CE

UPM 3100

Universal Power Meter

Use and Programming

English

1UAMUPM3K101

algodue® ELETTRONICA

Rev. 01 - 2003

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1. Introduction

This Manual provides information on how to install and program the instrument. The box also contains an additional Manual, providing installation and set-up instructions.
Both Manuals are not intended for general use, but for qualified technicians.
This term indicates a professional and skilled technician, authorised to act in accordance with the safety standards relating to the dangers posed by electric current.
This person must also have basic first aid training and be in possession of suitable Personal Protective Equipment.

WARNING!
It is strictly forbidden for anyone who does not have the above-mentioned features to install or use the device.

The device complies with the European Union directives in force, as well as with the technical standards implementing these requirements, as certified by the EC mark on the device and on this Manual.
Using the tool for purposes other than intended ones, deducible by the manual content, is strictly forbidden.

The manufacturer reserves the right to modify the device and/or technical specifications included in this Manual.
The Manufacturer shall not shoulder any responsibility for any use of the instrument which is different from that illustrated in this manual and in the *Installation and configuration manual*, or for non- /imperfect application of the specified instructions.

The information contained in this manual and in the Installation and Configuration Manual was carefully checked at the time of publication. However, the Manufacturer does not accept liability for any inaccuracy, errors, missing updates, and reserves the right to modify the device and / or documentation without prior notice.

Any brands quoted in the publication belong to the legitimate registered owners.

NOTE
This Manual refers to the complete instrument version. Some displays may not be available if the instrument was purchased without some functions.

2. Graphic symbols

Some instructions in the Manual and on the device are highlighted by graphic symbols to draw the reader’s attention to the operational dangers.
The following graphic symbols are used:

DANGER !
This warning indicates the possible presence of voltage higher than 1kV on the marked terminals (even for short periods).

WARNING!
This warning indicates the possible occurrence of an event which may cause a serious accident or considerable damage to the device if suitable precautionary countermeasures are not taken.

ATTENTION!
This warning indicates the possible occurrence of an event which may cause a light accident or damage to the device if suitable precautionary countermeasures are not taken.

NOTE
This warning indicates important information which must be read carefully.

3.Precautionary measures

In standard operation mode, the instrument is connected with power sources that are potentially dangerous for operators. The connecting terminals of the power supply cables, the voltage and current transformers and the digital and analog inputs and outputs are powered.

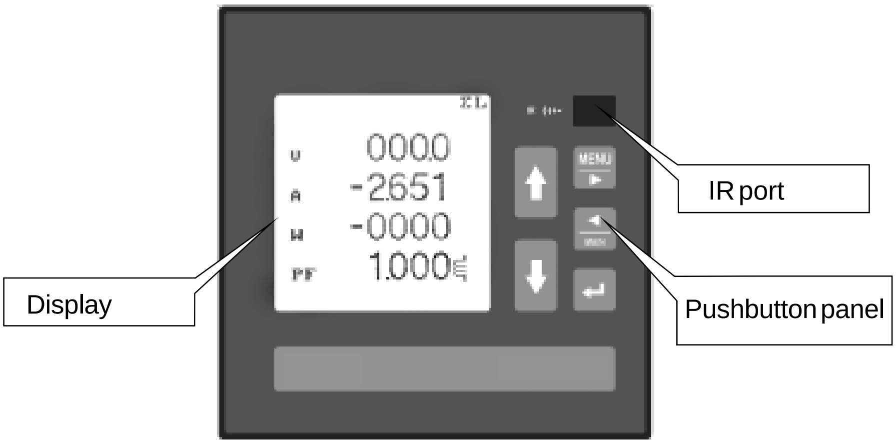
WARNING!
Electrocution may cause serious accidents and eventually fatal injuries.

This is why the instrument must be installed, programmed and used by skilled and trained technicians. See chapter 1 for the definition of “skilled technician”.
After the installation, the terminals to which cables are connected must be inaccessible.

The equipment complies with the 89/366, 73/23 regulations and following amendments. However, if not properly installed, it may generate a magnetic field and radio interference. The EMC regulations on electro-magnetic compatibility and the instructions contained in the *Installation and Configuration* Manual must be complied with.

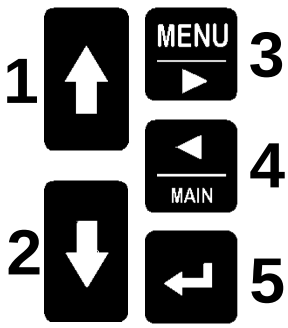
4. Equipment use

4.1 Layout



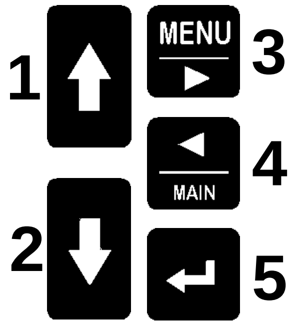
4.2 Push-button station

Here below is a list of the main functions.
The special functions, depending on the displayed page, are described in the relevant paragraphs.



1-2 ARROW KEYS
Normal display mode
a Press them to go to a different page or to move the cursor to the available options.
Programming mode
a Move the selection cursor to the available options.
b Modify the value of the figure (or group of figures) identified by the cursor.

3 MENU BUTTON
Normal display mode
a press it for at least 3 seconds to display the main menu
b scrolls pages in the OSCILLOSCOPE, HARMONICS and HISTOGRAM functions.



Programming mode

a To enter the password, press it together with **(4)**.
b Moves the selection cursor to the right-hand side figure
c To exit the programming mode, keep it pressed for at least 3 seconds.

4 MAIN BUTTON
Normal display mode

a Keep it pressed for at least 3 seconds to set the current page as main page.
b Keep it pressed for at least 3 seconds on the main page to delete it.
c To display the main page, press it together with **(5)**.
d Scrolls pages in the OSCILLOSCOPE, HARMONICS and HISTOGRAM functions.

Programming mode

a To enter the password, press it together with **(3)**.
b Moves the selection cursor to the left-hand side figure.

5 ENTER KEY
Normal display mode

a Confirms the selection and displays the selected function.
b To display the main page, press it together with **(4)**.

For connection with an LP40 printer:

c Press it together with **(3)** to enter the manual print menu.
d Press it together with **(1)** to print the displayed page.
e Press it together with **(2)** to move the paper forward.

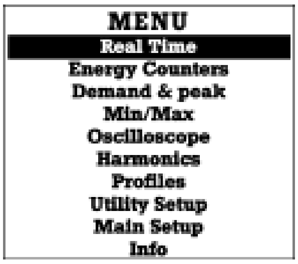
Programming mode

a Confirms the entered selection. Use the keys **(1)** and **(2)** to change the values.
b Confirms the modified values.

If the display light is off, press any one of the five keys to turn it on (it will stay on for the set time, as described in the section 8.12 of the Installation and Configuration Manual).

5. Main menu

To enter the Main Menu keep any key pressed for at least 3 seconds.

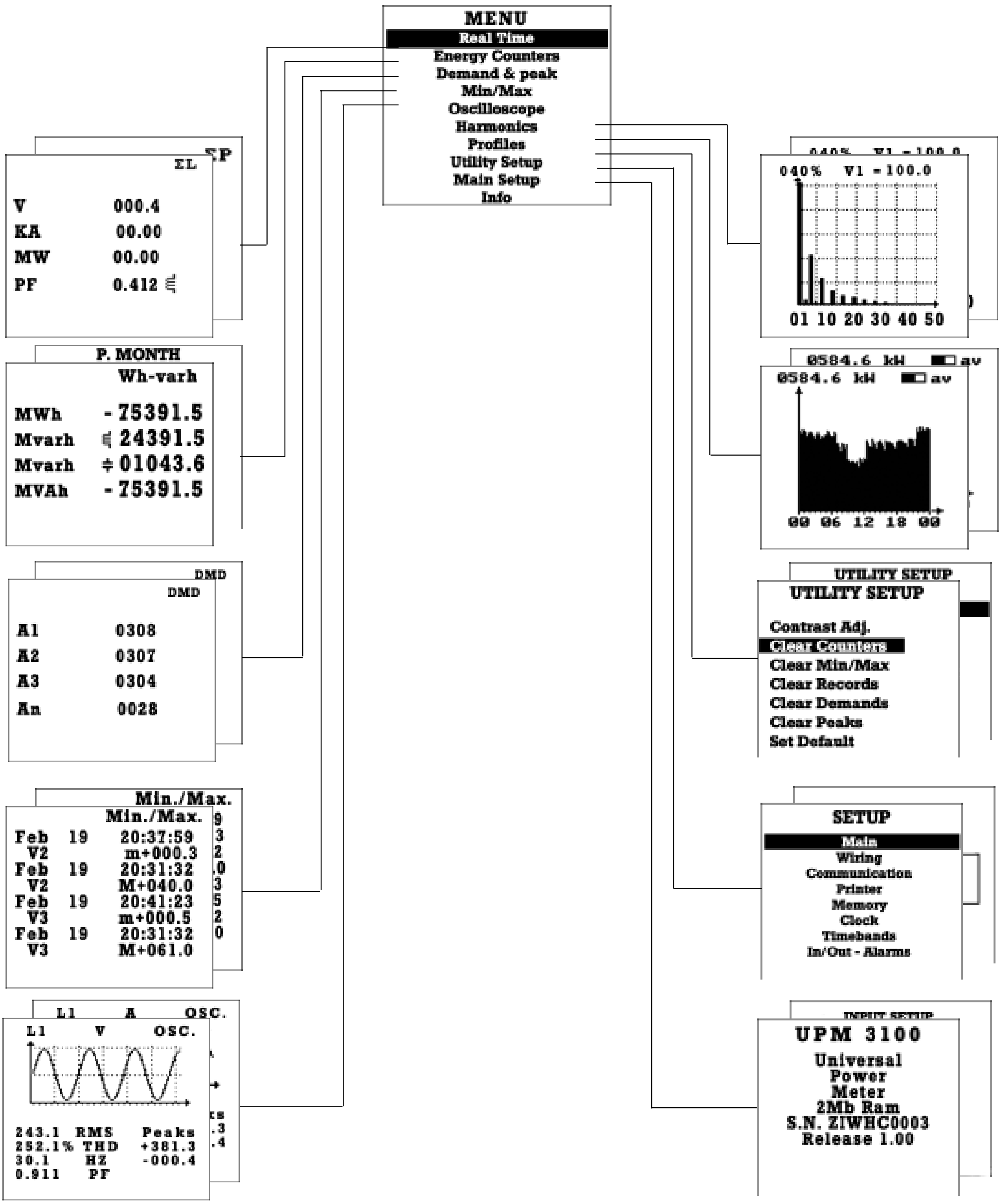


1	REAL TIME	Section 5.2
2	ENTERGY COUNTERS	Section 5.3
3	DEMAND & PEAK	Section 5.4
4	MIN/MAX	Section 5.5
5	OSCILLOSCOPE	Section 5.6
6	HARMONICS	Section 5.7
7	PROFILES	Section 5.8
8	UTILITY SETUP	Section 5.9
9	MAIN SETUP	Chapter 6
10	INFO	Section 5.10

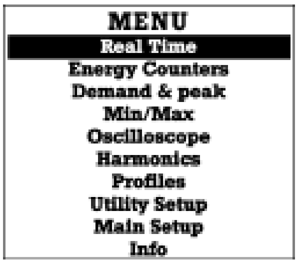
5.1 Page layout

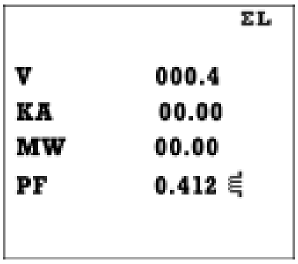
The following page shows the Main Menu structure.
To enter any page, move the cursor to the relevant description and press .

Main Menu


MENU
Real Time
Energy Counters
Demand & peak
Min/Max
Oscilloscope
Harmonics
Profiles
Utility Setup
Main Setup
Info
ΣL
V 000.4
KA 00.00
MW 00.00
PF 0.412
P. MONTH
Wh-varh
MWh - 75391.5
Mvarh 24391.5
Mvarh ÷ 01043.6
MVAh - 75391.5
DMD
A1 0308
A2 0307
A3 0304
An 0028
Min./Max.
Feb 19 20:37:59
V2 m+000.3
Feb 19 20:31:32
V2 M+040.0
Feb 19 20:41:23
V3 m+000.5
Feb 19 20:31:32
V3 M+061.0
L1 V OSC.
243.1 RMS Peaks
252.1% THD +381.3
30.1 HZ -000.4
0.911 PF
040% V1 = 100.0
01 10 20 30 40 50
0584.6 kW av
00 06 12 18 00
UTILITY SETUP
Contrast Adj.
Clear Counters
Clear Min/Max
Clear Records
Clear Demands
Clear Peaks
Set Default
SETUP
Main
Wiring
Communication
Printer
Memory
Clock
Timebands
In/Out - Alarms
UPM 3100
Universal
Power
Meter
2Mb Ram
S.N. ZIWHC0003
Release 1.00

5.2 Real time





The pages of this section display the real time values detected by the instrument.

1 Press MENU ▶ and keep it pressed for at least 3 seconds. The Main Menu will be displayed.

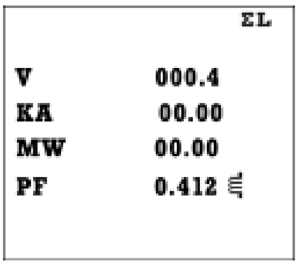
2 Press ↵. when the highlight bar is on REAL TIME. If the bar is not on REAL TIME, move it by means of the keys ↓ ↑.

