

UPM6100



Universal Power Meter

User's Manual
English

UPM 6100

UNIVERSAL POWER METER

USER'S MANUAL

Updated on 18.11.2004

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Note for the users of appliances



According to the article 13 of the Legislative Decree no. 151 dated July 25, 2005, "Enforcement of the 2002/95/EC and 2003/108/EC directives, relevant to the reduction of dangerous substances in electric and electronic appliances, as well as waste disposal", the symbol of a crossed dustbin applied on appliances or on their cases means that the product at the end of its life cycle must be disposed in a dedicated location than other waste.

The user must, therefore, dispose the appliance at its end-of-life in the relevant disposal site for electric and electronic waste or give it back to resellers at the time of purchasing a news equivalent one.

The correct disposal and consequant start up of a recycling of the unused appliance, treatment and final disposal compatible to the enviroment concurs to avoid possible negative effects on the enviroment and health and favours the reusing and / or recycling of the parts making the apparatus.

The abusive disposal of such products done by users is fined according to the present legislation.

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1 GENERAL INFORMATION

1.1 INTRODUCTION

This manual describes how to install, configure and use the instrument.

The publication is not intended for general use, but for qualified technicians. This term means a professional figure with specific technical qualifications, 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 requirements to install or use the instrument.

The instrument is made in compliance with the European Union directives in force, as well as with the technical standards implementing these requirements, as certified by the CE mark on the instrument and in this manual.

It is strictly forbidden to use the instrument for purposes other than those intended, described in the manual content.

The information contained in this manual cannot be shared with third parties. Any duplication of this manual, either partial or total, not authorised in writing by the manufacturer and obtained by photocopying, duplicating or using any other electronic means, violates the copyright terms and is punishable by law.

The information contained in this manual has been carefully checked at the time of publication. However, the manufacturer does not accept liability for any inaccuracy, errors, missing updates, and reserves the right, furthermore, to make changes to the instrument 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 display pages may not be available if the instrument is purchased without some functions.

1.2 GRAPHIC SYMBOLS

Some instructions, in the manual and on the instrument, 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 damage or considerable damage to the instrument 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 the instrument if suitable precautionary countermeasures are not taken.



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

1.3 DESCRIPTION

The instrument is a portable analyser able to measure and compute all the electrical parameters of a three-phase electrical system.

It is contained in a compact plastic case (IP65 protection degree with case and side panel cover closed). Even if the instrument is closed, its functions are not disabled.

The instrument is equipped with a standard RS232 serial port to be connected to a PC or to any other system. Together with the analyser, the DEDALO software is also provided, which gives the possibility to operate directly from PC and displays the measured values both in graphical and numerical format.

Moreover, the instrument allows the user to store data in Flash-memory and subsequently transfer them to a PC with the provided software or via flash card downloader.

The standard capacity of the removable Flash memory card is 4MB.

The instrument can carry out network harmonic content analysis with FFT system up to the 50th harmonic.

All the parameters are displayed on a graphic LCD display.

DATA STORAGE

Data can be stored in Flash memory card for further analysis.

The instrument can store simultaneously:

- Instantaneous values
- Min/Max values
- Harmonic content
- Average powers

The space available in the memory is organised in a dynamic way. Each storing campaign create its corresponding file. It is possible to display this list of file, to obtain information on their content and their dimensions, to erase the files stored in the flash. It is possible to program the start and stop time of the recordings, and the time between two consecutive recordings; the recording can be stopped temporarily, then restarted or erased.

1.4 TECHNICAL SPECIFICATIONS

POWER SUPPLY AUXILIARY VOLTAGE

85÷250 VAC (50/60 Hz) or 110÷250 VDC

Maximum repetitive voltage: 300V

Maximum non-repetitive voltage peak: 320V (20 msec)

Consumption with charged Battery: 10 VA max

Consumption during Battery charge: 25 VA max

Consumption during printout: 30VA max

Built-in fuse: 0.5A, 250V, T->1kA, 5x20

BATTERY

Built-in NiMH Battery, that ensures power supply even during a power line fault.

The Battery is recharged during the normal operating conditions, to guarantee optimal performance and long duration.

Nominal Voltage: 12 V

Nominal Capacity: 1.5 Ah

Operating autonomy: about 1 hour with no printing

Recharge time after complete discharge: 5÷7 hours

Indicator: LED for Battery status

- | | |
|---------------|--|
| OFF: | Battery power supply |
| ON-GREEN: | Mains power supply - Battery charged |
| ON-RED: | Mains power supply - Battery fast recharge |
| RED-BLINKING: | Battery almost out of charge - Malfunction |

VOLTAGE INPUTS

Voltage:	600 (750) VAC max L-L
Max continuous overvoltage:	1000Vrms L-L or L-N 600Vrms L- \perp
Max withstandable peak:	2kVrms L-L or L-N (1sec) 1kVrms L- \perp
Input impedance:	> 2 MOhm
Burden:	max 0.15 VA per phase

CURRENT INPUT

N°3: L ₁ , L ₂ , L ₃	for the following input signals: - 1 / 2 / 3 / 10 Vrms - direct connection to Rogowsky sensor (flexible clamp)
N°1: Aux	for the input signal: - 1 Vrms
Input impedance:	1MOhm approx
Surge withstand capability:	100 V (1 sec)



WARNING: The inputs are not isolated. Use always isolates transducers.

The instrument can only measure alternate currents with null DC component.

N°3: L₁, L₂, L₃ for CT connection and direct insertion:
- 1, 5 or 20A

Minimum measurable current: 20mA

Maximum overload: 100A for 1 second

This inputs are isolated up to 750 VL-L

INSTRUMENT ACCURACY

Voltage:	±0.2% reading ±0.05% full scale
Current:	±0.2% reading ±0.05% full scale (CT input) ±0.3% reading ±0.05% full scale (Direct input) ±0.5% reading ±0.1% full scale (Rogowsky input)
Power:	±1% reading ±0.1% full scale
Power factor:	1% reading (0.5 lagging ÷ 0.8 leading)
Energy:	1.5% reading (0.5 lagging ÷ 0.8 leading)
Frequency:	±0.05% reading ±2digit in 45 to 65Hz range
Temperature:	10 min after turn-on, ±2°C (0÷55°C) (32÷131°F)

MEASURING RANGE

The measurement is automatically synchronized to the measured frequency when this is in the range 45÷65 Hz (the voltage L1-N must be at least 10V). It is possible to select manually a fixed value for the measurement frequency in the range 45÷65Hz. With the WFR option the measuring range is extended to 14÷500 Hz.

MEASUREMENT METHOD

128 samples per period (2 periods); 256 total samples per measurement.
(sampling frequency at 50 Hz = 6.4 kHz)

Harmonics Analysis: Analysis carried out up to the 50th harmonic with FFT method on three voltages and three currents simultaneously.

Measurement interval: 10 seconds

RAM storing time interval: programmable (see section 5.6.2.)

Signal frequency range: 45 ÷ 65 Hz

SERIAL COMMUNICATION PORT

RS232 for PC connection (RS485 on request)

Communication speed rate programmable up to 57600 bps

Protocol: STANDARD

INPUT / OUTPUT (OPTIONAL)

MIX11 No. 1 analog output (0-20/ 4-20mA)

No. 1 MOS output for pulse emission or alarm tripping (50 VAC/DC 300mA optoisolated)

DI4-TR No. 4 isolated digital inputs

DISPLAY

Graphic LCD display, 128x128 dots resolution, with LED backlight

Backlight life > 100.000 hours

KEYBOARD

8 operating keys + ON/OFF key

DATA STORAGE

4MB removable Flash memory card

Stored data (see section 5.6.2):

- Instantaneous values
- Min/Max values
- Harmonic content
- Average powers

1MB backedup RAM - on the optional CPU2 coprocessor board

Stored data:

- Voltage DROPS & PEAKS (Sags and Swells)
- Fast MIN/AVG/MAX

REAL TIME CLOCK

Accuracy: ±5 sec. / day at 25°C (77°F) (with power supply on).

1F Supercap battery backup up to one month (with power supply off).

Auto Leap Years.

PROGRAMMABLE PARAMETERS

The calibration parameters and the programmable parameters of the instrument are stored in a EEPROM non volatile memory.

Data retention is 40 years without power supply.

ENVIRONMENTAL CONDITIONS

Operational temperature: from -5°C to + 55°C (from 23 to 131°F)

Storage temperature: from -15°C to + 60°C (from 5 to 140°F)

Operational humidity: Maximum 80% non condensing for temperatures up to 31°C (87,8°F), with linear fall of a temperature up to 40°C (104°F)

Altitude: up to 2000m

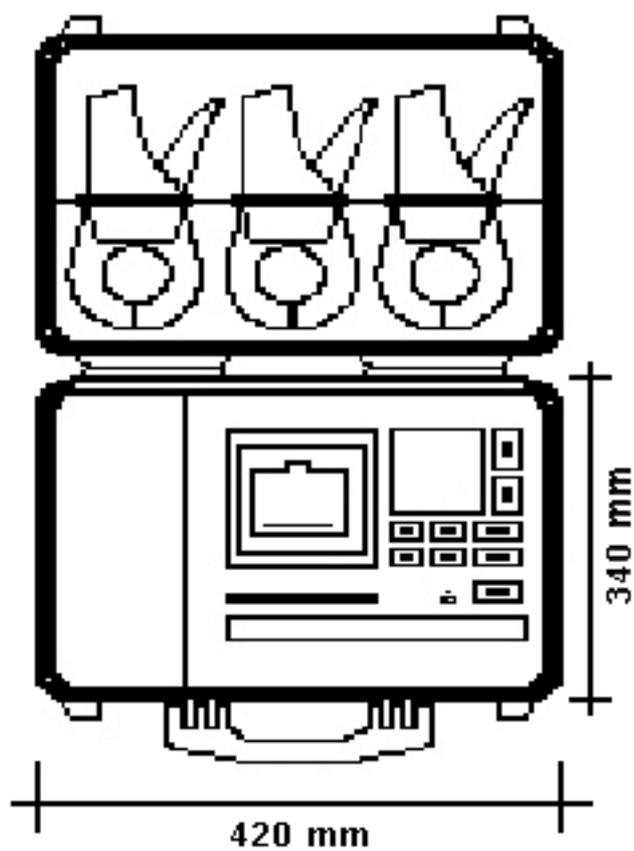
SIZE

ABS carrying case 420 x 340 x 210 (mm)

IP20 protection degree

WEIGHT

9700 g. approximately



SAFETY CONDITIONS

The instrument has been made and tested in compliance with the CEI EN 61010-1 (1993) standards plus variation CEI EN 61010-1/A2 (1995) and UL 61010A-1 (2002) for operating voltage up to 750.

Double insulation

Overvoltage class: III

Pollution degree: 2

Protection class: I

ELECTROMAGNETIC COMPATIBILITY

Immunity: meets EN50082-2

- Electrostatic discharge (meets EN 61000-4-2)
8kV in air - level 3
4 kV on contact - level 2
- Radiated electromagnetic field (meets EN 61000-4-3)
10 V/m - level 3
- Rapid transients (meets EN 61000-4-4)
2kV - level 3

Surge: meets EN 61000-4-5 2kV

Emission: meets EN 50081-2

- Radiated EN55011
class A - group 1
- Mains EN55011

PRINTER PRP40 (OPTIONAL)

Printout:

Impact dot matrix on normal paper (width: 57mm)

Columns = 42

Points per line = 252

Dotpitch = 0.19 x 0.37 mm

Printout speed = 1.0 line per sec.

Paper feeding speed = 3mm per sec.

Paper:

Width = 57 mm (58 max.)

Thickness= 65 ÷ 85 µm

Weight= 52 ÷ 64 g/m²

Internal paper-carrier core = Ø 12 mm min.

External roll diameter = Ø 50 mm max. (approx. 21m)

Ribbon:

Standard: EPSON ERC09 - Colour: black

Life: 250,000 characters with the supplied type under normal conditions

The ribbon's life depends on the storage environmental conditions

1.5 PERFORMED MEASUREMENTS (standard version)

Single-, bi- and three-phase (AC):

V RMS inst. / min. / max.
 A RMS inst. / min. / max.
 W inst. / min. / avg. / max.
 VA inst. / min. / max.
 VAr inst. / min. / max.
 PF inst. / min. / max.
 COSØ inst.
 Wh exported / imported
 VAh exported / imported
 VARh exported / imported / lagging / leading

Direct current:

V inst. / min. / max.
 A inst. / min. / max.
 W inst. / min. / avg. / max.
 Wh

Phase L1:

Hz

Others:

- harmonics up to 50th (V,A)
- oscilloscope of the signal(V,A)
- daily profiles (min, max)
- timebands

1.6 FORMULAS

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

2 INSTALLATION

2.1 PRELIMINARY INSPECTIONS

At box opening, check that there is no visible damage to the instrument due to transport. For any problem, contact the Technical Assistance Service for any possible repairs and/or replacements.

The instrument must not be exposed to the sun rays.

2.2 SAFETY INSTRUCTIONS



WARNING: Before making any connections, check that the wires are not under voltage.



WARNING: Before connecting, verify that the input to be connected corresponds to the value on the label.

The instrument carries out bi-directional measurements; for this reason, it is absolutely necessary to connect the instrument following the proper polarities to obtain correct values.



WARNING: Connect the wiring diagrams as described in section see 2.7 and respecting the cyclic order of the phases (IMPORTANT: L1 of the voltage input = L1 of the current input).



WARNING: When CTs and VTs are used (Current /Voltage Transformers), be sure to respect the input and output polarities.



WARNING: Never disconnect a direct current input without first cutting off the load power supply. If this is not possible, it is necessary to short-circuit the CT secondary.

2.2.1 SAFETY REQUIREMENTS FOR BATTERY USE

In case of battery replacement, use one with the same characteristics, do not reverse polarity and use only rechargeable NIMH batteries only.

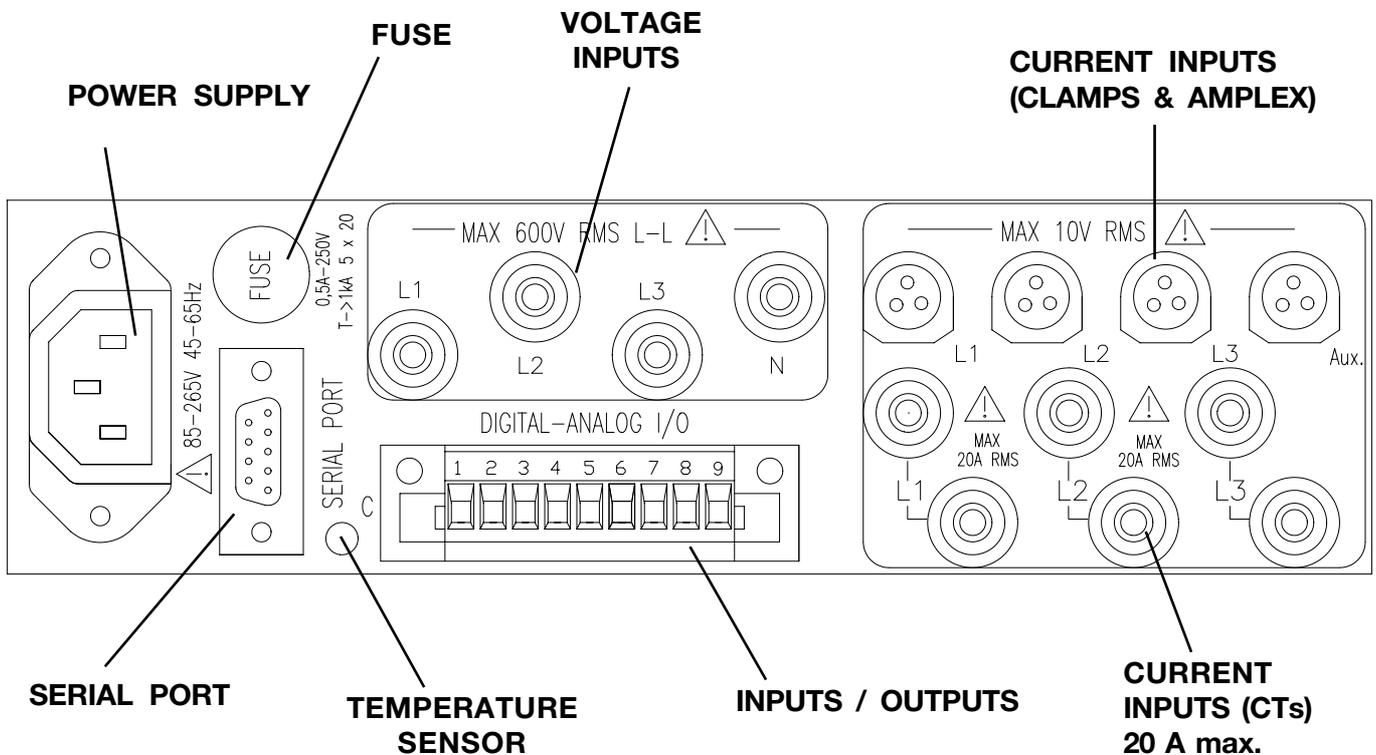
Do not recharge the battery away from the unit. Do not use a charger different from the one proper of this battery type.

 **WARNING:** Avoid short-circuiting of the terminals. Do not connect the positive and the negative terminals with a wire or other metal items.

 **WARNING:** Do not attempt to take the battery apart or subject to pressure or impact. Do not heat. The battery may be damaged, release dangerous substances, burn or explode.

