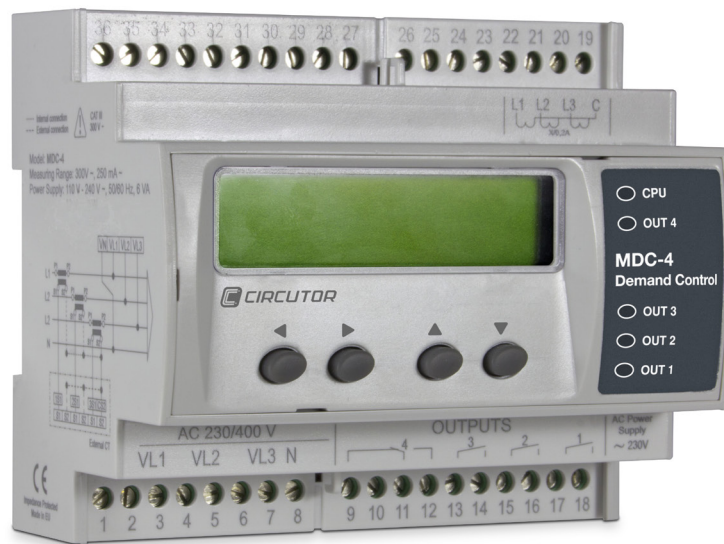




## Maximum demand control

### MDC-4



## INSTRUCTION MANUAL


(M013B01-03-14A)







## SAFETY PRECAUTIONS


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

	<p><b>DANGER</b> Warns of a risk, which could result in personal injury or material damage.</p>
---	---

	<p><b>ATTENTION</b> Indicates that special attention should be paid to a specific point.</p>
---	--

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

	<p>Incorrect handling or installation of the unit may result in injury to personnel as well as damage to the unit. In particular, handling with voltages applied may result in electric shock, which may cause death or serious injury to personnel. Defective installation or maintenance may also lead to the risk of fire. Read the manual carefully prior to connecting the unit. Follow all installation and maintenance instructions throughout the unit's working life. Pay special attention to the installation standards of the National Electrical Code.</p>
---	---

	<p><b>Refer to the instruction manual before using the unit</b> 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.</p>
---	--

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

## DISCLAIMER

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

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

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**REVISION LOG**

Table 1: Revision log.

Date	Revision	Description
09/14	M013B01-03-14A	Initial Version

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

## 1.- VERIFICATION UPON RECEPTION

Check the following points upon receiving 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.

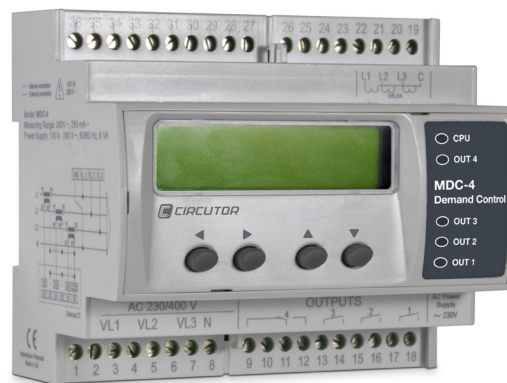


If any problem is noticed upon reception, immediately contact the transport company and/or **CIRCUTOR's** after-sales service.

## 2.- PRODUCT DESCRIPTION

The **MDC-4** unit controls maximum power demand, both in single and three-phase installations with and without neutral. The unit is equipped with a power analyzer that measures electrical parameters at the connection point. The measurement is taken in RMS, via four AC voltage inputs and four current inputs.

The current is measured indirectly with efficient transformers of the MC1 and MC3 series.



The unit features:

- **4 output relays**, to disconnect and connect the loads.
- **4 keys**, to browse through the different screens.
- **5 indicator LEDs**, to show the status of the loads and the CPU.
- **1 Display**, for viewing all the parameters.

## 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 **MDC-4** 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 observe 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. Please contact the after-sales service if you suspect that there is an operational fault in the unit.

### 3.2.- INSTALLATION

The unit is installed on a DIN rail.

The unit must be mounted inside an electric panel.

The unit must be connected to a power circuit that is protected with gL fuses (IEC 269) or M fuses, with a rating of 1 to 2 A. It must be fitted with a circuit breaker or equivalent device for disconnecting the unit from the power supply mains.

The power and voltage measuring circuit must be connected with cables that have a minimum cross-section of 1mm<sup>2</sup>.



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.

## 3.3.- UNIT TERMINALS

Table 2:List of MDC-4 terminals

Unit terminals	
1: VL1, Voltage input L1	13, 14: Relay output 2
3: VL2, Voltage input L2	15, 16: Relay output 1
5: VL3, Voltage input L3	17: Auxiliary Power Supply
6: N, Voltage input neutral	18: Auxiliary Power Supply
8: Relay output 4, NC	21: COM, Common current inputs
9: Relay output 4, C	22: S1, Current input L3
10: Relay output 4, NO	23: S1, Current input L2
11, 12: Relay output 3	24: S1, Current input L1