3 When in the menu, press ↓ or ↑ to scroll the available pages.

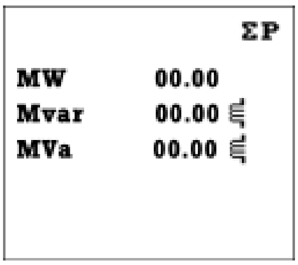
5.2.1 List of pages

The following list may vary depending on the connection scheme (see section 5.2.4). The sequence refers to a 3-phase, 4-wire, 3-current connection scheme, as shown when the key ↑ is pressed for each display.

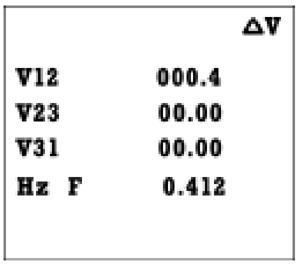
1



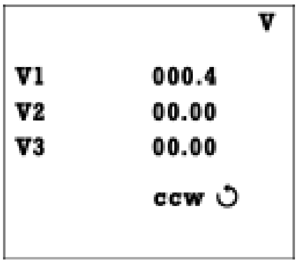
2



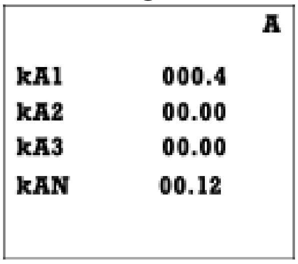
3



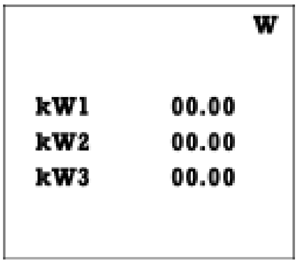
4



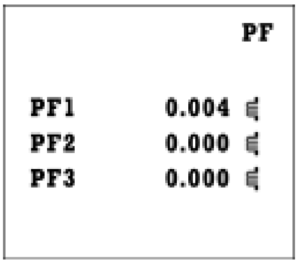
5



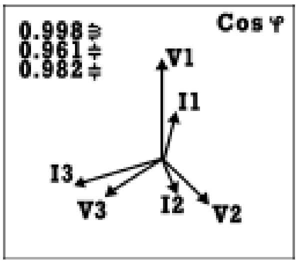
6



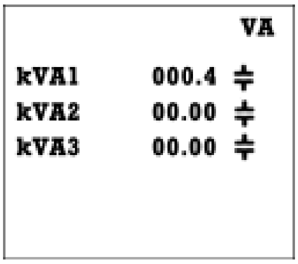
7



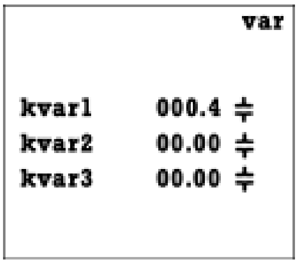
8



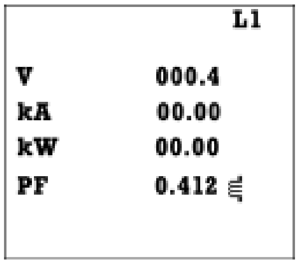
9



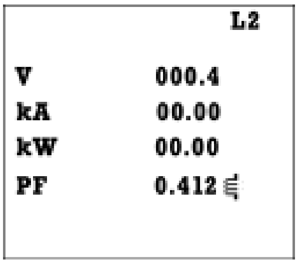
10



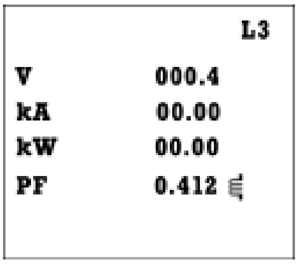
11



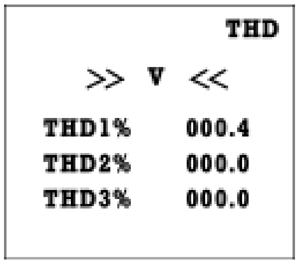
12



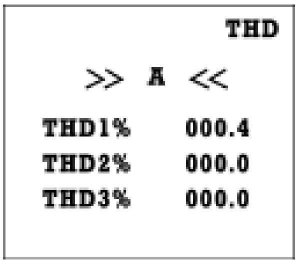
13



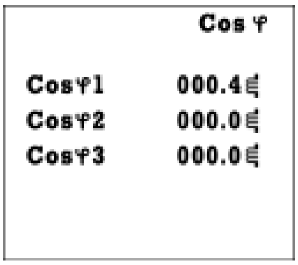
14



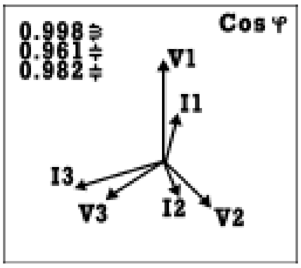
15



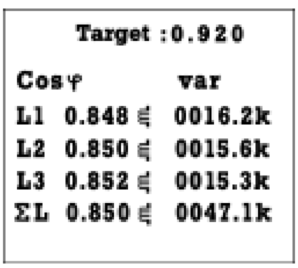
16



17



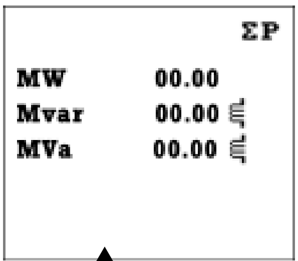
18



1 Voltage, current, active power, system power factor.
2 System active, reactive and apparent power
3 Phase and frequency linked voltages
4 Phase voltage and phase rotation sequence
5 Phase and neutral currents
6 Active phase powers
7 Phase power factors
8 Voltage-current vectorial chart (on PF)
9 Apparent phase powers
10 Reactive phase powers
11 Voltage, current, active power, L1 phase power factor.
12 Voltage, current, active power, L2 phase power factor.
13 Voltage, current, active power, L3 phase power factor.
14 Percentage distortion index of phase voltage
15 Percentage distortion index of phase currents
16 Phase CosØ
17 Voltage-current vectorial chart (on CosØ)
18 Re-phasing

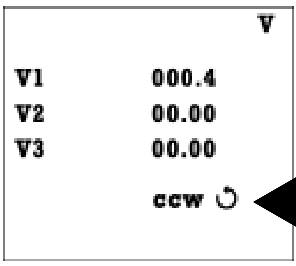
5.2.2 Symbols

Some pages contain the following symbols.



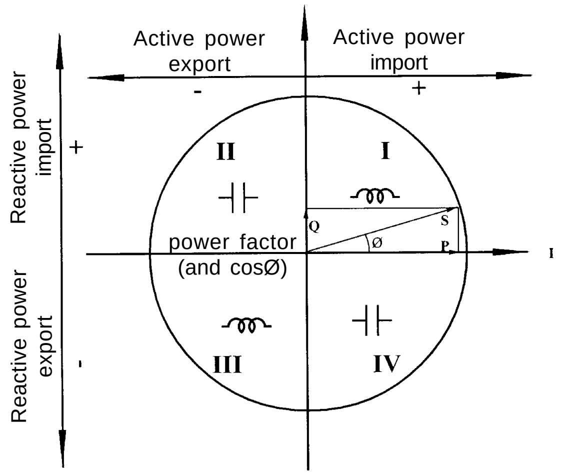
The simbol refers to an inductive load; the symbol indicates a capacitive load. These symbols are located next to cosØ, reactive power and reactive energy consumption
.

The symbol - placed before the Active power, indicates the exported energy.



Phase rotation indication:
CW (Clock Wise) = sequence, L1 - L2 - L3.
CCW (Counter Clock Wise) = sequence, L1 - L3 - L2

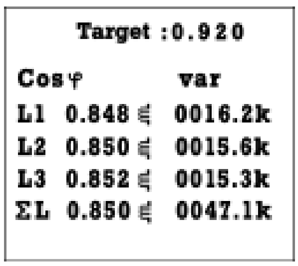
The figure below shows the geometric representation of active and reactive power and power factor, in compliance with the EN611268 Norm.



NOTES:
1 The chart refers to the current vector “I” (on the RH-side).
2 The direction of the voltage vector “V” changes depending on the phase displacement angle Ø
3 The displacement angle Ø between voltage “V” and current “I” is positive in the trigonometric expression (counter-clockwise).

5.2.3 Power factor compensation

This function calculates the power of the re-phasing capacitors (var), which are necessary to raise the measured CosØ to the requested value (Objective).



1 Press to set a new Objective value;

2 Choose one of the available values using the keys ;

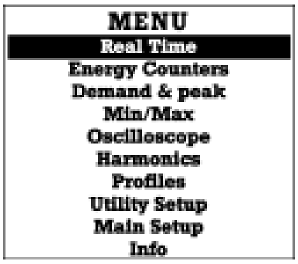
3 To confirm the selected value press .

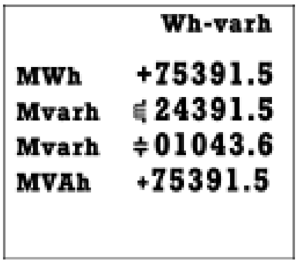
5.2.4 Page display

The values displayed in the REAL TIME section may change depending on the electrical connections (see chapter 7 of the Installation and Configuration Manual for the connections). The table below shows the displayed values depending on the connection type.

PAGE	DISPLAY VALUES	Connection Type						
		3 ph., 4 wires 3 current trasnformers	3 ph., 3 wires 3 current trasnformers	3 ph., 3 wires 2 current trasnformers	3 ph., 3 wires 1 current trasnformer	3 ph., 1 wire 3 current trasnformers	1 ph., 3 wires 2 current trasnformers	1 ph., 3 wires 1 current trasnformer
ΣL	V, A, W, PF	X	X	X	X	X	X	X
ΣP	W, var, VA	X	X	X	X	X	X	X
Harm	ThdV,ThdA,CosΦ,Hz							X
Δ V	V_{12}, V_{23}, V_{31}, Hz	X	X	X	X			
	V_{12}, Hz					X	X	
V	V_{1N}, V_{2N}, V_{3N}	X						
	V_{1N}, V_{2N}						X	
A	A_1, A_2, A_3, A_N	X						
	A_1, A_2, A_3		X	X		X		
	A_1, A_2, A_N						X	
W	W_1, W_2, W_3	X						
	W_1, W_2						X	
PF	PF_1, PF_2, PF_3	X						
	PF_1, PF_2						X	
Fresnel PF	A_1, A_2, A_3, V_1, V_2, V_3	X						
	A_1, A_2, V_1, V_2						X	
	A_1, V_1							X
VA	VA_1, VA_2, VA_3	X						
	VA_1, VA_2						X	
VAR	var_1, var_2, var_3	X						
	var_1, var_2						X	
ΣL_1	V, A, W, PF	X					X	
ΣL_2	V, A, W, PF	X					X	
ΣL_3	V, A, W, PF	X						
THD-V	V_{1N}, V_{2N}, V_{3N}	X						
	V_{1N}, V_{2N}						X	
THD-A	A_1, A_2, A_3	X	X			X		
	A_1, A_2						X	
	A_1, A_3			X				
	A_1				X			
CosΦ	$Cos\Phi_1$, $Cos\Phi_2$, $Cos\Phi_3$							
	$Cos\Phi_1$, $Cos\Phi_2$, $Cos\Phi$						X	
Fresnel CosΦ	A_1, A_2, A_3, V_1, V_2, V_3	X						
	A_1, A_2, V_1, V_2						X	
	A_1, V_1							X
Pw. compensat.	var_1, var_2, var_3	X						
	var_1, var_2, var						X	
	var_1							X

5.3 Energy counters





The pages of this section display the energy counters.

1 Press and keep it pressed for at least 3 seconds. The main menu will be displayed.

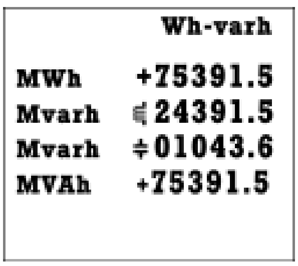
2 Move the highlight bar to ENERGY COUNTERS by means of the keys and press .

3 When in the menu, press or to scroll the available pages.

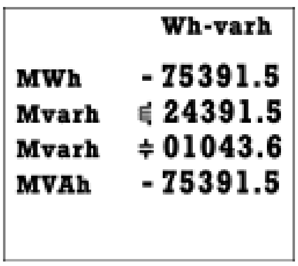
5.3.1 List of pages

The instrument shows the energy consumption divided into time periods.
Two pages display the total data in real time; eight more pages (4 for imported and 4 for exported energy) show the energy consumption divided per tariff period for the current and previous day and for the current and previous month.
If the input card DI4-TR is installed (optional), the page described in the next paragraph is also present.
The following sequence is shown as it appears when the key is pressed for each display.

