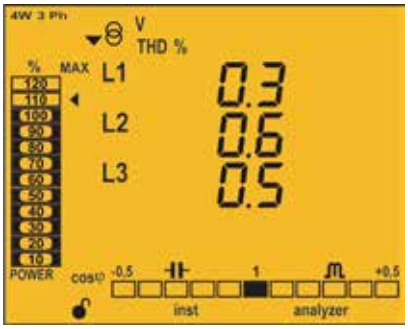
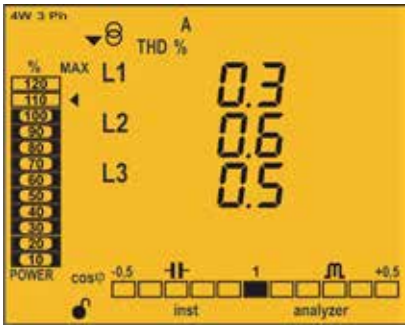
The unit displays 11 different screens for the **analyzer** profile (**Table 9**)

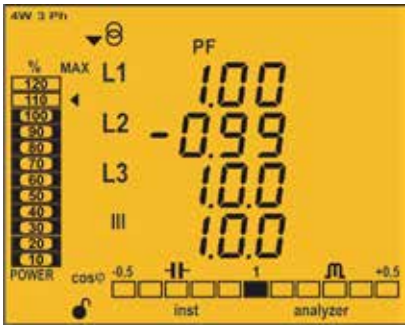
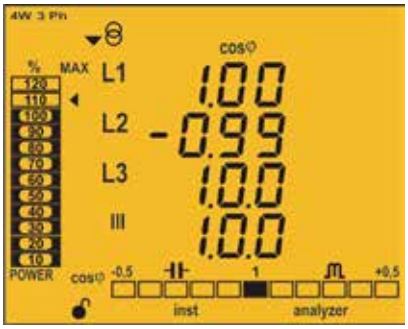
Use keys ◄ and ► to browse the different screens.

The **inst** symbol on the bottom of the screen indicates that the values being displayed are of the instantaneous type.

**Table 8: Analyzer profile screens.**

| Screen | Parameters (units) |
|---|---|
|  | phase-phase Voltage L1-L2 ($V^{ph-ph}$)<br>phase-phase Voltage L2-L3 ($V^{ph-ph}$)<br>phase-phase Voltage L3-L1 ($V^{ph-ph}$)<br>Frequency (Hz) |
|  | phase-neutral Voltage L1 ($V^{ph-N}$)<br>phase-neutral Voltage L2 ($V^{ph-N}$)<br>phase-neutral Voltage L3 ($V^{ph-N}$)<br>Frequency (Hz) |
|  | Current L1 (A)<br>Current L2 (A)<br>Current L3 (A)<br>Neutral Current (A)(1)<br><br>(1) *Not available for the 3 - 3Ph and 3 - Ar On installation types.* |
|  | Active Power L1 (M/K W)<br>Active Power L2 (M/K W)<br>Active Power L3 (M/K W)<br>Active Power III (M/K W)<br><br>*The generation values are not measured when the 2 quadrant option is selected.* |

| Screen | Parameters (units) |
|---|---|
|  | Apparent Power L1 (M/KVA)<br>Apparent Power L2 (M/KVA)<br>Apparent Power L3 (M/KVA)<br>Apparent Power III (M/KVA)<br><br>*The generation values are not measured when the 2 quadrant option is selected.* |
|  | Inductive Reactive Power L1 (M/Kvar$^{L}$)<br>Inductive Reactive Power L2 (M/Kvar$^{L}$)<br>Inductive Reactive Power L3 (M/Kvar$^{L}$)<br>Inductive Reactive Power III (M/Kvar$^{L}$) |
|  | Capacitive Reactive Power L1 (M/Kvar$_{C}$)<br>Capacitive Reactive Power L2 (M/Kvar$_{C}$)<br>Capacitive Reactive Power L3 (M/Kvar$_{C}$)<br>Capacitive Reactive Power III (M/Kvar$_{C}$) |
|  | THD % Voltage L1 (V THD %)<br>THD % Voltage L2 (V THD %)<br>THD % Voltage L3 (V THD %) |
|  | THD % Current L1 (A THD %)<br>THD % Current L2 (A THD %)<br>THD % Current L3 (A THD %) |

| Screen | Parameters (units) |
|---|---|
|  | Power factor L1 (PF)<br>Power factor L2 (PF)<br>Power factor L3 (PF)<br>Power factor III (PF) |
|  | Cos φ L1 (cos φ)<br>Cos φ L2 (cos φ)<br>Cos φ L3 (cos φ)<br>Cos φ III (cos φ) |

Also displayed on these screens are:

✓ **Maximum values**

To see the maximum values of the screen being displayed, press the key for 2 seconds.

The **max** symbol is shown on the display (**Figure 19**)

The maximum and minimum values are reset on the programming menu.

( ***"4.9.12. Deleting maximum and minimum values"***)

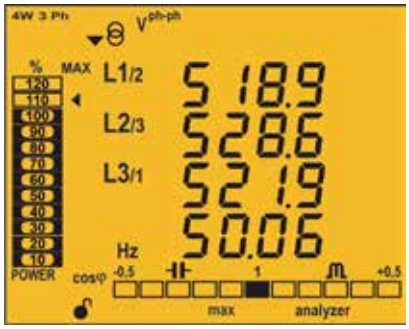


**Figure 14: Analyzer profile screen displaying the maximum values.**

✓ **Minimum values**

To see the minimum values of the screen being displayed, press the key for 2 seconds.

The **min** symbol will be displayed (**Figure 20**)

The maximum and minimum values are reset on the programming menu.

( ***"4.9.12. Deleting maximum and minimum values"***)

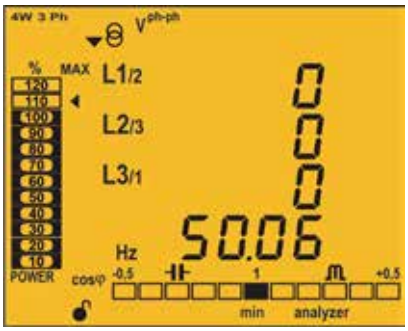



**Figure 15: Analyzer profile screen displaying the minimum values.**

✓ **Maximum Demand**

The unit calculates the maximum demand of the following:

- Current
- Three-Phase Active Power.
- Three-Phase Apparent Power.

This value can be displayed on the display screen of the parameter by pressing the and keys at the same time.

The **dem** symbol appears on the display (**Figure 21**)

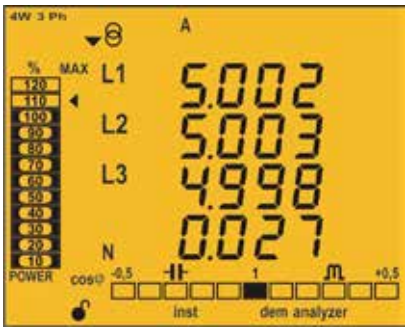



**Figure 16: Analyzer profile screen displaying the maximum demand values.**

Press keys or to stop displaying the maximum demand values.
The maximum demand values are reset on the programming menu:
***"4.9.8. Deleting maximum demand"***

### 4.5.2. e³ PROFILE

This profile is identified with the **e³** symbol on the bottom of the screen (**Figure 22**).

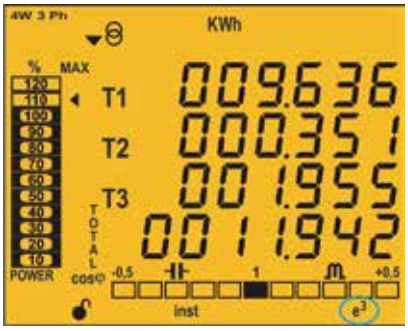



**Figure 17: MCA PLUS II screen with the e³ profile.**

The installation's consumed and generated energy are displayed on the **e³** profile of the unit.

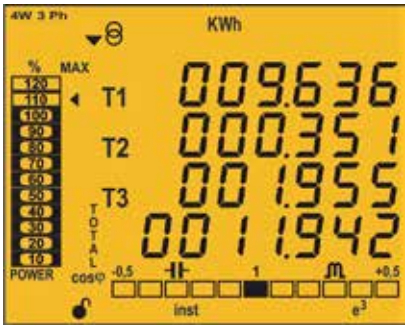
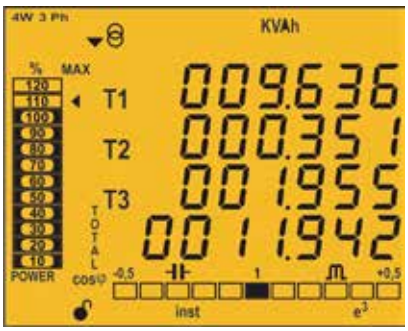
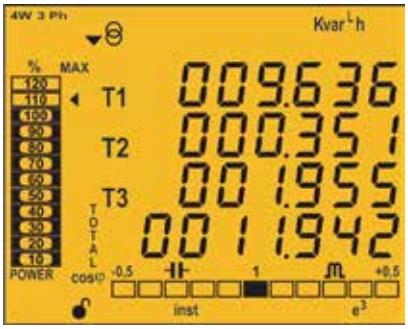
The installation status is also displayed:

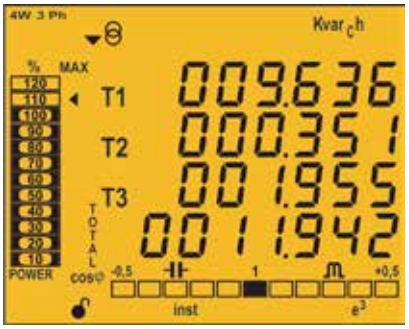
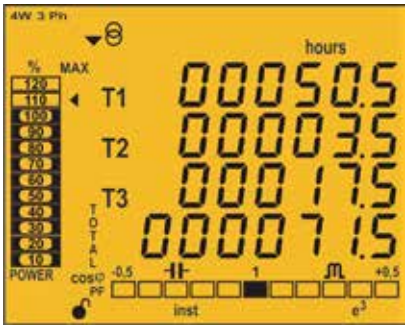
- Installation is consuming energy.
- Installation is generating energy.

A long keystroke (3 sec) of key > will display the consumption values.
The consumption values are identified with the negative sign on the screen, which appears in front of each parameter.
A long keystroke (3 sec) of key < will display the generation values.

Use keys < and > to browse the different screens (short keystroke).