 **WARNING:** The alkaline electrolyte in the battery may damage seriously the eyes and skin and clothing upon contact.

2.3 CONNECTIONS

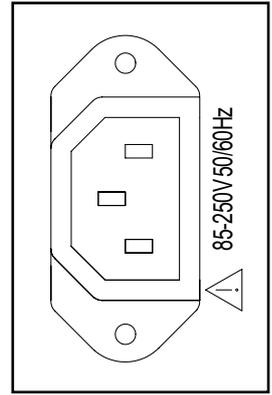


2.4 POWER SUPPLY

This instrument is provided with a protection fuse 5x20 type T of 0,5A-250V on the power supply.

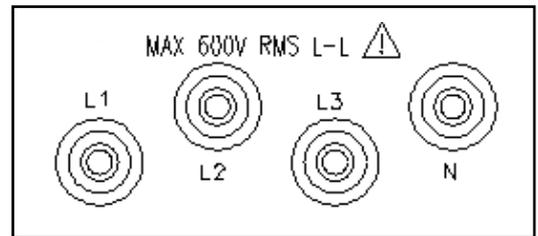
In case of fuse replacement - disconnect the instrument power supply cable, take off the fuse from holder situated near the supply connector, replace the fuse with a similar one and finally close the fuse holder.

It is forbidden to use repaired or short-circuit fuses.



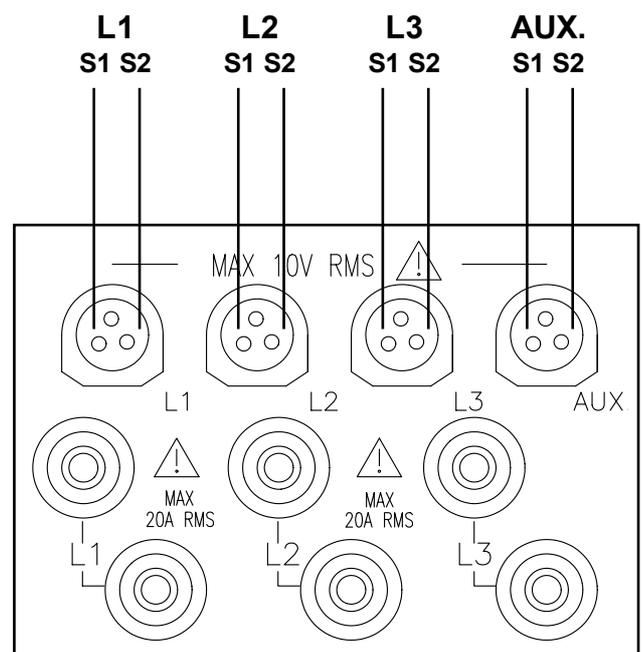
2.5 VOLTAGE INPUTS

This instrument is provided with 4 sockets for voltage measurement



2.6 CURRENT INPUTS

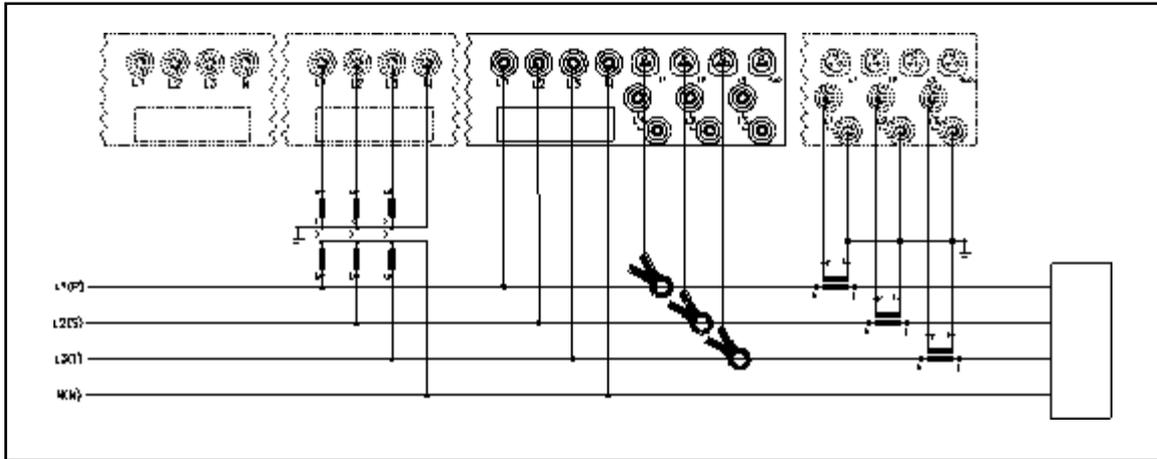
This instrument is provided with 4 three-poles connectors for current measurement with clamps whose output is 1V at fullscale (3V or 10V programmable) and 6 inputs for CT connection or for the direct wiring in the circuit where the current has to be measured; programmable fullscale 1, 5 or 20A.



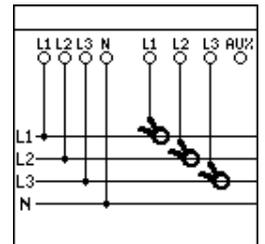
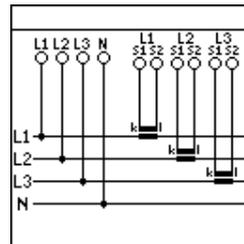
2.7 WIRING DIAGRAMS

When a three wire system (without neutral) is connected, the phase values are not displayed because they could be uncorrected. Infact, these values refer to an unreal neutral, generated into the instrument. Only the parameters physical related to the selected wiring diagram are displayed.

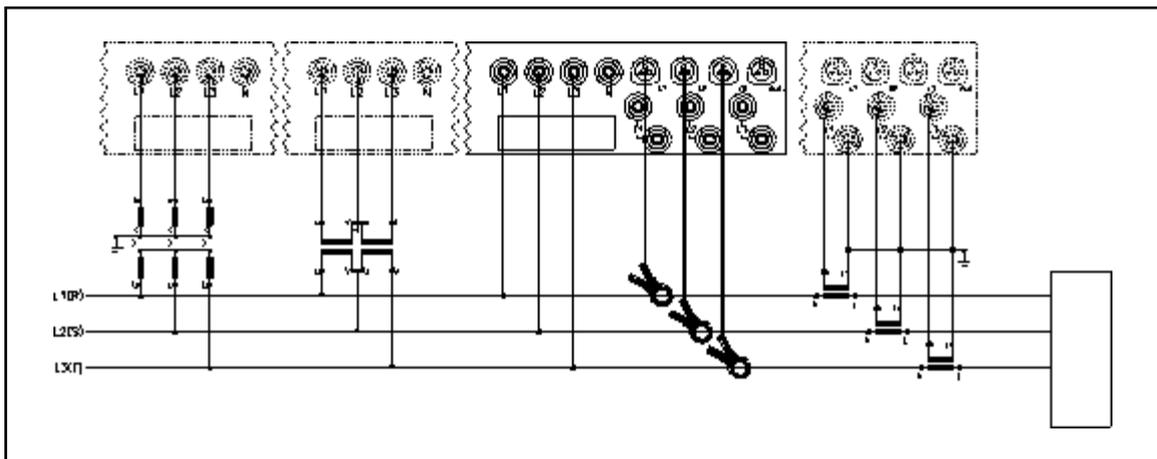
3-PHASE 4-WIRE / 3CT



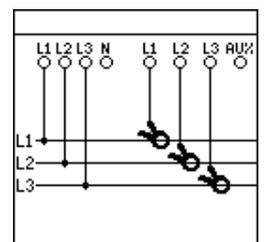
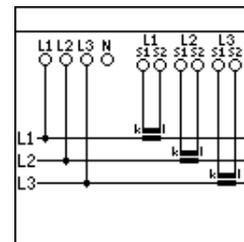
Select **3-PH 4-WR/3CT** in instrument programming (see section 5.4).
On the INFO pages are displayed these diagrams depending on the use of CTs or Clamps.



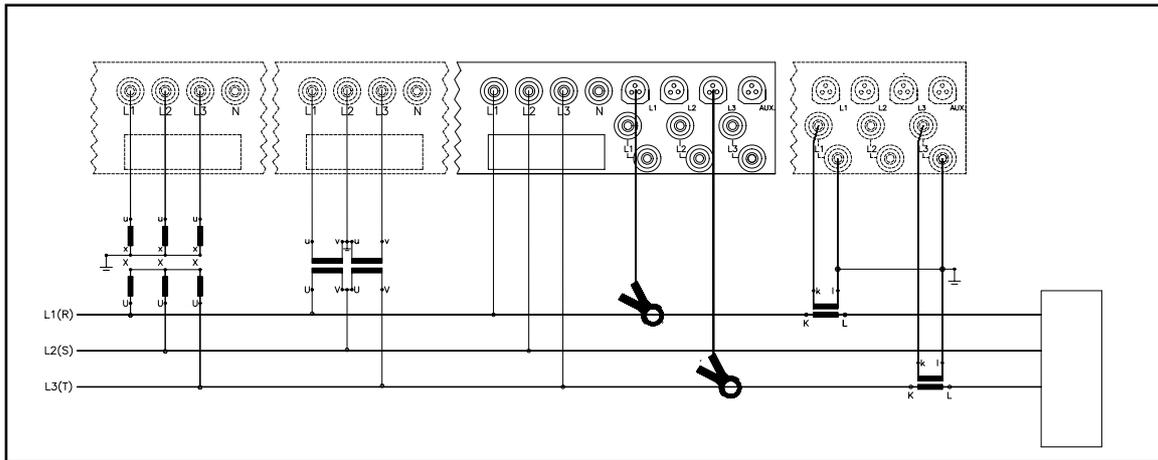
3-PHASE 3-WIRE / 3CT



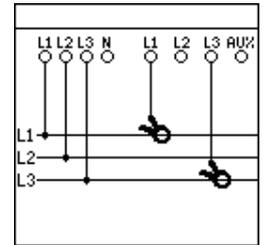
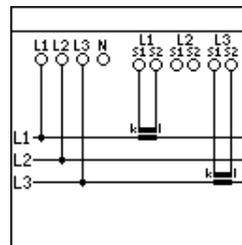
Select **3-PH 3-WR/3CT** in instrument programming (see section 5.4).
On the INFO pages are displayed these diagrams depending on the use of CTs or Clamps.



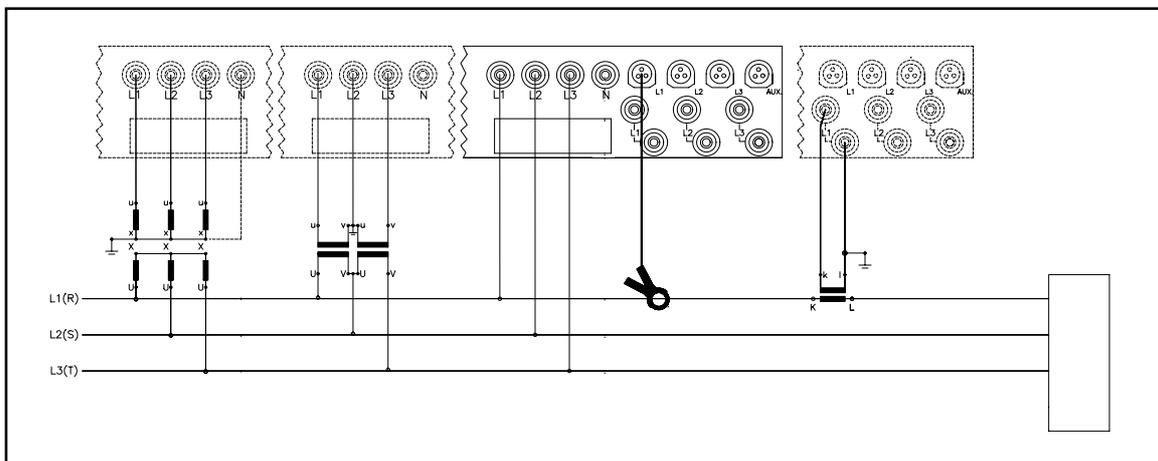
3-PHASE 3-WIRE / 2CT



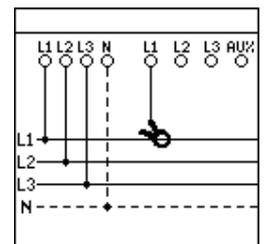
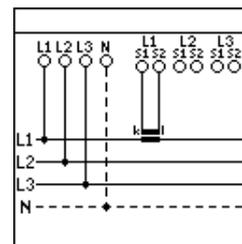
Select **3-PH 3-WR/2CT** in instrument programming (see section 5.4).
 On the INFO pages are displayed these diagrams depending on the use of CTs or Clamps.



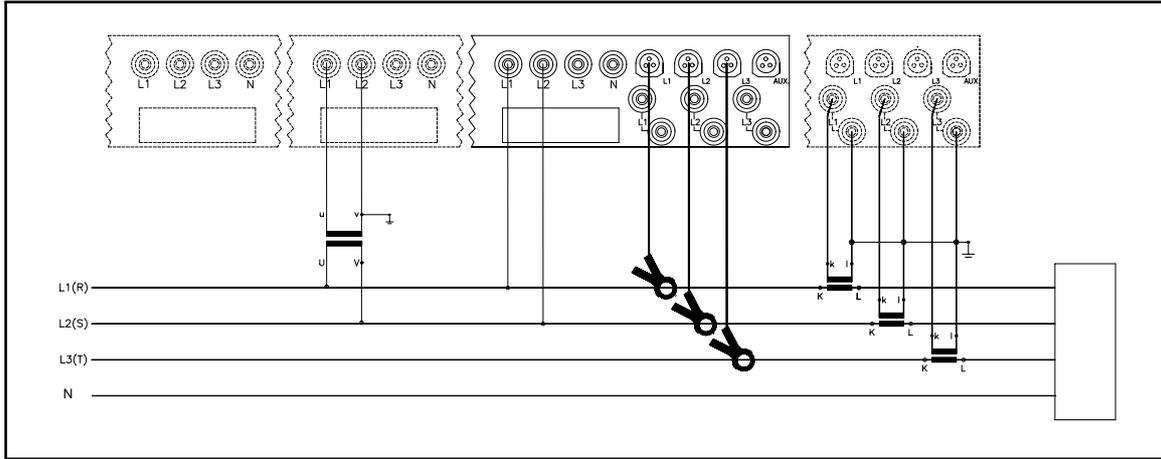
3-PHASE 3-WIRE / 1CT



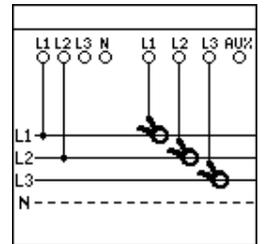
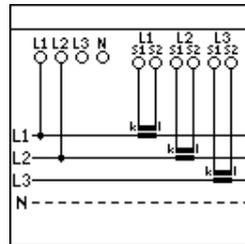
Select **3PH-3WR/1-CT** in instrument programming (see section 5.4).
 On the INFO pages are displayed these diagrams depending on the use of CTs or Clamps.



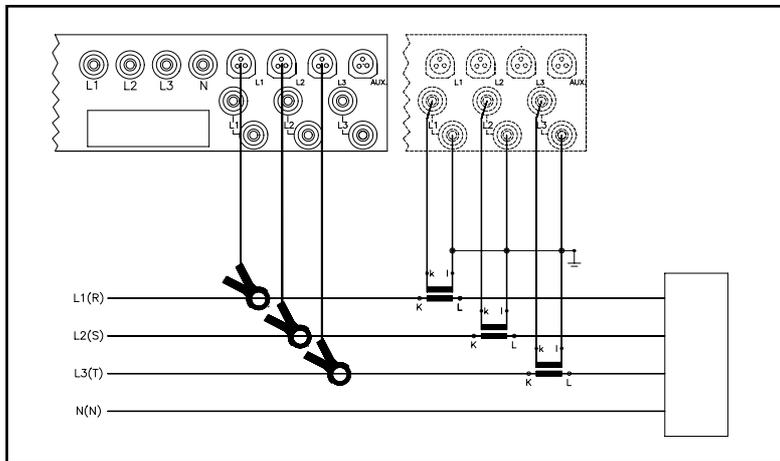
3-PHASE 1-VOLT / 3CT



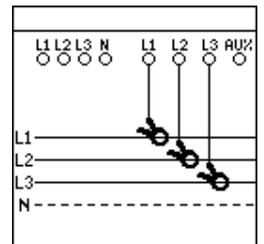
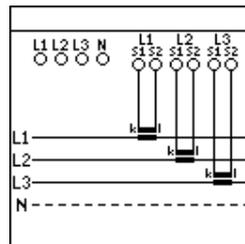
Select **3-PH 1-VOLT/3CT** in instrument programming (see section 5.4).
 On the INFO pages are displayed these diagrams depending on the use of CTs or Clamps.