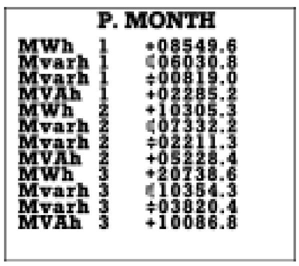
1



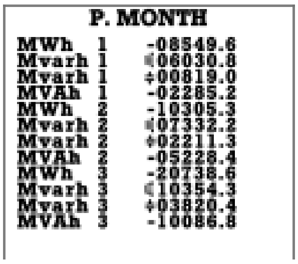
2



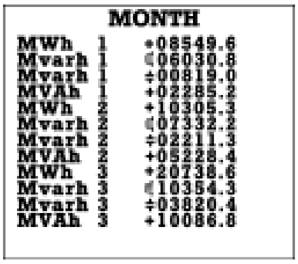
3



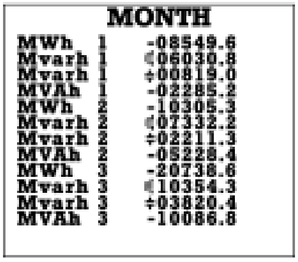
4



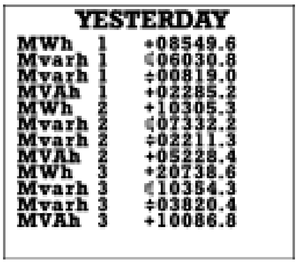
5



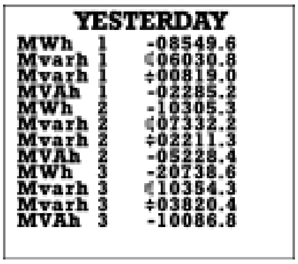
6



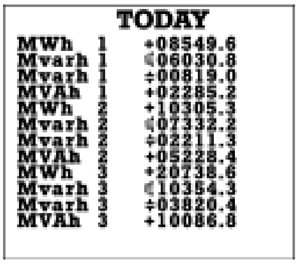
7



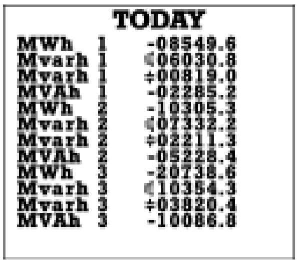
8



9

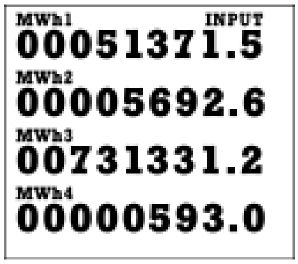


10



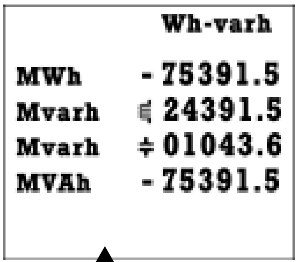
1 Consumption of imported active, reactive and apparent energy
2 Consumption of exported active, reactive and apparent energy
3 Consumption of imported active, reactive and apparent energy divided per tariff period (previous month)
4 Consumption of exported active, reactive and apparent energy divided per tariff period (previous month)
5 Consumption of imported active, reactive and apparent energy divided per tariff period (current month)
6 Consumption of exported active, reactive and apparent energy divided per tariff period (current month)
7 Consumption of imported active, reactive and apparent energy divided per tariff period (yesterday)
8 Consumption of exported active, reactive and apparent energy divided per tariff period (yesterday)
9 Consumption of imported active, reactive and apparent energy divided per tariff period (yesterday)
10 Consumption of exported active, reactive and apparent energy divided per tariff period (today)

5.3.2 Input counter



If the DI4-TR card is installed (4 digital inputs, optional), the page shown to the side is present. The total energy sent to each input is displayed on this page.
Each input can be assigned a different multiplying factor in the PROGRAMMING menu (see next chapter).

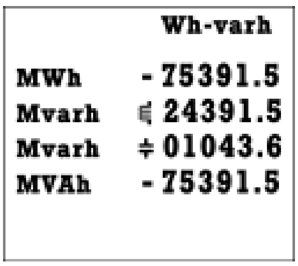
5.3.3 Symbols



The symbol indicates an inductive load; the symbol indicates a capacitive load. These symbols are located next to the items concerning the reactive energy consumption (Mvarh).

The sign - indicates that the value refers to an exported unit.

5.3.4 Main display



Active energy consumption

Inductive reactive energy consumption

Capacitive reactive energy consumption

Apparent energy consumption

5.3.5 Input counter reset

The totalizers of total energy, time-specific energy and the digital input counters can be separately reset.
See section 5.9 for these operations.

5.4 Demand & Peak

MENU
Real time
Energy Counters
Demand & Peak
Min/Max
Oscilloscope
Harmonics
Profiles
Utility Setup
Main Setup
Info

	DMD
A1	0308
A2	0307
A3	0304
An	0028

The pages of this section display the min. and max. values of the main measurements.

1 Press MENU ▶ and keep it pressed for at least 3 seconds. The main menu will be displayed.

2 Move the highlight bar to DEMAND&PEAK by means of the keys and press .

3 When in the menu, press or scroll the available pages

5.4.1 List of pages

The following list may vary depending on the connection scheme (see section 5.2.4). The sequence refers to a 3-phase, 4-wire, 3-current connection scheme, as shown when the key is pressed for each display.

The pages with the **DMD** abbreviation on the upper right-hand side refer to average values. The pages with **PEAK** refer to peak values.

1

	DMD
A1	0308
A2	0307
A3	0304
An	0028

2

	DMD
kW	0194
kVa	0201
W/VA	0.965

3

	DMD
A	0308
kvar	0030
kvar	0003

4

```
            DMD
A1     - 0308
A2     - 0307
A3     - 0304
An     - 0028
```

5

```
            DMD
kW     - 0194
kVa    - 0201
W/VA   - 0.965
```

6

```
            DMD
A      - 0308
kvar   - 0030
kvar   - 0003
```

AVERAGE VALUES (DMD)
List of average values

1 Phase current 1, 2, 3 and neutral (purchase)
2 System active and apparent power (purchase). Ratio between active and apparent power (PF)
3 System current, system inductive reactive power and system capacitive reactive power (purchase)
4 Phase current 1, 2, 3 (sale)
5 System active and apparent power (sale). Ratio between active and apparent power (PF)
6 System current, system inductive reactive power and system capacitive reactive power (sale)

7

```
              Peak
Jul  15    08:56:42
 A1   Pdmd +0318.
Jul  15    08:55:45
 A2   Pdmd +0318.
Jul  15    08:56:40
 A3   Pdmd +0318.
Jul  15    08:55:32
 An   Pdmd  0033.
```

8

```
              Peak
Jul  15    08:58:42
kW     Pdmd +0196.
kVA     dmd +0205.
kvar    dmd +0025.
W/VA    dmd +0.956
```

9

```
              Peak
Jul  15    08:56:12
kVA    Pdmd +0205.
kW      dmd +0196.
kvar    dmd +0025.
W/VA    dmd +0.956
```

10

```
              Peak
Jul  15    08:51:20
kvar   Pdmd +0025.
kW      dmd +0196.
kVA     dmd +0205.
W/VA    dmd +0.956
```

11

```
              Peak
Jul  15    08:44:34
kvar   Pdmd +0001.
kW      dmd +0098.
kVA     dmd +0102.
W/VA    dmd +0.961
```

12

```
              Peak
Jul  15    08:56:42
 A1   Pdmd -0318.
Jul  15    08:55:45
 A2   Pdmd -0318.
Jul  15    08:56:40
 A3   Pdmd -0318.
```

13

```
            Peak
Jul  15   08:58:42
kW      Pdmd - 0196.
kVA      dmd - 0205.
kvar     dmd - 0025.
W/VA     dmd - 0.956
```

14

```
            Peak
Jul  15   08:56:12
kVA     Pdmd - 0205.
kW       dmd - 0196.
kvar     dmd - 0025.
W/VA     dmd - 0.956
```

15

```
            Peak
Jul  15   08:51:20
kvar    Pdmd - 0025.
kW       dmd - 0196.
kVA      dmd - 0205.
W/VA     dmd - 0.956
```

16

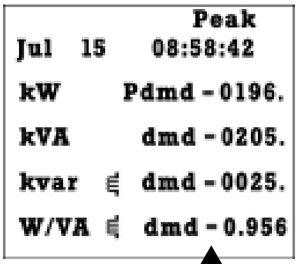
```
            Peak
Jul  15   08:44:34
kvar    Pdmd - 0001.
kW       dmd - 0098.
kVA      dmd - 0102.
W/VA     dmd - 0.961
```

PEAK VALUES

List of detected peak values (of average values)

7 Phase current 1, 2, 3 and neutral (purchase)
8 System active power (purchase). The following average values are also recorded together with this value: system apparent power, system reactive power (inductive or capacitive), ratio between active and apparent power (PF)
9 System apparent power (purchase). The following average values are also recorded together with this value: system active power, system reactive power (inductive or capacitive), ratio between active and apparent power (PF)
10 System reactive inductive power (purchase). The following average values are also recorded together with this value: system active power, system apparent power, ratio between active and apparent power (PF)
11 System reactive capacitive power (purchase). The following average values are also recorded together with this value: system active power, system apparent power, ratio between active and apparent power (PF)
12 See point 7 (sale)
13 See point 8 (sale)
14 See point 9 (sale)
15 See point 10 (sale)
16 See point 11 (sale)

5.4.2 Symbols



Some pages contain the following symbols.

The symbol indicates an inductive load; the symbol indicates a capacitive load.

The sign - indicates that the value refers to an exported unit (sale).

5.4.3 Page display

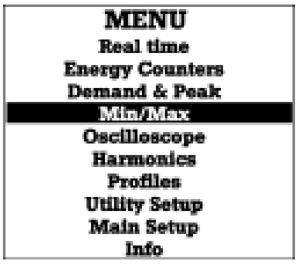
The values displayed in the DEMAND&PEAK section may change depending on the electrical connections (see chapter 7 of the Installation and Configuration Manual for the connections).
The table below shows the displayed values depending on the connection type.

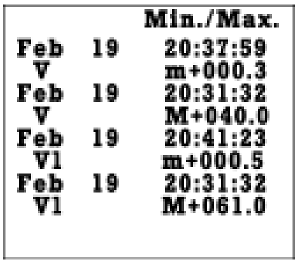
PAGE	DISPLAYED VARIABLES	3ph., 4 wires 3current trasnformers	3ph., 3 wires 3current trasnformers	3ph.,3 wires 2current trasnformers	3ph.,3 wires 1current trasnformer	3ph.,1 wire 3current trasnformers	1ph., 3 wires 2current trasnformers	1ph., 2 wires 1current trasnformer
A DMD	A_1, A_2, A_3, A_N	X						
	A_1, A_2, A_3		X	X				
	A_1, A_2, A_N						X	
W DMD	W, VA, W/VA	X	X	X	X	X	X	X
	A, var i, var c	X					X	X
	var i, var c		X	X	X	X		
A DMD PEAK	A_1, A_2, A_3, A_N	X						
	A_1, A_2, A_3		X	X				
	A_1, A_2, A_N						X	X (A_1)
W DMD PEAK	W, VA, var, W/VA	X	X	X	X	X	X	X
VA DMD PEAK	VA, W, var, W/VA	X	X	X	X	X	X	X
var DMD PEAK	var, W, VA, W/VA	X	X	X	X	X	X	X

5.4.4 Reset

The average values and peak values of average values can be separately reset. See section 5.9 for these operations.

5.5 Min / Max





The pages of this section display the minimum and maximum values detected by the instrument. Date and time are shown for all the available measurements

1 Press MENU ▶ and keep it pressed for at least 3 seconds. The main menu will be displayed.

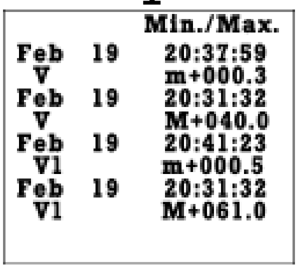
2 Move the highlight bar to MIN/MAX by means of the keys ⬇ ⬆ and press ↵.

3 When in the menu, press ⬇ or ⬆ to scroll the available pages.

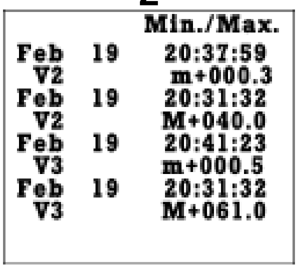
5.5.1 List of pages

The following list may vary depending on the connection scheme (see section 5.2.4). The sequence refers to a 3-phase, 4-wire, 3-current connection scheme, as shown when the key ⬆ is pressed for each display.

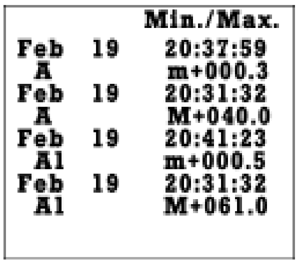
1

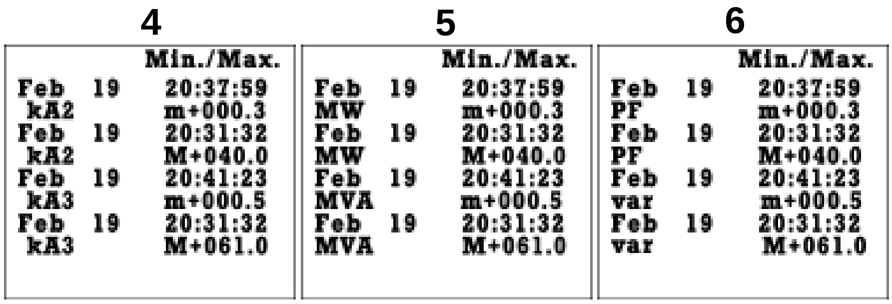


2



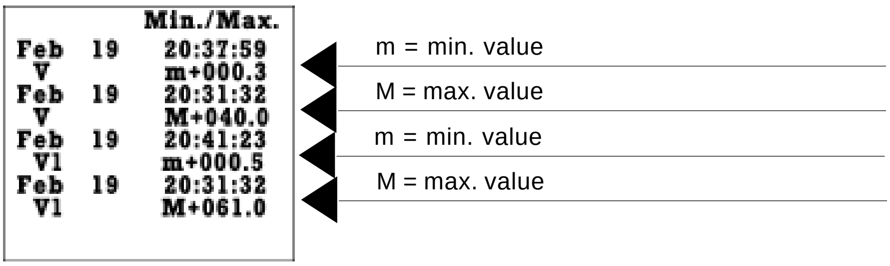
3





1 Minimum (m) and maximum (M) values of V and V1.
2 Minimum (m) and maximum (M) values of V_2 and V_3.
3 Minimum (m) and maximum (M) values of A and A_1.
4 Minimum (m) and maximum (M) values of A_2 and A_3.
5 Minimum (m) and maximum (M) values of W and VA.
6 Minimum (m) and maximum (M) values of PF and var.