**Table 9: Screens of the e³ profile.**

| Screen | Parameters (units) |
|---|---|
|  | Active Energy Tariff 1 , T1 (M/KWh)<br>Active Energy Tariff 2 , T2 (M/KWh)<br>Active Energy Tariff 3 , T3 (M/KWh)<br>Total Active Energy (M/KWh)<br><br>*Consumption and generation values*<br><br>*Only available for the 4 quadrant option.* |
|  | Apparent Energy Tariff 1, T1 (M/KVAh)<br>Apparent Energy Tariff 2, T2 (M/KVAh)<br>Apparent Energy Tariff 3, T3 (M/KVAh)<br>Total Apparent Energy (M/KVAh)<br><br>*Consumption and generation values*<br><br>*Only available for the 4 quadrant option.* |
|  | Inductive Reactive Energy Tariff 1, T1 (M/Kvar$^{L}$h)<br>Inductive Reactive Energy Tariff 2, T2 (M/Kvar$^{L}$h)<br>Inductive Reactive Energy Tariff 3, T3 (M/Kvar$^{L}$h)<br>Total Inductive Reactive Energy (M/Kvar$^{L}$h)<br><br>*Consumption and generation values*<br><br>*Only available for the 4 quadrant option.* |

| Screen | Parameters (units) |
|---|---|
|  | Capacitive Reactive Energy Tariff 1, T1 (M/Kvar$_C$h)<br>Capacitive Reactive Energy Tariff 2, T2 (M/Kvar$_C$h)<br>Capacitive Reactive Energy Tariff 3, T3 (M/Kvar$_C$h)<br>Total Capacitive Reactive Energy (M/Kvar$_C$h)<br><br>*Consumption and generation values*<br><br>*Only available for the 4 quadrant option.* |
|  | Cost Tariff 1, T1 (cost)<br>Cost Tariff 2, T2 (cost)<br>Cost Tariff 3, T3 (cost)<br>Total Cost (cost)<br><br>*Consumption and generation values* |
|  | $CO_2$ Emissions Tariff 1, T1 (kg$CO_2$)<br>$CO_2$ Emissions Tariff 2, T2 (kg$CO_2$)<br>$CO_2$ Emissions Tariff 3, T3 (kg$CO_2$)<br>Total $CO_2$ Emissions (kg$CO_2$)<br><br>*Consumption and generation values* |
|  | No. of hours Tariff 1, T1(hours)<br>No. of hours Tariff 2, T2(hours)<br>No. of hours Tariff 3, T3(hours)<br>Total No. of hours (hours) |

Symbols **T1**, **T2** and **T3** on the display indicate the three tariffs available on the unit. The corresponding symbol flashes to indicate the selected tariff.

### 4.5.3. USER

This profile is identified with the **user** symbol on the bottom of the screen (**Figure 23**).

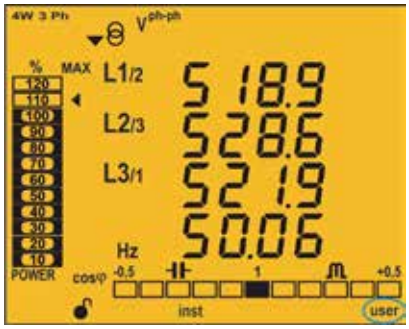



**Figure 18: Screen of the MCA PLUS II with the user profile.**

This profile displays the screens selected in the programming menu ( ***"4.9.9. Selecting the operation profile"***).

## 4.6.- HARMONICS

The unit can display the voltage and current harmonics, up to the 31st order harmonic, for each one of the lines, L1, L2 and L3.

They must be activated in the programming menu to be displayed (***"4.9.15. Activating the harmonics display screen."***).

Press the  key on the last profile screen to show all operation profiles on the harmonics display screens.

Harmonics are displayed as shown on **Figure 24**.

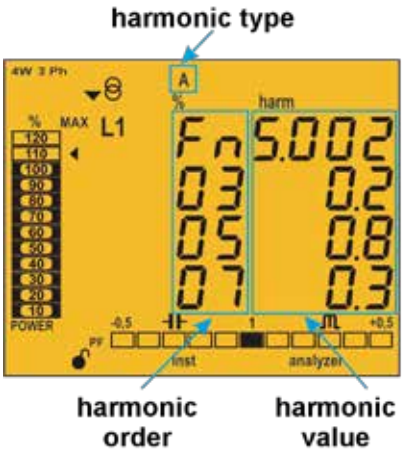



**Figure 19: MCA PLUS II Current harmonics screen.**

Press key  to open the next harmonics screen.

Press key  to display the different types of harmonics:

- Voltage harmonics L1- L2 - L3
- Current harmonics L1- L2 -L3

## 4.7.- INPUTS

The **MCA PLUS II** has two digital inputs (terminals 12 and 13 on **Figure 1**) that can be programmed to operate as a logic or tariff selection input.
See ***"4.9.26. Operating mode of digital input 1"*** and ***"4.9.27. Operating mode of digital input 2"***

The selected tariff can be determined in accordance with the status of the inputs, as shown in **Table 11**.

**Table 10: Selecting the tariff in accordance with the input status.**

| IN1, Input 1 | | IN2, Input 2 | | Tariff |
|---|---|---|---|---|
| Logic input | Tariff selection | Logic input | Tariff selection | |
| x | | x | | T1 |
| x | | | 0 | T1 |
| x | | | 1 | T3 |
| | 0 | x | | T1 |
| | 1 | x | | T2 |
| | 0 | | 0 | T1 |
| | 0 | | 1 | T2 |
| | 1 | | 0 | T3 |
| | 1 | | 1 | T1 |

## 4.8.- OUTPUTS

The unit features:

- ✓ Two alarm relays (terminals 3, 4 and 5, as shown in **Figure 1**), fully programmable, see ***"4.9.19 Programming alarm 1 (Relay 1)"*** and "***4.9.21. Programming alarm 2 (Relay 2)***"

- ✓ Two digital outputs, optoisolated NPN transistors (terminals 6, 7 and 8 on **Figure 1**), fully programmable, see ***"4.9.22. Programming alarm 3 (Digital output T1)"*** and ***"4.9.23. Programming alarm 4 (Digital output T2)"***.

## 4.9.- PROGRAMMING

From the programming menu you can:

- ✓ Lock the status of the menu.
- ✓ Define the transformation ratios.
- ✓ Select the number of quadrants and type of installation.
- ✓ Select the operation profile of the unit.
- ✓ Program the carbon emission ratio, $kgCO_{2,}$.
- ✓ Program the cost ratio.
- ✓ Program the maximum demand parameters.
- ✓ Delete the energy meters and the maximum and minimum values.
- ✓ Modify the display's backlight.
- ✓ Activate the harmonic display option.
- ✓ Program alarms.
- ✓ Program Modbus communications

The **MCA PLUS II** does not record programming changes until the programming is complete. If the unit is RESET before finishing the programming or no key is pressed for 30 seconds, the configuration will not be stored in the memory.

To enter the programming menu press the key for 3 seconds.

The home screen of the menu indicates whether the menu is locked or not:


unLo
When you enter the programming menu you can view and modify the programming. Icon on the display indicates that the unit is not locked.

Loc
When you enter the programming you can view the programming but not modify it. Icon indicates the locking status.

Press key to access the first programming step.

The following screen will be displayed if the programming menu is locked:


Enter the password in this screen to modify the programming parameters.
Press key for 3 seconds to edit the password. The **prog** icon will be displayed on the bottom of the screen.
To enter or modify the value, press the key repeatedly, increasing the value of the flashing digit.

When the desired value is shown on the screen, move onto the next digit by pressing the key to modify the other values.

If you press the key after changing the last digit, it will jump back to the first digit so you can modify the previously programmed values again.

To validate the data, press for 3 seconds and the **prog** icon will disappear from the display.

If the password is correct, the icon will change its status to not locked .
If you do not enter the password or it is incorrect, you can open the programming menu but it cannot be modified.
The programming menu is unlocked for a short period of time and it will be locked again when you exit the unit's menu.
To permanently unlock the unit, select the programming parameter ***"4.9.33. Locking the programming"***

Press key to access the next programming step.

**Default password:** 1234.

### 4.9.1. Primary voltage


On this screen the voltage transformer primary is programmed.
Press key for 3 seconds to edit the transformer primary value. The **prog** icon will be displayed on the bottom of the screen.
To enter or modify the value, press the key repeatedly, increasing the value of the flashing digit.

When the desired value is shown on the screen, move onto the next digit by pressing the key to modify the other values.
If you press the key after changing the last digit, it will jump back to the first digit so you can modify the previously programmed values again.

To validate the data, press for 3 seconds and the **prog** icon will disappear from the display.

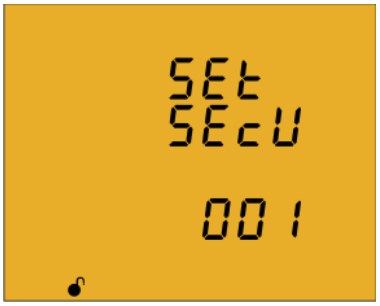
The programmed value will be deleted if the entered value is higher than the maximum programming value.

**Maximum programming value:** 599999.
**Minimum programming value:** 1.
**Voltage ratio x Current ratio** < 600000

**NB:** The ratio is the relation between the primary and the secondary.

Press key to access the next programming step.

### 4.9.2. Secondary voltage




On this screen the voltage transformer secondary is programmed.
Press key ☰ for 3 seconds to edit the transformer secondary value. The **prog** icon will be displayed on the bottom of the screen.
To enter or modify the value, press the ☰ key repeatedly, increasing the value of the flashing digit.

When the desired value is shown on the screen, move onto the next digit by pressing the key › to modify the other values.

If you press the › key after changing the last digit, it will jump back to the first digit so you can modify the previously programmed values again.

To validate the data, press ☰ for 3 seconds and the **prog** icon will disappear from the display.

The programmed value will be deleted if the entered value is higher than the maximum programming value.

**Maximum programming value:** 999.
**Minimum programming value:** 1.

Press key › to access the next programming step.

### 4.9.3. Primary current


The current transformer primary is programmed on this screen.
Press key ☰ for 3 seconds to edit the transformer primary value. The **prog** icon will be displayed on the bottom of the screen.
To enter or modify the value, press the ☰ key repeatedly, increasing the value of the flashing digit.

When the desired value is shown on the screen, move onto the next digit by pressing the key › to modify the remaining values.

If you press the › key after changing the last digit, it will jump back to the first digit so you can modify the previously programmed values again.

To validate the data, press ☰ for 3 seconds and the **prog** icon will disappear from the display.

The programmed value will be deleted if the entered value is higher than the maximum programming value.

**Maximum programming value:** 10000.
**Minimum programming value:** 1.
**Voltage ratio x Current ratio** < 600000

**NB:** The ratio is the relation between the primary and the secondary.

Press key > to access the next programming step

### 4.9.4. Secondary current

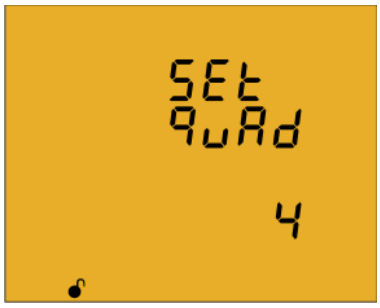

On this screen the current transformer secondary is selected.
Press key ≡ for 3 seconds to edit the transformer secondary value. The **prog** icon will be displayed on the bottom of the screen.

Press key ≡ to browse the two possible options for the current transformer secondary (1A or 5A).

To validate the data, press ≡ for 3 seconds and the **prog** icon will disappear from the display.

Press key > to access the next programming step

### 4.9.5. Number of quadrants




The quadrant number on which the unit takes the measurement is selected on this screen.