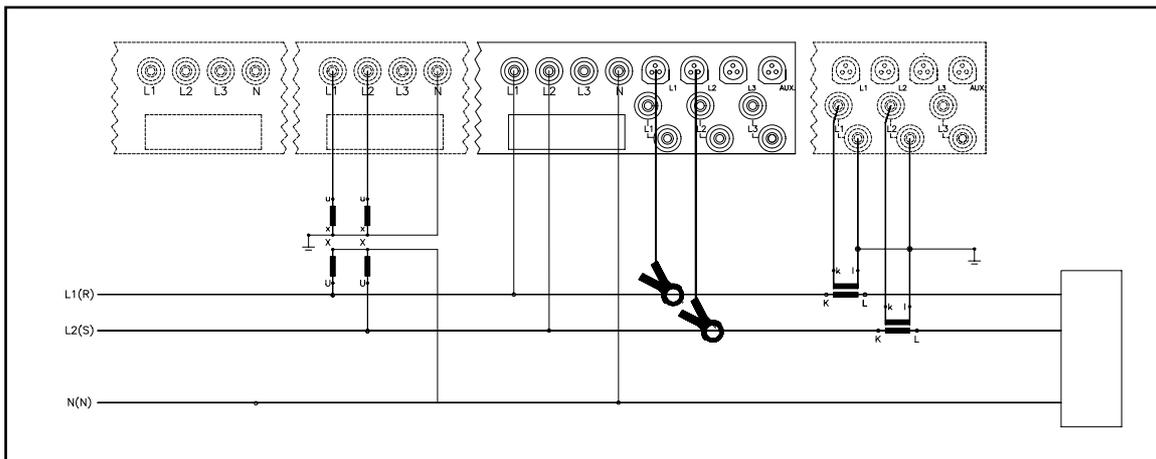
3-PHASE 0-VOLTAGE / 3CT



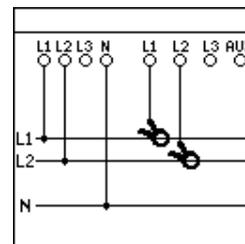
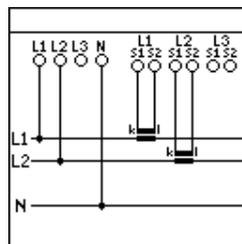
Select **3PH-0-VOLT/3CT** in instrument programming (see section 5.4).
 On the INFO pages are displayed these diagrams depending on the use of CTs or Clamps.



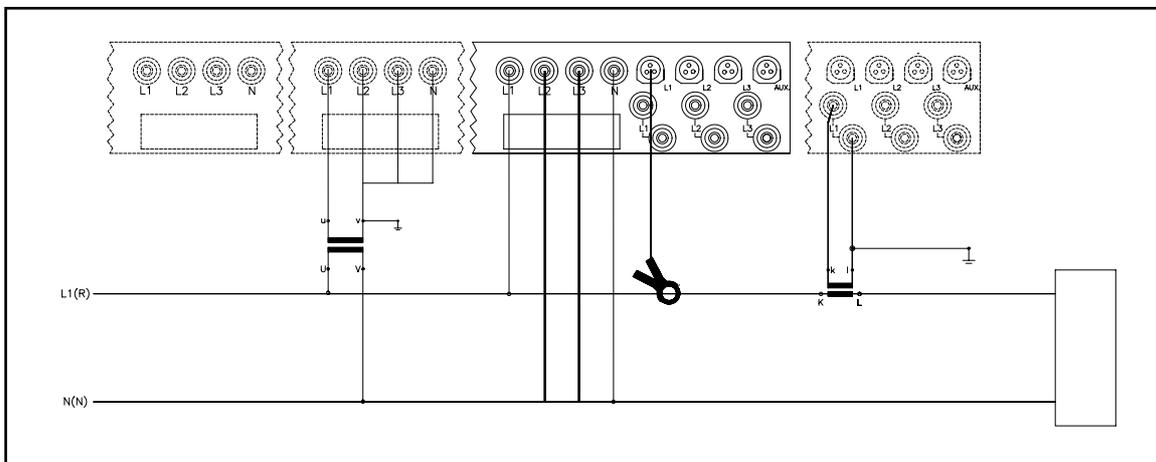
1-PHASE 3-WIRE (L1-L2)



Select **1PH-3WR (L1-L2)** in instrument programming (see section 5.4).
 On the INFO pages are displayed these diagrams depending on the use of CTs or Clamps.



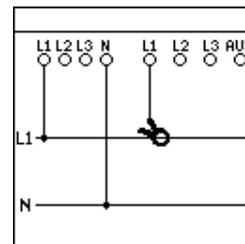
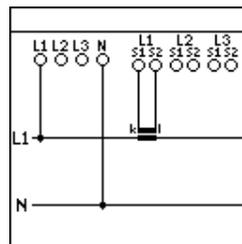
ONE-PHASE (L1)



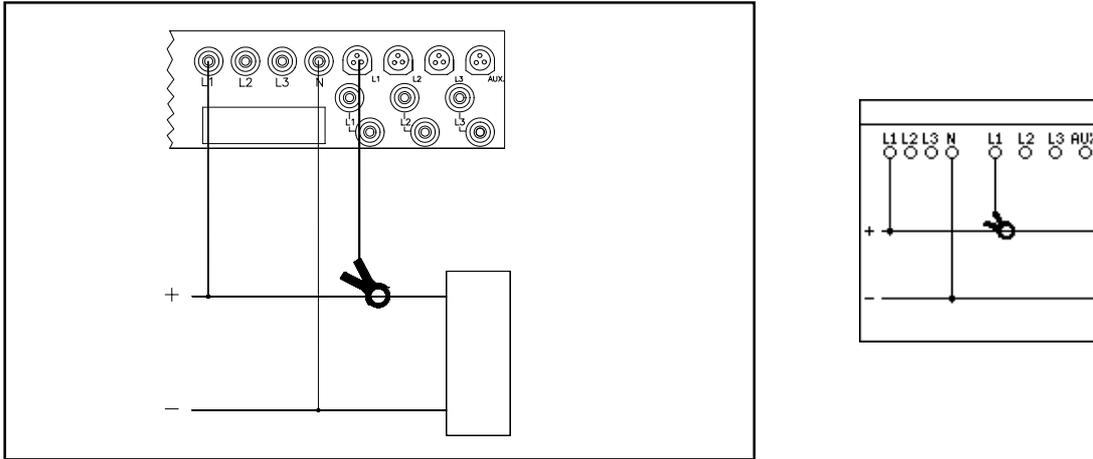
Select **1PHASE (L1)** in instrument programming (see section 5.4).

On the INFO pages are displayed these diagrams depending on the use of CTs or Clamps.

Note: when the voltage is greater than 30V, connect also L2 and L3 to N.

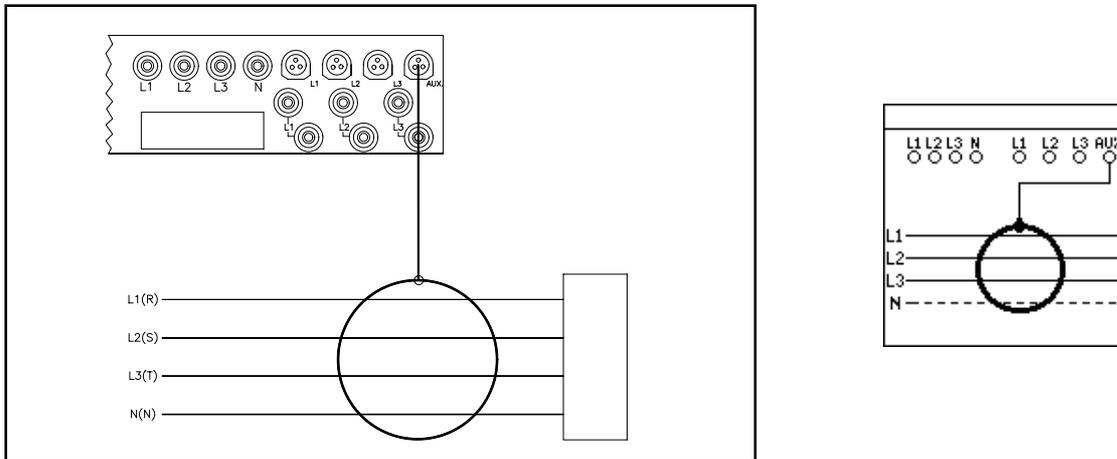


D.C. CURRENT



Select **1PHASE DC** in instrument programming (see section 5.4).
On the INFO pages is displayed this diagram.

EARTH LEAKAGE



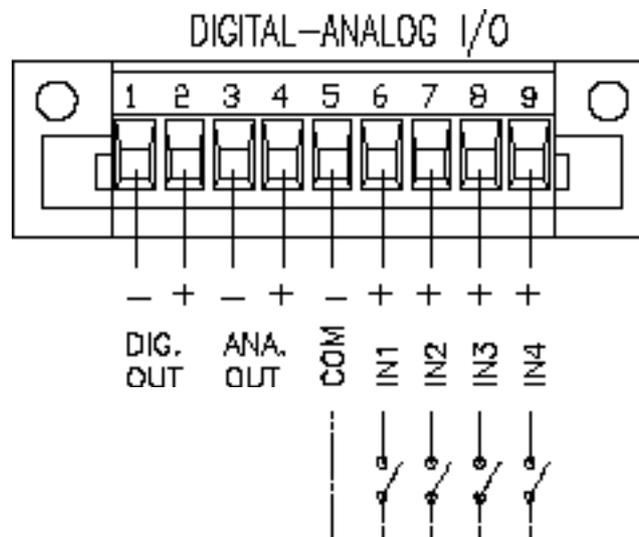
Select **EARTH LEAKAGE** in instrument programming (see section 5.4).
On the INFO pages is displayed this diagram.

3 INPUT/OUTPUT (OPTIONS)

The standard version of the instrument is supplied with 4MB Flash Memory + RTC, RS232 serial port, internal battery Ni-MH, wiring accessories.

Different options are also available:

- MIX11
Nr.1 MOS digital output for pulse emission or alarm tripping (50VAC/DC 300mA optoisolated)
- DI4-TR
Nr.4 isolated digital inputs
- PRP40
Internal 40 columns printer
- CPU2
Co-processor board



3.1 DIGITAL INPUTS CONNECTION

The module has four (4) galvanically sealed digital inputs.

Through the digital inputs it is possible to acquire pulses proportional to active energy consumption detected from other instrument or counters.

The maximum frequency acquisition is 4 pulses per second.

To program the input see section 5.9 on this manual.



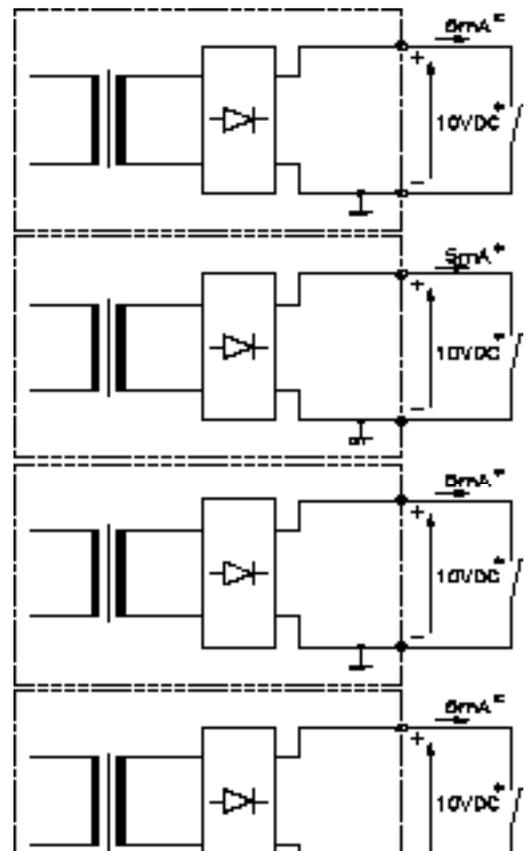
WARNING: As the digital inputs are internally power supplied, it is necessary to provide the input with a free voltage contact as indicated in the picture below.

On the instrument the provided extraction terminals are of the screw type (type K), for conductors up to 4 mm² with 20A rating and protected in accordance with standards VDE0110 and VBG4.

For the connection use a normal single or multi-polar cable.

For long-distance connections, the wires connected to the instrument must be channelled in a duct separate from the one for the power supply wires.

In the case of an intersection with power lines, if possible, this intersection must be made at right angles (90°).



* Indicative value

3.2 DIGITAL OUTPUT



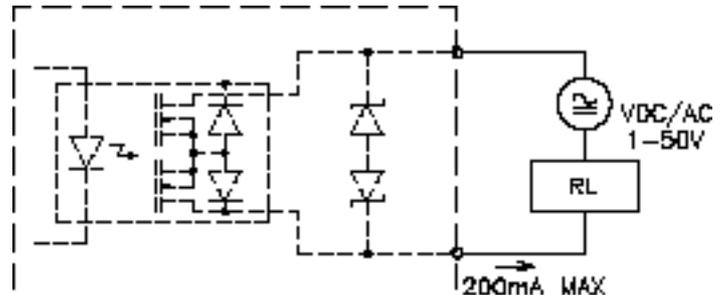
WARNING: The photoMOS outputs can drive load whose supply voltage is 50VAC/DC max and whose load current is 200mA max.



WARNING: As the digital output is not internally power supplied, therefore it is necessary to provide external power supply as indicated in the picture below.

The output is not protected against short circuit overloads.

Typical resistance value of photo MOS output with closed contact is 2,5 Ohm.



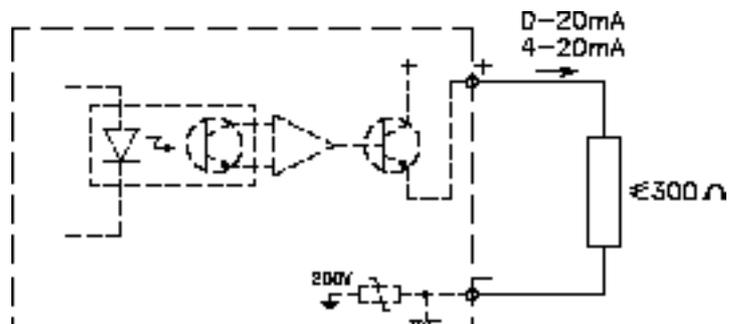
3.3 ANALOG OUTPUT

The value of the output can be programmed as 0-20 or 4-20mA as described in detail in section 5.9 of this manual.



WARNING: The output is galvanically isolated from the other parts of the instrument.

The maximum voltage value which can be delivered is 10V, therefore the load must never exceed 300 Ohms.

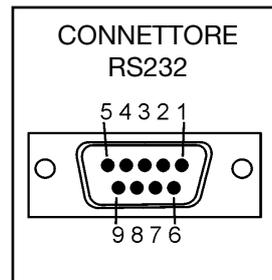


3.4 RS232 SERIAL COMMUNICATION PORT

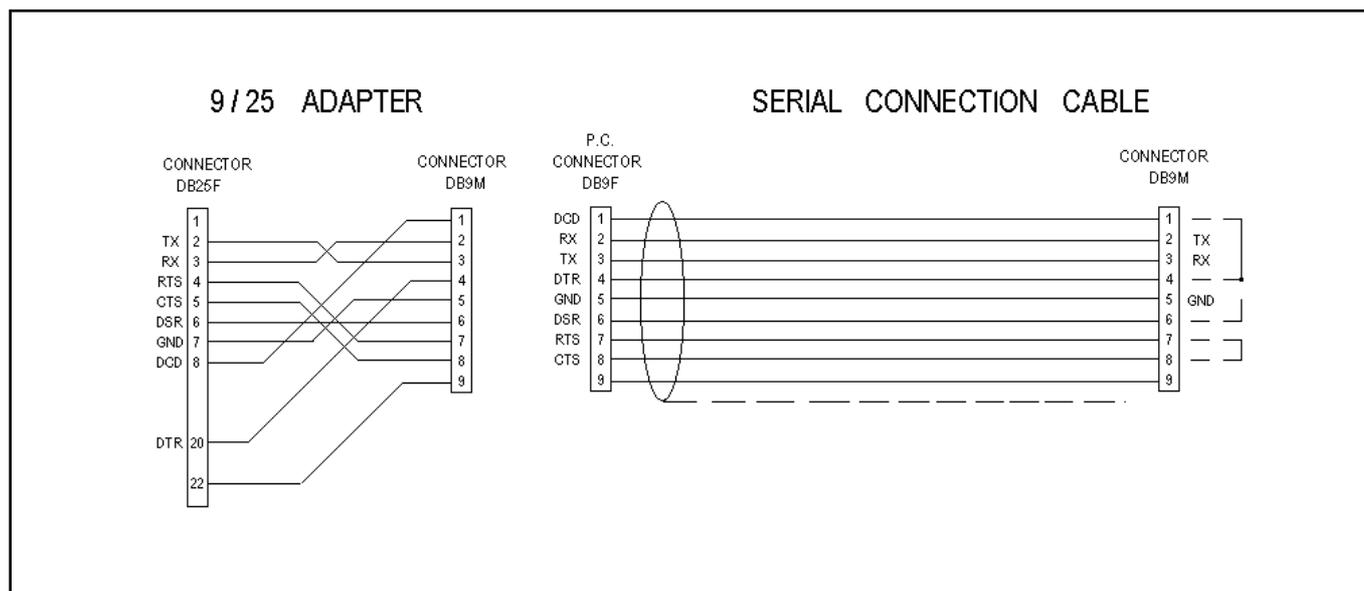
Communication with the instrument is possible by means of an asynchronous serial transmission line, RS232. All transmitted characters are part of the ASCII code.

The RS232 interface allows a connection between only one instrument and PC.

The interrogation of the instrument is always possible using its SERIAL NUMBER. It is also possible to query the instrument with the its LOGICAL NUMBER or using LOGICAL NUMBER 00.