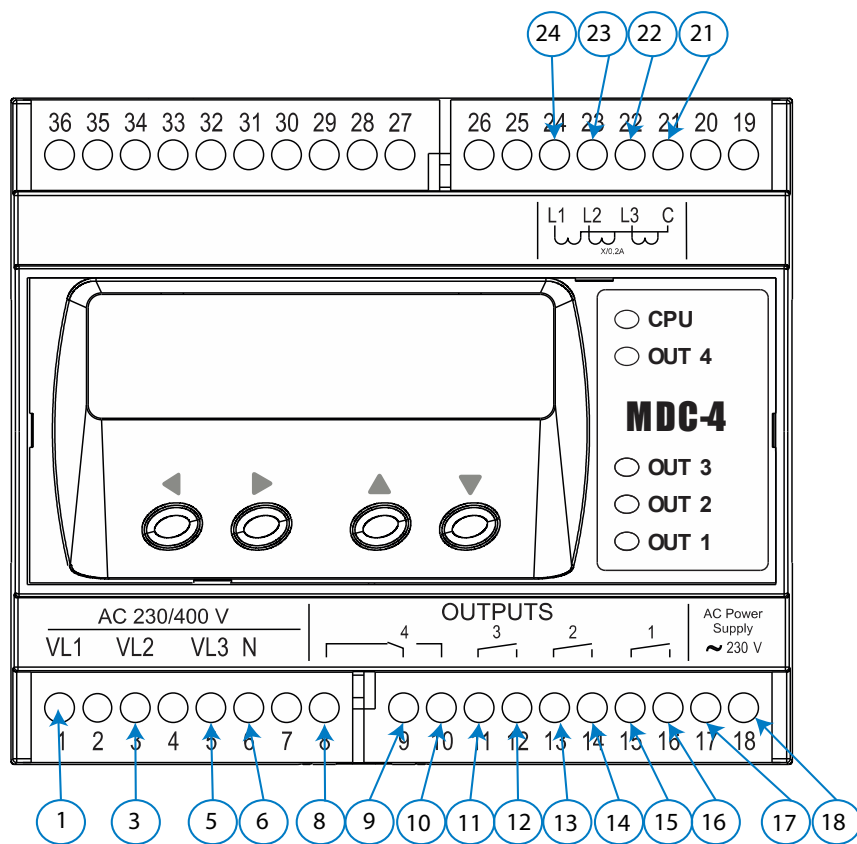


Figure 1:MDC-4 terminals.

3.4.- CONNECTION DIAGRAM

3.4.1.- Three-phase network measurement with a 4-wire connection.

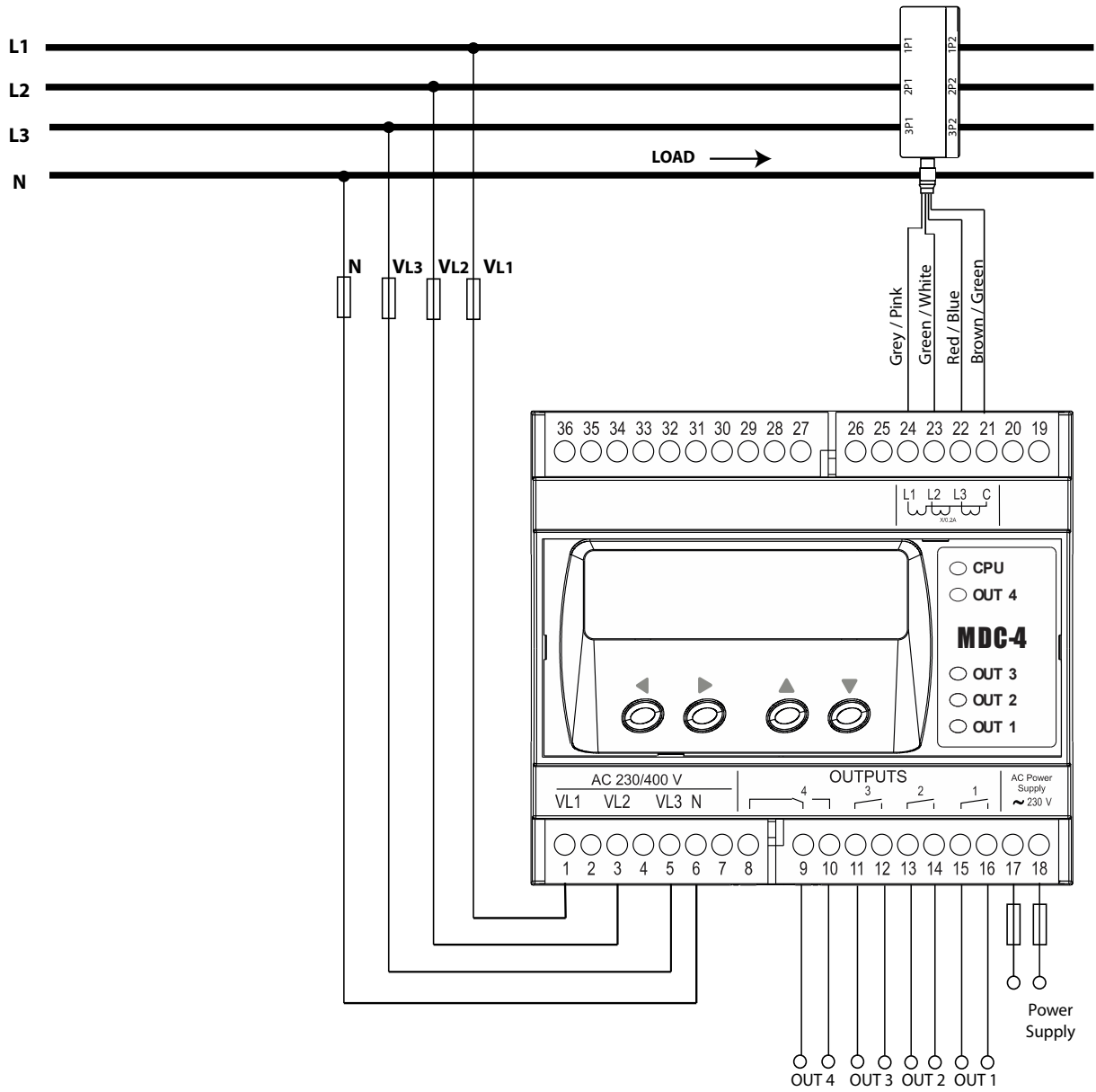



Figure 2: Three-phase network measurement with a 4-wire connection.