5.5.2 Symbols



5.5.3 Page display

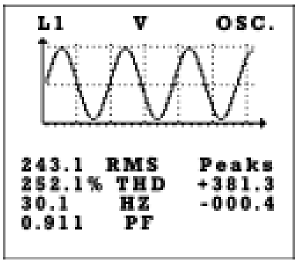
The values displayed in the MIN/MAX section may change depending on the electrical connections (see chapter 7 of the Installation and Configuration Manual for the connections).
The table below shows the displayed values depending on the connection type.

PAGE	DISPLAY VALUE	3 ph, 4 wires 3 current transformers	3 ph, 3 wires 3 current transformers	3 ph, 3 wires 2 current transformers	3 ph, 3 wires 1 current transformers	3 ph, 1 wire 3 current transformers	1 ph, 3 wires 2 current transformers	1 ph, 2 wires 1 current transformers
V, V_1	V, V_1	X					X	
	V		X	X	X	X		
	V_1							X
V_2, V_3	V_2, V_3	X						
	V_2						X	
A, A_1	A, A_1	X	X	X	X	X	X	
	A_1							X
A_2, A_3	A_2, A_3	X	X	X		X		
	A_2						X	
W, VA	W, VA	X	X	X	X	X	X	X
PF, Var	PF. Var	X	X	X	X	X	X	X

5.5.4 Zeroing

All minimum and maximum values can be zeroed.
See section 5.9 for this operation.
After zeroing the values, the instrument will show “—.-” till the next measurement different from 0 (zero).

5.6 Oscilloscope



The pages of this section graphically show the current and voltage waves of each phase (L1, L2, L3).

1 Press and keep it pressed for at least 3 seconds. The main menu will be displayed.

2 Move the highlight bar to OSCILLOSCOPE by means of the keys and press .

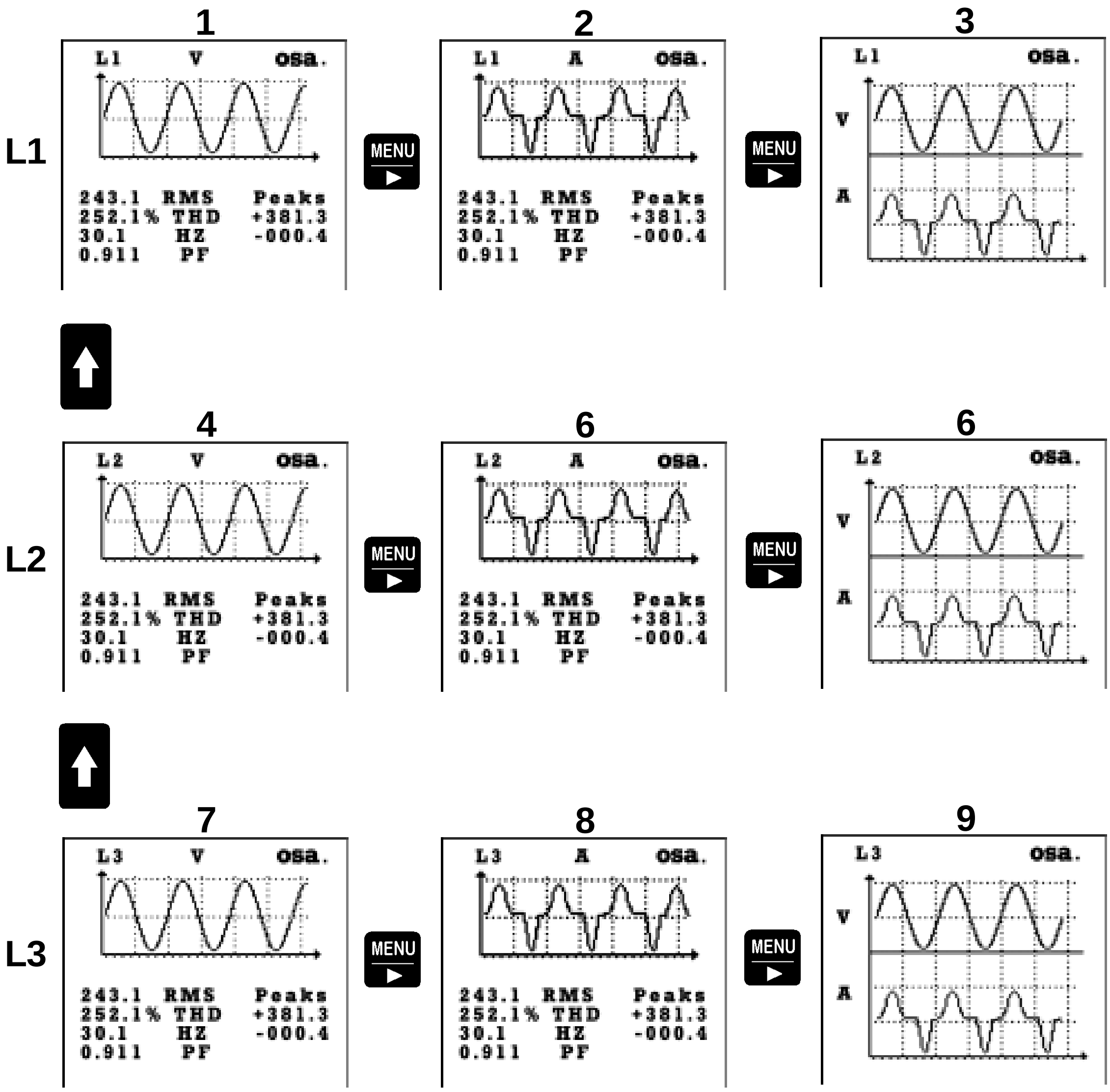
3 When in the menu, press or to scroll the available pages.

4 When inside a phase, press or to display the graphics.

5.6.1 List of pages

The following list may vary depending on the connection scheme (see section 5.2.4). The sequence refers to a 3-phase, 4-wire, 3-current connection scheme, as shown when the key is pressed for each display. Press or to display additional pages for each phase. The pages show the following data:

- graphics;
- RMS value (phase – neutral);
- THD;
- frequency;
- PF (Power factor)
- Min/max peaks;



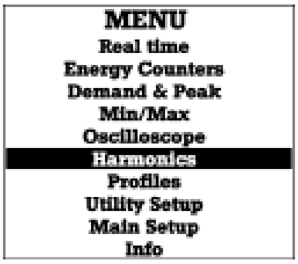
1 Graphic/numeric display of voltage, phase 1
2 Graphic/numeric display of current, phase 1
3 Graphic/numeric display of voltage/ current, phase 1
4 Graphic/numeric display of voltage, phase 2
5 Graphic/numeric display of current, phase 2
6 Graphic/numeric display of voltage/ current, phase 2
7 Graphic/numeric display of voltage, phase 3
8 Graphic/numeric display of current, phase 3
9 Graphic/numeric display of voltage/ current, phase 3

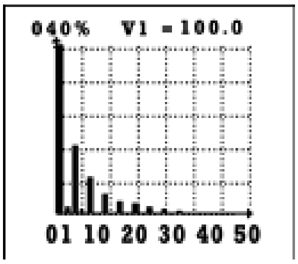
5.6.2 Page display

The values displayed in the OSCILLOSCOPE section may change depending on the electrical connections (see chapter 7 of the Installation and Configuration Manual for the connections).
The table below shows the displayed values depending on the connection type.

PAGE	DISPLAY VALUE	3 ph, 4 wires 3 current transformars	3 ph, 3 wires 3 current transformars	3 ph, 3 wires 2 current transformars	3 ph, 3 wires 1 current transformars	3 ph, 1 wire 3 current transformars	1 ph, 3 wires 2 current transformars	1 ph, 2 wires 1 current transformars
L1	V_1, A_1, V_1-A_1	X					X	X
	A_1		X	X	X	X		
L2	V_2, A_2, V_2-A_2	X					X	
	A_2		X			X		
L3	V_3, A_3, V_3-A_3	X						
	A_3		X	X		X		

5.7 Harmonics





The pages of this section show the current and voltage harmonic content.

1 Press and keep it pressed for at least 3 seconds. The main menu will be displayed.

2 Move the highlight bar to HARMONICS by means of the keys and press .

3 When in the menu, press or to scroll the available pages.

4 When in the display, press or to access the data pages.

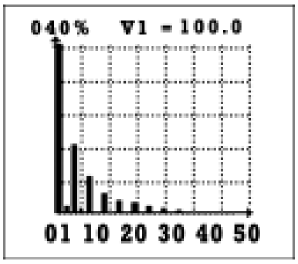
5.7.1 List of pages

The following list may vary depending on the connection scheme (see section 5.2.4). The sequence refers to a 3-phase, 4-wire, 3-current connection scheme, as shown when the key is pressed for each display.

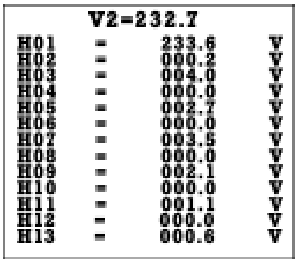
Pess or to display additional pages.

The instrument provides a percentage graphic or numeric display of the three voltage and current values, up to the 50th harmonics.
The numeric display pages show percentage or absolute values.

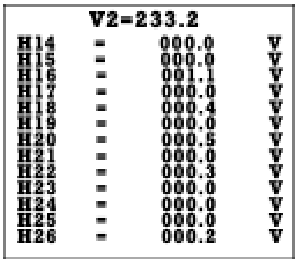
1



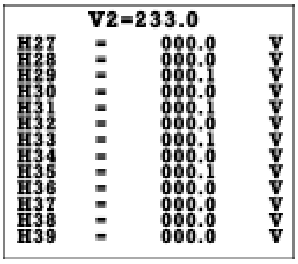
2



3



4

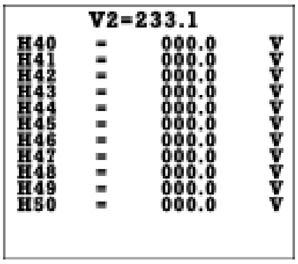


1 Graphic representation of harmonics. Three pages for voltage values (V1, V2, V3) and three pages for currents (I1, I2, I3).

2-3-4-5
Percentage values (from the 1st to the 50th harmonics)

6-7-8-9
Absolute values (from the 1st to the 50th harmonics)

5



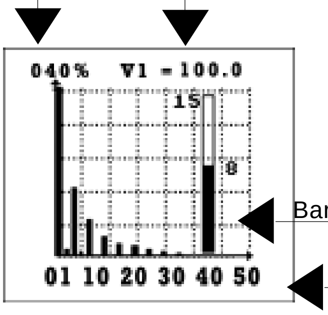
5.7.2 “Under limit” indication

The harmonic analysis is not performed when the voltage values are lower than the full scale values by 5% or if the current values are 0.5% lower.
The message “Under Limit” is shown in these cases.

5.7.3 Set-up of full scale

Percentage value of full scale

Displayed parameter and RMS value



Bar to setup the full scale

Harmonics no.

To set the full scale:

1 Press ↵ to display the bar showing the full scale percentage.

2 Press ↓ or ↑ to increase or decrease the full scale percentage (from 1 to 15%).

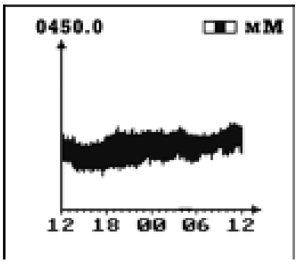
3 Press ↵ to confirm. The bar disappears and the new value is stored.

5.7.4 Page display

The data shown in the HARMONICS section may change depending on the electrical connections (see chapter 7 of the Installation and Configuration Manual for the connections).
The table below shows the displayed values depending on the connection type.

PAGE	DISPLAY VALUE	3 ph, 4 wires 3 current transformers	3 ph, 3 wires 3 current transformers	3 ph, 3 wires 2 current transformers	3 ph, 3 wires 1 current transformers	3 ph, 1 wire 3 current transformers	1 ph, 3 wires 2 current transformers	1 ph, 2 wires 1 current transformers
V_1	V_1	X					X	X
V_2	V_2	X					X	
V_3	V_3	X						
A_1	A_1	X	X	X	X	X	X	X
A_2	A_2	X	X			X	X	
A_3	A_3	X	X	X		X		

5.8 Profiles



The pages of this section show the histogram of the min/max values. The dates of the current and previous day can be displayed.

