■ TREE PHASE POWER QUALITY ANALYSER

C.A 8332
C.A 8334

ENGLISH

User's manual

CHAUVIN ARNOUX

Meaning of the symbol ⚠ :
Warning ! Please refer to the User's Manual before using the instrument.
In this User's Manual, the instructions preceded by the above symbol, should they not be carried out as shown, can result in a physical accident or damage the instrument and the installations.

Thank you for acquiring a **C.A. 8332 or C.A.8334 three phase power quality analyser.**
To obtain the best possible service from your instrument:
- **read** these operating instructions carefully,
- **comply** with the precautions for use.

⚠ PRECAUTIONS FOR USE ⚠

- Respect the climatic conditions for use (see § 6).
- Respect the rating and type of the fuse to avoid damaging the instrument and cancelling the warranty (see § 7.1)
- This instrument can be used on category-III installations for voltages not exceeding 600 V in relation to the earth (as per IEC 664-1 Ed. 92).
  Category III equipment is permanent installation equipment and equipment subject to special specifications, for reasons of reliability and availability.
- Ensure that you only use accessories with surge and voltage categories in relation to the earth at least equal to those of the product.
- Ensure the measurement leads and sensors are disconnected before removing the battery.
- Use battery packs supplied by the maker.

WARRANTY

Our guarantee is applicable for **twelve months** after the date on which the equipment is made available (extract from our General Conditions of Sale, available on request).

CONTENTS

1. INTRODUCTION

C.A 8332 and C.A 8334 are three phase power quality analysers which are compact and shock-resistant. Their ergonomic design and the simplicity of their user interface make their use pleasant and intuitive.
They not only enable the user to obtain an instant image of a network's principal characteristics but also to monitor their variation over a period of time. Their multi-task measurement system simultaneously handles all the measurement functions of the various magnitudes, detection, continuous recording: and their display without any constraints.

They are intended for the technicians and engineers of the test and maintenance teams working in industry and the administration, for measurements, enabling them to carry out checks and diagnostic work on single phase, two phase or three phase low voltage networks.

The principal measurements made are:

- Measurement of AC rms voltages up to 480 V (phase-to-neutral) or 830 V (phase-to-phase) for two-wire, three-wire or four-wire networks.
- Measurement of alternating RMS currents up to 3000 A rms.
- Measurement of the frequency of 50 Hz, 60 Hz (10 Hz to 70 Hz) networks.
- Calculation of neutral current by vector summing of phase current for star configurations.
- Calculation of peak factors for currents and voltages.
- Calculation of the K factor for currents (transformers).
- Calculation of short-term flicker for voltages.
- Calculation of the phase unbalance for voltage and current.
- Measurement of harmonic angles and rates (with respect to fundamental value or with respect to RMS value) for voltage, current or power, up to level 50. Calculation of overall harmonic distortion factors.
- Measurement of active, reactive and apparent power per phase and their aggregate.
  Calculation of the power, shift and tangent factor .
  Aggregate of energies from a point in time chosen by the operator.
- Monitoring of the average value of any parameter, calculated over a period running from 1 sec to 2 hours. Storage of values over an unlimited period in the instrument memory.
- Recording, time stamping and characterisation of disturbance: Swells, dips and interruptions, overrun of power and harmonic thresholds...
- Detection of transients and recording of the associated waveforms.

2. PRESENTATION

2.1 Unit *(see § 9. Appendix)*

① Display on a LCD colour screen with graphic representation of network parameters in the mode chosen using the keys ⑤ (see § 2.2).

② 6 variable function keys to modify the current display mode

③ 4 keys which allow the user to:

- access the instrument configuration parameters (*see § 3.1)*
- memorise the current screen and access screens already stored in the memory
- print the measurement results on an external printer (*see "To order" paragraph*)
- obtain assistance on the current display mode functions in the language chosen by the user

④ ON / OFF key

⑤ Keys for choosing the display mode at any time:

- Transients: display of waveforms, motor startup current (Inrush) and interruption.
- Harmonics:
  - representation of the harmonic ratios of voltage, current and power, order by order,
  - determination of harmonic current produced by non-linear loads,
  - analysis of the problems caused by harmonics according to their order (heating of neutrals, conductors and motors, etc.)
- Waveforms : representation of voltage and current waveforms or vector representation (Fresnel diagram) used for:
  - the identification of signal distortion signatures,
  - the display of amplitude and phase unbalance for voltage and current
  - the checking of connections in the correct phase order

W Power / Energy: - the display of power levels and the associated parameters (power factor, displacement and tangent),
- energy metering,
- Four quadrants measurement to discern produced /consumed active energies and inductive / capacitive reactive energies.