Press key ≡ for 3 seconds to edit the number of quadrants. The **prog** icon will be displayed on the bottom of the screen.

Press key ≡ to browse the two options:
2 or 4 quadrants.

To validate the data, press ≡ for 3 seconds and the **prog** icon will disappear from the display.

Press key > to access the next programming step

### 4.9.6. Type of installation


The type of installation is selected on this screen.

Press key ≡ for 3 seconds to edit the type of installation. The **prog** icon will be displayed on the bottom of the screen.

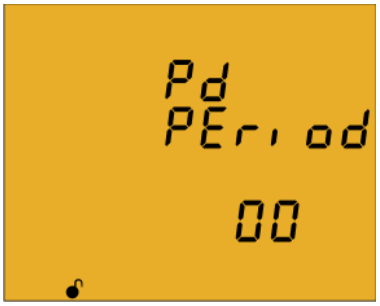
The key is used to browse the different options

4-3Ph Three-phase network measurement with a 4-wire connection.
3-3Ph Three-phase network measurement with a 3-wire connection.
3-Ar0N Three-phase network measurement with a 3-wire connection and transformers with an ARON connection .
3-2Ph Two-phase network measurement with a 3-wire connection.
2-2Ph Single-phase network measurement, phase to phase, with a 2-wire connection.
2-1Ph Single-phase network measurement, phase to neutral, with a 2-wire connection.

To validate the data, press for 3 seconds and the **prog** icon will disappear from the display.

Press key to access the next programming step.

### 4.9.7. Maximum demand integration period




The maximum demand integration period is programmed in minutes on this screen.
Press key for 3 seconds to edit the integration period value. The **prog** icon will be displayed on the bottom of the screen.
To enter or modify the value, press the key repeatedly, increasing the value of the flashing digit.

When the desired value is shown on the screen, move onto the next digit by pressing the key to modify the other values.

If you press the key after changing the last digit, it will jump back to the first digit so you can modify the previously programmed values again.

To validate the data, press for 3 seconds and the **prog** icon will disappear from the display.

The programmed value will be deleted if the entered value is higher than the maximum programming value.

**Maximum programming value:** 60.
**Minimum programming value:** 1.

Press key to access the next programming step.

### 4.9.8. Deleting maximum demand


On this screen you select whether or not to delete the maximum demand.
Press key ☰ for 3 seconds to edit the deletion selection. The **prog** icon will be displayed on the bottom of the screen.

Press key ☰ to browse the two deletion options: Yes or No.

To validate the data, press ☰ for 3 seconds and the **prog** icon will disappear from the display.

Press key › to access the next programming step

### 4.9.9. Selecting the operation profile


The unit's operation profile is selected on this screen.
Press key ☰ for 3 seconds to edit the operation profile selection. The **prog** icon will be displayed on the bottom of the screen.

Press key ☰ to browse the three profile options:

AnALY Analyzer profile, **analyzer**,
E3 Electrical energy efficiency profile, **e³**,
USEr User profile, **user**,

To validate the data, press ☰ for 3 seconds and the **prog** icon will disappear from the display.

Press key › to access the next programming step

✓ **Selecting the screens that will be displayed (*User profile*)**

The following screen is displayed if you have selected the **user** profile:


This screen is used to select whether the unit's display screens are defined by the user or not.

Press key ☰ for 3 seconds to edit the selection. The **prog** icon will be displayed on the bottom of the screen.

Press key ☰ to browse the two profile options:

YES the display screens are those that were stored in previous programming settings of the unit. (In the case of new units, these will be the same as those of the **analyzer** profile)
nO, the display screens are selected.

To validate the data, press ☰ for 3 seconds and the **prog** icon will disappear from the display.

Press key › to access the next programming step

✓ **Selecting the screens**

The following screen will be displayed if you have selected nO :


This screen displays the first screen of the **analyzer** profile, *Phase-phase Voltage* and the **user** profile viewing option can be selected.

Press key ☰ for 3 seconds to edit the selection. The **prog** icon will be displayed on the bottom of the screen.

Press key ☰ to browse the two options:

YES , to display the screen in the user menu.
nO, to stop displaying the screen.

To validate the data, press ☰ for 3 seconds and the **prog** icon will disappear from the display.

Press key › to access the next programming step

***This programming step is repeated for each one of the 18 screens of the unit.***

### 4.9.10. Backlight, Turning on the backlit display


The time that the Backlight will stay lit (in seconds) is programmed on this screen after the last keystroke on the unit .

Press key ☰ for 3 seconds to edit the backlight value. The **prog** icon will be displayed on the bottom of the screen.

To enter or modify the value, press the ☰ key repeatedly, increasing the value of the flashing digit. When the desired value is shown on the screen, move onto the next digit by pressing the key › to modify the other values.

If you press the key after changing the last digit, it will jump back to the first digit so you can modify the previously programmed values again.

To validate the data, press for 3 seconds and the **prog** icon will disappear from the display.

The value 00 indicates that the backlight will stay permanently lit.
The backlight time may range from 5 to 99 seconds.

Press key to access the next programming step.

### 4.9.11. Selecting the Cos φ - PF bar on the display


This screen is used to select the Cos φ - PF bar viewing option.
Press key for 3 seconds to edit the selection. The **prog** icon will be displayed on the bottom of the screen.

Press key to browse the two viewing options.

CoS Displaying the Cos φ.
PF Displaying the Power Factor

To validate the data, press for 3 seconds and the **prog** icon will disappear from the display.

Press key to access the next programming step.

### 4.9.12. Deleting maximum and minimum values


On this screen you select whether or not to delete the maximum and minimum values
Press key for 3 seconds to edit the selection. The **prog** icon will be displayed on the bottom of the screen.

Press key to browse the two options (Yes and No).

To validate the data, press for 3 seconds and the **prog** icon will disappear from the display.

Press key to access the next programming step.

### 4.9.13. Deleting energy values


On this screen you select whether or not to delete the energy values
Press key ☰ for 3 seconds to edit the selection. The **prog** icon will be displayed on the bottom of the screen.

Press key ☰ to browse the two options (Yes and No).

To validate the data, press ☰ for 3 seconds and the **prog** icon will disappear from the display.

Press key › to access the next programming step.

### 4.9.14. Selecting the Range of energies


The operation of the range of energy is selected on this screen.
Press key ☰ for 3 seconds to edit the selection. The **prog** icon will be displayed on the bottom of the screen.

Press the ☰ key to browse different options:

AUtO The unit displays the kWh and MWh. When the energy value reaches 999999kWh, the unit automatically selects the MWh range.
SHOrt The unit only displays the KWh. When the energy value reaches 999999kWh, the unit resets the measurement to 0kWh.

***To validate the modification of the range of energies, delete the energy values first.***

To do so, press the ☰ validation key for 3 seconds; the energy value deletion screen will be displayed. Select YES to delete the energy values; the unit will go back to the energy range selection screen.
To complete the validation, press the ☰ key for 3 seconds; the prog icon will disappear from the display.

Press key › to access the next programming step.

### 4.9.15. Activating the harmonics display screen.


This screen is used to select whether harmonics are displayed or not.
Press key ☰ for 3 seconds to edit the selection. The **prog** icon will be displayed on the bottom of the screen.
Press key ☰ to browse the two options (Yes and No).

To validate the data, press ☰ for 3 seconds and the **prog** icon will disappear from the display.

Press key › to access the next programming step.

### 4.9.16. kgC0$_2$ carbon emission ratio of generated energy


The carbon emissions ratio is the amount of emissions released into the atmosphere to produce a unit of electricity (1 kWh). The ratio for the European mix is approximately 0.65 kgCO$_2$ per kWh.

Press key ☰ for 3 seconds to edit the emission ratio selection. The **prog** icon will be displayed on the bottom of the screen.

The emission ratio of the 3 tariffs of the unit, T1, T2 and T3, is programmed on this screen.

To enter or modify the value, press the ☰ key repeatedly, increasing the value of the flashing digit.

When the desired value is shown on the screen, move onto the next digit by pressing the key › to modify the other values.

If you press the › key after changing the last digit, it will jump back to the first digit so you can modify the previously programmed values again.
Press key ‹ to browse the different tariffs.

To validate the data, press ☰ for 3 seconds and the **prog** icon will disappear from the display.

The programmed value will be deleted if the entered value is higher than the maximum programming value.

**Maximum programming value:** 1.9999.
**Minimum programming value:** 0.

Press key › to access the next programming step.

### 4.9.17. kgC0$_2$ carbon emission ratio of consumed energy


The carbon emissions ratio is the amount of emissions released into the atmosphere to produce a unit of electricity (1 kWh). The ratio for the European mix is approximately 0.65 kgCO$_2$ per kWh.

Press key ☰ for 3 seconds to edit the emission ratio selection. The **prog** icon will be displayed on the bottom of the screen.

The emission ratio of the 3 tariffs of the unit, T1, T2 and T3, is programmed on this screen.

To enter or modify the value, press the key repeatedly, increasing the value of the flashing digit.

When the desired value is shown on the screen, move onto the next digit by pressing the key to modify the other values.

If you press the key after changing the last digit, it will jump back to the first digit so you can modify the previously programmed values again.

Press key to browse the different tariffs.

To validate the data, press for 3 seconds and the **prog** icon will disappear from the display.

The programmed value will be deleted if the entered value is higher than the maximum programming value.

**Maximum programming value:** 1.9999.
**Minimum programming value:** 0.

Press key to access the next programming step.

### 4.9.18. Cost Ratio of generated energy


The cost per kWh of electricity of the three tariffs of the unit is calculated on this screen.

Press key for 3 seconds to edit the cost ratio selection. The **prog** icon will be displayed on the bottom of the screen.
To enter or modify the value, press the key repeatedly, increasing the value of the flashing digit.

When the desired value is shown on the screen, move onto the next digit by pressing the key to modify the other values.

If you press the key after changing the last digit, it will jump back to the first digit so you can modify the previously programmed values again.

Press key to browse the different tariffs.

To validate the data, press for 3 seconds and the **prog** icon will disappear from the display.

The programmed value will be deleted if the entered value is higher than the maximum programming value.

**Maximum programming value:** 1.9999.
**Minimum programming value:** 0.
Press key to access the next programming step.

### 4.9.19. Cost Ratio of consumed energy


The cost per kWh of electricity of the three tariffs of the unit is calculated on this screen.

Press key ☰ for 3 seconds to edit the cost ratio selection. The **prog** icon will be displayed on the bottom of the screen.
To enter or modify the value, press the ☰ key repeatedly, increasing the value of the flashing digit.

When the desired value is shown on the screen, move onto the next digit by pressing the key › to modify the other values.
If you press the › key after changing the last digit, it will jump back to the first digit so you can modify the previously programmed values again.

Press key ‹ to browse the different tariffs.

To validate the data, press ☰ for 3 seconds and the **prog** icon will disappear from the display.

The programmed value will be deleted if the entered value is higher than the maximum programming value.

**Maximum programming value:** 1.9999.
**Minimum programming value:** 0.

Press key › to access the next programming step.