	<p>The MC3 transformer secondary value is set to 0.250 A.</p>
---	---

### 3.4.2.- Three-phase network measurement with a 3-wire connection.

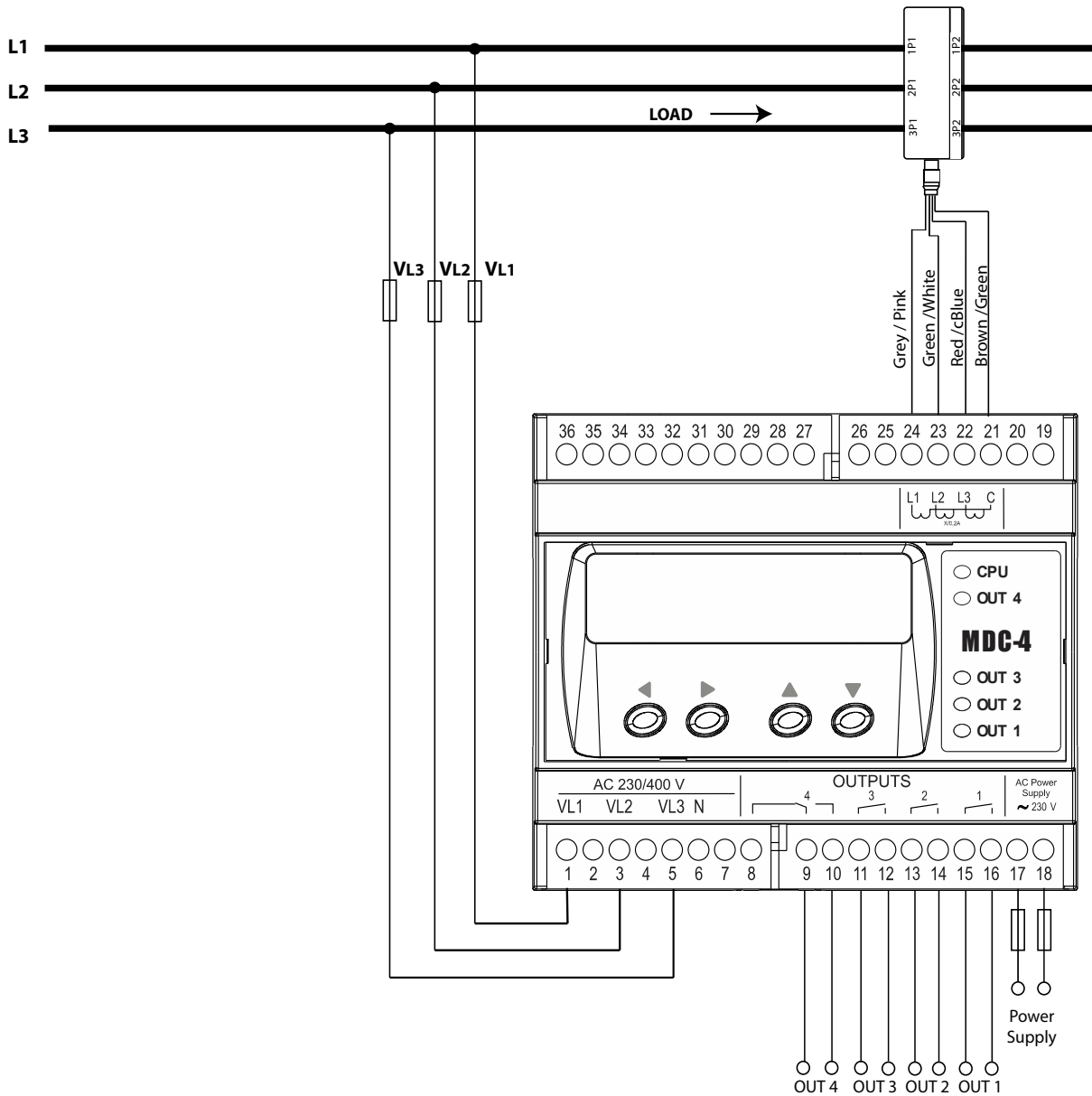


Figure 3: Three-phase network measurement with a 3-wire connection.



The MC3 transformer secondary value is set to 0.250 A.

3.4.3.- Single-phase network measurement.