Recording: - time-related representation as bar charts or curves, of mean power levels or of the mean value of any other parameter,
- mains voltage stability check,
- management of power consumed and generated (most economical choice with energy distributor),
- monitoring of harmonic variations,

Alarms: - a list of the alarms recorded according to the thresholds programmed during configuration,
- logging of supply network interruption with half-period resolution,
- determination of energy consumption overruns,
- checking of compliance with energy supply quality contract.

⑥ 4 keys: and which enable movement of the cursor, browsing or the selection of data.

⑦ Validation key

⑧ Network supply connector

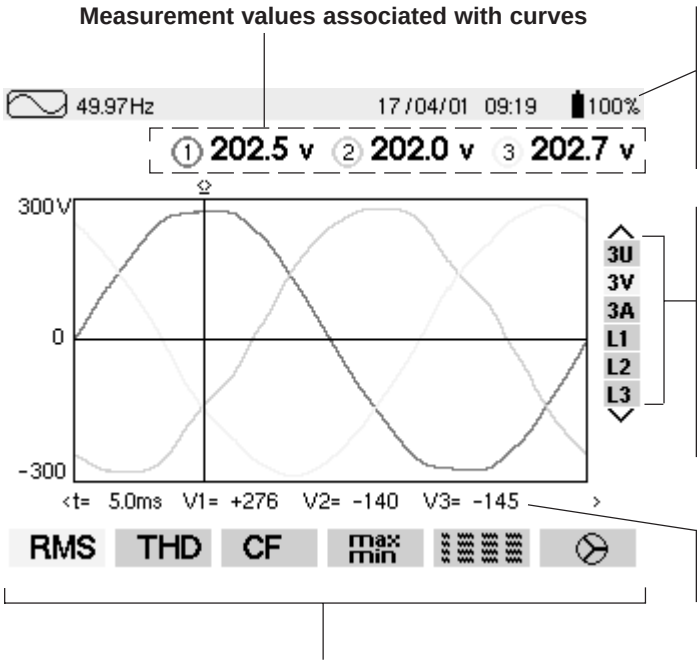
⑨ IR RS232 bidirectional optical output for transferring data to a PC (bidirectional) or printing to a dedicated printer (DPU 414 - SEIKO).

⑩ 4 voltage inputs situated on the top of the instrument

⑪ 3 current inputs on the top of the instrument to enable the use of ammeter sensors (MN clamp, C clamp, Amp*FLEX,* PAC clamp.)

⑫ Protective case

2.2 Display



Important parameters concerning the instrument:
- Display mode
- The frequency of the measured network
- The proportion of memory occupied for certain modes
- The current date and time
- The battery charge status (see § 2.3)

Selection of the curves to display by pressing on the keys :
- **3U** displays the three compound voltages U_{12}, U_{23}, U_{31},
- **3V** displays the 3 phase-to-phase voltages V_{1N}, V_{2N}, V_{3N},
- **3A** displays the three phase currents and 4A with the neutral current of a three-phase system,
- **L1, L2** or **L3** display the current and voltage in turn on phase 1, 2 or 3.

Instant values of signals at an instant "t", at the intersection of the cursor and the curves. The cursor is moved along the time scale with the keys .

Selection of the measurement type using the variable function keys ②, situated below the screen:

RMS True RMS measurement

THD Overall harmonic distortion factor

CF Crest factor

max/min Extreme and average values

Simultaneous display of the various measurements

Fresnel diagram of signals

⚠ The calculation of the DPF, Tan, KF, ϕ, UNB, Min, Max, VAR, Harmonics, PST, and DF parameters and the frequency measurement can only be performed if Ch 1, with voltage V1, is connected to the network.