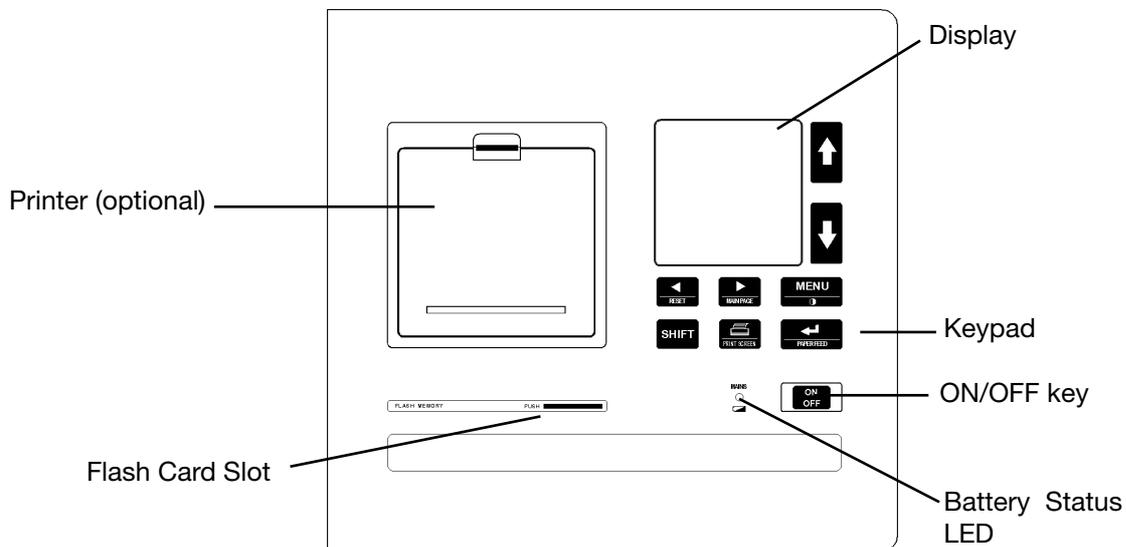


In order to connect the instrument to PC, a RS232 standard shielded cable with 2 subminiature DB 9 pin connector and a serial adapter DB25/DB9 are supplied. Refer to the Tecnical Service before using different cables.



4. USING THE INSTRUMENT

4.1 FRONT PANEL GENERAL OVERVIEW



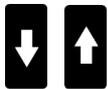
4.2 KEYPAD FUNCTIONS

SINGLE KEYS



MENU key

Normal mode: displays Main Menu.



UP, DOWN keys

Normal mode: page scroll, menu cursor scroll.

Programming mode: change the value of the highlighted digit.



LEFT, RIGHT keys

Programming mode: select the highlighted digit.



ENTER key

Normal mode: confirms the selection.

Programming mode: confirms the selection or the modified digits.



PRINT key

Normal mode: access to the manual print menu (optional function).

MULTIPLE KEYS COMBINATIONS



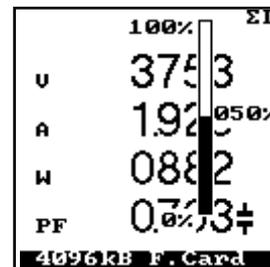
SHIFT + RIGHT keys = MAINPAGE

Normal mode: press simultaneously for

- 1 second ➔ display the previously set Main Page
- 3 seconds ➔ set the current page as Main Page or reset the current Main Page

 +   **SHIFT + MENU** keys = LCD CONTRAST

Normal mode: pressed simultaneously on each displayed page, access the LCD contrast setup bar (set the value from 0 to 100% using **UP** or **DOWN** keys and confirm with **ENTER** key). After 5 seconds, the display returns to the previous page.



 +   **SHIFT + PRINT** keys = PRINT SCREEN

Normal mode: pressed simultaneously, the current displayed page is printed (optional function).

 +   **SHIFT + LEFT** keys = RESET

Normal mode: pressed simultaneously for at least 3 seconds, reset the counters of the current page.

 +  +   **SHIFT + ENTER + MENU** keys = SET DEFAULT

Normal mode: pressed simultaneously for at least 5 seconds, a general RESET will be performed with factory default values.

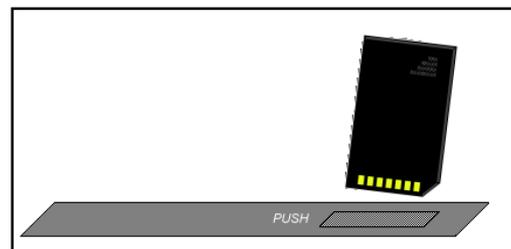
 **WARNING:** all setup parameters (I/O, recording, trend, print, ecc.) will be lost.

 +  +   **LEFT + RIGHT + ENTER** keys = FORMAT

Normal mode: pressed simultaneously for at least 3 seconds, display the Flash Memory format page; to confirm, select YES.

4.3 FLASH MEMORY CARD

The instrument is equipped with a removable Flash memory card. Insert the Flash card with the contacts side downwards. To remove it, push on the Flashcard.



If the Flash card is inserted, at the bottom of the display the flash memory size is displayed (see the first picture below).

If the Flash card is not inserted or it is inserted in a wrong way, at the bottom of the display it will be displayed an error message (see the second picture below).

If the inserted Flash card is not formatted, or if the **LEFT + RIGHT + ENTER** keys are pressed simultaneously, the instrument formats the Flashcard and displays a message (see the third picture below).



4.4 EQUIPMENT SWITCHING ON

When the instrument switches on, the following page is displayed:



After a few seconds the set wiring mode will be displayed. These pages can be recalled at any time from the Info section.

If Main Page was previously set, this page will be displayed after two minutes after the instrument was switched on.

Any displayed page of the instrument can be set as Main Page, menu and Setup pages excluded.



ATTENTION: When the instrument is not used for more than 7 days, execute the initialization pressing simultaneously **SHIFT + ENTER + MENU** keys until the instrument restarts (at least 5 seconds).

4.5 MAIN MENU

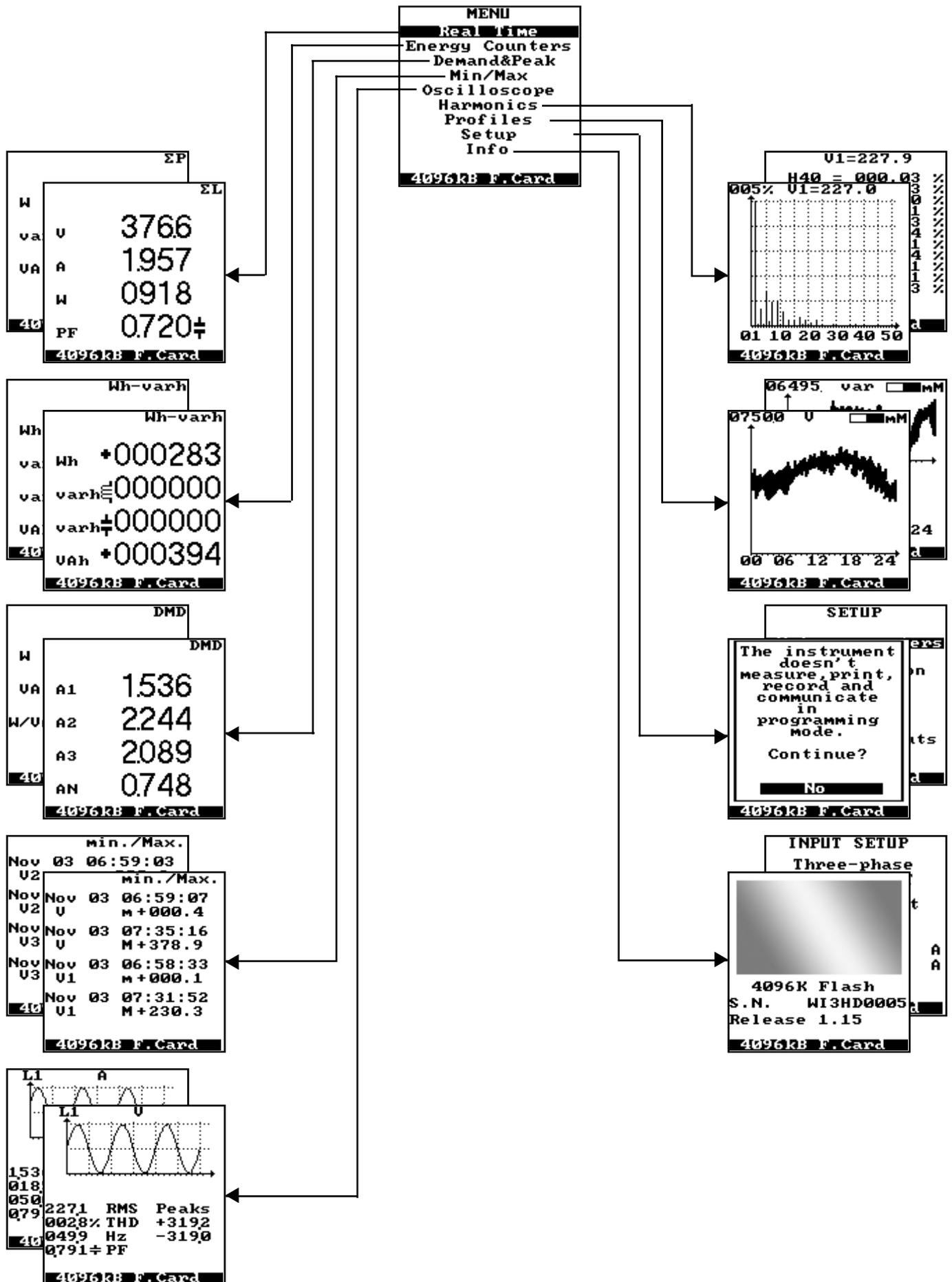
To enter Main Menu press **MENU** key; it allows to display and to select the instrument main functions.

- 1. Real Time Section 4.6
- 2. Energy Counters Section 4.7
- 3. Demand & Peak Section 4.8
- 4. Min/Max Section 4.9
- 5. Oscilloscope Section 4.10
- 6. Harmonics Section 4.11
- 7. Profiles Section 4.12
- 8. Setup Chapter 5
- 9. Info Section 4.13



NOTE: The following list of pages can be different as it depends on the selected wiring mode (see section 5.4). The pages described in the manual refers to a 3phase-4wires/3CT wiring mode.

The following chart shows the different display section of the instrument selected from the Main Menu.



4.5.1 SYMBOLS

Symbols	\sim	\pm	-	+	\odot
Parameters	COS ϕ , Reactive Power, Reactive Energy	COS ϕ , Reactive Power, Reactive Energy	Active Power, energy values	Energy values	CW= Clockwise CCW= CounterClockWise
Meaning	INDUCTIVE LOAD	CAPACITIVE LOAD	EXPORTED ENERGY	IMPORTED ENERGY	PHASE ROTATION

4.5.2 POWER FACTOR COMPENSATION

It allows to calculate the reactive power (var) of the re-phasing capacitors, which are necessary to raise the measured COS ϕ to the requested value (Target).

Press **ENTER** key to set a new Target value; select one of the available values pressing **UP** or **DOWN** keys; confirm the selected value pressing **ENTER** key.

Target:	0800
Cos ϕ	var
L1	0810± ----
L2	0522± ----
L3	0897± ----
409613 F. Card	

4.6 REAL TIME VALUES PAGES

The following chart shows all the Real Time values pages. Here below, a description of each page:

1. Voltage, current, active power, system power factor
2. System active, reactive and apparent power
3. Line voltages and frequency
4. Phase voltages and phase rotation sequence
5. Phase and neutral currents
6. Active phase powers
7. Phase power factors
8. Voltage-current Fresnel diagram (on PF)
9. Phase angle V
10. Phase angle A
11. Phase apparent powers
12. Phase reactive powers
13. L1- voltage, current, active power, power factor
14. L2- voltage, current, active power, power factor
15. L3- voltage, current, active power, power factor
16. Total harmonic distortion of phase voltages
17. Total harmonic distortion of phase currents
18. Phase COS ϕ
19. Voltage and current Fresnel diagram (on COS ϕ)
20. Re-phasing
21. Temperature

↓

ΣL	
U	3766
A	1.957
W	0918
PF	0.720 $\frac{+}{-}$
4096kB F. Card	

var	
var1	-0200 $\frac{+}{-}$
var2	-0403 $\frac{+}{-}$
var3	-0195 $\frac{+}{-}$
4096kB F. Card	

L1	
U	227.1
A	1527
W	0275
PF	0.795 $\frac{+}{-}$
4096kB F. Card	

ΣP	
W	0900
var	-0791 $\frac{+}{-}$
UA	1262 $\frac{+}{-}$
4096kB F. Card	

UA	
UA1	0347 $\frac{+}{-}$
UA2	0475 $\frac{+}{-}$
UA3	0443 $\frac{+}{-}$
4096kB F. Card	

L2	
U	2103
A	2227
W	0241
PF	0.513 $\frac{+}{-}$
4096kB F. Card	

ΔU	
U12	3806
U23	3683
U31	3799
HzAU	0499
4096kB F. Card	

ANG A	
φ(A12)	120.6°
φ(A13)	241.4°
φ(A23)	120.8°
4096kB F. Card	

L3	
U	2127
A	2086
W	0390
PF	0.881 $\frac{+}{-}$
4096kB F. Card	

U	
U1	2276
U2	2101
U3	2125
CW	0
4096kB F. Card	

ANG U	
φ(U12)	120.2°
φ(U13)	240.7°
φ(U23)	120.5°
4096kB F. Card	

THDU	
THDU1%	0029
THDU2%	0031
THDU3%	0027
4096kB F. Card	

Temperature	
°C	24
4096kB F. Card	

A	
A1	1.539
A2	2.263
A3	2.083
AN	0.759
4096kB F. Card	

0.795 $\frac{+}{-}$	U1	PF
0.510 $\frac{+}{-}$		
0.883 $\frac{+}{-}$		
I1	I2	
U3	I3	U2
4096kB F. Card		

THDA	
THDA1%	0183
THDA2%	0179
THDA3%	0159
4096kB F. Card	

Target:	0800
Cosφ	var
L1	0810 $\frac{+}{-}$ ----
L2	0522 $\frac{+}{-}$ ----
L3	0897 $\frac{+}{-}$ ----
4096kB F. Card	

W	
W1	0275
W2	0248
W3	0391
4096kB F. Card	

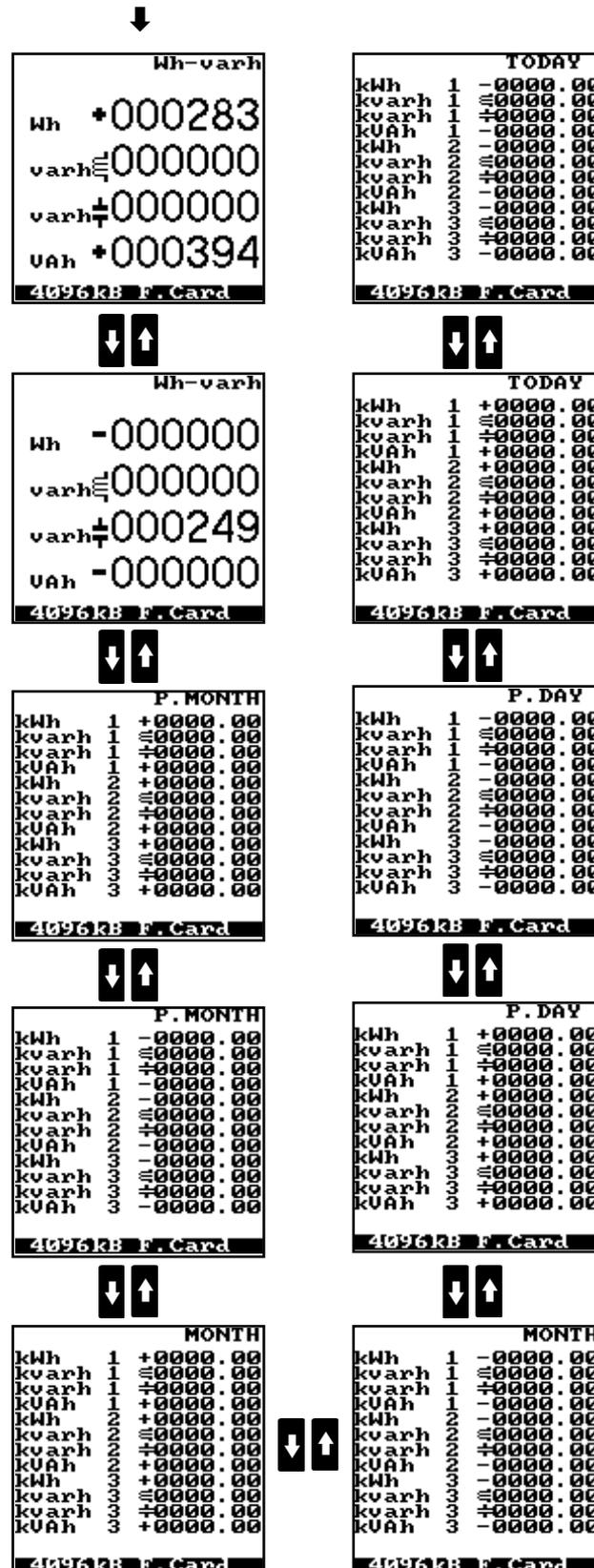
PF	
PF1	0.796 $\frac{+}{-}$
PF2	0.511 $\frac{+}{-}$
PF3	0.885 $\frac{+}{-}$
4096kB F. Card	

Cosφ	
Cosφ1	0.809 $\frac{+}{-}$
Cosφ2	0.524 $\frac{+}{-}$
Cosφ3	0.894 $\frac{+}{-}$
4096kB F. Card	

0.809 $\frac{+}{-}$	U1	Cosφ
0.524 $\frac{+}{-}$		
0.894 $\frac{+}{-}$		
I1	I2	
U3	I3	U2
4096kB F. Card		

4.7 ENERGY COUNTERS PAGES

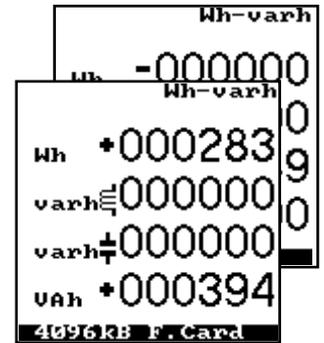
The following chart shows all the pages of total energy counters, the timeband counters and the digital input counters (optional).