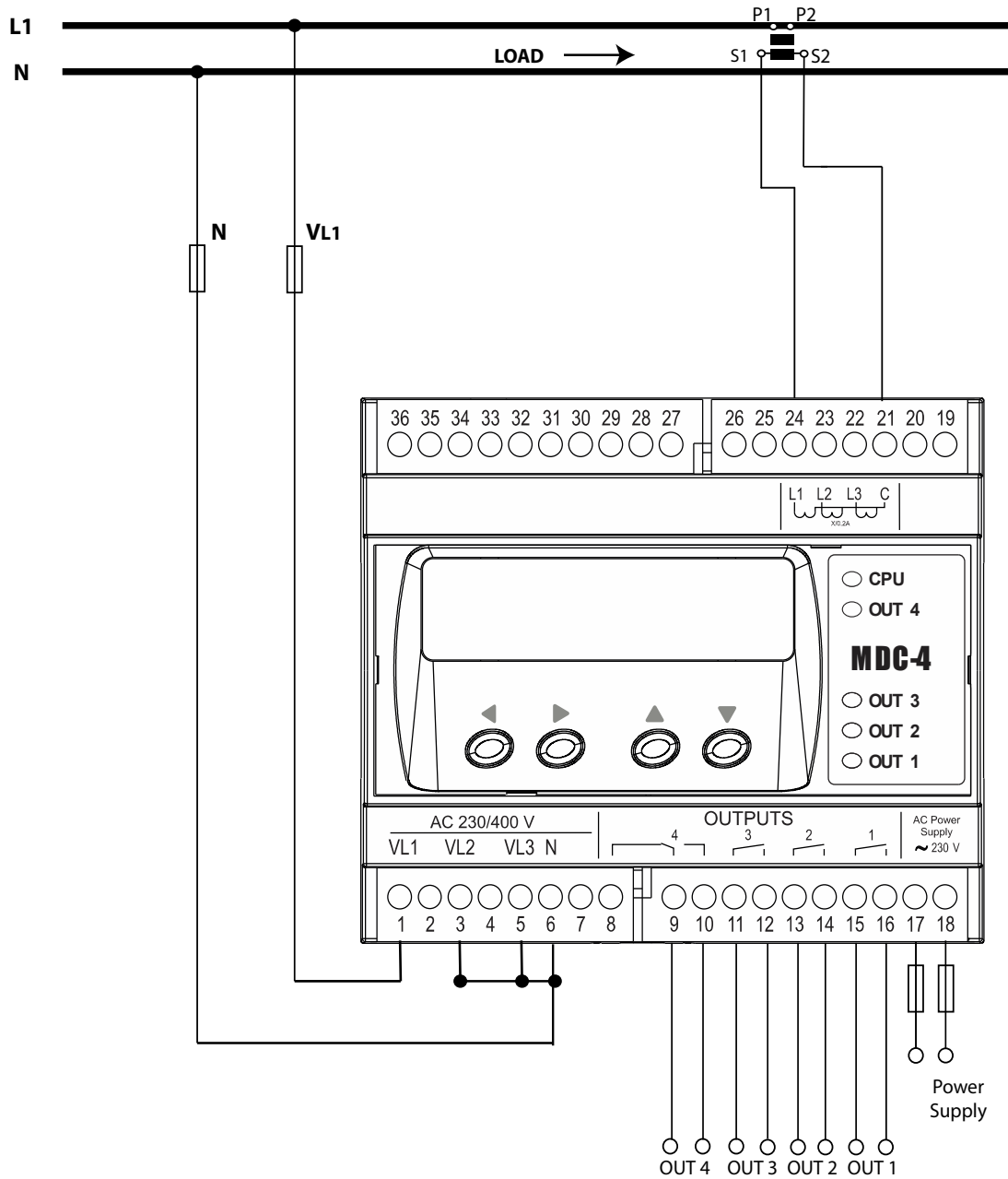



Figure 4: Single-phase network measurement.

	<p>The MC1 transformer secondary value is set to 0.250 A.</p>
---	---

## 4.- OPERATION

### 4.1.- OPERATING PRINCIPLE

The **MDC-4** has been designed to control the maximum demand of an installation. The unit is equipped with a power analyzer that measures electrical parameters at the connection point.

Since the unit does not have a synchronism input, the maximum demand is calculated on a scrolling window.

Depending on the unit's configuration and bearing in mind the calculated maximum demand, the unit connects and disconnects the installation's electrical loads (which should not be priority loads) in order to avoid exceeding the configured maximum power. Load connection or disconnection depends on the instantaneous level of maximum demand. This system proceeds to disconnect the loads in accordance with the % maximum demand value measured.

The load control by level ensures that the user does not exceed the contracted power, which generally implies having to pay high penalties. At the same time, it enables adjusting the contract to the real power each installation needs and managing the punctual disconnection of some non-priority loads, which also results in important power savings in the electricity bill.

The unit is equipped with relay outputs for the management of up to 4 electrical loads or load groups.

**Example:** Let's take an installation such as that shown in **Figure 5**, in which the level of each of the output relays has been programmed as follows:

**OUT1:** 70% of the contracted power.

**OUT2:** 80% of the contracted power.

**OUT3:** 90% of the contracted power.

**OUT4:** 95% of the contracted power.

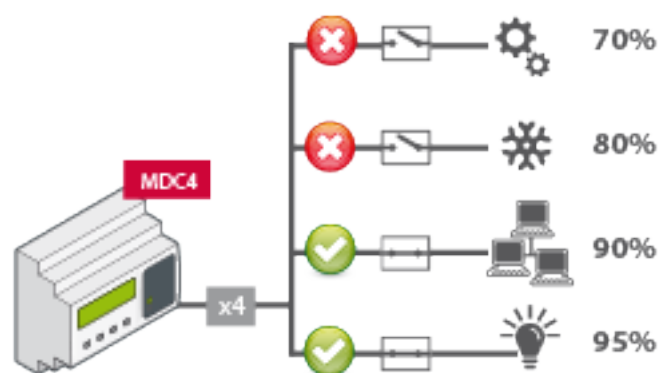


Figure 5: MDC-4 installation.

The graph in **Figure 6** shows the unit's response:

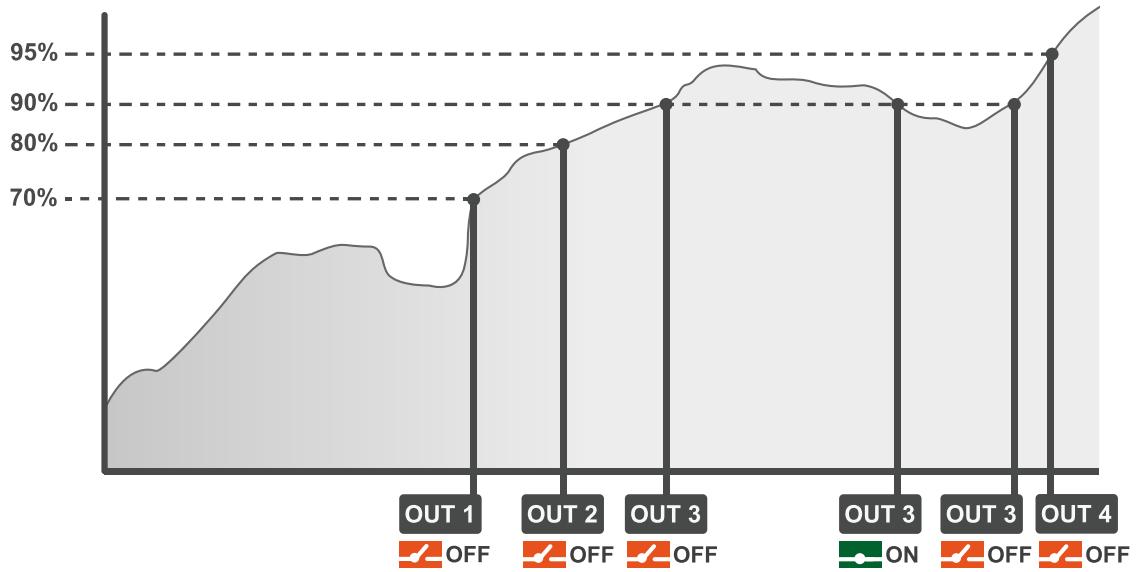


Figure 6: Graph with the response of the MDC-4

## 4.2.- PARAMETERS

The unit displays the electrical parameters shown in **Table 3**.

Table 3: MDC-4 measuring parameters.






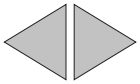
Measuring parameter	Units	Phases L1-L2-L3	Total III
Phase-neutral voltage	V	✓	
Phase-phase voltage	V	✓	
Current	A	✓	
Active Power	W	✓	✓
Reactive power	var	✓	✓
Cos φ	φ	✓	✓
Active Energy	kW·h		✓
Current Date and Time	-		
<b>Maximum demand parameters</b>	<b>Units</b>		
Contracted power	W		
Instantaneous maximum demand	W		
Status of the output relays	-		
Maximum demand maximum value	W		
The % of time that each output relay has been disconnected	%		

### 4.3.- KEYS FUNCTIONS

The **MDC-4** has 4 keys that allow you to browse the various screens and program the unit.




Key functions on the measuring screens (**Table 4**):

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

Key	Short keystroke	Long keystroke (2 s)
	Previous <b>Measuring</b> screen	
	Next <b>Measuring</b> screen	
	Previous <b>Maximum demand</b> screen	Viewing the maximum demand maximum value.
	Next <b>Maximum demand</b> screen	
		Opens the programming menu
		Opens the menu for programming the current Date and Time.

Key functions in the programming menus (**Table 5**):

**Table 5: Function of keys.**

Key	Keystroke
	Moves an editable digit
	Go to programming screen
	Increases the digits (0-9) or rotates between the different options.

### 4.4.- DISPLAY

The unit has a display of two lines each containing 20 characters, on which all the measuring parameters are viewed, in addition to specific information for the control of the unit's relay outputs and the operation time of each of the loads.

#### 4.5.- LED INDICATORS

The **MDC-4** unit features:

- A **CPU** LED, which indicates that the unit is working correctly when it flashes for 1 second.
- Four LEDs (**OUT 1**, **OUT 2**, **OUT 3**, **OUT 4**), which indicate whether the load is connected or disconnected. If the LED is on, this indicates that the load is disconnected.

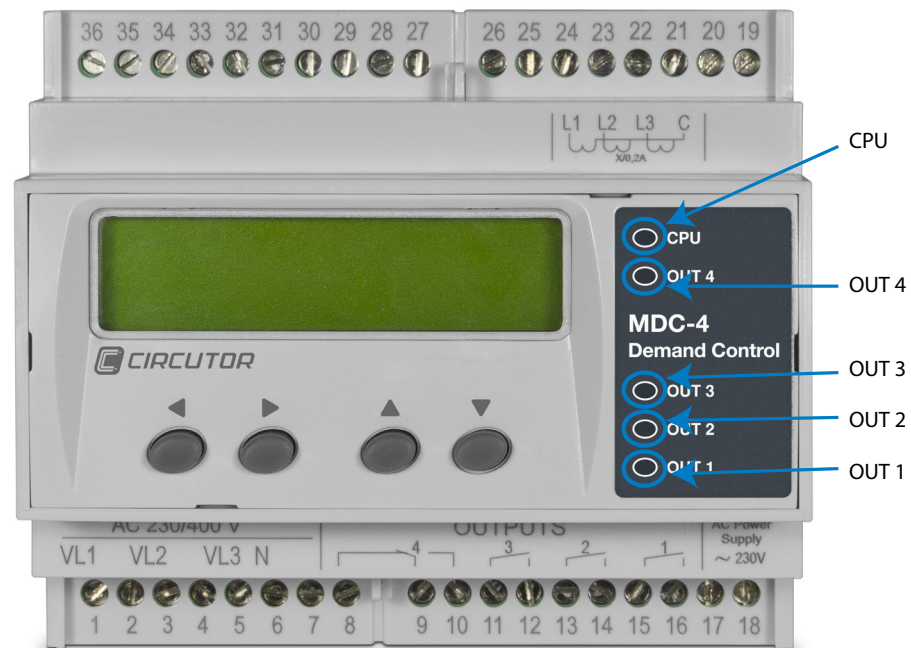




Figure 7: LED indicators.