### 4.9.20. Programming alarm 1 (Relay 1)


The variable code is selected on this screen, depending on **Table 12,** which will control alarm relay 1.
Press key ☰ for 3 seconds to edit the code selection. The **prog** icon will be displayed on the bottom of the screen.

To enter or modify the value, press the ☰ key repeatedly, increasing the value of the flashing digit.

When the desired value is shown on the screen, move onto the next digit by pressing the key › to modify the other values.

When you enter the code of a variable on the display, the symbols for that variable will be activated.
Set the value to 00 if you do not wish to program a variable.

If you press the key after changing the last digit, it will jump back to the first digit so you can modify the previously programmed values again.

To validate the data, press for 3 seconds and the **prog** icon will disappear from the display. Press key to access the next programming step.

**Table 11: Parameter codes used to program the outputs.**

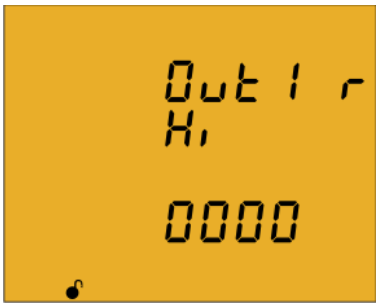
| Parameter | Phase | Code | Phase | Code | Phase | Code | Phase | Code |
|---|---|---|---|---|---|---|---|---|
| Phase-Neutral Voltage | L1 | 01 | L2 | 09 | L3 | 17 | - | - |
| Current | L1 | 02 | L2 | 10 | L3 | 18 | - | - |
| Active power | L1 | 03 | L2 | 11 | L3 | 19 | III | 25 |
| Inductive Reactive Power | L1 | 04 | L2 | 12 | L3 | 20 | III | 26 |
| Capacitive Reactive Power | L1 | 05 | L2 | 13 | L3 | 21 | III | 27 |
| Apparent power | L1 | 06 | L2 | 14 | L3 | 22 | III | 28 |
| Power factor | L1 | 07 | L2 | 15 | L3 | 23 | III | 29 |
| Cosine φ | L1 | 08 | L2 | 16 | L3 | 24 | III | 30 |
| % THD V | L1 | 36 | L2 | 37 | L3 | 38 | - | - |
| % THD A | L1 | 39 | L2 | 40 | L3 | 41 | - | - |
| Phase-Phase Voltage | L1/2 | 32 | L2/3 | 33 | L3/1 | 34 | - | - |
| Frequency | - | 31 | - | - | - | - | - | - |
| Neutral current | - | 35 | - | - | - | - | - | - |
| Maximum current demand | L1 | 45 | L2 | 46 | L3 | 47 | III | 44 |
| Active Power Maximum Demand | - | - | - | - | - | - | III | 42 |
| Apparent Power Maximum Demand | - | - | - | - | - | - | III | 43 |

In addition, there are some parameters (**Table 13**) that refer to the three phases at the same time (OR function). If you have selected one of these variables, the alarm will be activated when any of the three phases meets the programmed conditions.

**Table 12:Multiple parameter codes for alarm programming.**

| Types of parameters | Code |
|---|---|
| Phase-Neutral Voltage | 200 |
| Current | 201 |
| Active power | 202 |
| Inductive Reactive Power | 203 |
| Capacitive Reactive Power | 204 |
| Power factor | 205 |
| Phase-Phase Voltage | 206 |
| % THD V | 207 |
| % THD A | 208 |
| Apparent Power | 209 |

### ✓ Programming the maximum value




The **maximum value**: the alarm is activated when this value is exceeded.
Press key ☰ for 3 seconds to edit the maximum value selection.
The **prog** icon will be displayed on the bottom of the screen.
To enter or modify the value, press the ☰ key repeatedly, increasing the value of the flashing digit.

When the desired value is shown on the screen, move onto the next digit by pressing the key › to modify the other values.

In the case of some parameters (**Table 14**), you can modify the position of the decimal point. To do so, press key › after modifying the last digit and the decimal point will start flashing. Press key ☰ repeatedly to modify the position of the decimal point.

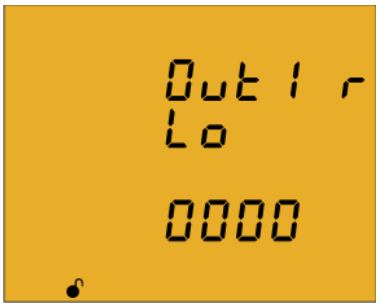
To validate the data, press ☰ for 3 seconds and the **prog** icon will disappear from the display.

Press key › to access the next programming step

**Table 13:Decimal point and units of the alarm parameters.**

| Types of parameters | Units | Decimal point |
|---|---|---|
| Voltage | 2000 V<br>200.0 V<br>20.00 kV<br>2.000 kV | Programmable |
| Current | A | Programmable |
| Frequency | Hz | Fixed |
| Power | kW | Programmable |
| Power factor | PF | Fixed |
| Cosine φ | φ | Fixed |
| Maximum current demand | A | Programmable |
| Maximum power demand | kW | Programmable |
| THD | % | Fixed |

### ✓ Programming the minimum value




The **minimum value**: the alarm is activated below this value.
Press key ☰ for 3 seconds to edit the minimum value selection.
The **prog** icon will be displayed on the bottom of the screen.
To enter or modify the value, press the ☰ key repeatedly, increasing the value of the flashing digit.
When the desired value is shown on the screen, move onto the next digit by pressing the key › to modify the other values.

In the case of some parameters (**Table 14**) you can modify the position of the decimal point. To do so, press key after modifying the last digit and the decimal point will start flashing. Press key repeatedly to modify the position of the decimal point.

To validate the data, press for 3 seconds and the **prog** icon will disappear from the display.

Press key to access the next programming step.

✓ **Programming the connection time delay**


The alarm connection delay is programmed on this screen in seconds.
Press key for 3 seconds to edit the delay selection. The **prog** icon will be displayed on the bottom of the screen.
To enter or modify the value, press the key repeatedly, increasing the value of the flashing digit.

When the desired value is shown on the screen, move onto the next digit by pressing the key to modify the other values.

If you press the key after changing the last digit, it will jump back to the first digit so you can modify the previously programmed values again.

To validate the data, press for 3 seconds and the **prog** icon will disappear from the display.

Press key to access the next programming step.

✓ **Programming the hysteresis value**

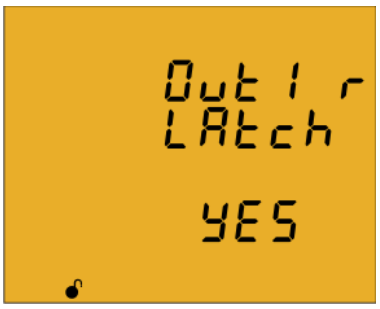

The hysteresis value, i.e., difference between the alarm connection and disconnection value, in %, is programmed on this screen.
Press key for 3 seconds to edit the hysteresis value selection. The **prog** icon will be displayed on the bottom of the screen.
To enter or modify the value, press the key repeatedly, increasing the value of the flashing digit.

When the desired value is shown on the screen, move onto the next digit by pressing the key to modify the other values.

If you press the key after changing the last digit, it will jump back to the first digit so you can modify the previously programmed values again.

To validate the data, press for 3 seconds and the **prog** icon will disappear from the display.
Press key to access the next programming step.

✓ **Programming the latch**




The interlocking is selected on this screen, i.e., if the alarm is interlocked after it has been tripped, even when the condition that triggered it has disappeared.
Press key for 3 seconds to edit the selection. The **prog** icon will be displayed on the bottom of the screen.
Press key to browse the two options (Yes and No).

To validate the data, press for 3 seconds and the **prog** icon will disappear from the display.

Press key to access the next programming step.

***Note:*** *If the unit is reset, the status of alarms is deleted and all alarms will return to the programmed standby status, provided that the condition that triggered them has been resolved.*

✓ **Programming the time delay 2**


The alarm disconnection delay is programmed on this screen in seconds.
Press key for 3 seconds to edit the maximum value selection. The **prog** icon will be displayed on the bottom of the screen.
To enter or modify the value, press the key repeatedly, increasing the value of the flashing digit.

When the desired value is shown on the screen, move onto the next digit by pressing the key to modify the other values.

If you press the key after changing the last digit, it will jump back to the first digit so you can modify the previously programmed values again.

To validate the data, press for 3 seconds and the **prog** icon will disappear from the display.

Press key to access the next programming step.

✓ **Programming the contact status**


The status of relay contacts is selected on this screen.
Press key ☰ for 3 seconds to edit the selection. The **prog** icon will be displayed on the bottom of the screen.
Press key ☰ to browse the two options:

NO Normally open contact.
NC Normally closed contact.

To validate the data, press ☰ for 3 seconds and the **prog** icon will disappear from the display.

Press key › to access the next programming step

### 4.9.21. Programming alarm 2 (Relay 2)


The values for alarm relay 2 are programmed on this screen.

They are programmed as in the case of alarm relay 1, see ***"4.9.20. Programming alarm 1 (Relay 1)"***

### 4.9.22. Programming alarm 3 (Digital output T1)


All values for digital output T1 are programmed on this screen.

The variable code is selected on this screen, depending on **Table 15,** which will control digital output T1.
Press key ☰ for 3 seconds to edit the code selection. The **prog** icon will be displayed on the bottom of the screen.

Press key ☰ for 3 seconds to edit the code selection. The **prog** icon will be displayed on the bottom of the screen.

To enter or modify the value, press the ☰ key repeatedly, increasing the value of the flashing digit.

When the desired value is shown on the screen, move onto the next digit by pressing the key › to modify the other values.

When you enter the code of a variable on the display, the symbols for that variable will be activated.
Set the value to **00** if you do not wish to program a variable.

If you press the key after changing the last digit, it will jump back to the first digit so you can modify the previously programmed values again.

To validate the data, press for 3 seconds and the **prog** icon will disappear from the display. Press key to access the next programming step

**Table 14: Parameter codes used to program digital outputs.**

| Parameter | Tariff | Code | Tariff | Code | Tariff | Code | Tariff | Code |
|---|---|---|---|---|---|---|---|---|
| Consumed Active Energy | T1 | 49 | T2 | 70 | T3 | 91 | total | 112 |
| Generated Active Energy | T1 | 59 | T2 | 80 | T3 | 101 | total | 122 |
| Consumed Inductive Reactive Energy | T1 | 51 | T2 | 72 | T3 | 93 | total | 114 |
| Generated Inductive Reactive Energy | T1 | 61 | T2 | 82 | T3 | 103 | total | 124 |
| Consumed Capacitive Reactive Energy | T1 | 53 | T2 | 74 | T3 | 95 | total | 116 |
| Generated Capacitive Reactive Energy | T1 | 63 | T2 | 84 | T3 | 105 | total | 126 |
| Consumed Apparent Energy | T1 | 55 | T2 | 76 | T3 | 97 | total | 118 |
| Generated Apparent Energy | T1 | 65 | T2 | 86 | T3 | 107 | total | 128 |
| Consumed $CO_2$ Emissions | T1 | 56 | T2 | 77 | T3 | 98 | total | 119 |
| Generated $CO_2$ Emissions | T1 | 66 | T2 | 87 | T3 | 108 | total | 129 |
| Consumption Cost | T1 | 57 | T2 | 78 | T3 | 99 | total | 120 |
| Generation Cost | T1 | 67 | T2 | 88 | T3 | 109 | total | 130 |
| No. of hours | T1 | 68 | T2 | | T3 | 110 | total | 131 |

✓ **Programming kilowatts per pulse**


Press key for 3 seconds to edit the kilowatts per pulse selection. The **prog** icon will be displayed on the bottom of the screen.