1 Press MENU ▶ and keep it pressed for at least 3 seconds. The main menu will be displayed.

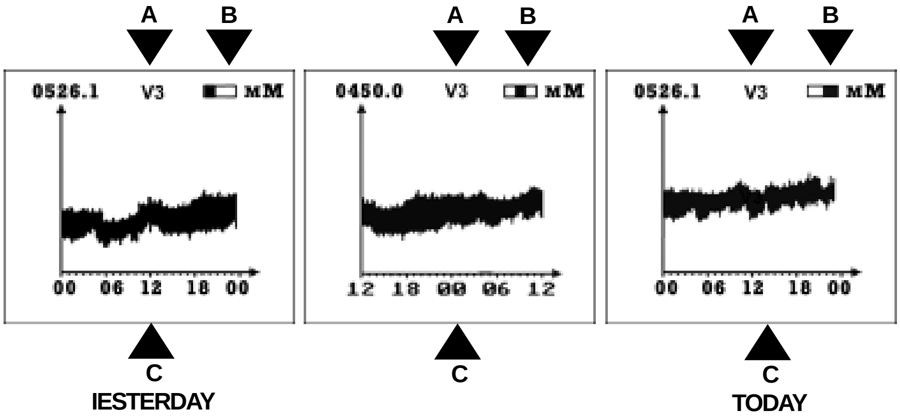
2 Move the highlight bar to PROFILES by means of the keys and press .

3 When in the menu, press or to scroll the available pages.

5.8.1 List of pages

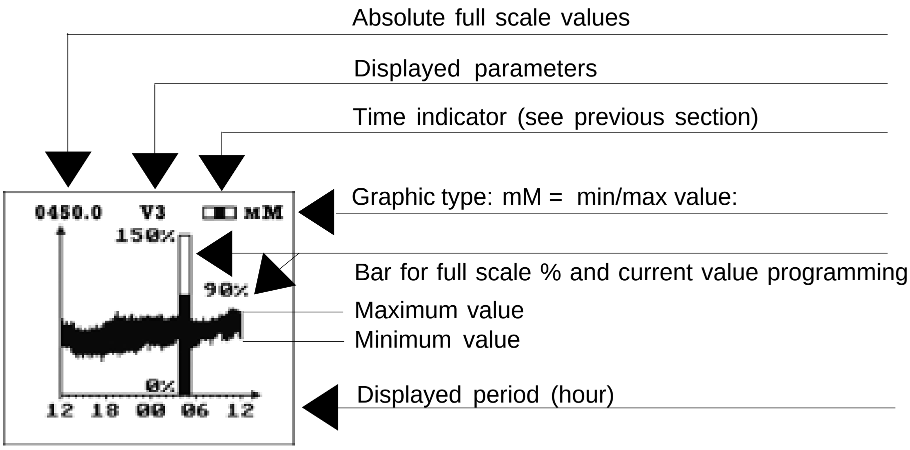
The following list may vary depending on the connection scheme (see section 5.2.4). The sequence refers to a 3-phase, 4-wire, 3-current connection scheme.

Press or to display the histogram of units **(A)**. Press ◀ MAIN or MENU ▶ to change the displayed time (24 hours) **(C)**. The indicator **(B)** on top of the page shows the displayed period.

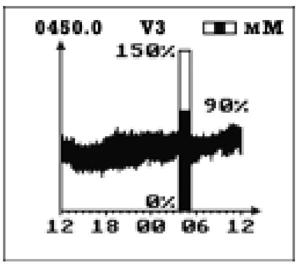


Value of **(A)**: **V, V1, V2, V3, A, A1, A2, A3, W, VA, PF, var**

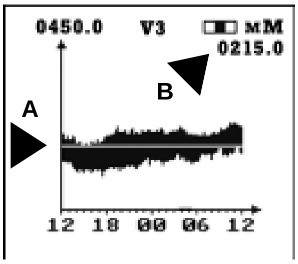
5.8.2 Page description



5.8.3 Set-up



1 Press ↵ to display the bar showing the full scale percentage.



2 Press or to increase or decrease the full scale percentage, respectively (from 1 to 15%).

3 Press to confirm. The bar disappears and the new value is stored. A horizontal cursor is displayed **(A)**.

4 Press or to change the position of the cursor **(A)** and show the corresponding absolute value **(B)**.

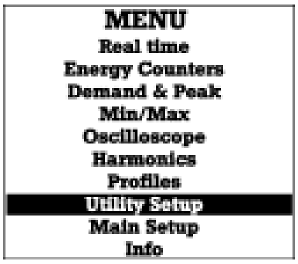
5.8.4 Page display

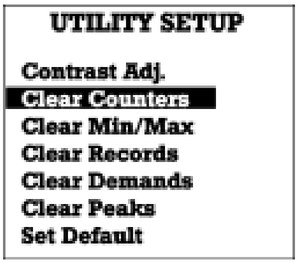
The displayed pages of the HISTOGRAM section may change depending on the electrical connection (see chapter 7 of the Installation and Configuration Manual for the connections).
The table below shows the displayed values depending on the connection type.

PAGE	DISPLAYED VARIABLES	3 ph., 4 wires 3 current trasnformers	3 ph., 3 wires 3 current trasnformers	3 ph., 3 wires 2 current trasnformers	3 ph., 3 wires 1 current trasnformer	3 ph., 1 wire 3 current trasnformers	1 ph., 3 wires 2 current trasnformers	1 ph., 2 wires 1 current trasnformer
V	Valore min/max di V	X	X	X	X	X	X	X
V_1	Valore min/max di V_1	X					X	
V_2	Valore min/max di V_2	X					X	
V_3	Valore min/max di V_3	X						
A	Valore min/max di A	X	X	X	X	X	X	X
A_1	Valore min/max di A_1	X	X	X	X	X	X	
A_2	Valore min/max di A_2	X	X	X		X	X	
A_3	Valore min/max di A_3	X	X	X		X		
W	Valore min/max di W	X	X	X	X	X	X	X
VA	Valore min/max di VA	X	X	X	X	X	X	X
PF	Valore min/max di PF	X	X	X	X	X	X	X
var	Valore min/max di var	X	X	X	X	X	X	X

5.9 Utility Setup

The pages of this section are accessed to adjust the contrast and reset.



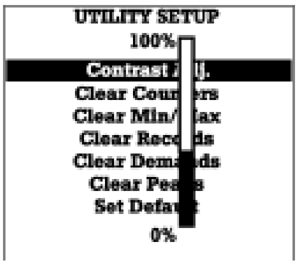


1 Press MENU ▶ and keep it pressed for at least 3 seconds. The main menu will be displayed.

2 Move the highlight bar to UTILITY SETUP of the keys and press .

3 Move the highlight bar to the requested menu by means of the keys and press .

5.9.1 Contrast adjustment

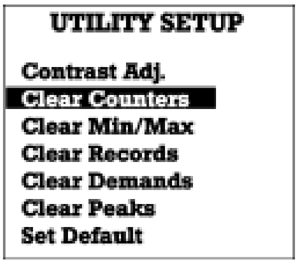


To adjust the display contrast, click on the space bar on CONTRAST ADJUSTMENT.

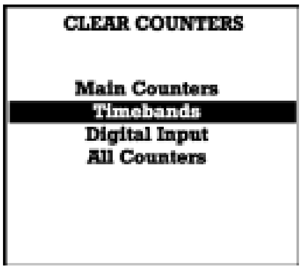
Press to decrease the contrast and, to increase it. Press to confirm.

5.9.2 Meter and counter reset

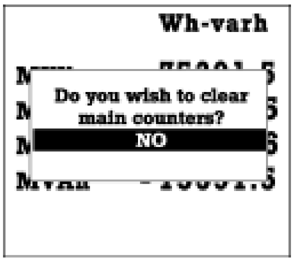
To reset the energy meters and the digital input counters (see section 5.3) follow the procedure below:

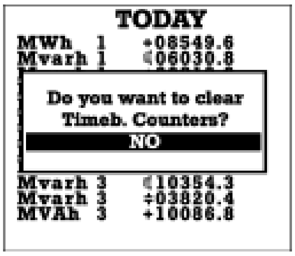


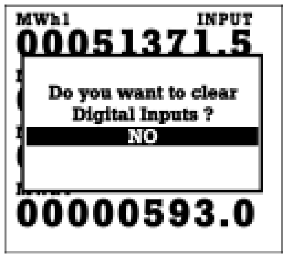
1 Move the highlight bar to CLEAR COUNTERS by means of the keys and press .

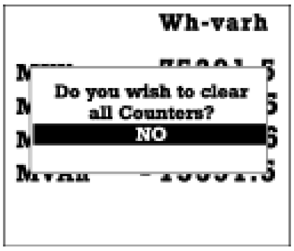


2 Move the highlight bar to the words which describe the counters to be reset by means of the keys (system counters, time periods, digital inputs, all). Press .



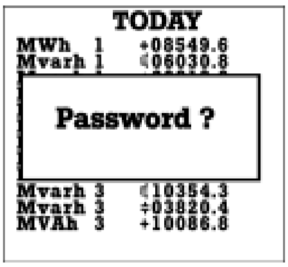






3 Regardless of the type of operation, the instrument will ask to confirm before resetting the counters ("NO" is the default answer. Press if you do not want to reset) .

To reset, select "YES" by means of the keys; then press to confirm.

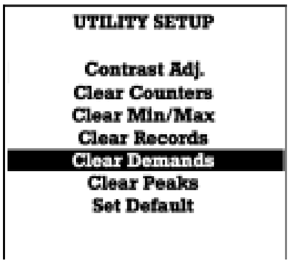


4 When the password is requested, press the keys simultaneously within 5 seconds. The counter will be reset.

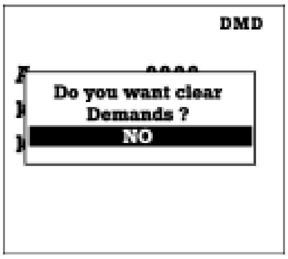
The figure shows the time period display.

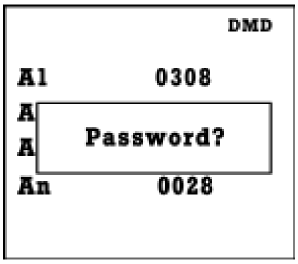
5.9.3 Clear Demands

To zero the average values of the main measurements (DEMAND, see section 5.4) follow the procedure below.



1 Move the highlight bar to CLEAR DEMANDS by means of the keys and press .



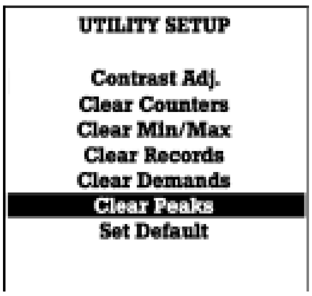


2 The instrument will ask to confirm before resetting (“NO” is the default answer. Press if you do not want to zero).

To reset, select “YES” by means of the keys , then press to confirm.

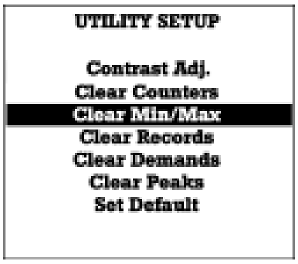
3 When the password is requested, press the keys MAIN MENU simultaneously within 5 seconds. The zeroing will be made.

5.9.4 Clear Peaks



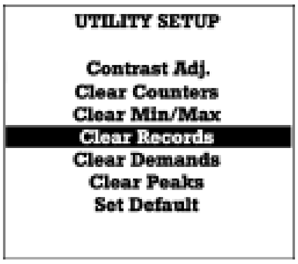
To zero the maximum values of the main measurements (PEAK, see section 5.4) follow the procedure described under section 5.9.3.

5.9.5 Clear Min/Max



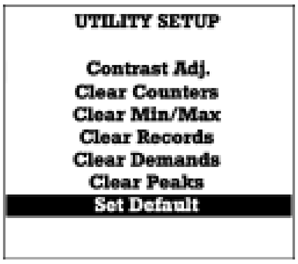
To zero the minimum and maximum values (MIN/MAX, see section 5.5) follow the procedure described under section 5.9.3.

5.9.6 Clear records



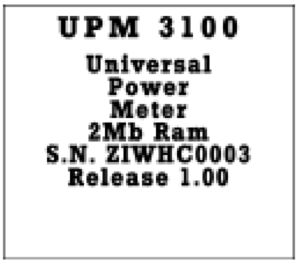
To zero the records, follow the procedure described under section 5.9.3.

5.9.7 Set default



Thanks to the initialisation, the default parameters of the instrument can be restored. Follow the procedure described under section 5.9.3.

5.10 Info



1 Press MENU ▶ and keep it pressed for at least 3 seconds. The Main Menu will be displayed.

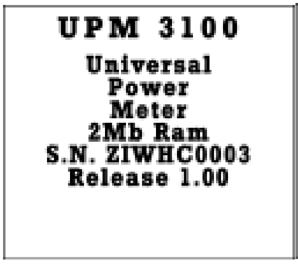
2 Move the highlight bar to INFO by means of the keys and press .

3 When in the menu, press or to scroll the available pages.

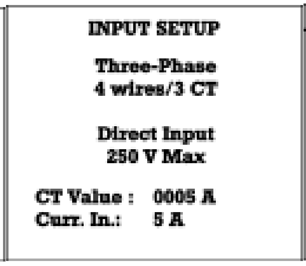
5.10.1 List of pages

The following list may change depending on the system configuration. The sequence is shown and displayed when the key is pressed.