## 4.6.- DISPLAY IMPROVEMENTS

The unit has two types of screens for viewing:

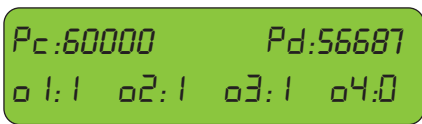
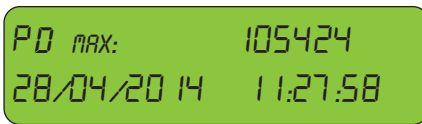

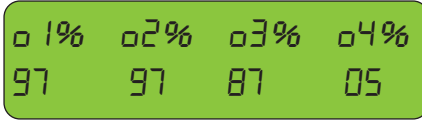
- ✓ Maximum demand screens.
- ✓ Measuring screens.

### 4.6.1.- Maximum demand screens.

Use keys  and  to browse the various screens.

The measuring screens are viewed by pressing the  or  keys.

Table 6: Maximum demand screens.

Screen	Parameters (units)
 <p>PC:60000 Pd:56687 o1:1 o2:1 o3:1 o4:0</p>	<p>PC: Power contracted by the user (W). Pd: Instantaneous calculated maximum demand (W). o1...o4: Status of the output relays: 0 : Load connected 1 : Load disconnected</p>
 <p>Pd MAX: 105424 28/04/2014 11:27:58</p>	<p>Holding down the  key (2 seconds). Pd MAX: Maximum demand maximum value Date and time when maximum value occurred. It returns to the contracted power screen after 10 seconds.</p>
 <p>o1% o2% o3% o4% 97 97 87 05</p>	<p>The % of time that each output relay has been disconnected since it was connected to the unit or since the last reset.</p>

The % of time that each output relay has been disconnected and the maximum demand maximum value that can be reset in the programming menu.

#### 4.6.2.- Measuring screens.

Use keys and to browse the various screens.

The maximum demand screens are viewed by pressing the or keys.

Table 7: Measuring screens.

Screen	Parameters (units)
	<i>VL12</i> : Phase-Phase Voltage L1-L2 (V). <i>VL23</i> : Phase-Phase Voltage L2-L3 (V). <i>VL31</i> : Phase-Phase Voltage L3-L1 (V).
	<i>VL1</i> : Phase-Neutral Voltage L1 (V). <i>VL2</i> : Phase-Neutral Voltage L2 (V). <i>VL3</i> : Phase-Neutral Voltage L3 (V).
	<i>A1</i> : Current L1 (A). <i>A2</i> : Current L2 (A). <i>A3</i> : Current L3 (A).
	<i>W1</i> : Active power L1 (W). <i>W2</i> : Active power L2 (W). <i>W3</i> : Active power L3 (W).
	<i>VAR-1</i> : Reactive power L1 (Var). <i>VAR-2</i> : Reactive power L2 (Var). <i>VAR-3</i> : Reactive power L3 (Var).
	<i>Cos 1</i> : Cos $\phi$ L1 <i>Cos 2</i> : Cos $\phi$ L2 <i>Cos 3</i> : Cos $\phi$ L3
	<i>Cos III</i> : Cos $\phi$ III <i>VAR III</i> : Reactive power III (Var).
	<i>W III</i> : Active power III (W). <i>kWh</i> : Active energy III (kWh).
	Current date and time.

The active energy III value can be reset in the programming menu.

## 4.7.- OUTPUT RELAYS

The unit has four relays (terminals 8, 9, 10, 11, 12, 13, 14, 15 and 16 in **Figure 1**) for connecting and disconnecting the installation's loads, to ensure that the programmed maximum power is not exceeded.

## 4.8.- PROGRAMMING

From the programming menu you can:

- ✓ Program the current primary.
- ✓ Program the maximum demand period.
- ✓ Program the contracted power.
- ✓ Delete the value for energy, the load disconnection times and the maximum demand maximum value.
- ✓ Configure the output relays.

The **MDC-4** does not record the programming changes until all parameters have been programmed. If the unit is RESET before programming all parameters or no key is pressed for 60 seconds, the configuration will not be stored in the memory.

To enter the programming menu, hold the  and  keys for two seconds; the main programming screen will be displayed.





Press the  key to enter the first programming screen.

### 4.8.1. Current primary




In this step the current primary value is programmed.

Press the  button to increase the digit that is currently flashing.

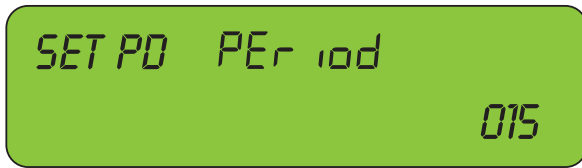
When the desired value is shown on the screen, move onto the next digit by pressing the key  to modify the remaining values.

**Maximum value:** 250 A.

**Minimum value:** 1 A.

Press the  key to access the next programming step.

#### 4.8.2. Period of maximum demand integration



In this step the maximum demand integration period is programmed.

Press the ▲ button to increase the digit that is currently flashing.

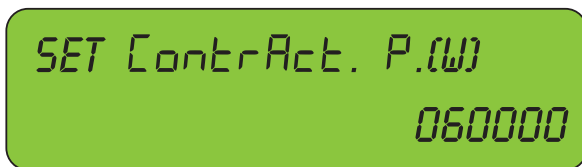
When the desired value is shown on the screen, move onto the next digit by pressing the key ▶ to modify the remaining values.

**Maximum value:** 60 minutes.

**Minimum value:** 1 minute.

Press the ▼ key to access the next programming step.

#### 4.8.3. Contracted power



In this step the contracted power for the installation is programmed.

Press the ▲ button to increase the digit that is currently flashing.

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

**Maximum value:** 500,000 W.

**Minimum value:** 0 W.

Press key ▼ to access the next programming step.