4.7.1 PAGES DESCRIPTION

Imported and exported energy counters of the active and reactive energy.

- Active energy [kWh]
- Inductive reactive energy [kvarh]
- Capacitive reactive energy [kvarh]
- Apparent energy [kVAh]



Input counters (optional)

The DI4-TR option (4 digital input) allows to count the energy pulses sent to each input (in kWh) from another device. In instrument Setup Menu can be set a multiplying factor for each input (see section 5.9).



WARNING: When **SHIFT + RESET** keys are pressed simultaneously for at least 3 seconds, the four counters will be reset.

Time Band Counters

The instrument manage separate energy counters divided into three programmable bands (tariffs).

Totally, 96 counters are used, grouped as follows:

- 4 counters for imported energy and 4 counters for exported energy
- different pages for separate counters for TODAY, PREVIOUS DAY, MONTH, PREVIOUS MONTH.

4.8 DEMAND & PEAK VALUES PAGES

The instrument displays the following demand values (separate values for imported and exported values):

- 3-phase system current
- phase 1 current
- phase 2 current
- phase 3 current
- neutral current
- 3-phase system active power
- 3-phase system apparent power
- 3-phase system reactive power (inductive and capacitive)
- ratio of 3-phase system active and apparent power (PF)

The instrument records and displays the following peak of demand values with date and time reference (separate values for imported and exported):

- phase 1 current
- phase 2 current
- phase 3 current
- neutral current
- 3-phase system active power
- 3-phase system apparent power
- 3-phase system reactive power

3-phase system active power

Together with the peak demand value of active power, the following average values are also recorded: system apparent power, system reactive power (inductive or capacitive) and power factor (active/apparent power ratio).

3-phase system apparent power

Together with the peak demand value of apparent power, the following average values are also recorded: system active power, system reactive power (inductive or capacitive) and power factor (active/apparent power ratio).

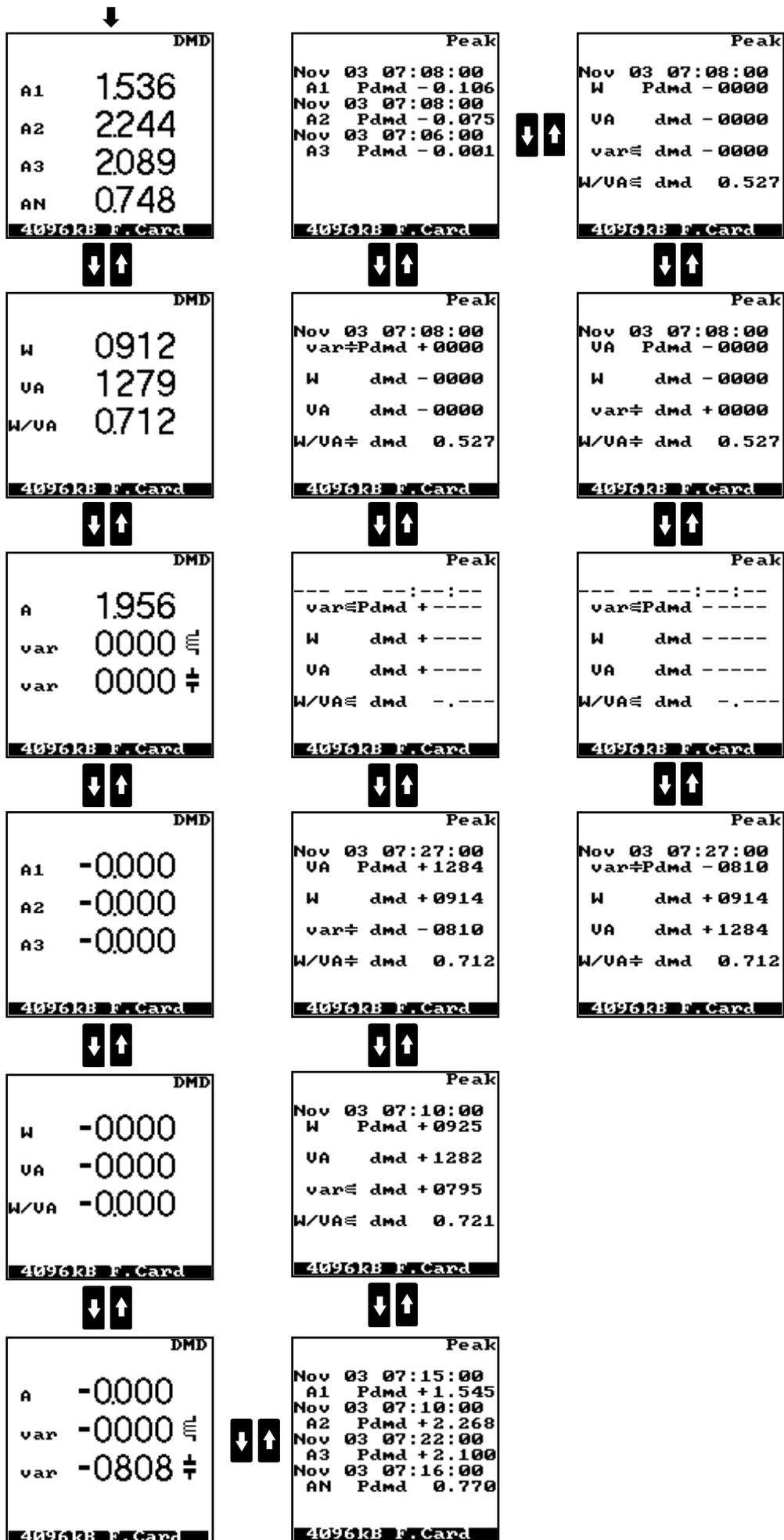
3-phase system reactive power

Together with the peak demand value of system reactive power (inductive and capacitive), the following average values are also recorded: system active power, system apparent power and power factor (active/apparent power ratio).



WARNING: When **SHIFT** + **RESET** keys are pressed simultaneously for at least 3 seconds, the Peak values will be reset.

The following chart shows all demand and all peak of demand values pages.



4.9 MINIMUM AND MAXIMUM VALUES PAGES

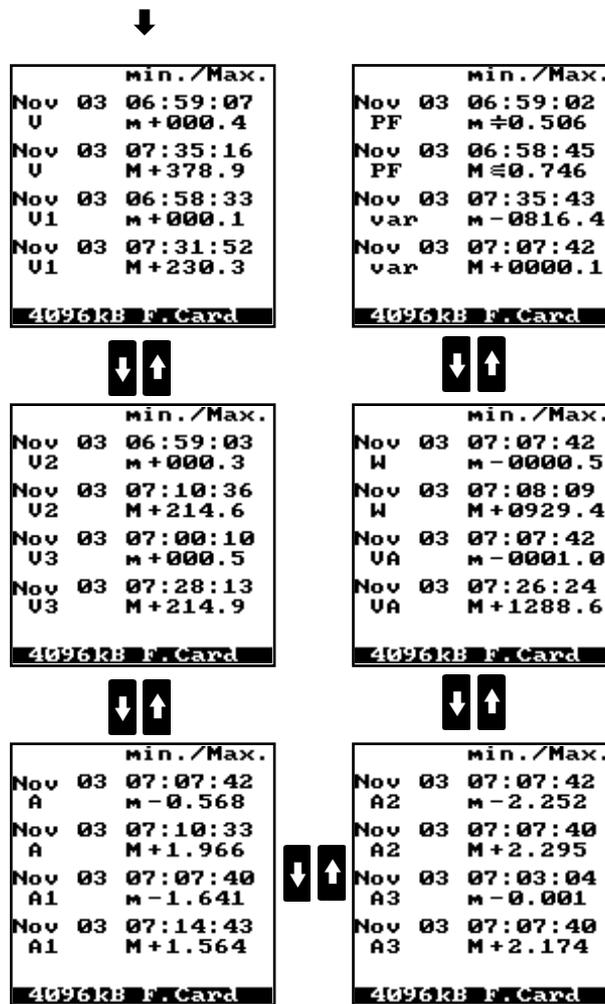
The instrument records and displays the minimum/maximum values for 12 parameters with date and time references. On the left of each recorded value, a displayed letter identifies the meaning of the value as follows:

- **m** = minimum value
- **M** = maximum value



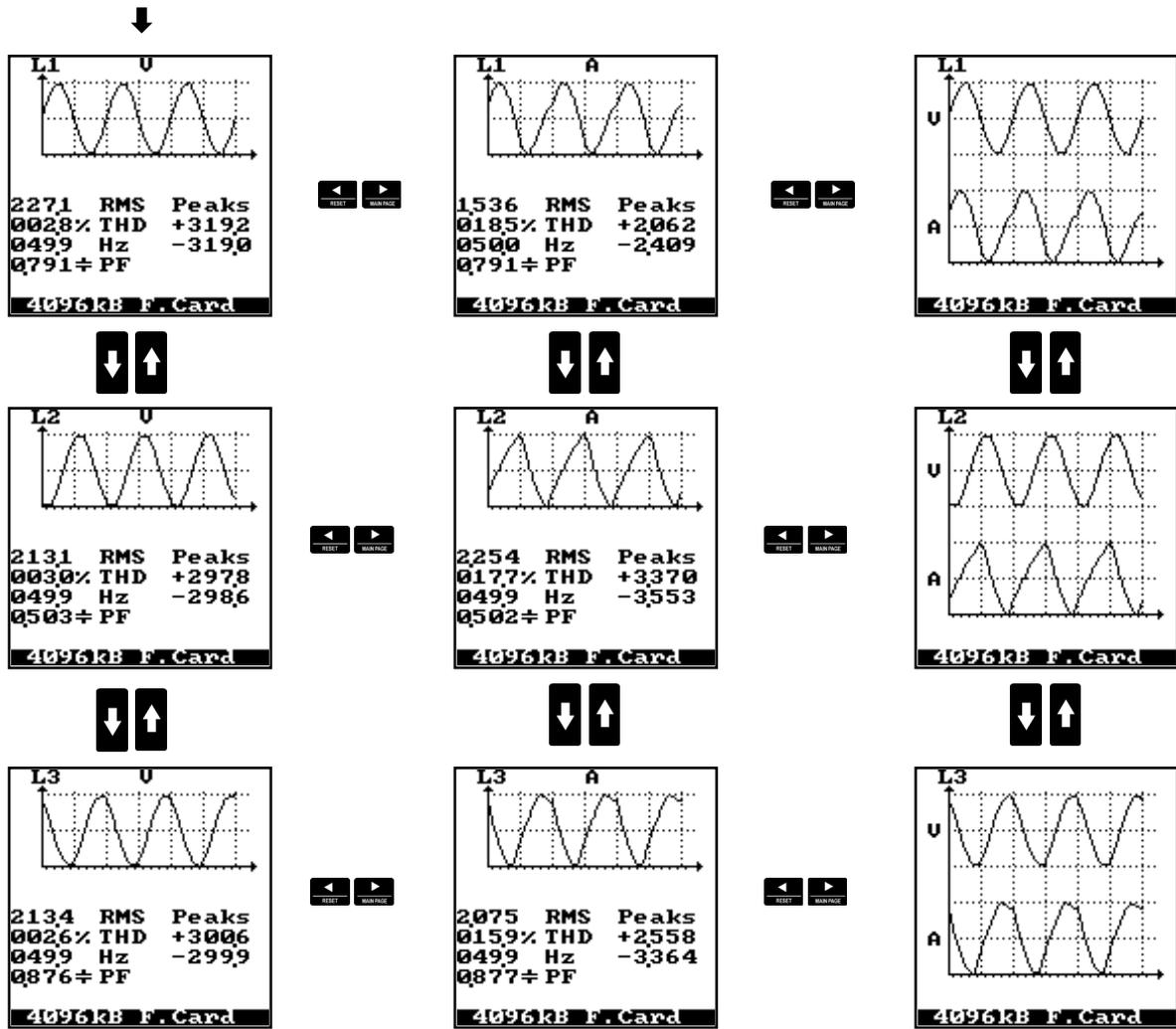
WARNING: When **SHIFT + RESET** keys are pressed simultaneously for at least 3 sec., the stored minimum and maximum values are reset. "----." will be displayed till a new value will be stored.

This chart shows the minimum and maximum values pages.



4.10 OSCILLOSCOPE PAGES

The instrument allows to display current and voltage waveforms in graphic format. The following chart shows all oscilloscope pages.



Voltage and current pages contain the following information:

- Signal waveform
- RMS value
- THD
- Frequency
- PF
- Maximum and minimum peaks

4.11 HARMONIC ANALYSIS

These pages display the values of the harmonic content of the measured voltage and current.

The instrument allows to display the harmonic content for the three phase voltages and currents up to the 50th harmonic in graphic and numerical format. The pages of this last format allow to display the values of the harmonic content both in percentage or absolute values.

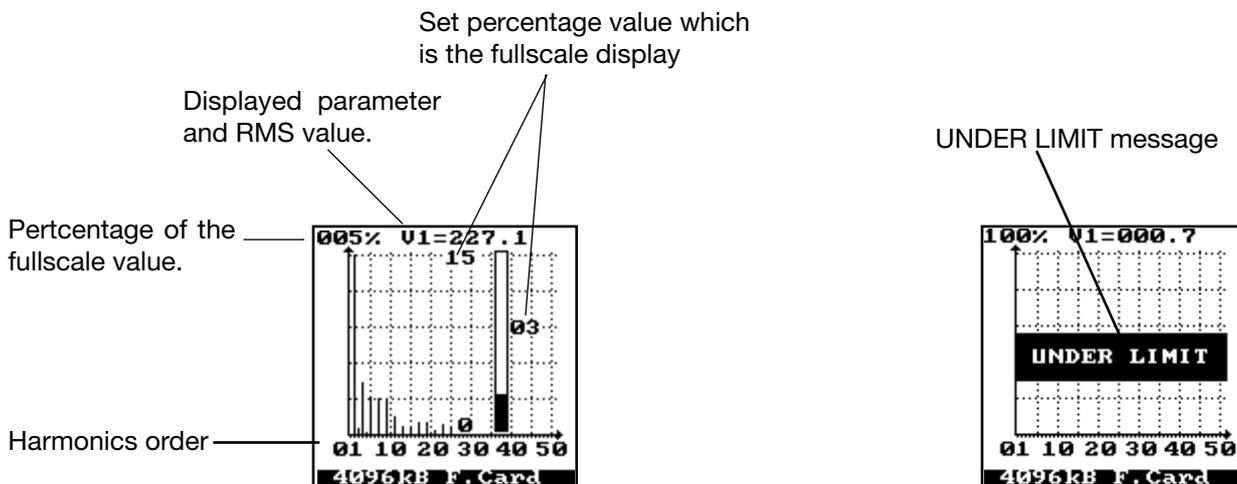
The percentage values are relative to the fundamental component.

When the current signals are lower than 0.5% of fullscale or the voltage signals are lower than 5% of fullscale, the harmonic analysis is not carried out, due to the low signal-noise ratio, the instrument displays the message "UNDER LIMIT".

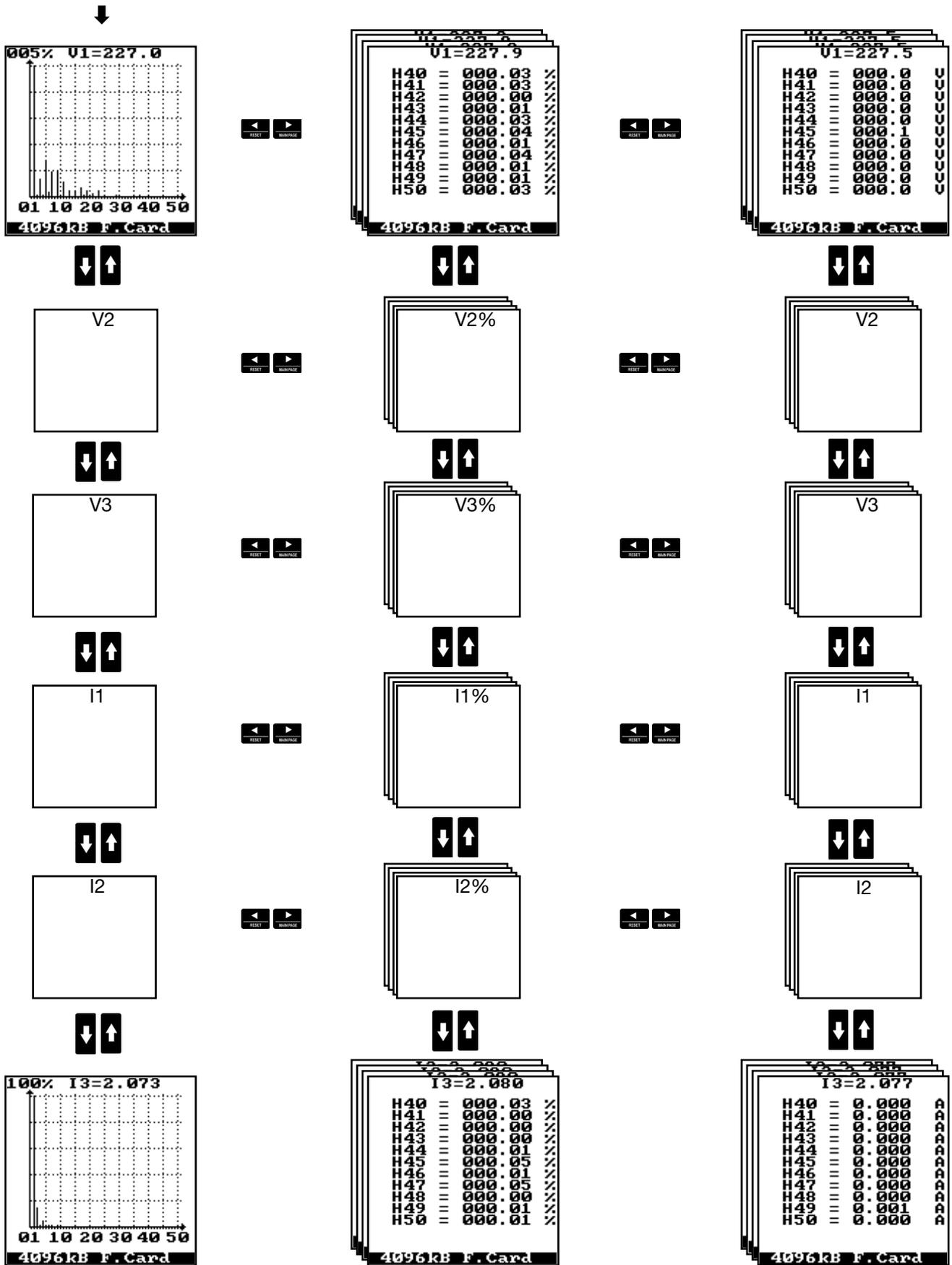
4.11.1 FULLSCALE SETTING

To set the vertical axis fullscale, a percentage value can be set relative to the fundamental component.