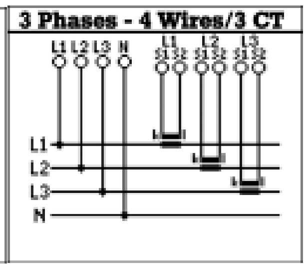
1



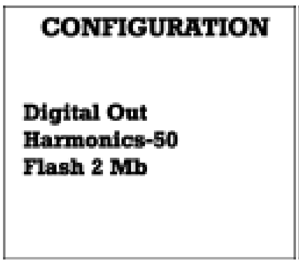
2



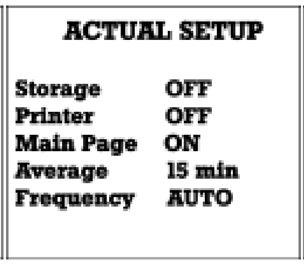
3



4

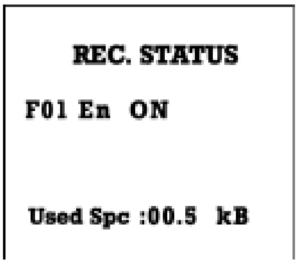


5



6

7

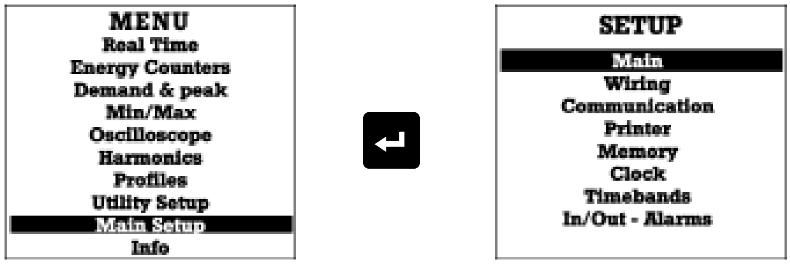


1 Identification data (instrument name, memory, serial number, firmware version)
2 Type of connection and ratios of voltmetric and amperometric transformers
3 Connection diagram
4 I/O configuration (available options)
5 Programmed functions
6 Date, time and day of the week
7 Information on programmed recording

If the CPU2 is installed, an additional page providing information on the programmed recording is also available (VDROP-VMAX options).

6. Main Setup menu

Access the Main Setup menu from the Main Menu by moving the highlight bar to MAIN SETUP and pressing ↵.



NOTE

When the Main Setup menu is entered, the instrument stops the measurement, recording, calculation and communication processes. The outputs, if any, remain in the status they were in before entering the programming mode.
The Manual refers to the complete instrument version. Some displays may not be shown is the instrument was purchased without including some functions.

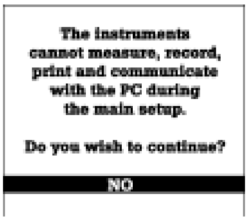
See the section below for the methods to enter or quit the Main Setup menu.

1	MAIN	Section 6.3
2	WIRING	Chapter 8.9 Installation Manual
3	COMMUNICATION	Section 6.4
4	PRINTER	Manual of the LPR40 printer
5	MEMORY	Section 6.5
6	CLOCK	Chapter 8.8 Installation Manual
7	TIMEBANDS	Chapter 6.6
8	IN/OUT-ALARMS	Chapter 8.11 Installation Manual + I/O Options Manual

6.1 Access to and quitting the Main Setup menu

6.1.1 Access

The procedure described in this section must be performed whenever access to the Main Setup menu is needed.



1 Recall the Main Menu by pressing for at least 3 seconds.

2 Press or until Main Setup is selected. Press to confirm.

When the password is requested press simultaneously.

The warning shown in the previous picture is displayed whenever the Main Setup menu is accessed.
When this function is entered, printing and communication with the PC are inhibited.

3 Press **or** to select **YES**.

To confirm press **.**

6.1.2 Quit

To quit the Main Setup menu, press MENU ▶ for at least 3 seconds. A page requesting confirmation will be displayed.

The following options are available:

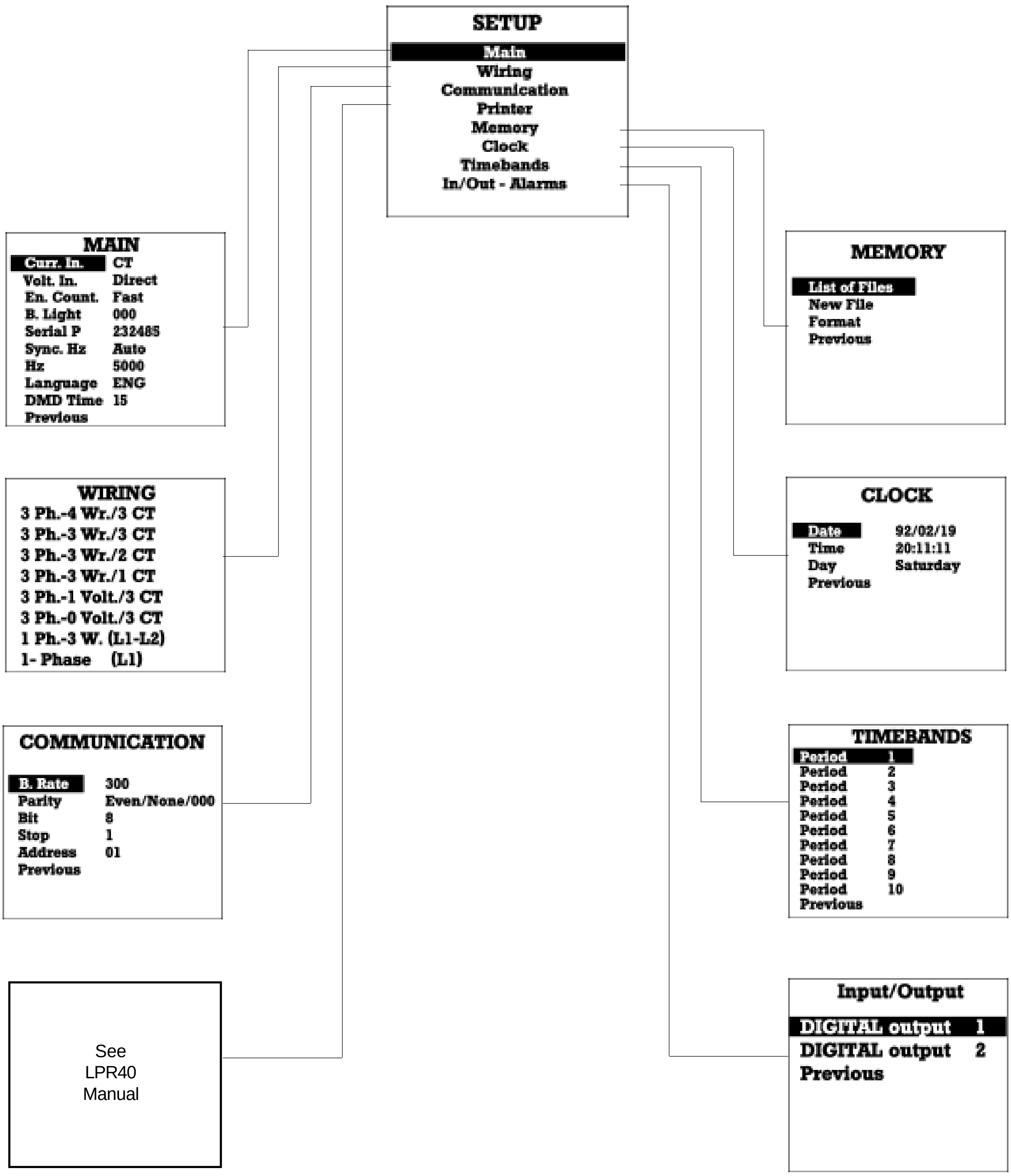
YES to confirm, save and quit programming. This is the default option. To confirm press ↵ .
NO to quit without saving and exit the Main Setup menu.
CONTINUE to remain in the Main Setup menu.

To choose NO or CONTINUE, press ⬇ or ⬆ and ↵ to confirm.

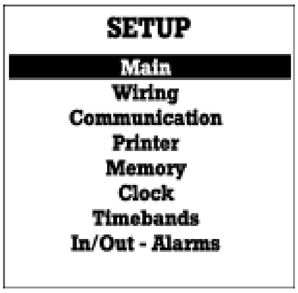
6.2 Page layout

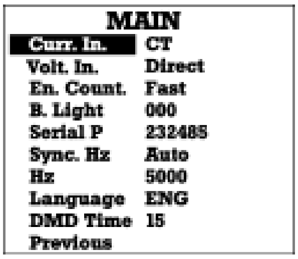
The following page shows the structure of the Main Setup menu. To enter any page, move the cursor to the corresponding page and press ↵ .

Main Setup Menu



6.3 Main





The pages in this section show some instrument set-up data.

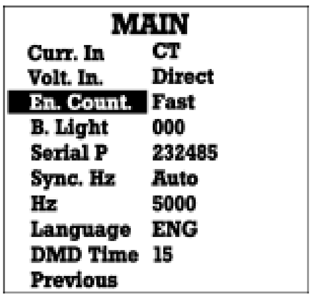
1 In the Main Setup menu, move the highlight bar to MAIN and press .

2 To scroll the items, press or .

NOTE

Some items of the Main Menu (Curr.In, Volt.In., B.Light, SerialP, Language) are not described in the following paragraphs because they are dealt with in the Installation and Configuration Manual.

6.3.1 Energy counters



The item En. Count. is used to change the meter resolution.

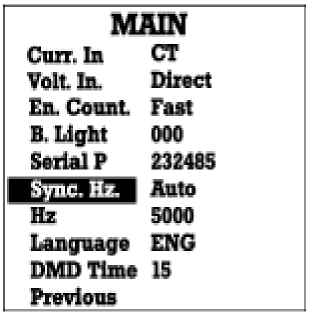
Move the highlight bar as shown in the picture, press to enable, change, or confirm the selection . The following options are available:

Vel. High resolution. Small quantities of energy update the meter. In max. consumption mode, the meter is completed in 6 days. Suitable to measure consumption over short periods.

Len. Standard resolution. The meter is updated more slowly than in the "Vel" option. The meter is completed in 20 months. Suitable to measure consumption over long periods.

The parameter **EN. COUNT.** does not influence the performance of the totalizers divided per time period and does not affect the counters of digital input pulses (optional).

6.3.2 Synchronisation mode



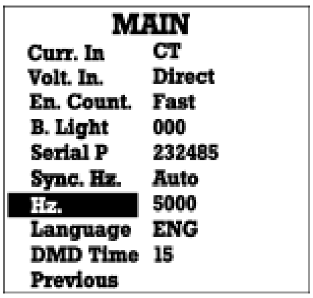
The item **Sync.Hz.** (Synchronisation) is used to set the line frequency synchronisation mode.

Move the highlight bar as shown in the picture; press to enable, change or confirm the selection The following options are available:

Auto when the frequency and voltage values are within the measurement range, the instrument is automatically linked with the frequency of the line power measured on the L1 line. When these values are out of the measurement range, the FIXED value, described in the next section, is used. This option guarantees a more stable measurement of the measured parameters.

Fixed The frequency is set at a fixed value (see next section).

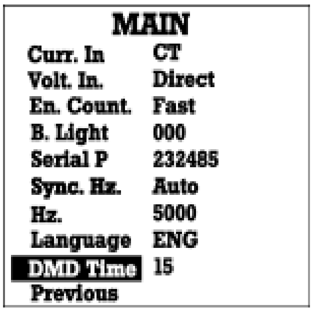
6.3.3 Synchronisation frequency



The item **Hz** (Frequency) is used to set the synchronisation frequency value (see previous paragraph).

Move the highlight bar as shown in the picture; press to enable the selection, or move the cursor, or change the value , or confirm it.

6.3.4 Average power integration time (DMD Time)

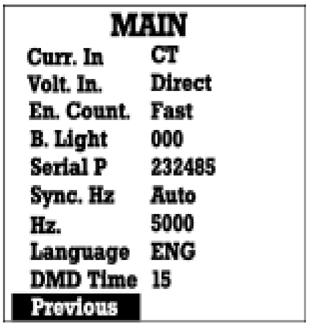


The item **DMD Time** (Average power integration time) is used to set the calculation time for the displayed average values (“Demand”).

Move the highlight bar as shown in the picture; press to enable, change, or confirm the selection. The following options are available: 1, 5, 10, 15, 30, 60 minutes

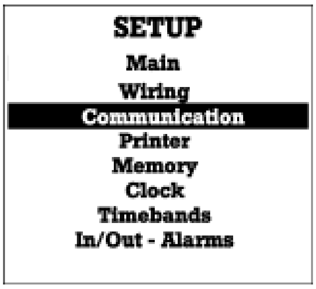
NOTE

These values are reset when the instrument is switched on, when quitting the Main Setup menu and after programming the operating parameters by means of the PC software. To obtain real average values, wait for a period as long as the programmed time. The values are updated at the end of the programmed integration time.



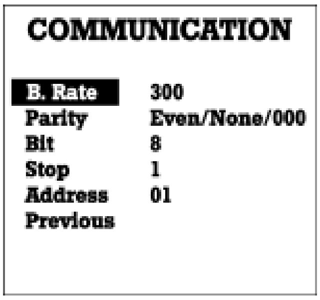
To go back to the Main Setup menu, move the highlight bar to PREVIOUS and press .

6.4 Communication



The communication parameters of the instrument serial port are set in this section.