#### 4.8.4. Deleting the maximum demand maximum value.

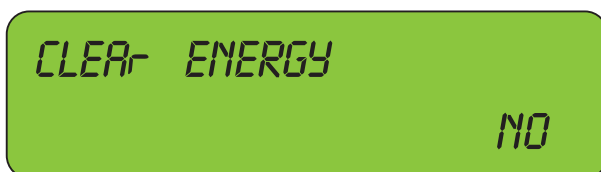


In this step you select whether or not to delete the maximum demand maximum value.

Press the ▲ button to select between the two possible options: NO or YES.

Press key ▼ to access the next programming step.

#### 4.8.5. Deleting the energy value



In this step you select whether or not to delete the energy value.


Press the ▲ button to select between the two possible options: NO or YES.

Press key ▼ to access the next programming step.

#### 4.8.6. Deleting the output relay disconnection times.

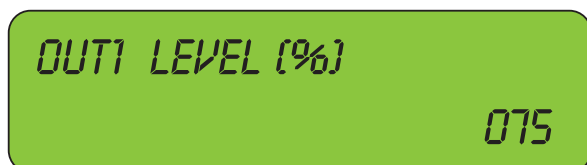


In this step you select whether or not to delete the % of time that each output relay has been disconnected.

Press the  button to select between the two possible options: *NO* or *YES*.


Press key  to access the next programming step.


#### 4.8.7. Level of output relay no. 1



In this step you program the value (%) of contracted power from which the output relay is disconnected.

**Example:** If OUT1 is programmed to 75%, when the maximum demand value reaches 75% of the contracted power in the installation, output relay no.1 will be disconnected, thus disconnecting all the corresponding loads.


Press the  key to increase the digit that is currently flashing.

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

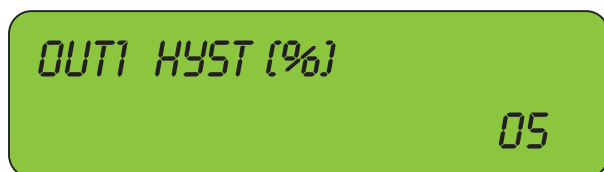
**Maximum value:** 100%.

**Minimum value:** 0 %.


**Default:** OUT1 : 75% , OUT2 : 80%, OUT3 : 90%, OUT4 : 95%


Press key  to access the next programming step.

#### 4.8.8. Hysteresis of output relay no. 1



The hysteresis value, i.e., difference between the relay connection and disconnection point, in %, is programmed in this step.

Press the  button to increase the digit that is currently flashing.

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

**Maximum value:** 99 %.

**Minimum value:** 0 %.

Press key  to access the next programming step.

#### 4.8.9. Delay in connecting output relay no. 1



In this step the delay in connecting the output relay is programmed.

Press the ▲ button to increase the digit that is currently flashing.

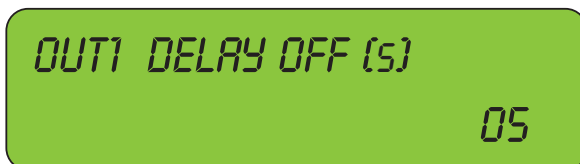
When the desired value is shown on the screen, move onto the next digit by pressing the key ▶ to modify the remaining values.

**Maximum value:** 99 seconds.

**Minimum value:** 0 seconds.

Press key ▼ to access the next programming step.

#### 4.8.10. Delay in disconnecting output relay no. 1



In this step the delay in disconnecting the output relay is programmed.

Press the ▲ button to increase the digit that is currently flashing.

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

**Maximum value:** 99 seconds.

**Minimum value:** 0 seconds.

Press key ▼ to access the next programming step.

#### 4.8.11. Status of the contacts for output relay no. 1



In this step the status of the output relay contact is selected.

Press the ▲ button to select between the two possible options:

*N.C.* normally closed.

*N.O.* normally open.

Press key ▼ to access the next programming step.

In the next steps, the level, hysteresis and connection and disconnection delays are programmed, as well as the status of the contactors for output relays 2, 3 and 4.

The programming is identical to that of sections **4.8.7**, **4.8.8**, **4.8.9**, **4.8.10** and **4.8.11**.

## 4.9.- PROGRAMMING THE CURRENT DATE AND TIME

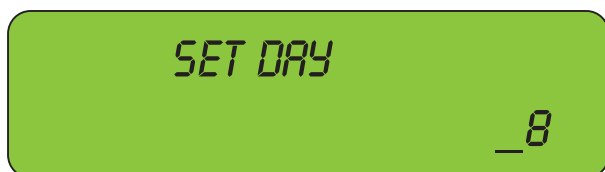
The **MDC-4** does not record the programming changes until all parameters have been programmed. If the unit is RESET before programming all parameters or no key is pressed for 60 seconds, the configuration will not be stored in the memory.

To enter the programming menu for the current date and time, hold the ◀ and ▶ key for 2 seconds; the main programming screen will be displayed.



Press the ▼ key to enter the first programming step.

### 4.9.1. Day



In this step the day of the month is programmed. Press the ▲ button to increase the digit that is currently flashing.

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

Press key ▼ to access the next programming step.

### 4.9.2. Month



In this step the current month is programmed. Press the ▲ button to increase the digit that is currently flashing.

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

Press key ▼ to access the next programming step.

#### 4.9.3. Year



In this step the current year is programmed.  
Press the ▲ button to increase the digit that is currently flashing.

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

Press key ▼ to access the next programming step.

#### 4.9.4. Time



In this step the current hour is programmed.  
Press the ▲ button to increase the digit that is currently flashing.

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

Press key ▼ to access the next programming step.

#### 4.9.5. Minutes



In this step the minutes are programmed.  
Press the ▲ button to increase the digit that is currently flashing.