- Press **ENTER** key and a vertical cursor appears with the percentage indication of fullscale
- set the needed fullscale (from 1 to 15%) with **UP** or **DOWN** keys
- finally, confirm the value with **ENTER** key and the vertical cursor will disappear



The following chart shows all harmonic content pages.



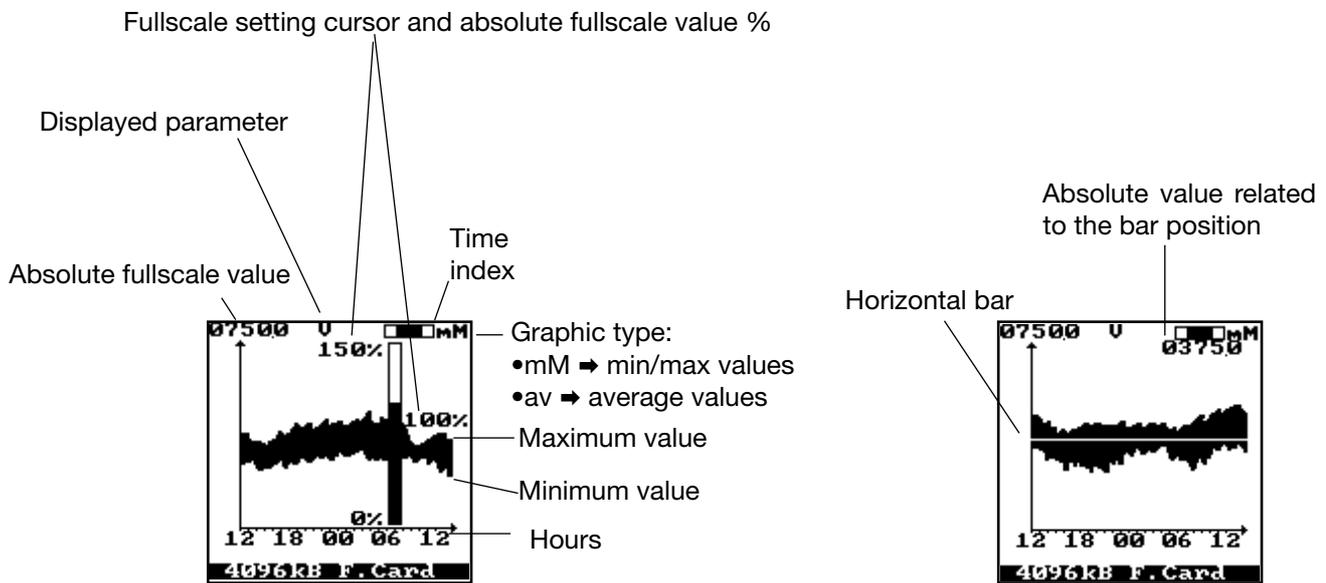
4.12 PROFILE PAGES

The instrument allows to display the histogram of the minimum and maximum values. It is possible to display the present and the previous days graphics.

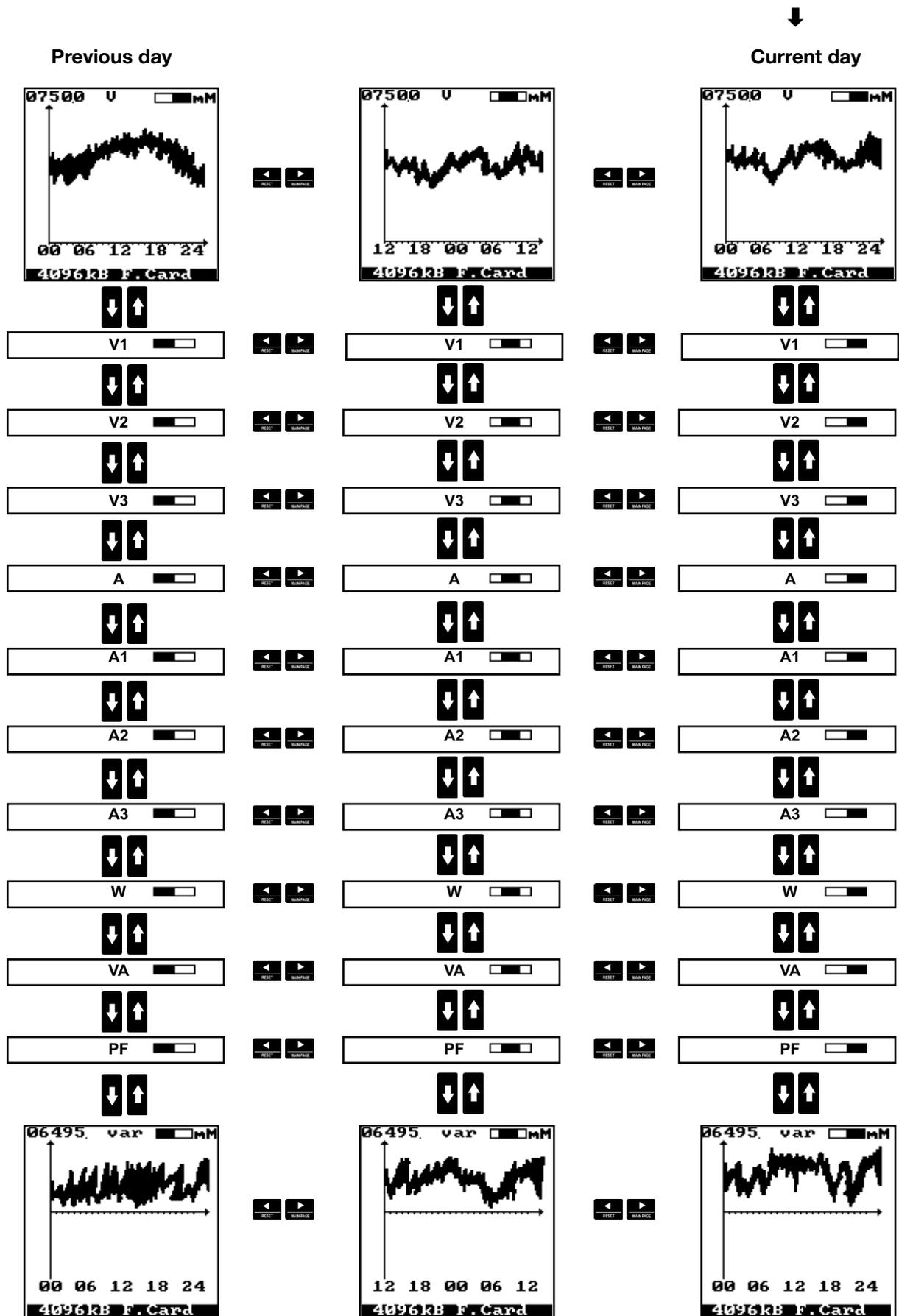
4.12.1 FULLSCALE AND BAR SETTING

To set the vertical axis fullscale percentage value, follow the procedure below:

- press **ENTER** key and a vertical cursor appears with the percentage indication of fullscale
- set the needed fullscale (from 1 to 150%) with **UP** or **DOWN** keys
- press **ENTER** key and a horizontal bar appears
- move the bar vertically and display the graphic value related to the bar position
- finally, confirm the value with **ENTER** key and the vertical cursor will disappear



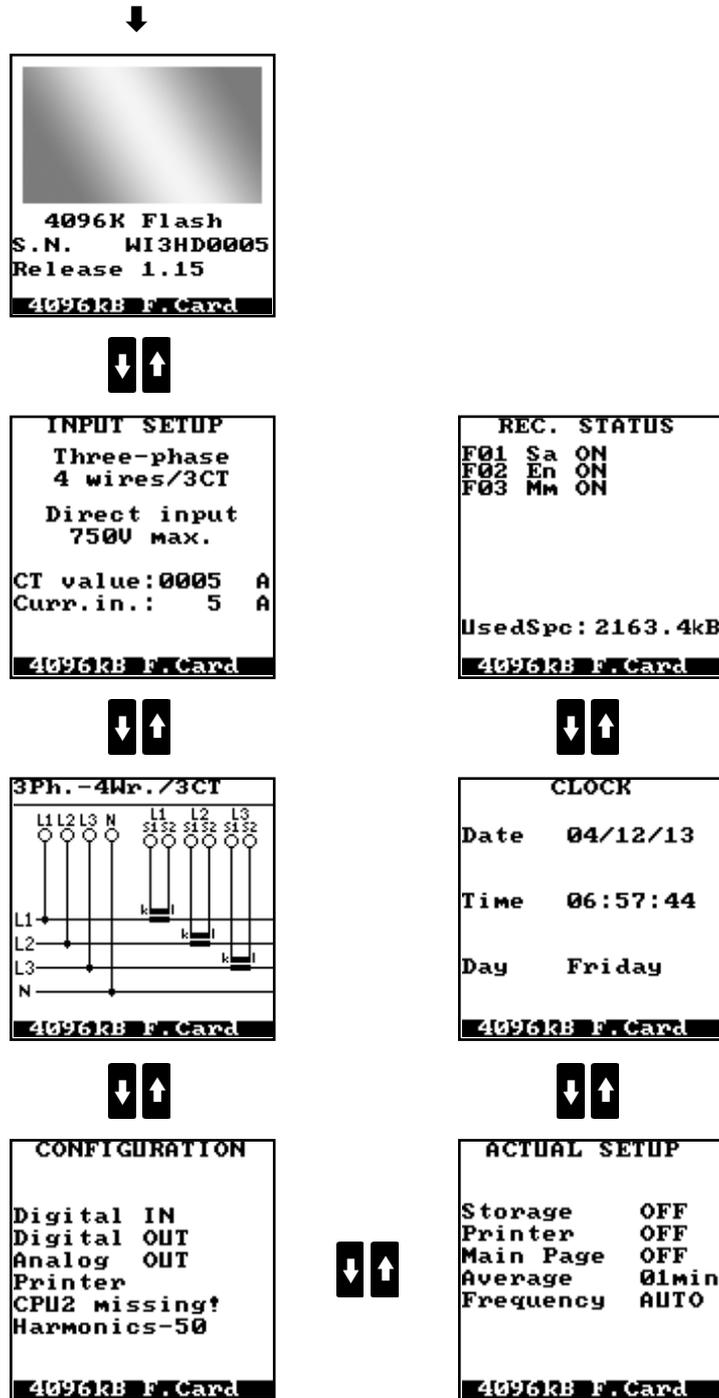
The following chart shows all profile pages.



4.13 INFO PAGES

This function allows to display different information about the operating status of the instrument.

The following chart shows all info pages.



5. PROGRAMMING

5.1 ACCESS AND EXIT FROM SETUP MODE

5.1.1 ACCESS

To enter Programming mode, select **Setup** in Main Menu and confirm with **ENTER** key. The following page appears with a warning message. To enter Setup Menu, select **YES** with **UP** or **DOWN** keys and confirm with **ENTER** key.



5.1.2 EXIT

When some parameters are modified, at the exit from Setup section, the instrument will display a message to inform that all data in the memory of the instrument will be deleted. This occurs when:

- current input or voltage input were changed
- new memory settings
- wiring selection was modified

There are three possibilities:

- YES** → confirm setup, save and exit
- NO** → abort setup and exit without saving
- CONTINUE** → continue to remain in Setup mode



To exit from Programming mode from any Setup page and return to Main Menu, press **MENU** key. A warning message appears, with a confirmation request.

There are three possibilities:

- YES** → confirm setup, save and exit
- NO** → abort setup and exit without saving
- CONTINUE** → continue to remain in Setup mode

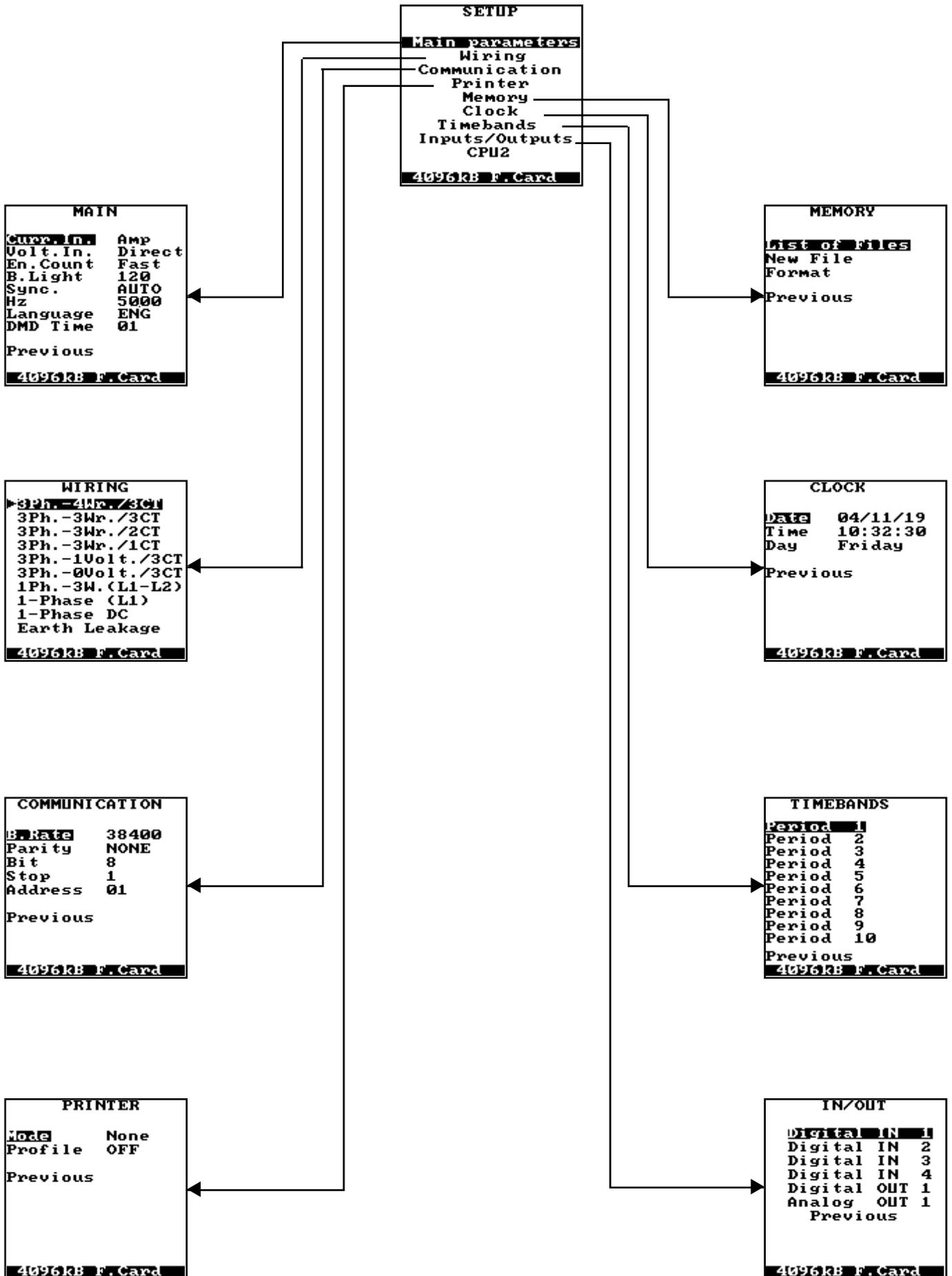


5.2 SETUP MENU

1. Main	Section 5.3
2. Wiring	Section 5.4
3. Communication.....	Section 5.5
4. Printer (optional).....	Chapter 6
5. Memory	Section 5.6
6. Clock.....	Section 5.7
7. Timebands	Section 5.8
8. In/Out (optional)	Section 5.9



The following chart shows the different Setup pages of the instrument.



5.3 MAIN SETUP

To access this Setup page, press **ENTER** key when in the Setup Menu **Main** is selected. The following items are displayed:

MAIN	
Curr. In.	Amp
Volt. In.	Direct
En. Count	Fast
B. Light	120
Sync.	AUTO
Hz	5000
Language	ENG
DMD Time	01
Previous	
4096KB F. Card	

- **Curr. In.** - current input mode selection

Volt select the current clamp input with voltage output;

A.Flex select the Rogowski flexible clamp input;

Amp select the input to be used with CT-s;

Direct select the direct insertion input up to 20A.