To enter or modify the value, press the key repeatedly, increasing the value of the flashing digit.

When the desired value is shown on the screen, move onto the next digit by pressing the key to modify the other values.

If you press the key after changing the last digit, it will jump back to the first digit so you can modify the previously programmed values again.

To validate the data, press for 3 seconds and the **prog** icon will disappear from the display.

Press key to access the next programming step.

The programmed value will be deleted if the entered value is higher than the maximum programming value.

**Maximum programming value:** 999.999 KWh
**Minimum programming value:** 000.001 KWh

***Example:*** *To program 500 Wh per pulse: 000.500*
*To program 1.5 kWh per pulse: 001.500*

✓ **Programming the pulse width**


The width of the pulse is selected on this screen in ms.
Press key ☰ for 3 seconds to edit the pulse width selection. The **prog** icon will be displayed on the bottom of the screen.

To enter or modify the value, press the ☰ key repeatedly, increasing the value of the flashing digit.

When the desired value is shown on the screen, move onto the next digit by pressing the key › to modify the other values.

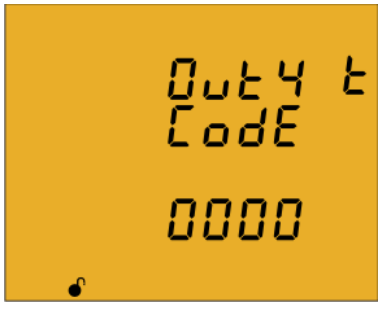
If you press the › key after changing the last digit, it will jump back to the first digit so you can modify the previously programmed values again.

To validate the data, press ☰ for 3 seconds and the **prog** icon will disappear from the display.

Press key › to access the next programming step.
The programmed value will be deleted if the entered value is higher than the maximum programming value.

**Maximum programming value:** 500 ms.
**Minimum programming value:** 30 ms.

### 4.9.23. Programming alarm 4 (Digital output T2)




All values for digital output T2 are programmed on this screen.

They are programmed as in the case of digital output T1, see ***"4.9.24. Programming alarm 3 (Digital output T1)"***

### 4.9.24. Operating mode of digital input 1


The function of digital input 1 is selected on this screen.

Press key ☰ for 3 seconds to edit the function selection. The **prog** icon will be displayed on the bottom of the screen.
Press key ☰ to browse the two options:

LoGi c Logic input
tAri FF Tariff selection.

To validate the data, press ☰ for 3 seconds and the **prog** icon will disappear from the display.

Press key › to access the next programming step.

### 4.9.25. Operating mode of digital input 2


The function of digital input 2 is selected on this screen.

Press key ☰ for 3 seconds to edit the function selection. The **prog** icon will be displayed on the bottom of the screen.
Press key ☰ to browse the two options:

LoGi c Logic input
tAri FF Tariff selection.

To validate the data, press ☰ for 3 seconds and the **prog** icon will disappear from the display.

Press key › to access the next programming step.

### 4.9.26. Modbus Communications: Peripheral number


The peripheral number is programmed on this screen.

Press key ☰ for 3 seconds to edit the peripheral number selection. The **prog** icon will be displayed on the bottom of the screen.
To enter or modify the value, press the ☰ key repeatedly, increasing the value of the flashing digit.

When the desired value is shown on the screen, move onto the next digit by pressing the key › to modify the other values.

If you press the key after changing the last digit, it will jump back to the first digit so you can modify the previously programmed values again.

The peripheral number ranges from 0 to 255.

To validate the data, press for 3 seconds and the **prog** icon will disappear from the display.

Press key to access the next programming step.

### 4.9.27. Modbus Communications: Transmission speed


The transmission speed of modbus communications is programmed on this screen.

Press key for 3 seconds to edit the transmission speed selection. The **prog** icon will be displayed on the bottom of the screen.
Press key to browse the two options: **9600** or **19200**.

To validate the data, press for 3 seconds and the **prog** icon will disappear from the display.

Press key to access the next programming step.

### 4.9.28. Modbus Communications: Parity

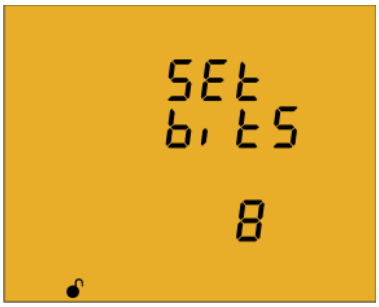

The type of parity of Modbus communications is selected on this screen.
Press key for 3 seconds to edit the parity type selection. The **prog** icon will be displayed on the bottom of the screen.
Press key to browse the two options:

no no parity
EUEn even parity.
odd odd parity.

To validate the data, press for 3 seconds and the **prog** icon will disappear from the display.

Press key to access the next programming step.

### 4.9.29. Modbus Communications: Number of data bits




The number of data bits of Modbus communications are programmed on this screen.

Press key for 3 seconds to edit the bit number selection. The **prog** icon will be displayed on the bottom of the screen.
Press key to browse the two options: **7** or **8** bits.

To validate the data, press for 3 seconds and the **prog** icon will disappear from the display.

Press key to access the next programming step.

### 4.9.30. Modbus Communications: Number of Stop bits


The number of Stop bits of Modbus communications are programmed on this screen.

Press key for 3 seconds to edit the Stop bits number selection. The **prog** icon will be displayed on the bottom of the screen.
Press key to browse the options: **1** or **2** bits.

To validate the data, press for 3 seconds and the **prog** icon will disappear from the display.

Press key to access the next programming step.

### 4.9.31. Locking the programming


This screen is for protecting the data configured in the programming menu.

Press key for 3 seconds to edit the locking/unlocking selection. The **prog** icon will be displayed on the bottom of the screen.
Press key to browse the two options:

unLo

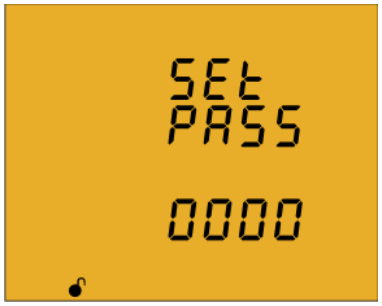
When you enter the programming menu you can view and modify the programming. Icon on the display indicates the permanently locked status.

Loc

When you enter the programming you can view the programming but not modify it. Icon indicates the locking status. Enter the password to modify the programming values.
To validate the data, press for 3 seconds and the **prog** icon will disappear from the display.

Press key > to access the next programming step.

### 4.9.32. Password




The password to modify the programming parameters is programmed on this screen.

Press key ≡ for 3 seconds to edit the password selection. The **prog** icon will be displayed on the bottom of the screen.
To enter or modify the value, press the ≡ key repeatedly, increasing the value of the flashing digit.

When the desired value is shown on the screen, move onto the next digit by pressing the key > to modify the other values.
If you press the > key after changing the last digit, it will jump back to the first digit so you can modify the previously programmed values again.

To validate the data, press ≡ for 3 seconds and the **prog** icon will disappear from the display.

Press key > to access the next programming step.

**Default password:** 1234.

## 4.10.- COMMUNICATIONS

**MCA PLUS II** units have an RS-485 serial communication output with the **MODBUS RTU** ® communications protocol.

### 4.10.1. CONNECTIONS

The RS -485 cable must be wired with twisted pair cable with mesh shield (minimum 3 wires), with a maximum distance between the **MCA PLUS II** and the master unit of 1200 metres.
A maximum of 32 **MCA PLUS II** units can be connected to this bus.

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

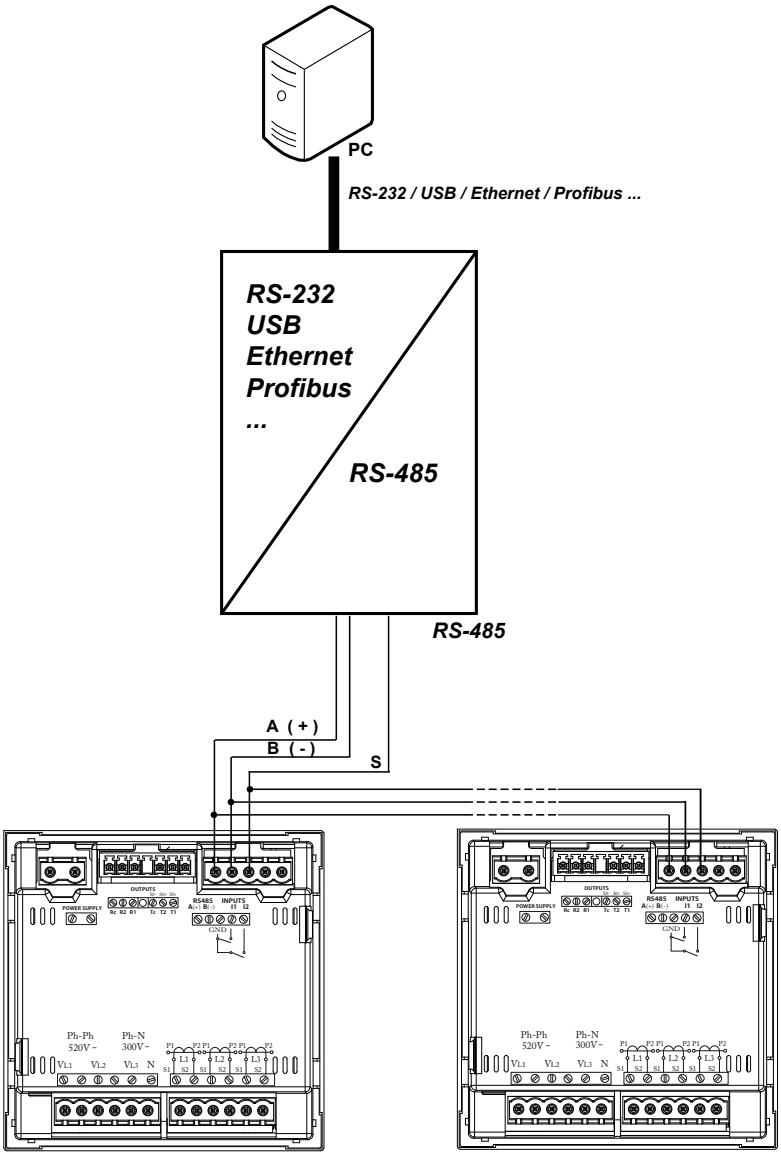



**Figure 20: RS-485 Connection diagram.**

### 4.10.2. PROTOCOL

In the Modbus protocol, the **MCA PLUS II** unit uses the RTU (Remote Terminal Unit) mode.