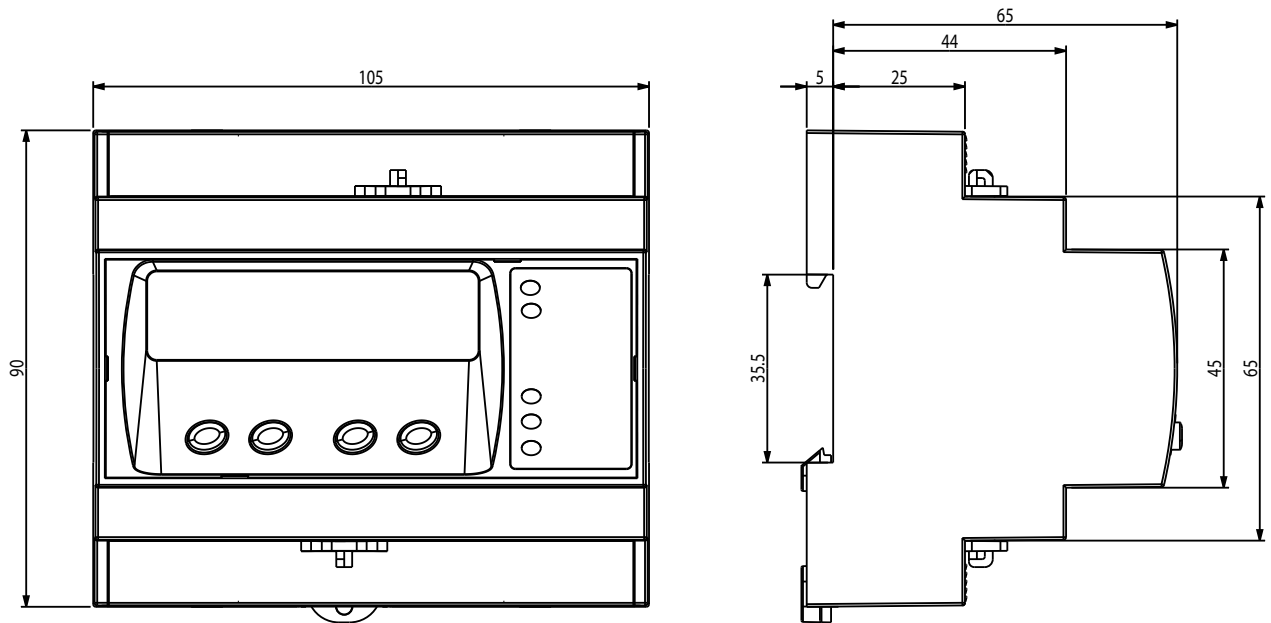
When the desired value is shown on the screen, move onto the next digit by pressing the key ▶ to modify the remaining values.

Press key ▼ to access the next programming step.

**NB:** The unit does not automatically change from summer time to winter time.

## 5.- TECHNICAL FEATURES

AC power supply	
Rated voltage	110 ...240 V ~
Frequency	50 / 60Hz
Consumption	4...6 VA
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	400kΩ
Minimum measurement voltage (Vstart)	10 V
Installation category	CAT III 300 V
Current measurement circuit	
Nominal current (In)	... / 0.250 A
Current measurement margin	5 ... 100% In
Minimum measurement current (Istart)	10 mA
Installation category	CAT III 300 V
Measurement accuracy	
Accuracy in voltage measurement	0.5%
Accuracy in current measurement	0.5%
Accuracy in power measurement	1%
Relay outputs	
Quantity	4
Maximum voltage, open contacts	250 ~
Maximum current	6 A
Maximum switching power	750 W
Electrical working life (250 VAC / 5A)	60x10 <sup>3</sup> cycles
Mechanical working life	10x10 <sup>6</sup> cycles
User interface	
Display	Alphanumeric LCD screen, 2 lines each containing 20 characters
Keys	4 keys
LED	5 LEDs
Environmental features	
Operating temperature	0°C ... +50°C
Storage temperature	-10°C ... +60°C
Relative humidity (non-condensing)	5 ... 95%
Maximum altitude	2,000 m
Protection degree	IP20
Mechanical features	
Dimensions	Figure 8
Weight	250 gr
Enclosure	UL94-V0 self-extinguishing plastic



**Figure 8: Dimensions of the MDC-4.**

Standards	
<b>UNE-EN 61010-1:2011</b>	Safety requirements for electrical equipment for measurement, control and laboratory use -- Part 1: General requirements
<b>UNE-EN 61000-4-2:2010</b>	Electromagnetic compatibility (EMC) -- Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test
<b>UNE-EN 61000-4-3: 2007</b>	Electromagnetic compatibility (EMC) -- Part 4-3: Testing and measurement techniques - Radiated, radio-frequency, electromagnetic field immunity test
<b>UNE-EN 61000-4-4: 2013</b>	Electromagnetic compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test
<b>UNE-EN 61000-4-5: 2007</b>	Electromagnetic compatibility (EMC) -- Part 4-5: Testing and measurement techniques - Surge immunity test
<b>UNE-EN 61000-4-11:2005</b>	Electromagnetic compatibility (EMC) -- Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests
<b>UNE-EN 61000-6-4:2007/A1:2011</b>	Electromagnetic compatibility (EMC) -- Part 6-4: Generic standards - Emission standard for industrial environments

## 6.- MAINTENANCE AND TECHNICAL SERVICE

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

### Technical Assistance Service

Vial Sant Jordi, s/n, 08232 - Viladecavalls (Barcelona)

Tel: 902 449 459 ( España ) / +34 937 452 919 (outside of Spain)

email: sat@circutor.es

## 7.- GUARANTEE

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

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



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

**8.- CE CERTIFICATE**



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