2.3 Presentation of the different battery states

1. Battery charging

25% ***The battery sign and percentage are blinking***

Percentage of the total capacity already charged (between 0 and 99%)

Battery capacity level in proportion to the actual charge

2. Battery full (End of charge or begin of discharge

100% ***The battery sign and percentage are fix***

3. Battery discharging

25% ***The battery sign and percentage are fix***

Percentage of the remain capacity

Battery capacity level in proportion to the remain percentage

4. Battery empty discharging

0% ***The battery sign and percentage are fix***

5. New battery charging

? ***The battery sign and percentage are blinking***

Interrogative point showing unknown capacity level

Fix battery capacity level

6. New battery discharging

? ***The battery sign and percentage are fix***

Interrogative point showing unknown capacity level

Fix battery capacity level

3. INITIAL OPERATION

The instrument is initially started up by pressing on the ⏻ key, the startup screen indicates the instrument software version and its serial number.

If there is no AC mains supply, the instrument can operate with batteries only, provided they are correctly charged.

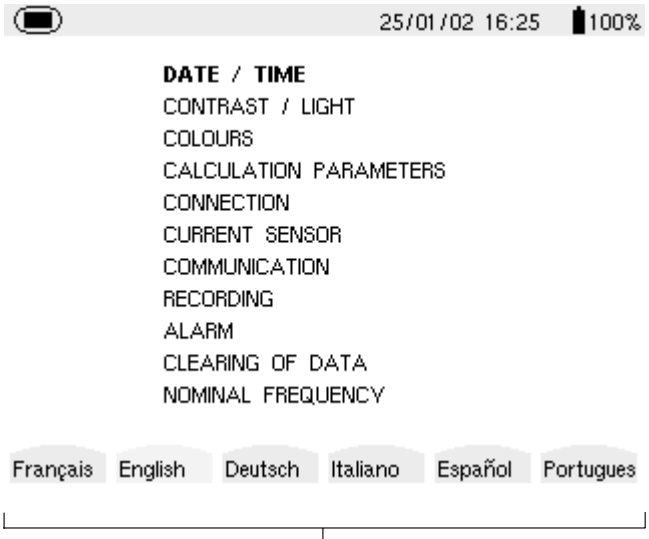
The instrument's batteries are charged when it is connected to the AC mains supply.

Note: When the equipment is stopped using the ⏻ key, a confirmation is requested if the equipment is in the process of recording or detecting transients.

3.1 Configuration of the instrument

⚠ **The instrument must be configured the first time it is used** and then whenever necessary. The configuration is saved in the non-volatile memory when the instrument is switched off (with ⏻ key).

When the ▬ key is pressed, the following choices appear:



- Choose the language used with the variable function keys ②, situated just below the screen.
- Select the other configuration settings with the ▲▼ keys
- Validate with the key ↵

The settings available are presented in the following paragraphs.

3.1.1 Date / Time

10/10/2000 16:45

- Select the number to be modified with the ◄► keys, it will appear in bold type.
- Modify the value of the number selected with the ▲▼ keys
- Validate the setting with the ↵ key, the Configuration menu will once again be displayed on the screen.

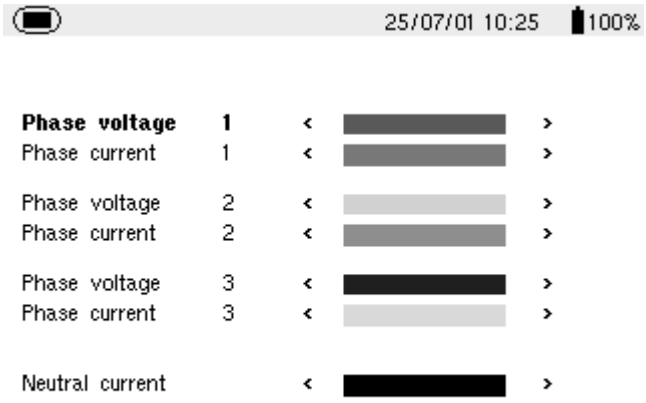
Note: The date and time system used is indicated at the foot of the screen; these can also be modified.