The Modbus functions implemented in the unit are as follows:

**0x03 and 0x04 function**. Reading integer logs.
**0x05 function**. Writing a relay.
**0x10 function**. Writing multiple logs.

#### 4.10.2.1 Ejemplo de lectura : Función 0x04.

**Question:** Instantaneous value of the phase voltage of L1

| Address | Function | Initial log | No. of logs | CRC |
|---|---|---|---|---|
| 0A | 04 | 0000 | 0002 | 70B0 |

**Address: 0A**, Peripheral number: 10 in decimals.
**Function: 04**, Read function.
**Initial Log: 0000**, log on which the reading will start.
**No. of logs: 0002**, number of logs read.
**CRC: 70B0**, CRC Character.

**Response:**

| Address | Func-tion | No. of Bytes | Log No. 1 | Log No. 2 | CRC |
|---|---|---|---|---|---|
| 0A | 04 | 04 | 0000 | 084D | 8621 |

**Address: 0A**, Responding peripheral number: 10 in decimals.
**Function: 04**, Read function.
**No. of bytes: 04**, No. of bytes received.
**Log: 0000084D**, value of the phase voltage of L1: VL1 x 10 : 212.5V
**CRC: 8621**, CRC Character.

***Note :*** *Every Modbus frame has a maximum limit of 20 variables (40 logs).*

#### 4.10.2.2. Writing example: 0x05 function.

**Question:** Deleting maximum and minimum values.

| Address | Function | Initial log | Value | CRC |
|---|---|---|---|---|
| 0A | 05 | 0834 | FF00 | CEEF |

**Address: 0A**, Peripheral number: 10 in decimal.
**Function: 05**, Read function.
**Initial Log: 0834**, log of the parameter for deleting maximum and minimum values.
**Value: FF00**, we indicate that we want to delete the maximum and minimum values.
**CRC: CEEF**, CRC character.

**Response:**

| Address | Function | Initial log | Value | CRC |
|---|---|---|---|---|
| 0A | 05 | 0834 | FF00 | CEEF |

### 4.10.3. COMANDOS MODBUS

#### 4.10.3.1. Measurement variables.

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

**Table 15: Modbus memory map (Table 1)**

| Parameter | Symbol | Instantaneous | Maximum | Minimum | Units |
|---|---|---|---|---|---|
| L1 Phase voltage | V 1 | 00-01 | 106-107 | 164-165 | V x 10 |
| L1 Current | A 1 | 02-03 | 108-109 | 166-167 | mA |
| L1 Active Power | kW 1 | 04-05 | 10A-10B | 168-169 | W |
| L1 Inductive Power | kvarL 1 | 06-07 | 10C-10D | 16A-16B | var |
| L1 Capacitive Power | kvarC 1 | 08-09 | 10E-10F | 16C-16D | var |
| L1 Apparent Power | kVA 1 | 0A-0B | 110-111 | 16E-16F | VA |
| L1 Power Factor | PF 1 | 0C-0D | 112-113 | 170-171 | x 100 |
| Cos φ L1 | Cos φ 1 | 0E-0F | 114-115 | 172-173 | x 100 |
| L2 Phase voltage | V 2 | 10-11 | 116-117 | 174-175 | V x 10 |
| L2 Current | A 2 | 12-13 | 118-119 | 176-177 | mA |
| L2 Active Power | kW 2 | 14-15 | 11A-11B | 178-179 | W |
| L2 Inductive Power | kvarL 2 | 16-17 | 11C-11D | 17A-17B | var |
| L2 Capacitive Power | kvarC 2 | 18-19 | 11E-11F | 17C-17D | var |
| L2 Apparent Power | kVA 2 | 1A-1B | 120-121 | 17E-17F | VA |
| L2 Power Factor | PF 2 | 1C-1D | 122-123 | 180-181 | x 100 |
| Cos φ L2 | Cos φ 2 | 1E-1F | 124-125 | 182-183 | x 100 |
| L3 Phase voltage | V 3 | 20-21 | 126-127 | 184-185 | V x 10 |
| L3 Current | A 3 | 22-23 | 128-129 | 186-187 | mA |
| L3 Active Power | kW 3 | 24-25 | 12A-12B | 188-189 | W |
| L3 Inductive Power | kvarL 3 | 26-27 | 12C-12D | 18A-18B | var |
| L3 Capacitive Power | kvarC 3 | 28-29 | 12E-12F | 18C-18D | var |
| L3 Apparent Power | kVA 3 | 2A-2B | 130-131 | 18E-18F | VA |
| L3 Power Factor | PF 3 | 2C-2D | 132-133 | 190-191 | x 100 |
| Cos φ L3 | Cos φ 3 | 2E-2F | 134-135 | 192-193 | x 100 |
| Active Three-phase Power | kW III | 30-31 | 136-137 | 194-195 | W |
| Inductive Three-phase power | kvarL III | 32-33 | 138-139 | 196-197 | var |
| Capacitive Three-phase Power | kvarC III | 34-35 | 13A-13B | 198-199 | var |
| Apparent three-phase power | kVA III | 36-37 | 13C-13D | 19A-19B | VA |
| Three-phase Power Factor | PF III | 38-39 | 13E-13F | 19C-19D | x100 |
| Three-phase Cos φ | Cos φ III | 3A-3B | 140-141 | 19E-19F | x100 |
| L1 Frequency | Hz | 3C-3D | 142-143 | 1A0-1A1 | Hz x100 |
| L1-L2 Voltage | V12 | 3E-3F | 144-145 | 1A2-1A3 | V x 10 |
| L2-L3 Voltage | V23 | 40-41 | 146-147 | 1A4-1A5 | V x 10 |
| L3-L1 Voltage | V31 | 42-43 | 148-149 | 1A6-1A7 | V x 10 |

| Parameter | Symbol | Instantaneous | Maximum | Minimum | Units |
|---|---|---|---|---|---|
| Neutral Current N | A N | 44-45 | 14A-14B | 1A8-1A9 | mA |
| L1 voltage % THD | %THDV1 | 46-47 | 14C-14D | 1AA-1AB | % x 10 |
| L2 voltage % THD | %THDV2 | 48-49 | 14E-14F | 1AC-1AD | % x 10 |
| L3 voltage % THD | %THDV3 | 4A-4B | 150-151 | 1AE-1AF | % x 10 |
| L1 current % THD | %THDI1 | 4C-4D | 152-153 | 1B0-1B1 | % x 10 |
| L2 current % THD | %THDI2 | 4E-4F | 154-155 | 1B2-1B3 | % x 10 |
| L3 current % THD | %THDI3 | 50-51 | 156-157 | 1B4-1B5 | % x 10 |
| Maximum demand kW III | Md (Pd) | 52-53 | 158-159 | - | W |
| Maximum demand kVA III | Md (Pd) | 54-55 | 15A-15B | - | VA |
| Maximum demand I AVG | Md (Pd) | 56-57 | 15C-15D | - | mA |
| Maximum demand I L1 | Md (Pd) | 58-59 | 15E-15F | - | mA |
| Maximum demand I L2 | Md (Pd) | 5A-5B | 160-161 | - | mA |
| Maximum demand I L3 | Md (Pd) | 5C-5D | 162-163 | - | mA |

### 4.10.3.2. Energy variables

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

**Table 16: Modbus memory map (Table 2)**

| Parameter | Symbol | Tariff 1 | Tariff 2 | Tariff 3 | Total | Units |
|---|---|---|---|---|---|---|
| Consumed active energy kW) | kWh III | 5E-5F | 88-89 | B2-B3 | DC-DD | kWh |
| Consumed active energy (W) | kWh III | 60-61 | 8A-8B | B4-B5 | DE-DF | Wh |
| Consumed inductive reactive energy (kvarhL) | kvarhL III | 62-63 | 8C-8D | B6-B7 | E0-E1 | kvarh |
| Consumed inductive reactive energy (varhL) | kvarhL III | 64-65 | 8E-8F | B8-B9 | E2-E3 | varh |
| Consumed capacitive reactive energy (kvarhC) | kvarhC III | 66-67 | 90-91 | BA-BB | E4-E5 | kvarh |
| Consumed capacitive reactive energy (varhC) | kvarhC III | 68-69 | 92-93 | BC-BD | E6-E7 | varh |
| Consumed apparent energy (kVAh) | kVAh III | 6A-6B | 94-95 | BE-BF | E8-E9 | kVAh |
| Consumed apparent energy (VAh) | kVAh III | 6C-6D | 96-97 | C0-C1 | EA-EB | VAh |
| Consumed $CO_2$ emissions | $KgCO_2$ | 6E-6F | 98-99 | C2-C3 | EC-ED | x10 |
| Consumption cost | $ | 70-71 | 9A-9B | C4-C5 | EE-EF | x10 |
| Generated active energy (kW) | kWh III | 72-73 | 9C-9D | C6-C7 | F0-F1 | kWh |
| Generated active energy (W) | kWh III | 74-75 | 9E-9F | C8-C9 | F2-F3 | Wh |
| Generated inductive reactive energy (kvarhL) | kvarhL III | 76-77 | A0-A1 | CA-CB | F4-F5 | kvarh |
| Generated inductive reactive energy (varhL) | kvarhL III | 78-79 | A2-A3 | CC-CD | F6-F7 | varh |
| Generated capacitive reactive energy (kvarhC) | kvarhC III | 7A-7B | A4-A5 | CE-CF | F8-F9 | kvarh |
| Generated capacitive reactive energy (varhC) | kvarhC III | 7C-7D | A6-A7 | D0-D1 | FA-FB | varh |
| Generated apparent energy (kVAh) | kVAh III | 7E-7F | A8-A9 | D2-D3 | FC-FD | kVAh |
| Generated apparent energy (VAh) | kVAh III | 80-81 | AA-AB | D4-D5 | 100-101 | VAh |

| Parameter | Symbol | Tariff 1 | Tariff 2 | Tariff 3 | Total | Units |
|---|---|---|---|---|---|---|
| Generated $CO_2$ emissions | $KgCO_2$ | 82-83 | AC-AD | D6-D7 | 102-103 | x10 |
| Generation Cost | $ | 84-85 | AE-AF | D8-D9 | 104-105 | x10 |
| Hours per tariff | Hours | 86-87 | B0-B1 | DA-DB | 106-107 | sec |