In case of **Volt**, **A.Flex** and **Amp** input selection a second page will be displayed for the ratio setup.

- **Volt. In.** - voltage input mode selection

Direct select the direct insertion input for up to 600 +25% VAC_{L-L};

VT Val select the voltage input to be used with external transformers. A second page will be displayed for the ratio setup.

- **En.Count** - energy counters resolution (counting speed)

Fast high resolution. A small quantity of energy updates the counter. At maximum consumption the counter is filled up in 6 days. Suitable to evaluate the consumption in a short time.

Slow standard resolution. The counter update is lower than "fast" choice. The counter is filled up in 20 months. Suitable for long term analysis.

- **B.Light** - display backlight ON time

Setup of the display backlight ON time after the last key has been pressed. Setup range: 0..999 seconds. If 0 is set, the backlight is always ON. If the instrument is powered from external mains supply, the backlight is always ON, and this setup time is not considered. When the backlight is OFF, press any key to activate it.

- **Sync. Hz** - sampling synchronization mode

AUTO the instrument is automatically locked-up to the power line frequency measured on phase L1, when the frequency and voltage values are within the measuring range, otherwise the fixed programmed value is considered (see next parameter). This choice ensure to have an indication of the measured parameters more stable.

FIXED the frequency is programmed with a fixed value (see next parameter).

- **Hz** - sampling synchronization frequency

Set the fixed synchronization frequency in Hz.

- **Language** - display language, available choices: english, german, italian, french, spanish.

- **Wav Time** - integration time for demand values calculation, in minutes.

- **Previous** - return to the previous page.

5.3.1 Current Transducers with voltage output

In MAIN setup page select Curr.In. → Volt.

- **Range A** - Sets the transducer primary current nominal value.

- **Output V** - Selects the transducer output voltage nominal value; the available values are: 1, 2, 3, 10 V

- **Previous** - Return to the previous page

MAIN	
Curr. In.	Volt
Volt. In.	Direct
En. Count	Fast
B. Light	120
Sync.	AUTO
Hz	5000
Language	ENG
DMD Time	01
Previous	
4096KB F. Card	

Here below some examples of displayed values format in function the current clamp setup values.

Clamp inputs setup	Displayed values format
Range A 0020 Output V 2	A 00.00 W 0000 VA 0000
Range A 0030 Output V 3	A 00.00 kW 00.00 kVA 00.00
Range A 0200 Output V 2	A 000.0 kW 00.00 kVA 00.00
Range A 0300 Output V 3	A 000.0 kW 000.0 kVA 000.0

5.3.2 Current Transducers with current output

In MAIN setup page select Curr.In. → Amp.

- **Range A** - Sets the CT primary current nominal value
- **Output A** - Selects the CT output current nominal value, the available values are: 1 or 5A
- **Previous** - Return to the previous page

MAIN	
Curr. In.	Amp
Volt. In.	Direct
En. Count	Fast
B. Light	120
Sync.	AUTO
Hz	5000
Language	ENG
DMD Time	01
Previous	
4096RB P. Card	

5.3.3 AmpFlex Transducer (flexible clamps)

In MAIN setup page select Curr.In. → A.Flex.

- **Range A** - Selects the transducer primary current nominal value, the available values are: 700 and 3000 A
- **Previous** - Return to the previous page

MAIN	
Curr. In.	A.Flex
Volt. In.	Direct
En. Count	Fast
B. Light	120
Sync.	AUTO
Hz	5000
Language	ENG
DMD Time	01
Previous	
4096RB P. Card	



WARNING: use only the special Ampflex clamps provided with the instrument.

5.3.4 Voltage Transformer

In MAIN setup page select Volt.In. → VT Val.

- **Primary** - Sets the VT primary voltage nominal value
- **Secondary** - Sets the VT secondary voltage nominal value
- **Previous** - Return to the previous page

MAIN	
Curr. In.	Amp
Volt. In.	VT Val
En. Count	Fast
B. Light	120
Sync.	AUTO
Hz	5000
Language	ENG
DMD Time	01
Previous	
4096RB P. Card	

5.4 WIRING MODE SELECTION

For a correct wiring, please refer to section 2.7 of this manual.

For three phase network all the parameters are displayed only in 3Ph.-4Wr./3CT mode. Otherwise, only the parameters with a physical connection to the chosen wiring diagram are displayed.



NOTE: If the neutral is not available it is possible to ground the N terminal. In this way, the instrument can be set in 4 wires and all parameters are displayed (a good grounding is recommended for a correct measuring).

- **3Ph.-4Wr./3CT** 3 phase, 4 wire, 3 current
- **3Ph.-3Wr./3CT** 3 phase, 3 wire, 3 current
- **3Ph.-3Wr./2CT** 3 phase, 3 wire, 2 current
The second current is automatically calculated. Connect only current on phase 1 and 3.
- **3Ph.-3Wr./1CT** 3 phase, 3 wire, 1 current
Connect only current on phase 1.
- **3Ph.-1Volt./3CT** 3 phase, 1 Volt, 3 current
Connect only V_{L1-L2} line voltage.
- **3Ph.-0Volt./3CT** 3 phase, 0 Volt, 3 current
It allows to set the V_{L1-N} voltage and PF_{L1} fixed values, necessary for the calculation of the other displayed parameters (power, energy...). These fixed values are not measured by the instrument.
- **1Ph.-3W.(L1-L2)** 1 phase, 3 wire, 2 current
Connect only phase 1 and 2 voltage and current inputs.
- **1-Phase (L1)** 1 phase, 2 wire, 1 current (AC measurement)
- **1-Phase DC** 1 phase, 2 wire, 1 current
DC measurement, only voltage, current, active power are measured. Connect only phase 1 voltage and current inputs.
- **Earth Leakage** Earth leakage current measurement
To connect the current clamp, AUX input must be used.

5.5 COMMUNICATION SETUP

Here below, a communication parameters description:

- **B. Rate** Communication speed, available values: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600 bps
- **Parity** Parity bit selection
- **Bit** Data bits (fixed)
- **Stop** Stop bit (fixed)
- **Address** Logical number, expressed in hexadecimal value, set range: \$01... \$FF
- **Previous** Return to the previous page



5.6 MEMORY PAGES

The instrument is able to store the measured and calculated data in different files. It is possible to set 4 different simultaneous recordings. Each recording can be programmed independently, as for both the start/stop date and time and for the number of parameters to be recorded.



- **List of files** It allows to manage the files already contained in the memory at the moment; different operations can be carried out
- **New file** It allows to create a new recording file for data storage (max 10 files)
- **Format** Formatting the flash card. A confirmation message is displayed, choose YES to format the card



ATTENTION: When flash card is formatted, all files will be deleted!

- **Previous** Return to the previous page

TYPE OF STORED DATA	SAMPLING TIME	CONTINUOUS OR START/STOP RECOR.	POSSIBLE RECORDED PARAMETERS
AVERAGE POWER	PROGRAMMABLE: 1, 5, 10, 15, 30, 60 MINUTES	PROGRAMMABLE	Active, Reactive Inductive, Reactive Capacitive, Apparent (IMPORTED/EXPORTED)
MINIMUM MAXIMUM VALUES	PROGRAMMABLE: 1...9999 MINUTES	PROGRAMMABLE	V; V _{L1-N} ; V _{L2-N} ; V _{L3-N} ; I; I _{L1} ; I _{L2} ; I _{L3} ; P; S; PF; P _{AV}
SAMPLES	PROGRAMMABLE: 1... 9999 SECONDS	PROGRAMMABLE	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} ; COS ϕ _{L1} ; COS ϕ _{L2} ; COS ϕ _{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} ; P _{AV}
HARMONICS	PROGRAMMABLE: 1, 5, 10, 15, 30, 60 MINUTES	PROGRAMMABLE	V _{L1-N} ; V _{L2-N} ; V _{L3-N} ; I _{L1} ; I _{L2} ; I _{L3}

5.6.1 LIST OF FILES

It displays the list of the files contained in the memory. For each file different operations can be carried out:



- **File index** Ex: F 01
- **Type of stored data** En=Energy, Sa=Samples, Ha=Harmonics, Mm=Min/Max
- **File reference number** Ex: 00
- **Storing status** Yes/No/Wait
- **File management**

To select operations which can be carried out, press **ENTER** and with **UP** or **DOWN** choose between the available options:

- Stop** stop the recoding
- St.** start the recording
- Del.** gain space in the memory deleting the file; a confirmation message will be displayed
- Info** information on the recording
- Can.** cancel, no modification, return to LIST OF FILES page



- **Previous** Return to the previous page

 **NOTE:** It is not possible to set, simultaneously, in "St." state (START) more than one file for each type.

To display information on a file, select the file from the list, press **ENTER**, select Info in the file management field and press **ENTER** again. A new page will give all information on the selected file. Fields description:

- **Type** Type of data stored in the file
- **Enable** Recording status (Y / N)
- **S.Time** Sampling time
- **Date** Date of file creation
- **Time** Time of file creation
- **St/Stp** Recording interval:
 - CONT.** continuous
 - CLOCK** time interval set in the Start/Stop page
- **Params** Yes/No indicates the recording status of the indicated parameter; use the **LEFT** or **RIGHT** keys to choose the available parameters
- **Size** File size
- **Active** Real status of the file (Y=storing, N=no storing)
- **Previous** Return to the previous page



5.6.2 NEW FILE

Creates a new file for data recording in the flash card (max 10 files):

- **Type** Select the type of data to be recorded: Energy, Min/Max, Harmonics, Samples
- **Enable** **YES** will start the recording after the registration;
NO the recording can be started later
- **S.Time** Set the time interval between two consecutive recordings; if you are recording Energy and Harmonic it is possible to choose the interval among these possible values: 5, 10, 15, 30, 60 min; otherwise the interval can be set in range 0000...9999, seconds for Samples and minutes for Min/Max
- **St/Stp** Recording interval:
CONT. continuous
CLOCK recording time interval set in the Start/Stop page
- **Params** All the values selectable are shown in sequence:
UP or **DOWN** keys - select the parameters
LEFT or **RIGHT** keys - enables/disables the storage of the selected parameter
- **Register** Register the file
- **Previous** Return to previous page



START / STOP

Set Start/Stop date and time recordings.

- **Start date and hour of the recording**
S Date (format: yy/mm/dd)
S Time (format: hh:mm:ss)
- **Stop date and hour of the recording**
E Date (format: yy/mm/dd)
E Time (format: hh:mm:ss)
- **Previous** Return to the previous page



5.7 CLOCK PAGE

Set day, date and time displayed by the instrument.

- **Date** Current date (format: YY/MM/DD)
- **Time** Current time (format: hh:mm:ss)
- **Day** Day of the week (i.e. Monday)
- **Previous** Return to the previous page



5.8 TIMEBANDS PAGES

It is possible to program up to 10 daily schedule (periods); each schedule, containing up to 3 tariffs and 8 tariff changes, can be associated to different days of the week and months of the year.

- **Time 1...8** It allows to set the start time (hour/minutes) of one or more tariffs in a day (up to 8 tariff changes). For each start time it is possible to set three different tariffs (1,2,3).

The tariff "0" must be used only in order to stop the daily programming, any value indicated in the following lines will not be considered.

- **Day**

LEFT or **RIGHT** keys - Select the day of the week

UP or **DOWN** keys - Enable/disable (YES/NO) each day in the period

- **Month**

LEFT or **RIGHT** keys - Select the month

UP or **DOWN** keys - Enable/disable (YES/NO) each month in the period

- **Previous**

Return to the previous page

TIMEBANDS	
Period	1
Period	2
Period	3
Period	4
Period	5
Period	6
Period	7
Period	8
Period	9
Period	10
Previous	409603 P. Card

PERIOD 1		
Time 1	00:00	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	409603 P. Card	



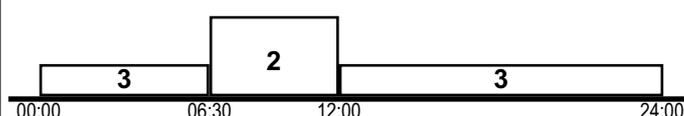
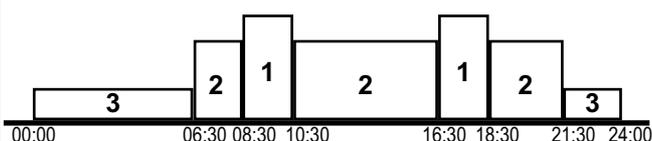
ATTENTION: If the same day and the month are set in two different periods, the instrument will consider the settings made in the period with the lower number.



ATTENTION: Days and months, not set in any periods, will be considered with tariff 3.

Example for timebands programming in October-March period.

Period	Days	Tariff
1	from Mon to Fri	1-2-3
2	Sat	2-3
	Sun (not programmed)	3 (auto)

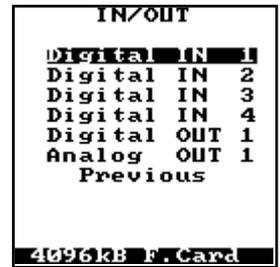


PERIOD	MONTH	DAY	TIME
PERIOD 1	OCTOBER	MONDAY	00:00 = 3
	NOVEMBER	TWESDAY	06:30 = 2
	DICEMBER	WENDSDAY	08:30 = 1
	JANUARY	THURDAY	10:30 = 2
	FEBRUARY	FRIDAY	16:30 = 1
	MARCH		18:30 = 2
			21:30 = 3
			24:00 = 0

PERIOD	MONTH	DAY	TIME
PERIOD 2	OCTOBER	SATURDAY	00:00 = 3
	NOVEMBER		06:30 = 2
	DICEMBER		12:00 = 3
	JANUARY		24:00 = 0
	FEBRUARY		
	MARCH		

5.9 INPUT / OUTPUT PAGES

The IN/OUT menu enables to select the I/O channels to be set. The configuration of this page depends on the instrument equipment.



NOTE: The digital inputs, digital outputs and analog outputs channels are optional.

DIGITAL INPUTS

It allows to set the digital inputs parameters.

- **Mode** Only PULSE mode is active: it allows to count the energy pulses from mechanical or static energy counters
- **Set** Input coefficient in kWh/pulse
- **Previous** Return to the previous page



PULSE COEFFICIENT CALCULATION

The formula for the input pulse coefficient calculation is the following:

$$\text{Set} = i \times \text{CTs Ratio} \times \text{VTs Ratio}$$

Where:

i = Wh/pulse secondary (features of the measure counters)

CTs Ratio = Current Transformation ratio of the **CT** used for the insertion of the counters

VTs Ratio = Voltage Transformation ratio of the **VT** used for the insertion of the counters

Example:

Suppose that the pulses come from three-phase counters with insertion through VT2000/100 and CT200/5 with 8000 p/kWh on output.

$$i = 1 / 8 = 0,125 \text{ Wh/pulse}$$

$$\text{Set} = 0,125 \times 40 \times 20 = 100 \text{ Wh/pulse}$$

DIGITAL OUTPUT

It allows to set the digital outputs parameters.

- **Var.** Parameter associated to the output



NOTE: For pulse output, only the energy parameters can be programmed.