3.1.2 Light / Contrast

Two bargraphs appear in this display

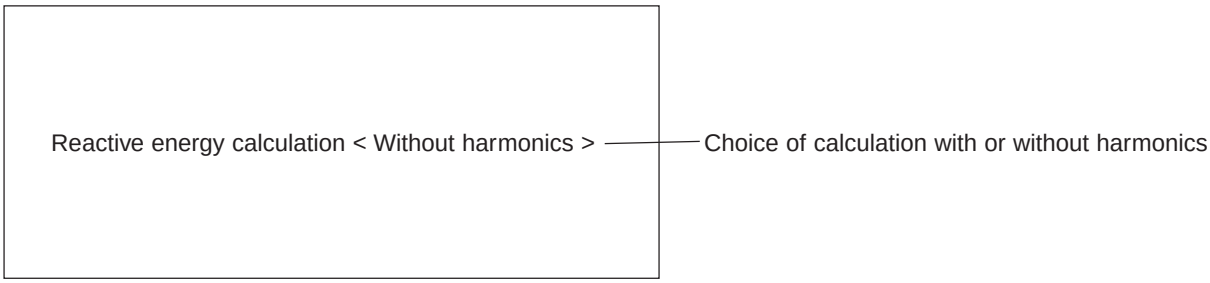
- Choose Light or Contrast with the ▲▼ keys
- The setting is chosen with the ◄► keys and the setting level indicated on the bargraph.
- Validate the setting with the ↵ key, the Configuration menu will once again be displayed on the screen.

3.1.3 Colours



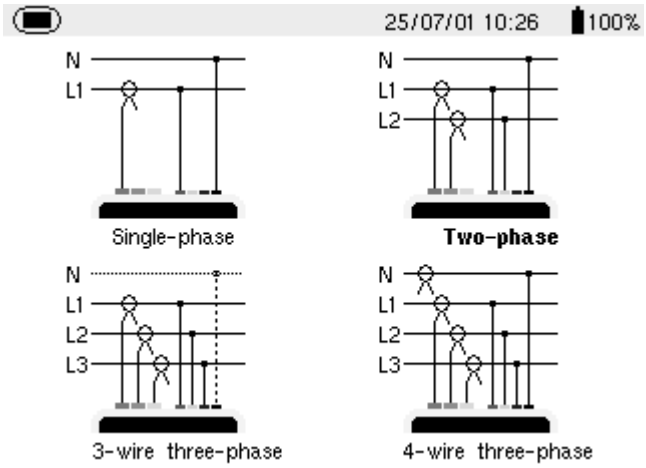
- Choose the channel concerned with the keys
- Choose the colour with the keys
- Validate the setting with the key, the Configuration menu will once again be displayed on the screen.

3.1.4 Calculation parameters

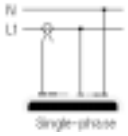
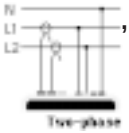


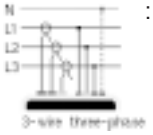
- Choose the method with the keys
- Validate the setting with the key, the Configuration menu will once again be displayed on the screen.

3.1.5 Connection

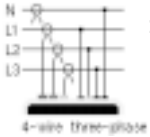


- Choose the connection with the ◄ ► and ▲ ▼ keys
  Validate the setting with the ↵ key, the Configuration menu will once again be displayed on the screen.

⚠ **Single phase**  **or two-phase**  **,** the neutral current is not measured or calculated.

3-wire, three phase  :

1. Three phase, triangle network: only power totals are representative of the actual situation
2. Three-phase star network: the neutral current is not calculated. It is necessary to connect neutral to obtain representative power levels per phase.

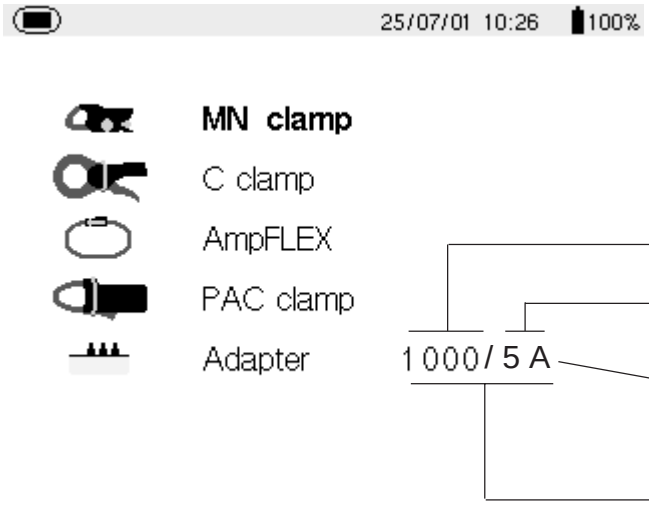
4-wire three-phase  : the neutral current is calculated and its value and waveform are displayed.