1 In the Main Setup menu, move the highlight bar to COMMUNICATION and press .



2 To scroll the items press or

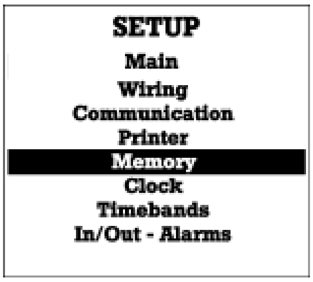
3 To change a parameter, press , or to confirm.

B. Rate (Baud Rate)
Communication speed on the serial line (300, 600, 1200, 2400, 4800, 9600, 19200, 38400).

NOTE
The IR port must be se at a speed of 9600 to 38400 baud.

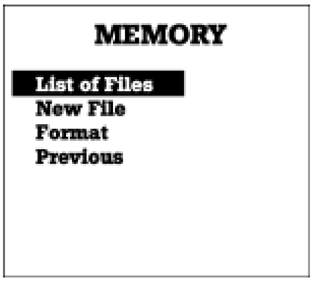
Parity
Parity generation (none, even, odd)
Bit
Data bit number (8 fixed).
Stop
Stop bit number (1 fixed).
Address
Logic number assigned to the instrument for the enquiry (hexadecimal, from 01 to FF).
Previous
Returns to the Main Setup menu.

6.5 Memory



This section is used to manage the file storage in the instrument memory.

1 In the Main Setup menu, move the highlight bar to MEMORY and press .



2 To scroll the menu items, press or .

3 To enter the menus press .

6.5.1 Save mode

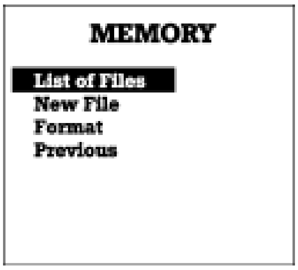
The instrument saves the data into files. The recording stops when the memory is full.

4 different save processes can be programmed simultaneously (see table below), without downloading the data, and up to 10 measurement campaigns can be executed.

The recording can be programmed according to the start/stop date and time and the number of variables to be stored.

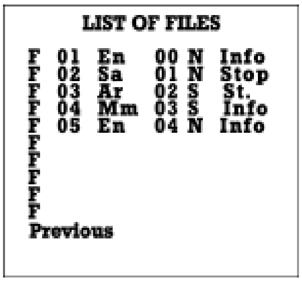
TYPE OF RECORDING	FREQUENCY OR INTEGRATION TIME	CONTINUOS START/STOP RECORDING	RECORDED UNIT
AVERAGE POWER	Programmable: 1, 5, 10, 15, 30, 60 minutes	Programmable	Programmable options: Active, Reactive Inductive, Reactive Capacitive, Apparent (PURCHASE/SALE)
MINIMUM/ MAXIMUM	Programmable: from 1 to 9999 minutes	Programmable	Programmable options: V; V_{L1-N}; V_{L2-N}; V_{L3-N}; I; I_{L1}; I_{L2}; I_{L3}; P; S; PF; Q
SAMPLES	Programmable: from 1 to 9999 secondes	Programmable	Programmable options: V; V_{L1-N}; V_{L2-N}; V_{L3-N}; V_{L1-L2}; V_{L2-L3}; V_{L3-L1}; I; I_{L1}; I_{L2}; I_{L3}; I_N; PF; PF_{L1}; PF_{L2}; PF_{L3}; Cosø$_{L1}$; Cosø$_{L2}$; Cosø$_{L3}$; S; S_{L1}; S_{L2}; S_{L3}; P; P_{L1}; P_{L2}; P_{L3}; Q; Q_{L1}; Q_{L2}; Q_{L3}; F; THD-V_{L1-N}; THD-V_{L2-N}; THD-V_{L3-N}; THD-I_{L1}; THD-I_{L2}; THD-I_{L3};
HARMONICS	Programmable: 1, 5, 10, 15, 30, 60 minutes	Programmable	Programmable options: V_{L1-N}; V_{L2-N}; V_{L3-N}; I_{L1}; I_{L2}; I_{L3}

6.5.2 File list



This section is used to manage the stored files, delete them or to control the start, stop, information and reset.

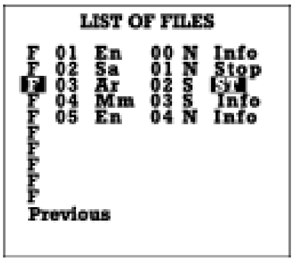
Move the highlight bar as shown in the picture and press ↵ .

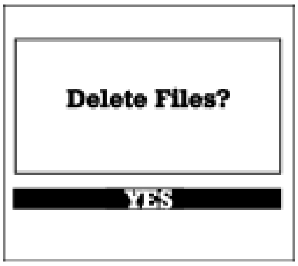


The page shows the stored files; each one contains:
- reference name (e.g.: F 01);
- stored data type (En=average power/ energy, Sa=Samples, Ar=Harmonics, Mm=Min/Max);
- file reference logic number (e.g.: 00);
- recording state (Yes/No/Wait);

Press the key ↵ or scroll the options (Info, Stop etc.)

↓ or ↑ to:

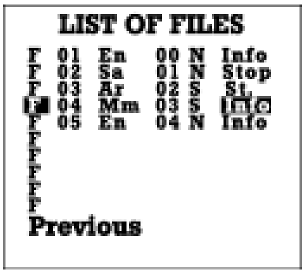


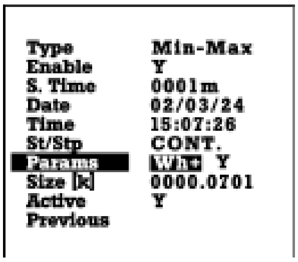


Stop
Stop recording;
St
Discontinue recording;
Del
Free up some memory space by deleting the file; the confirmation window is shown before deleting the file (see picture to the side)
Info
Obtain information on the data stored in the file; the window described in the next section is shown.
Can
Make no changes and return to the file list.

> **NOTE**
> **For each recording type, only one file can be in St. state.**

6.5.3 File information





Information on the storage file can be obtained through the **Info** function. For access to it, see the previous section.

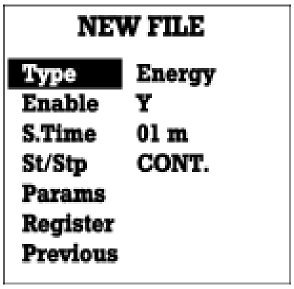
Type
Type of data stored in the file;
Enable
Recording state (enabled, disabled);
S. Time
Time between two consecutive recordings;
Date
File creation date;
Time
File creation time;
St./Stp
Recording frequency:
CONT.= continuous,
CLOCK= the period is defined in the Start/Stop window.

Params

Yes/No indicates the recording state of the indicated variable; to scroll the available variables, press then or

Size
File size;
Active
Current file use (S= recording , N= not recording);
Previous
Returns to the FILE LIST page.

6.5.4 New file



This section is used to create a new data storage file. Up to 10 files can be created.

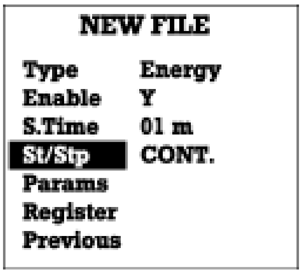
Move the highlight bar as shown in the picture and press .

Type
Selects the type of data to be stored: En.(average power), Min/Max, Harmonics, Samples;
Enable
Enables / disables the recording;
S. Time
Sets the interval between two consecutive recordings.
Average and harmonic power: 5, 10, 15, 30, 60 min
Samples: from 0000 to 9999 sec.
Min/Max: from 0000 to 9999 min.
St/Stp (Storage interval):
CONT.= continuous;
CLOCK = time interval defined in the Start/ Stop window (see figure to the side and next paragraph).
Params
All selectable values are listed.

Press or to scroll the available parameters, press MAIN or MENU to enable or disable the recording (YES/NO).

Register
Saves the new file and goes back to the MEMORY page.
Previous
Returns to the MEMORY page without saving the new file.

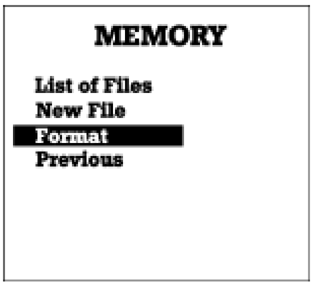
6.5.5 Start/Stop



To enable this function, set the recording interval (start/stop, see previous paragraph) on CLOCK.
It is used to define the recording start and stop date and time.

St = Recording start
Stp = Recording stop
Date and time
(Date format: yy/mm/dd).
(Time format: hh:mm:ss).
Previous
Returns to the NEW FILE page.

6.5.6 Formatting



This function is use to delete all memory data. The following message is displayed during formatting: WAIT…. FORMATTING.

6.6 Timebands

SETUP
Main
Wiring
Communication
Printer
Memory
Clock
Timebands
In/Out - Alarms

This section is used to program the periods into which energy consumption is divided.

1 In the Main Setup menu, move the highlight bar to TIMEBANDS and press .

TIMEBANDS

Period	1
Period	2
Period	3
Period	4
Period	5
Period	6
Period	7
Period	8
Period	9
Period	10
Previous	

2 To go to the periods press or

3 To access the period press .

PERIOD 1

Time	1	10:00	0
Time	2	00:00	0
Time	3	00:00	0
Time	4	00:00	0
Time	5	00:00	0
Time	6	00:00	0
Time	7	00:00	0
Time	8	00:00	0
Day		Mon	NO
Month		Jan	NO
Previous			

Up to 10 periods of the year can be programmed.
Up to 8 different daily rates can be programmed for each period. This programme can be linked with different days of the week and months of the year (see the example in the next paragraph).

Time 1...8

Defines the beginning of one or more rate periods in one day (hours:minutes). Up to 8 different rates can be set.

To go to various options, press or .

To make any changes, press .

To move the cursor to the number press or . To change it press or . To confirm press .

The last column on the RH-side is used to set three different periods: **0, 1, 2, 3.** Enter "0" to end the daily programming; no one of the values entered in the following lines will be recognised.

Day

To change it press .

Press or to select the day of the week.

Press or to include or exclude (YES/NO) the displayed day in the period.

The days that are not selected in any period are automatically assumed as 24 hours, period 3.

Month

To change it press .

Press or to select the month.

Press or to include or exclude (YES/NO) the displayed month in the period.

The months that are not selected in any period are automatically assumed as having all days in period 3.

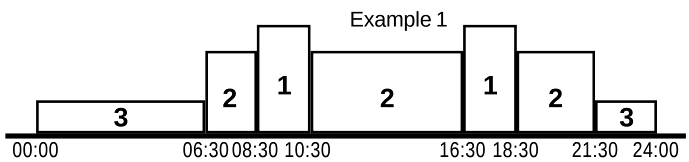
> **NOTE**
> **If the same day or same month are selected in two different periods by mistake, the instrument will retain the programming of the period with the lower number.**

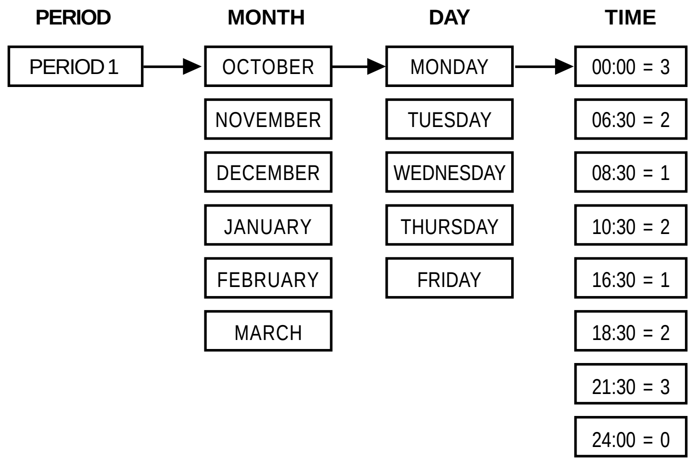
Previous

Goes back to the Main Setup menu.

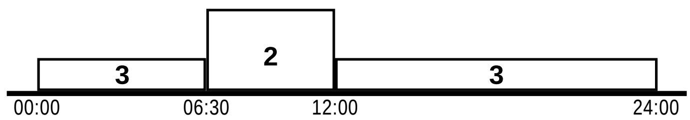
6.6.1 Example of time period programming

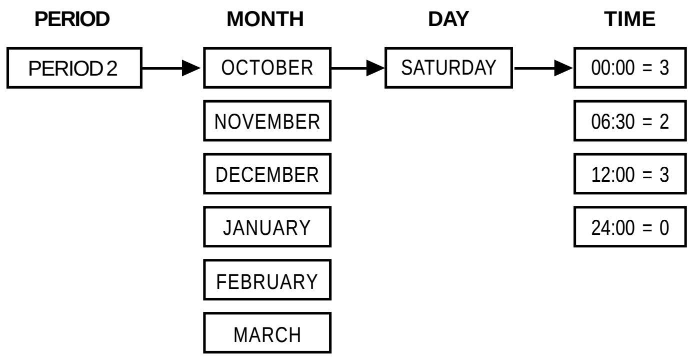
The following example *(Example 1)* shows how to program the time periods from October to March.





Example 2





The following table, related to the example 2, summarises the program.