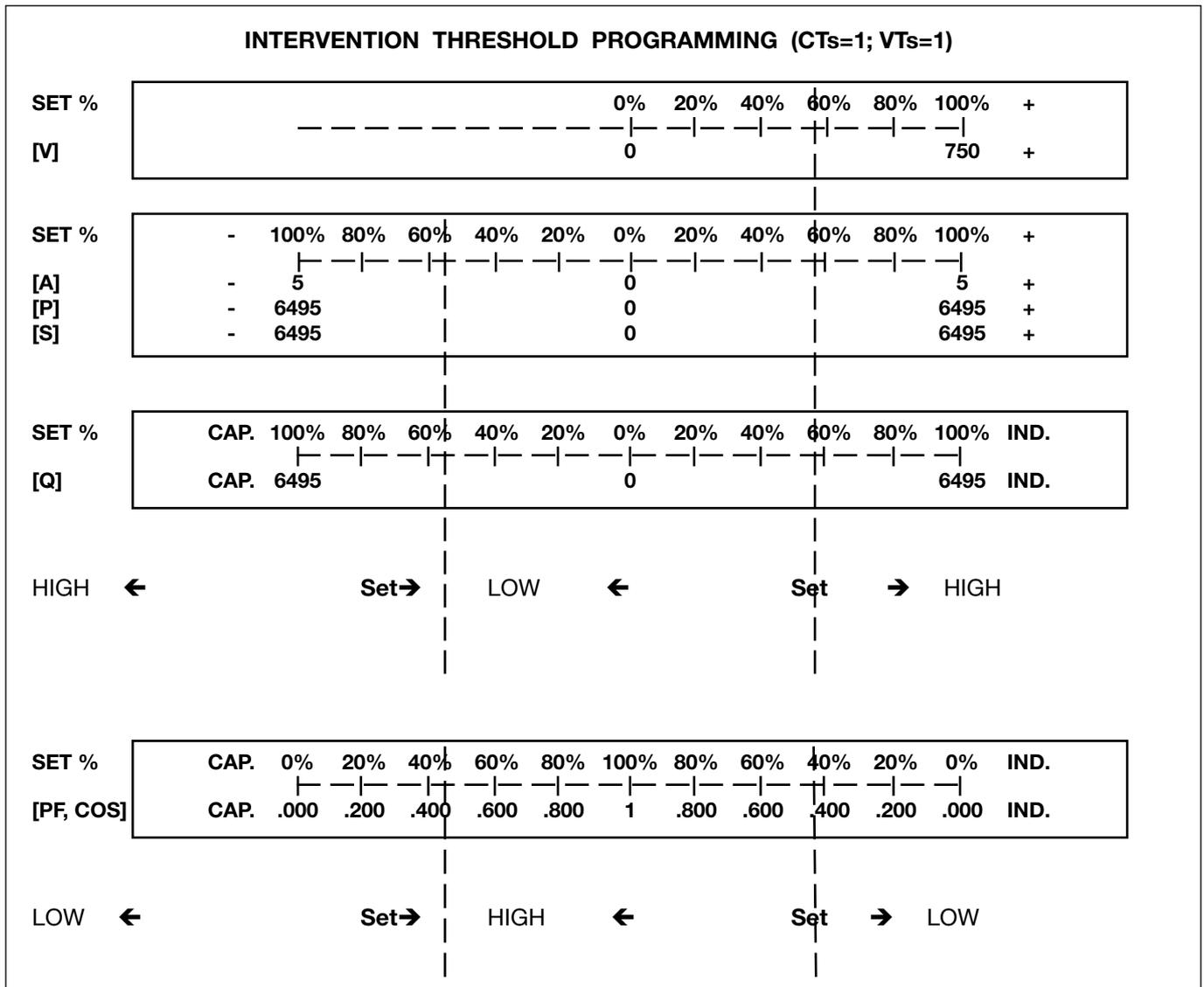
- **Mode** Output functioning mode:
 - PULS** pulse emission (only energy parameters)
 - HIGH** high threshold. The output is activated when the value of the selected parameter is higher than the set point (this mode cannot be used for energy parameters)
 - LOW** low threshold. The output is activated when the value of the selected parameter is lower than the set point (this mode cannot be used for energy parameters)



- **Delay** Depending on the selected mode:
PULS pulse width set (0..500 msec.)
HIGH/LOW delay of the output switching (0..999 sec.)
- **Hyst.** Threshold hysteresis (0-99% of SET value)

 **NOTE:** Hysteresis set has no effect in PULS mode.

- **Set** Depending on the selected mode:
PULS value of the pulse, expressed in Wh, VAh or varh
HIGH/LOW threshold value in percentage of the selected parameter fullscale. The figure below indicates the the threshold expressed in absolute value
- **Previous** Return to the previous page



FULLSCALE DEFINITION

VOLTAGE

- Direct insertion
Fullscale: 750V (600+25%)
Maximum programmable percentage: 100%
- Insertion with TV:
Fullscale: primary voltage of VTs
Maximum programmable percentage: 150%

CURRENT

- Fullscale: primary current of CTs
Maximum programmable percentage: 140%

POWER

The fullscale is the product between voltage and current fullscale.

System Power f.s. = Vf.s. x Af.s. x 1.73

Phase Power f.s. = (Vf.s. x Af.s.) / 1.73

CONSIDERATIONS ON THE PULSE VALUE CALCULATION

The maximum emission frequency of the pulses is 2 pulses per second, which are 7200 pulses per hour.

The minimum weight to attribute to the pulse in order to avoid losing count is:

$$e_{\min} = P_{\max} / (\text{CTsRatio} \times \text{VTsRatio} \times 7200)$$

Example 1:

A measurement carried out on a three-phase line **10 kV**

VT = 10000/100 V (KVT=100)

CT = 400/5 A (KCT=80)

P_{MAX}=4.5 MW

$$e_{\min} = 4500000 / (100 \times 80 \times 7200) = 0.078 \text{ Wh}$$

This result can be rounded off to a higher value (Ex. **0.1 Wh**) in order to facilitate the calculations of the energy consumed on an externally connected equipment (if any).

Example 2:

A measurement carried out on a three-phase line 380 V

VT = none (VTsRatio=1)

CT = none (CTsRatio=1)

P_{MAX}=3.3 kW

$$e_{\min} = 3300 / (1 \times 1 \times 7200) = 0.458 \text{ Wh}$$

This result can be rounded off to **1 Wh**.

CHANGING THRESHOLD VALUE

To modify the percentage value of the digital output threshold, follow the procedure below:

- select the Value parameter, and press **ENTER** key: the first digit will be highlighted
- press **UP** or **DOWN** keys to modify the figure, **LEFT** or **RIGHT** to move to another digit
- confirm with **ENTER** key

NOTE: Since the numerical values are rounded, it might be difficult, especially for low percentage values, to obtain the exact value. If this situation should occur, we advise you to choose the value slightly lower or higher than the desired one.

ANALOG OUTPUT

It allows to set the analog output parameters.

- **Var.** Parameter associated to the output (except for energy parameters)
- **Mode** Value of the output current
 - 0-20A** monodirectional output
 - 4-20A** monodirectional output
 - 0-20B** bidirectional output, the zero value of the parameter corresponds to 10 mA
 - 4-20B** bidirectional output, the zero value of the parameter corresponds to 12 mA
- **Min** Is the value of the selected parameter corresponding to the minimum value of the output current, 0 or 4mA. The value is defined as a percentage of the fullscale of the selected parameter. The figure below indicates the absolute value
- **Max** Is the value of the selected parameter corresponding to the maximal value of the output current, 20 mA. The value is defined as a percentage of the fullscale of the selected parameter. The figure below indicates the absolute value

ANALOG OUT 1	
Unit	None
Mode	0-20M
Min	%00000
Max	%00000
Previous	
4096KB F. Card	



NOTE: We advise you to set a difference of at least 10% between min and max parameters.

- **Previous** Return to the previous page

CHANGING PARAMETER VALUE

To modify the percentage value of Min or Max parameter, follow the procedure below:

- select the Value parameter, and press **ENTER** key: the first digit will be highlighted
- press **UP** or **DOWN** keys to modify the figure, **LEFT** or **RIGHT** to move to another digit
- confirm with **ENTER** key

NOTE: Since the numerical values are rounded, it might be difficult, especially for low percentage values, to obtain the exact value. If this situation should occur, we advise you to choose the value slightly lower or higher than the desired one.

6. PRINTOUT PRP40 (OPTIONAL)

6.1 MANUAL PRINTOUT

In the instrument equipped with printer, it is possible to perform a printscreen function pressing simultaneously **SHIFT + PRINT** keys.

To enter the manual printout menu, press **PRINT** key (function not available in Setup mode). With **UP** or **DOWN** keys different print items can be selected.



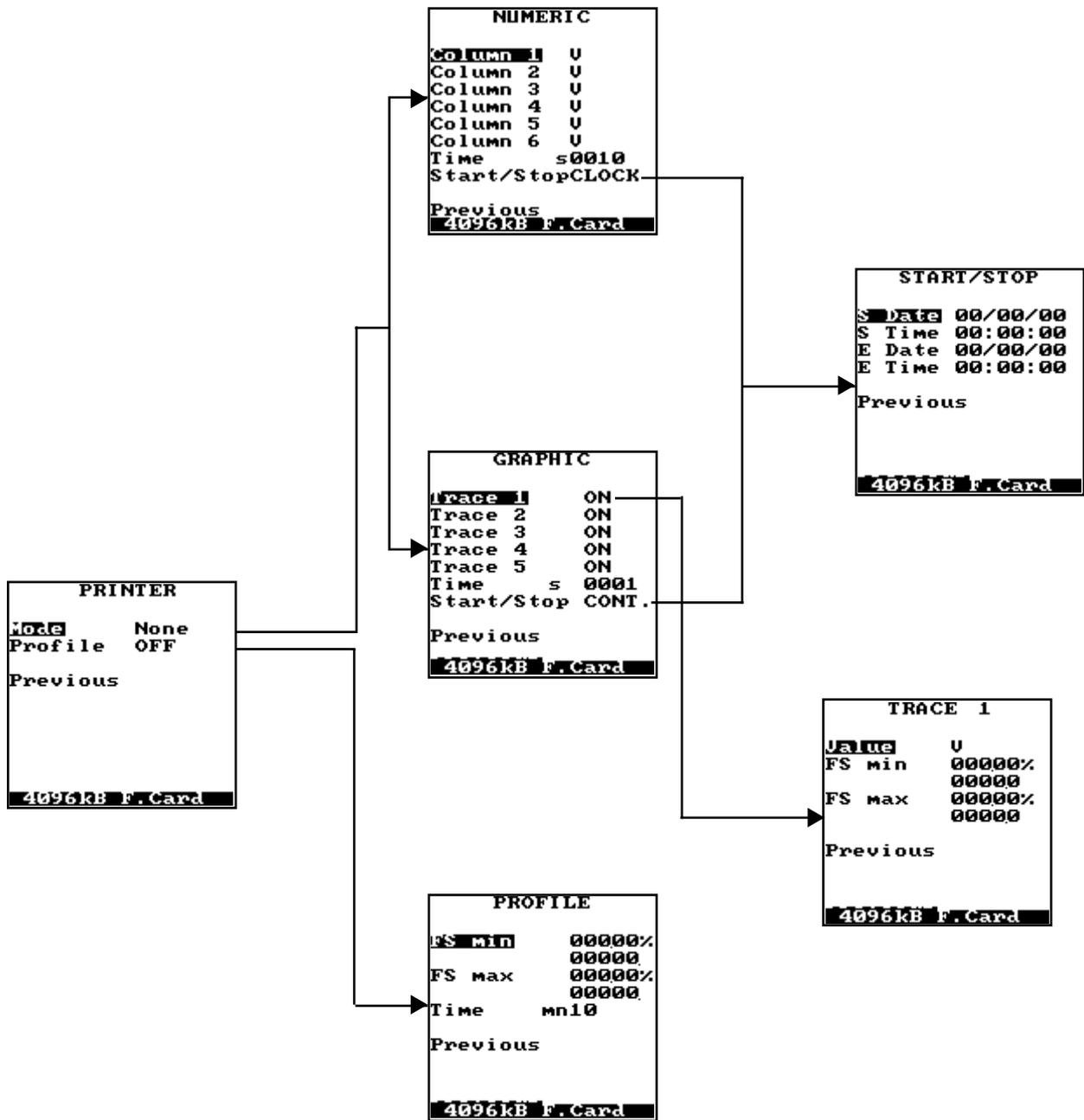
- **Measured Values** Printout of the instantaneous values
- **DMD & Peak Values** Printout of the demand and peak values
- **Harmonics Values** Printout of all the instantaneous harmonics
- **Average Power** Histogram printout of the day in progress (till the time of printout operation)
- **Min/Max Values** Printout of the minimum and maximum values
- **Summary** Printout of the main values (voltage, current, powers, ...), all voltage harmonics (50) in absolute and percentage values, all current harmonics (50) in absolute and percentage values
- **Timebands** Printout of the timebands counters (till the time of printout operation)
- **General Setup** Printout of all the instrument settings (wiring, current input, voltage input, frequency synchronization, ...)
- **Timeband Setup** Printout of the timebands settings of each period (1-10)
- **Exit** Return to the previous page

6.2 AUTOMATICAL PRINTOUT - PROGRAMMING

The automatical printout setup pages can be reached from the Setup Menu. It allows to access to the programming pages for the automatical data printout.

It is possible to printout all the instantaneous values at programmable intervals.

This chart shows the printout data programming pages.



6.2.1 PRINTER

Automatical printout menu.

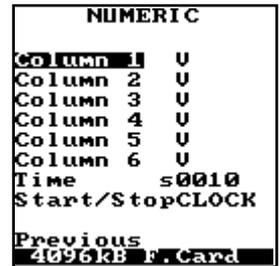
- **Mode** Selects the automatical printout mode:
 - None** no printout
 - Numeric** table printout (see section 6.2.2 and 6.2.5)
 - Graphic** graphic printout (see section 6.2.3, 6.2.4 and 6.2.5)
- **Profile** Prints automatically at 00:00 (midnight) the daily histogram of the average active and reactive powers. When ON is displayed, press **ENTER** key to access to the histogram programming page (see section 6.2.6).
- **Previous** Return to the previous page.



6.2.2 NUMERIC

It allows to print in numerical format. At the top of the printout, wiring mode, date and time will be shown.

- **Column 1....6** Set the parameters to be printed. Six columns are available and each one allows to select the desired parameter. To disable a printout column, select None. Every printed line can support 42 characters; therefore, if the amount of characters exceed this value, the last column is not printed. The length of each field on a printed line are:
 - 6 characters for hours: minutes (always to be considered)
 - 7 characters for an harmonic
 - 8 characters for an energy
 - 6 characters for the other measured parameters



PRINTOUT WIDTH CALCULATION
(HH:MM)(Value1)(Value2)(Value3)(Value4)(Value5)(Value6)

Es. 1: **6 measured values**
6 + 6 + 6 + 6 + 6 + 6 + 6 = tot. 42 (characters)

Es. 2: **5 harmonical values**
6 + 7 + 7 + 7 + 7 + 7 + 0 = tot. 41 (characters)

Es. 3: **4 energy values**
6 + 8 + 8 + 8 + 8 + 0 + 0 = tot. 38 (characters)

Es. 4: **2 measured values + 3 energy values**
6 + 6 + 6 + 8 + 8 + 8 + 0 = tot. 42 (characters)

NOTE: For V1h, V2h, V3h, I1h, I2h, I3h parameters it is necessary to specify the harmonics order to be printed.

- **Time** Time interval of the automatical printout. The available values are: 10, 15, 30, 60, 120, 300, 600, 900, 1800, 3600 seconds.
- **Start/Stop** Selects the automatical printout type:
 - CONT.** printout always enabled, continuous
 - CLOCK** printout enabled in a programmable period. When CLOCK is displayed, press **ENTER** key to access to the Start/Stop section of the programmed printout (see section 6.2.5)
- **Previous** Return to the previous page.

6.2.3 GRAPHIC

It allows to print in graphic format. At the top of the printout, wiring mode, date and time will be shown.

- **Trace 1...5** Enables the single graphic trace. When ON is displayed, press **ENTER** to access to the programming of each single trace. Up to 5 traces can be printed. Every printed trace is identified in a different graphic symbol and all the scales are printed with a regular time interval.
- **Time s** Time interval of the automatical printouts. The available values are: 10, 15, 30, 60, 120, 300, 600, 900, 1800, 3600 seconds.
- **Start/Stop** It selects the automatical printout type:
CONT. printout always enabled, continuous
CLOCK printout enabled in a programmable time interval. When CLOCK is displayed, press **ENTER** key to access to Start/Stop section of the programmed printout (see section 6.2.5).
- **Previous** Return to the previous page.



6.2.4 SINGLE TRACE SETUP

- **Value** Defines the parameter to be printed. Enter None to disable the trace. The graphic printout of the measurements is automatically carried out at programmed intervals and the elapsed time is indicated. A maximum of 5 parameters can be printed.
- **FS Min** Is the value of the selected parameter corresponding to the minimum limit of the graphic. The value is defined as a percentage of the fullscale of the selected parameter. The figure below indicates the absolute value.
- **FS Max** Is the value of the selected parameter corresponding to the maximum limit of the graphic. The value is defined as a percentage of the selected parameter. The figure below indicates the absolute value.
- **Previous** Return to the previous page.



6.2.5 START / STOP PRINTOUT

Sets the start and stop time of the automatical printout.

The access to this page is possible both from the Numeric and the Graphic section. The page is displayed only if the option CLOCK of the function Start/Stop has been selected.

- **S Date** Start date of the printout (format: YY/MM/DD)
- **S Time** Start time of the printout (format: hh:mm:ss)
- **E Date** End date of the printout (format: YY/MM/DD)
- **E Time** End time of the printout (format: hh:mm:ss)
- **Previous** Return to the previous page



6.2.6 PROFILE

If enabled (ON), the printout of the histogram of active and reactive average power is automatically carried out at the hour 00.00.

The minimum and maximum fullscale can be set and the resulting printout checked with the manual printout.

- **FS Min** Percentage value of the power fullscale, for the lower limit of the power histogram. The figure below indicates the absolute value.
- **FS Max** Percentage value of the fullscale, for the maximum limit of the power histogram. The figure below indicates the absolute value.
- **Time mn** Integration time for the average values of active and reactive average powers, the available values are:10, 15, 30, 60 minutes.
- **Previous** Return to the previous page.

```
PROFILE
FS min    00000%
FS max    00000%
Time      mn10
Previous
4096kB F. Card
```

6.3 PRINTER USE AND MAINTENANCE

6.3.1 COMMANDS

SHIFT + ENTER keys, pressed simultaneously for more than 3 seconds, allow to feed more paper from the printer (3mm/sec). To change one of the printer elements, follow the procedure described below.

6.3.2 CHANGING RIBBON

Both ribbon and paper roll are already installed on the delivered printer

- Turn off the instrument
- Open the printer cover
- Remove the old ribbon pushing on the "PUSH" label
- Tighten the new ribbon using the small wheel
- Mount the new ribbon in the printer pressing slightly
- Turn the small wheel to check that the ribbon is properly set under the printing head
- Turn on the instrument again
- Feed the paper pressing **SHIFT + ENTER** keys, check that the ribbon is properly installed
- Close the printer cover

6.3.3 CHANGING THE PAPER ROLL

Standard type paper roll is used for this printer

- Turn off the instrument
- Open the printer cover
- Remove the old roll
- Cut the paper at the beginning of the roll in an arrow like shape
- Insert the new roll and put the paper in the entry hole from the bottom
- Turn on the instrument again
- Press **SHIFT + ENTER** keys until the paper does not come out from the printer
- Close the printer cover

algodue[®]
ELETTRONICA

Via Passerina, 3 / a - 28010 FONTANETO D'AGOGNA (NO) - ITALY
<http://www.algodue.com> - E mail: info@algodue.com