⚠ V1 must be connected in any type of connection since the display is synchronised from V1 and the network frequency measured by V1.

■ **Synchronisation of the display of curves in "Waveform" mode**

Display selection (vertical right menu)	Reference channel for synchronisation
3U	U1
3V	V1
4A / 3A	A1
L1	V1
L2	V2
L3	V3

3.1.6 Current sensor



- Choose the sensor with the keys
- Validate the setting with the key, the Configuration menu will once again be displayed on the screen.

From 5 to 2999A, nominal value of primary current

Secondary current value

make the cursor appear/disappear and move.

allow the current required to be determined.

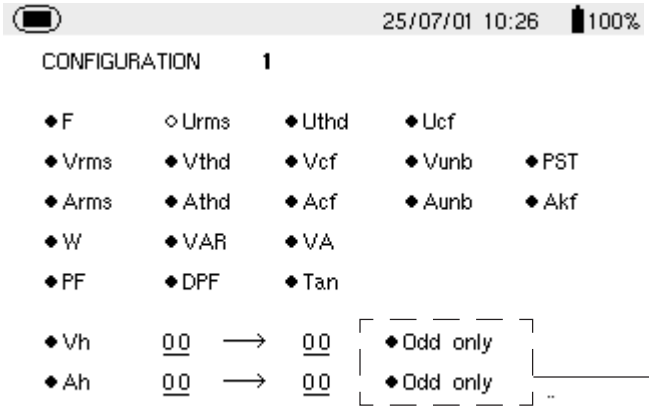
Current transducer ratio

3.1.7 Communication

Transmission speed **57600** BDS

- Choose from the values: 300, 2400, 4800, 9600, 19200, 38400, 57600 or 115200 bauds with the keys
- Validate the setting with the key, the Configuration menu will once again be displayed on the screen.

3.1.8 Recording



1. Choose the recording configuration using the keys
2. Move through the chosen field using the keys and validate the parameters using the keys; the field to be modified is shown in bold
3. Validate the setting with the key, the Configuration menu will once again be displayed on the screen.

If these lines are not validated, all the harmonic orders will be recorded.

Four different recording configurations can be stored

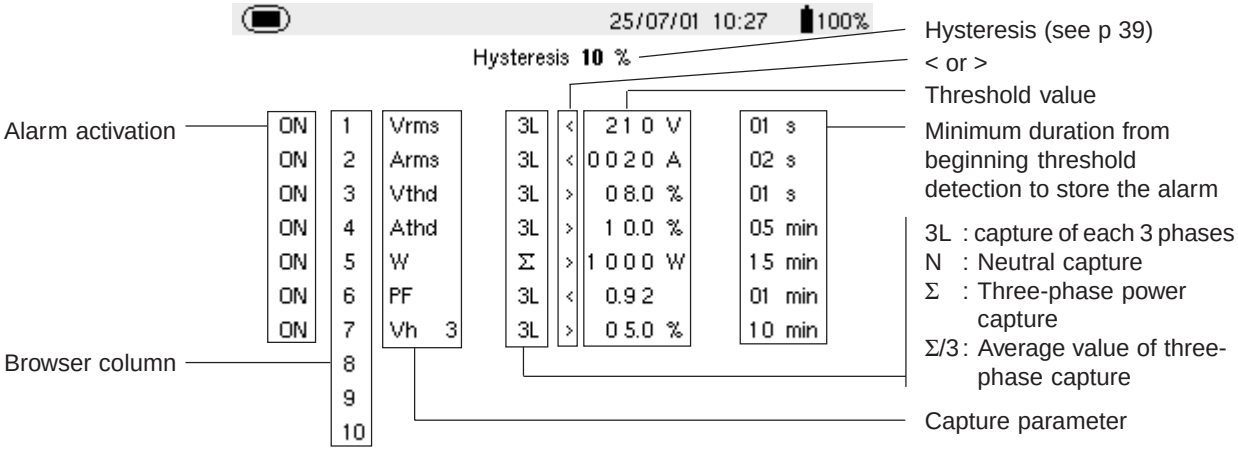
3.1.9 Alarm

⚠ **A programmed alarm must be set to ON to be taken into account** (general activation or deactivation of alarms is generated in 🔔 mode).