### 4.10.3.3. Voltage and current harmonics.

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

**Table 17:Modbus memory map (Table 3).**

| Parameter | L1 Voltage | L2 Voltage | L3 Voltage | Units |
|---|---|---|---|---|
| Fundamental Harm. | A28-A29 | A48-A49 | A68-A69 | V x 10 |
| 2nd Order harmonic | A2A | A4A | A6A | % x 10 |
| 3rd Order harmonic | A2B | A4B | A6B | % x 10 |
| 4th Order harmonic | A2C | A4C | A6C | % x 10 |
| 5th Order harmonic | A2D | A4D | A6D | % x 10 |
| 6th Order harmonic | A2E | A4E | A6E | % x 10 |
| 7th Order harmonic | A2F | A4F | A6F | % x 10 |
| 8th Order harmonic | A30 | A50 | A70 | % x 10 |
| 9th Order harmonic | A31 | A51 | A71 | % x 10 |
| 10th Order harmonic | A32 | A52 | A72 | % x 10 |
| 11th Order harmonic | A33 | A53 | A73 | % x 10 |
| 12th Order harmonic | A34 | A54 | A74 | % x 10 |
| 13th Order harmonic | A35 | A55 | A75 | % x 10 |
| 14th Order harmonic | A36 | A56 | A76 | % x 10 |
| 15th Order harmonic | A37 | A57 | A77 | % x 10 |
| 16th Order harmonic | A38 | A58 | A78 | % x 10 |
| 17th Order harmonic | A39 | A59 | A79 | % x 10 |
| 18th Order harmonic | A3A | A5A | A7A | % x 10 |
| 19th Order harmonic | A3B | A5B | A7B | % x 10 |
| 20th Order harmonic | A3C | A5C | A7C | % x 10 |
| 21st Order harmonic | A3D | A5D | A7D | % x 10 |
| 22nd Order harmonic | A3E | A5E | A7E | % x 10 |
| 23rd Order harmonic | A3F | A5F | A7F | % x 10 |
| 24th Order harmonic | A40 | A60 | A80 | % x 10 |
| 25th Order harmonic | A41 | A61 | A81 | % x 10 |
| 26th Order harmonic | A42 | A62 | A82 | % x 10 |
| 27th Order harmonic | A43 | A63 | A83 | % x 10 |
| 28th Order harmonic | A44 | A64 | A84 | % x 10 |
| 29th Order harmonic | A45 | A65 | A85 | % x 10 |
| 30th Order harmonic | A46 | A66 | A86 | % x 10 |
| 31st Order harmonic | A47 | A67 | A87 | % x 10 |

Table 18:Modbus memory map (Table 4).

| Parameter | L1 Current | L2 Current | L3 Current | Units |
|---|---|---|---|---|
| Fundamental Harm. | A88-A89 | AA8-AA9 | AC8-AC9 | mA x 10 |
| 2nd Order harmonic | A8A | AAA | AAC | % x 10 |
| 3rd Order harmonic | A8B | AAB | ACB | % x 10 |
| 4th Order harmonic | A8C | AAC | ADC | % x 10 |
| 5th Order harmonic | A8D | AAD | ACD | % x 10 |
| 6th Order harmonic | A8E | AAE | ACE | % x 10 |
| 7th Order harmonic | A8F | AAF | ACF | % x 10 |
| 8th Order harmonic | A90 | AB0 | AD0 | % x 10 |
| 9th Order harmonic | A91 | AB1 | AD1 | % x 10 |
| 10th Order harmonic | A92 | AB2 | AD2 | % x 10 |
| 11th Order harmonic | A93 | AB3 | AD3 | % x 10 |
| 12th Order harmonic | A94 | AB4 | AD4 | % x 10 |
| 13th Order harmonic | A95 | AB5 | AD5 | % x 10 |
| 14th Order harmonic | A96 | AB6 | AD6 | % x 10 |
| 15th Order harmonic | A97 | AB7 | AD7 | % x 10 |
| 16th Order harmonic | A98 | AB8 | AD8 | % x 10 |
| 17th Order harmonic | A99 | AB9 | AD9 | % x 10 |
| 18th Order harmonic | A9A | ABA | ADA | % x 10 |
| 19th Order harmonic | A9B | ABB | ADB | % x 10 |
| 20th Order harmonic | A9C | ABC | ADC | % x 10 |
| 21st Order harmonic | A9D | ABD | ADD | % x 10 |
| 22nd Order harmonic | A9E | ABE | ADE | % x 10 |
| 23rd Order harmonic | A9F | ABF | ADF | % x 10 |
| 24th Order harmonic | AA0 | AC0 | AE0 | % x 10 |
| 25th Order harmonic | AA1 | AC1 | AE1 | % x 10 |
| 26th Order harmonic | AA2 | AC2 | AE2 | % x 10 |
| 27th Order harmonic | AA3 | AC3 | AE3 | % x 10 |
| 28th Order harmonic | AA4 | AC4 | AE4 | % x 10 |
| 29th Order harmonic | AA5 | AC5 | AE4 | % x 10 |
| 30th Order harmonic | AA6 | AC6 | AE6 | % x 10 |
| 31st Order harmonic | AA7 | AC7 | AE7 | % x 10 |

### 4.10.3.4. Deleting parameters.

All the Modbus map addresses are hexadecimal.
The **0x05 function** is implemented for these variables.

Table 19:Modbus memory map: Deleting parameters.

| Parameters | Address | Valid data margin |
|---|---|---|
| Deleting energies | 834 | **FF00** |
| Deleting maximum and minimum values | 838 | **FF00** |
| Starting maximum demand | 839 | **FF00** |
| Deleting the hour counters (All tariffs) | 83D | **FF00** |
| Deleting the maximum value of the maximum demand | 83F | **FF00** |
| Deleting energies, maximum demand and maximum and minimum values | 848 | **FF00** |

#### 4.10.3.5. Power status.

TAll the Modbus map addresses are hexadecimal.
The **0x04 function** is implemented for this variable.
This variable indicates the quadrant in which the unit is operating.

**Table 20:Modbus memory map: Power status**

| Power status | | |
|---|---|---|
| **Variable** | **Address** | **Default value** |
| Power status | 7D1 | - |

The variable format is shown in **Table 22:**

**Table 21:Variable format: Power status.**

| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|
| **0** | **0** | **0** | **0** | **1:** Capacitive | **1:** Inductive | **1:** Generated | **1:** Consumed |

#### 4.10.3.6. Unit configuration variables.

All the Modbus map addresses are hexadecimal.
The **0x04 and 0x10 functions** are implemented for this variable.

The unit's Modbus function does not check whether the variables recorded are within the correct margins, they are only checked when they are read from the EEPROM. So if any parameter is recorded with an incorrect value the unit will be configured with its default value. The Modbus configuration will not take effect until the unit is reset.

##### 4.10.3.6.1. Transformation ratios.

**Table 22:Modbus memory map: Transformation ratios.**

| Transformation ratios | | | |
|---|---|---|---|
| **Configuration variable** [1] [2] | **Address** | **Valid data margin** | **Default value** |
| Voltage primary | 2710 - 2711 | **1 - 599999** | 1 |
| Voltage secondary | 2712 | **1 - 999** | 1 |
| Current primary | 2713 | **1 - 10000** | 5 |
| Current secondary | 2714 | **1:** .../1A<br>**5:** ../5 A | 5 |

[1] All variables must be programmed at the same time.
[2] Voltage ratio x Current ratio < 600000.
**Note**: The ratio is between the primary and the secondary.

### 4.10.3.6.2. Number of quadrants

**Table 23:Modbus memory map: Number of quadrants**

| Maximum demand | | | |
|---|---|---|---|
| **Configuration variable** | **Address** | **Valid data margin** | **Default value** |
| Number of quadrants | 2B64 | **0:** 4 quadrants<br>**1:** 2 quadrants | 0 |

### 4.10.3.6.3. Type of installation

**Table 24:Modbus memory map: Type of installation**

| Type of installation | | | |
|---|---|---|---|
| **Configuration variable** | **Address** | **Valid data margin** | **Default value** |
| Type of installation | 2B5C | **0:** 4-3Ph Three-phase network with 4 wires.<br>**1:** 3-3Ph Three-phase network with 3 wires.<br>**2:** 3-Ar On Three-phase network with 3 wires, Aron.<br>**3:** 3-2Ph Two-phase network with 3 wires.<br>**4:** 2-2Ph Single-phase network with 2 wires, phase-to-phase.<br>**5:** 2-1Ph Single-phase network with 2 wires, phase-to-neutral. | 0 |

### 4.10.3.6.4. Maximum demand

**Table 25:Modbus memory map: Maximum demand**

| Maximum demand | | | |
|---|---|---|---|
| **Configuration variable** | **Address** | **Valid data margin** | **Default value** |
| Integration period | 274C | **1 - 60** minutes | 15 |

### 4.10.3.6.5. Operating profile

**Table 26:Modbus memory map: Operating profile**

| Operating profile | | | |
|---|---|---|---|
| **Configuration variable** | **Address** | **Valid data margin** | **Default value** |
| Operating profile | 2B60 | **0: Analyzer**<br>**1: User**<br>**2:** Electrical energy efficiency, **e³** | 0 |

#### 4.10.3.6.6. Display backlight

**Table 27:Modbus memory map: Backlight**

| Backlight | | | |
|---|---|---|---|
| **Configuration variable** | **Address** | **Valid data margin** | **Default value** |
| Backlight | 2B5E | **0:** Always lit<br>**5 - 99** seconds | 0 |

#### 4.10.3.6.7. Activating the harmonics display screen

**Table 28:Modbus memory map: Display of harmonics**

| Display of harmonics | | | |
|---|---|---|---|
| **Configuration variable** | **Address** | **Valid data margin** | **Default value** |
| Display of harmonics | 2B62 | **0:** No<br>**1:** Yes | 1 |

#### 4.10.3.6.8. $CO_2$ consumption and generation emissions.

**Table 29:Modbus memory map: $CO_2$ consumption and generation emissions.**

| $CO_2$ emissions | | | |
|---|---|---|---|
| **Configuration variable** (1)(2) | **Address** | **Valid data margin** | **Default value** |
| Tariff 1 consumption emissions ratio | 2724 | **0 - 1.9999** | 0 |
| Tariff 2 consumption emissions ratio | 2725 | **0 - 1.9999** | 0 |
| Tariff 3 consumption emissions ratio | 2726 | **0 - 1.9999** | 0 |
| Tariff 1 generation emissions ratio | 2728 | **0 - 1.9999** | 0 |
| Tariff 2 generation emissions ratio | 2729 | **0 - 1.9999** | 0 |
| Tariff 3 generation emissions ratio | 272A | **0 - 1.9999** | 0 |

(1) All variables must be programmed at the same time.
(1) They have 1 decimal place.

#### 4.10.3.6.9 Cost of energy consumption and generation.

**Table 30:Modbus memory map: Cost of energy consumption and generation.**

| Cost per kWh | | | |
|---|---|---|---|
| **Configuration variable** (1)(2) | **Address** | **Valid data margin** | **Default value** |
| Cost per kWh of tariff 1 consumption | 272C | **0 - 1.9999** | 0 |
| Cost per kWh of tariff 2 consumption | 272D | **0 - 1.9999** | 0 |
| Cost per kWh of tariff 3 consumption | 272E | **0 - 1.9999** | 0 |
| Cost per kWh of tariff 1 generation | 2730 | **0 - 1.9999** | 0 |
| Cost per kWh of tariff 2 generation | 2731 | **0 - 1.9999** | 0 |
| Cost per kWh of tariff 3 generation | 2732 | **0 - 1.9999** | 0 |

(1) All variables must be programmed at the same time.
(1) They have 1 decimal place.