Period	Days	Rates
1	from Monday to Friday	1-2-3
2	Saturday	2-3
	Sunday (not program.)	3 (auto)

7. Technical features

7.1 Available versions

The instrument can be supplied configured as shown in the following table:

CONFIGURATION AND OPTIONS	
Serial interface RS232 / RS485	■
Power supply 85-250VAC (90-250VDC)	■
Power supply 19-60VDC	○
Optional slots	4
Digital Outputs (2 outputs are always present) *	○
Digital Input *	○
Analog Output *	○
External Analog output *	○
Ethernet	○
Lonbus *	○
Profibus *	○
Protocollo Modbus	■
Oscilloscope / Histogram	■
Harmonic analysis (50)	■
WFR (14 ... 500Hz)	○
VDROP	○
V MAX	○
Printer LPR40	○

■ - AVAILABLE ○ - OPTIONAL

* max. 4 options

7.2 Technical data

Auxiliary supply voltage
85 ÷ 250 VAC 50 / 60 Hz or 90 ÷ 250 VDC (19 ÷ 60 VDC upon request).
Max. repetitive voltage: 300VAC.
Max. non-repetitive peak voltage: 320VAC (20 msec).
Consumption: 6 ÷ 12VA (according to the installed options) .
Fuse: type T, 315mA (to be mounted externally).

Safety conditions
The instrument was manufactured and tested in compliance with the CEI EN61010-1 (1993) regulations and relevant amendments, CEI EN61010-1/A2 (1995) and UL 61010A-1 (2002), for working voltage up to 750 VAC rms.
Overvoltage category : III
Polluting level : 2

Voltmetric inputs
Voltage: 750 VAC max L-L
Max continuous overload:
1000Vrms L-L o L-N
600Vrms L- ⏚
Max acceptable peak:
2kVrms L-L o L-N (1sec)
1kVrms L- ⏚
Input impedance: > 1,3 MOhm
Load: max 0.15 VA per phase @ F.S.

Current input
Current: 1A or 5 A, programmable
Min / Max measurable current: 20mA / 7A
Max overload: 10A continuous, 100A for 1 sec.
Input impedance: approx. 0.02 Ohm
Load: Max 0.05VA per phase
Insulation: Max. 150Vrms between phases

Instrument precision
Voltage: ±0.2% reading ±0.05% full scale
Current: ±0.2% reading ±0.1% full scale
Powers: ±1% reading ±0.1% full scale (PF=1)
Power factor: 1% reading (0.5 inductive ÷ 0.8 capacitive)
Active energies: 1.5% reading (0.5 inductive ÷ 0.8 capacitive)
Frequency: ±0.05% reading ±2digit from 45 to 65Hz
Harmonic analysis: 0.5% (with measured harmonic component above 3% and input voltage and current above 10% of scale bottom).

Measurement range
Automatic frequency linking when the measurement frequency is comprised between 45 and 65 Hz (V_{L1-N} min. 10V).
A fixed value can be manually set (between 45 and 65 Hz).
Thanks to the WFR option, the measurement range is expanded to: 14-500Hz.

Measurement method
32 samplings per period for 8 periods; total: 256 samplings per measure (sampling frequency at 50 Hz: 1.6 kHz).
Harmonic analysis: carried out up to the 50th harmonics by means of the FFT method, simultaneously on 3 voltages and 3 currents.
Measurement frequency: 1 second (10 seconds for harmonics and THD).
Recording frequency: programmable.

Serial output
RS232 / 485 / switch-selectable PRINTER.
Baud rate programmable up to 38400.
Protocol: standard ASCII(Modbus upon request).

IR port
Baud rate programmable from 9600 to 38400.
Half duplex
Max. allowed distance: 1m.
Optical range ±15° (minimum), ±30° (maximum).

Input/output
The instrument has two digital outputs.
The optional parts include modules that can be easily installed on the back. Four slots are available for the installation of optional parts.
Each module is composed of:

N° 4	Isolated digital inputs for voltage-free contacts.
N° 2 / 4	Opto-insulated outputs for threshold alarms or pulse transmission.
N° 2	0-20 or 4-20mA active analog inputs, galvanic isolation.

Display
Backlit LCD graphic display, 128x128. Working life of background lighting: > 100.000 ore.

Keypad
5 keys on the front panel.

Data recording
RAM 2MB. The following data can be saved:
- instantaneous values;
- min./max. values;
- harmonic content;
- average power.

Data recording without power supply
The calibration and programming parameters are saved in the memory for an unlimited period of time.

Clock
Precision: ±5 sec. / day at 25°C (powered).
Information retaining time: 30 days
Automatic adjustment to leap years.

Programmable parameters
The instrument calibration and programming parameters are saved in an EEPROM-type non volatile memory.
The data are retained in the instrument, even if not switched on for 40 years.

Environmental conditions
Working temperature: from -10°C to +60 °C (from 14 to 140 °F).
Storage temperature: from - 20° to +75°C (from - 4 to 167 °F).
Working humidity: Max. 80%, non condensing for a temperature up to a 31°C (87.8 °F); linear decrease up to 40°C (104 °F).
Altitude: up to 2000m

Sizes
Casing 144 x 144 x 118 mm.

Weight
About 1500 g.

7.2.1 Electromagnetic compatibility

Immunity: as per EN50082-2
- Electrostatic discharges (as per EN 61000-4-2)
  8kV in air - level 3
  4kV, contact - level 2
- Irradiated electromagnetic field (as per EN 61000-4-3)
  10 V/m - level 3
- Transients (as per EN 61000-4-4)
  2kV - level 3
- Ridge (as per EN 61000-4-5)
  1/2kV - 1,2/50µs

Emission: as per EN 50081-2
- Radiated EN55011
  class A – group 1
- Mains EN55011
  class A – group 1

7.3 Performed measurements

TYPE OF MEASUREMENT	UNIT'	SUPPLIED
PHASE VOLTAGE (rms)	V_{L1-N} - V_{L2-N} - V_{L3-N} [V]	■
LINE VOLTAGE	V_{L1-L2} - V_{L2-L3} - V_{L3-L1} [V]	■
SYSTEM VOLTAGE	V [V]	■
LINE CURRENT	I_{L1} - I_{L2} - I_{L3} - I_N [A]	■
SYSTEM CURRENT	I [A]	■
POWER FACTOR	PF_{L1} - PF_{L2} - PF_{L3}	■
SYSTEM POWER FACTOR	PF	■
COS Ø	DPF_{L1} - DPF_{L2} - DPF_{L3}	■
APPARENT POWER	S_{L1} - S_{L2} - S_{L3} [VA]	■
APPARENT SYSTEM POWER	S [VA]	■
ACTIVE POWER	P_{L1} - P_{L2} - P_{L3} [W]	■
ACTIVE SYSTEM POWER	P [W]	■
REACTIVE POWER	Q_{L1} - Q_{L2} - Q_{L3} [var]	■
REACTIVE SYSTEM POWER	Q [var]	■
FREQUENCY	f [Hz]	■
ACTIVE SYSTEM ENERGY (INPUT)	Wh	■
APPARENT SYSTEM ENERGY (INPUT)	VAh	■
INDUCTIVE REACTIVE SYSTEM ENERGY (INPUT)	varh ind	■
CAPACITIVE REACTIVE SYSTEM ENERGY (INPUT)	varh cap	■
ACTIVE SYSTEM ENERGY (OUTPUT)	Wh	■
APPARENT SYSTEM ENERGY (OUTPUT)	VAh	■
INDUCTIVE REACTIVE SYSTEM ENERGY (OUTPUT)	varh ind	■
CAPACITIVE REACTIVE SYSTEM ENERGY (OUTPUT)	varh cap	■
AVERAGE VALUES (OR PEAK)	I - $V_{L1/L2/L3/N}$ - P - S - Q - PF	■
MIN/MAX VALUES	V - $V_{L1-N/L2-N/L3-N}$ - I - $I_{L1/L2/L3}$ P - S - PF - P_{AV}	■
INDEX OF VOLTAGE HARMONIC DISTORTION	THD_{L1} - THD_{L2} - THD_{L3} [%]	■
INDEX OF CURRENT HARMONIC DISTORTION	THD_{L1} - THD_{L2} - THD_{L3} [%]	■
FFT ANALYSIS		■
TIME PERIODS	Wh-VAh-varh ind-varh cap	■

■ - AVAILABLE ○ - OPTIONAL

7.4 Formulas

PHASE VOLTAGE	**3-PHASE SYSTEM VOLTAGE**
$V_{L1-N} = \sqrt{\frac{1}{n} * \sum_{j=1}^{n} (v_{L1-N})_j^2}$	$V = \frac{V_{L1-L2} + V_{L2-L3} + V_{L3-L1}}{3}$
LINE VOLTAGE	
$V_{L1-L2} = \sqrt{\frac{1}{n} * \sum_{j=1}^{n} ((v_{L1-N})_j - (v_{L2-N})_j)^2}$	
LINE CURRENT	**3-PHASE SYSTEM VOLTAGE**
$I_{L1} = \sqrt{\frac{1}{n} * \sum_{j=1}^{n} (i_{L1})_j^2}$	$I = \frac{I_{L1} + I_{L2} + I_{L3}}{3}$
NEUTRAL CURRENT	
$I_N = \sqrt{\frac{1}{n} * \sum_{j=1}^{n} ((i_{L1})_j + (i_{L2})_j + (i_{L3})_j)^2}$	
ACTIVE POWER	**3-PH. SYSTEM ACTIVE POWER**
$P_{L1} = \frac{1}{n} * \sum_{j=1}^{n} (v_{L1-N})_j * (i_{L1})_j$	$P = P_{L1} + P_{L2} + P_{L3}$
REACTIVE POWER	**3-PH. SYST. REACTIVE POWER**
$Q_{L1} = \frac{1}{n} * \sum_{j=1}^{n} (v_{L1-N})_j * (i_{L1})_{j-\frac{n}{4}}$	$Q = Q_{L1} + Q_{L2} + Q_{L3}$
APPARENT POWER	**3-PH. SYST. APPAR. POWER**
$S_{L1} = V_{L1-N} * I_{L1}$	$S = \sqrt{3} * V * I$
POWER FACTOR	**3-PH. SYST. POWER FACTOR**
$PF_{L1} = \frac{P_{L1}}{S_{L1}}$	$PF = \frac{P}{S}$

7.5 Functions available upon request

7.5.1 Communication protocol

For communication through standard RS232/485 interface, the instrument is supplied with a customised protocol.
The MODBUS protocol is also available and must be specified in the order.
The instrument can also be integrated in ETHERNET, LONBUS or PROFIBUS networks by means of optional communication cards.

7.5.2 Power supply

The standard instrument can be connected to 65 to 250 VAC or 90 to 250VDC mains; no operations are needed to change the voltage.
Upon request, the instrument can be equipped with a 19 to 60 VDC power supply.

7.5.3 Voltage drops

Thanks to the VDROP option, the instrument is capable of continuously monitoring the three voltage values with a 10 ms resolution. The detected data are compared with the set threshold values and saved together with the date and time of the event.
Thanks to the DEDALO software (see next paragraph) the data can be statistically analysed, in compliance with EN50160 norms on energy quality.

7.5.4 Minimum, avarage and maximum values

The MIN/MED/MAX function calculates the minimum, average and maximum values of 10 variables chosen among the ones that the instrument can measure, thanks to a continuous sampling procedure. These values are stored in the CPU2 RAM.
Thanks to the DEDALO software (se next paragraph) the data can be statistically analysed, in compliance with EN50160 norms on energy quality.

7.5.5 LPR40 Printer

The LPR40 allows the instrument to print the detected data. The operation can be manual or automatic (for further details, please refer to the LPR40 documentation).

The printer can also be set from the instrument keypad. Graphic, numeric or histogram prints can be made.
In automatic mode the print start and stop time and the requested frequency can be pre-set.

7.6 Software

7.6.1 Wintool

The Wintool software is provided free of charge.
Connect the instrument to the PC serial port for the software to carry out the following operations:

- numeric display of the instantaneous values measured by the instrument;
- instrument programming;
- transfer the text files recorded on CPU2 (VDROP and MIN/MED/MAX) to the PC.

7.6.2 Dedalo SP

The DEDALO SP software is available in 4 different versions; it expands WINTOOL functions and adds some new ones.

	Istantaneous	Programming	Transfer	Print	Alarms	Modem	Recording on file	Graphic analysis	File export
DEDALO SP	✓	✓	✓						
DEDALO SP P	✓	✓	✓	✓	✓	✓			
DEDALO SP A	✓	✓	✓				✓	✓	✓
DEDALO SP AP	✓	✓	✓	✓	✓	✓	✓	✓	✓

Istantaneous
Display of the instantaneous values measured by the instrument. To facilitate the analysis, the data can be shown in a numeric or graphic format.
The following values can be displayed:
- any instantaneous value (voltage, current, power, PF, etc.)
- Energies
- Harmonics up to the 64th level
- Voltage and current wave shape
- Chart of measured values
- Index indicators

Programming
Instrument programming by means of the software vs. keypad.

Download
Transfers the data recorded by the instrument on PC in a text file.

Prints
Prints the values measured according to a pre-set frequency.

Alarms
The user can set 8 threshold values for as many measurements. When a threshold is exceeded a graphic or sound alarm is sent out. All the alarms are recorded in a file containing date and time data, max and min. detected values and can be printed out.

Modem
It is used to display the measured values, program the instrument and transfer the data recorded by an instrument that is not connected with the PC (remote). The last function requires a modem and a telephone line.

Recording on file
The values measured by the instrument can be saved into a file on the hard drive.

Graphic analysis
The historical data can be analysed as charts or tables and charts of daily consumption can be plotted.

Export file
It is used to export the data recorded in the instrument by means of text files or spreadsheets.

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