■ **Alarm programming**

Choose the parameters associated with an alarm from the parameters proposed; phases survey, threshold value and minimum duration filtering can be programmed

NB: The programmed hysteresis is common to all alarms.



1. Select the modifiable field using the ◀ ▶ keys.

2. Activate or adjust the threshold values using the ▲ ▼ keys; the field to be modified appears in bold

3. Validate the setting with the ↵ key, the Configuration menu will once again be displayed on the screen.

NB : When an alarm is "OFF":

1) The parameters previously used are kept in the memory and reappear if the alarm is selected again.

2) To move quickly from one programmed alarm to another:
simply position the cursor on the alarm numbers column and use ▲ ▼.

⚠ **Modifying one or several characteristics of an alarm set to ON switches it automatically to OFF**.

3.1.10 **Recorded data delete**

When data delete is selected, the following question is displayed:

Are you sure you want to delete all the data?	
Yes	**No**

- Choose the relevant answer with the ◀ ▶ keys
- Validate the setting with the ↵ key

⚠ **When the data is deleted**, the instrument configuration returns to the default setting (maker's configuration) and the following are deleted:
- all detected alarms,
- all screen photos taken,
- all the captured transient states (on C.A 8334 only),
- and all recordings made.

⚠ **The instrument will automatically switch itself off once the data have been deleted.**

3.1.11 Rated frequency

Rated frequency of network: 50 Hz or 60 Hz

⚠ **This parameter determines the correction coefficients used for calculating power and energy.**

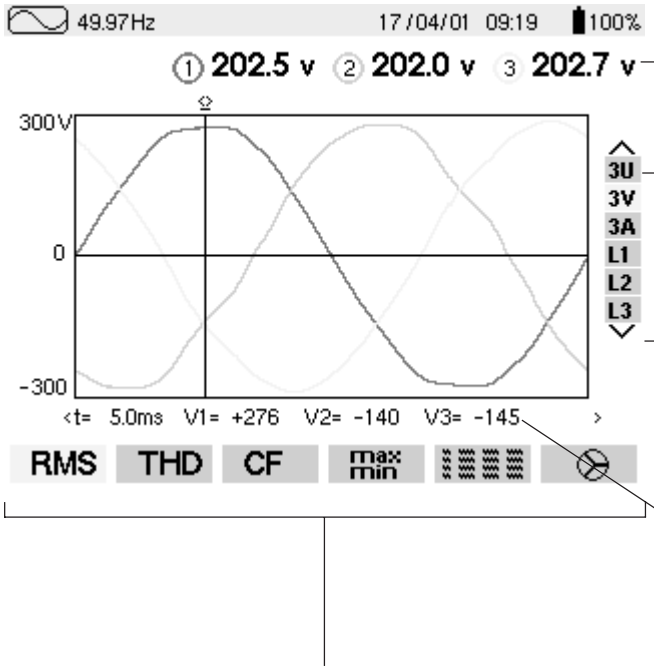
- Choose the rated frequency using the ◀ ▶ keys
- Validate the adjustment using the ↵ key: the screen displays the "Configuration" menu again.

4. DISPLAY MODES

4.1 Waveforms Mode

- Press on the display mode key
- The following screen is displayed:

■ **Measurement of rms voltage on a three phase system:**



Values measured for each curve every second (same colour), according to the measurement type chosen with the variable function keys ②, situated directly below the screen.

The curves to be displayed are selected by pressing on the keys:

- **3U** displays the three phase-phase voltages of a three phase system,
- **3V** displays the three single voltages of a three phase system,
- **3A** displays the three phase currents of a three-wire, three phase system,

⚠ **The neutral current is not a direct measurement** but the resulting total of the 3 currents measured.