### 4.10.3.6.10. Programming alarms 1 and 2 (Relays 1 and 2)

**Table 31:Modbus memory map: Programming alarms 1 and 2.**

| Programming alarms 1 and 2 | | | | |
|---|---|---|---|---|
| **Configuration variable** | **Address** | | **Valid data margin** | **Default value** |
| | **Relay 1** | **Relay 2** | | |
| Maximum value. | 2AF8-2AF9 | 2B02-2B03 | depending on the variable | 0 |
| Minimum value | 2AFA-2AFB | 2B04-2B05 | depending on the variable | 0 |
| Variable code | 2AFC | 2B06 | **Table 12** | 0 |
| Connection delay | 2AFD | 2B07 | **0 - 9999** seconds | 0 |
| Hysteresis: | 2AFE | 2B08 | **0 - 99** % | 0 |
| latch | 2AFF | 2B09 | **0** : No<br>**1:** Yes | 0 |
| Disconnection delay | 2B00 | 2B0A | **0 - 9999** seconds | 0 |
| Contacts status | 2B01 | 2B0B | **0** : Normally open<br>**1:** Normally closed | 0 |

### 4.10.3.6.11. Programming alarms 3 and 4 (Digital outputs T1 and T2)

**Table 32:Modbus memory map: Programming alarms 3 and 4.**

| Programming alarms 3 and 4 | | | | |
|---|---|---|---|---|
| **Configuration variable** | **Address** | | **Valid data margin** | **Default value** |
| | **Relay 1** | **Relay 2** | | |
| Kilowatts per impulse | 2B0C-2B0D | 2B16-2B17 | 0.001 - 999.999 kWh | 0 |
| Variable code | 2B10 | 2B1A | **Table 15** | 0 |
| Pulse width | 2B11 | 2B1B | **10 - 500** ms | 100 ms |

### 4.10.3.6.12. Digital inputs

**Table 33:Modbus memory map: Configuration of digital inputs.**

| Configuration variable | Address | | Valid data margin | Default value |
|---|---|---|---|---|
| | **Input 1** | **Input 2** | | |
| Operating mode [1] | 2B66 | 2B67 | **0**: Tariff<br>**1**: Logic state | 0 |

[1] If Input 1 is configured as a tariff and Input 2 is configured as a logic state (or vice versa) we will only have 2 tariffs.

We can also read the status of the digital inputs when they are in logic mode:

The **0x04 function** is implemented for this variable.

**Table 34:Modbus memory map: Status of the digital inputs (Logic state mode)**

| Status of digital inputs | | |
|---|---|---|
| **Variable** | **Address** | **Default value** |
| Status of digital inputs | 4E20 | - |

The variable format is shown in **Table 37:**

Table 35:Variable format: Status of digital inputs.

| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | **Input 2**<br>**0:** OFF<br>**1:** ON | **Input 1**<br>**0:** OFF<br>**1:** ON |

#### 4.10.3.6.13 Digital outputs

Reading the status of the digital outputs.
The **0x04 function** is implemented for this variable.

Table 36:Modbus memory map: Status of the digital outputs

| Status of the digital outputs | | |
|---|---|---|
| **Variable** | **Address** | **Default value** |
| Status of the digital outputs | 4E21 | - |

The variable format is shown in **Table 39:**

Table 37:Variable format: Status of the digital outputs.

| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | **Output 4**<br>**0:** OFF<br>**1:** ON | **Output 3**<br>**0:** OFF<br>**1:** ON | **Output 2**<br>**0:** OFF<br>**1:** ON | **Output 1**<br>**0:** OFF<br>**1:** ON |

#### 4.10.3.6.14 Communications

Table 38:Modbus memory map: Communications

| Communications | | | |
|---|---|---|---|
| **Configuration variable** | **Address** | **Valid data margin** | **Default value** |
| Protocol | 2742 | **0 :** Modbus | 0 |
| Peripheral number | 2743 | **0 - 255** | 1 |
| Transmission speed | 2744 | **0:** 9600 - **1:**19200 | 0 |
| Parity | 2745 | **0:** No parity<br>**1:** Odd parity<br>**2:** Even parity | 0 |
| Data bits | 2746 | **0 :** 8 bits<br>**1:** 7 bits | 0 |
| Stop bits | 2747 | **0 :** 1 stop bit<br>**1:** 2 stop bits | 0 |

## 5.- TECHNICAL FEATURES

| AC Power supply | |
|---|---|
| **Rated voltage** | 85 ... 265 V ~ |
| **Frequency** | 50 ... 60 Hz |
| **Consumption** | 3.5 ... 6 VA |
| **Installation category** | CAT III 300 V |

| DC Power supply | |
|---|---|
| **Rated voltage** | 95 ... 300 V ⎓ |
| **Consumption** | 2 ... 6 W |
| **Installation category** | CAT III 300 V |

| Voltage measurement circuit | |
|---|---|
| **Rated voltage (Un)** | 300 V P-N, 520 V P-P |
| **Voltage measurement margin** | 5 ... 120% Un |
| **Frequency measurement margin** | 45 ... 65Hz |
| **Input impedance** | 440 kΩ |
| **Min. voltage measurement (Vstart)** | 10 V |
| **Installation category** | CAT III 300 V |

| Current measurement circuit | |
|---|---|
| **Model** | **MCA PLUS II** |
| **Nominal current (In)** | .../5A or .../1A |
| **Current measurement margin** | 0.2 ... 120% In |
| **Maximum current, impulse < 1s** | 100 A |
| **Min. current measurement (Istart)** | 10 mA |
| **Installation category** | CAT III 300 V |

| Measurement accuracy | |
|---|---|
| **Model** | **MCA PLUS II** |
| **Voltage measurement** | 0.5% ± 1 digit |
| **Current measurement** | 0.5% ± 1 digit |
| **Frequency measurement** | 0.5% |
| **Active power measurement** | 0.5% ± 2 digits |
| **Reactive power measurement** | 1% ± 2 digits |
| **Active energy measurement** | Class 1 |
| **Reactive energy measurement** | Class 2 |

| Pulse outputs MCA PLUS II | |
|---|---|
| **Quantity** | 2 |
| **Type** | NPN ouputs |
| **Maximum voltage** | 24 V ⎓ |
| **Maximum current** | 50 mA |
| **Maximum frequency** | 16 impulses / sec |
| **Pulse width** | 30 ms to 500 ms (Programmable) |

| Relay outputs | |
|---|---|
| **Quantity** | 2 |
| **Max. voltage open contacts** | 250 V ~ |
| **Maximum current** | 6 A |
| **Maximum switching power** | 1500 W (AC1) |
| **Electrical life (250 VAC / 5A)** | $60x10^3$ cycles |
| **Mechanical life** | $10x10^6$ cycles |

| Digital inputs | |
|---|---|
| **Quantity** | 2 |
| **Type** | NPN Potential free contact |
| **Insulation** | optoisolated |

| Communications | |
|---|---|
| **Bus** | RS-485 |
| **Protocol** | Modbus RTU |
| **Baud rate** | 9600 - 1920 |
| **Stop bits** | 1 - 2 |
| **Parity** | without - even - odd |

| User interface | |
|---|---|
| **Display** | LCD Custom COG |
| **Keyboard** | Capacitive, 3 keys |
| **LED** | 3 LED |

| Environmental features | |
|---|---|
| **Operating temperature** | -5ºC... +45ºC |
| **Storage temperature** | -10ºC ... +50ºC |
| **Relative humidity (non-condensing)** | 5 ... 95% |
| **Maximum altitude** | 2000 m |
| **Protection degree** | IP31<br>Front panel: IP51 (IP65 with accessory) |

| Mechanical features | |
|---|---|
| **Dimensions ( Figure 26)** | 96.7x96.7x62.5 mm |
| **Weight** | 330 gr |
| **Surround** | Self-extinguishing V0 plastic |
| **Attachment** | Panel |

| Standards | |
|---|---|
| **Safety of electronic measuring units** | UNE EN 61010: 2010 |
| **Electromagnetic compatibility (CEM). Part 6-3: Generic standards. Emission standard for residential, commercial and light industry environments.** | UNE EN 61000-6-3:2007 |
| **Electromagnetic compatibility (CEM). Part 6-1: Generic standards. Immunity in residential, commercial and light industry environments** | UNE EN 61000-6-1:2007 |
| **Coordination of the insulation of units installed in low voltage systems (networks).** | IEC 664:2007 |
| | VDE 0110 |
| | UL 94 |

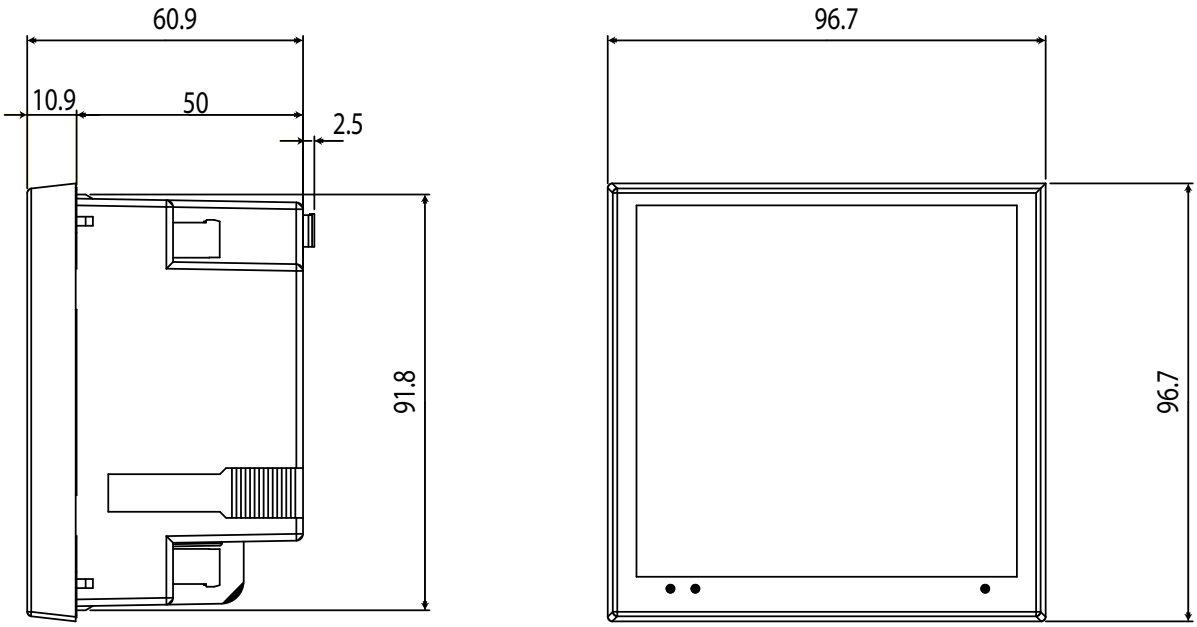



**Figure 21: Dimensions of the MCA PLUS II.**

## 6.- MAINTENANCE AND TECHNICAL SERVICE

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

**Technical Assistance Service**
C/Vallès, 32 - Pol. Ind. Can Bernades 08130 - Santa Perpètua de Mogoda (Barcelona)
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## 7.- GUARANTEE

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

**LIFASA** 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.
• **LIFASA** 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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