- **L1**, **L2** or **L3** display the current and voltage in turn on phase 1, 2 or 3.

Instant values of signals at an instant "t", at the intersection of the cursor and the curves. The cursor is moved along the time scale with the keys.

The measurement type is selected using the variable function keys ②, located beneath the screen.

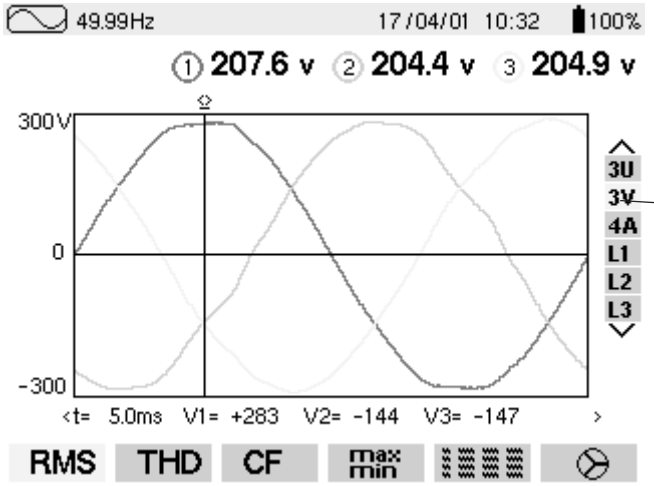
All these measurements are valid in 3U, 3V, 3A, L1, L2, L3

Important: The choice of curves to be displayed (keys) depends on the type of connection (see § 3.1.5):

- 4-wire, three phase: 3U, 3V, 4A, L1, L2, L3
- 3-wire, three phase: 3U, 3V, 3A, L1, L2, L3
- Two-phase: 2V, 3A, L1, L2
- Single phase: No choice (L1)

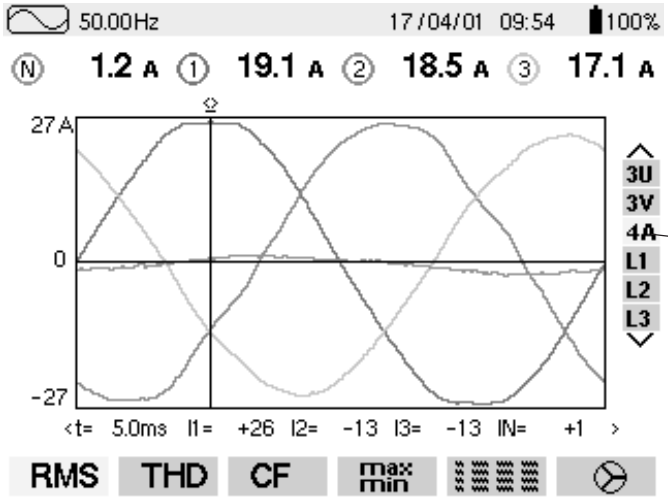
This comment is valid for all display modes.

■ **Measurement of phase to phase RMS voltages on the 3 phases**



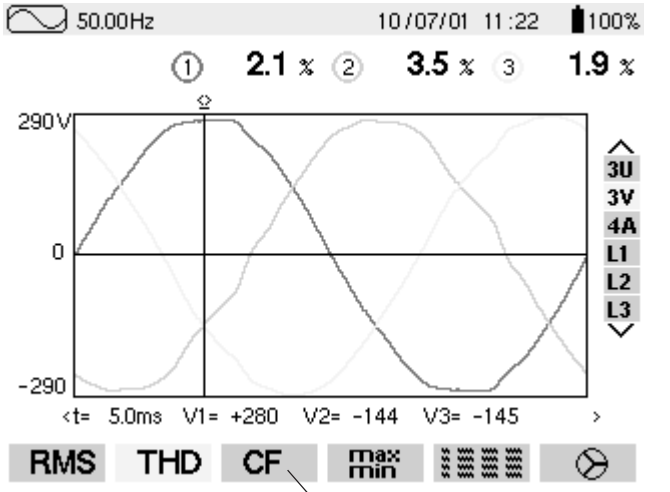
Selection of 3 V

■ **Measurement of RMS current on the 3 phases and the neutral of a 4-wire three phase system**



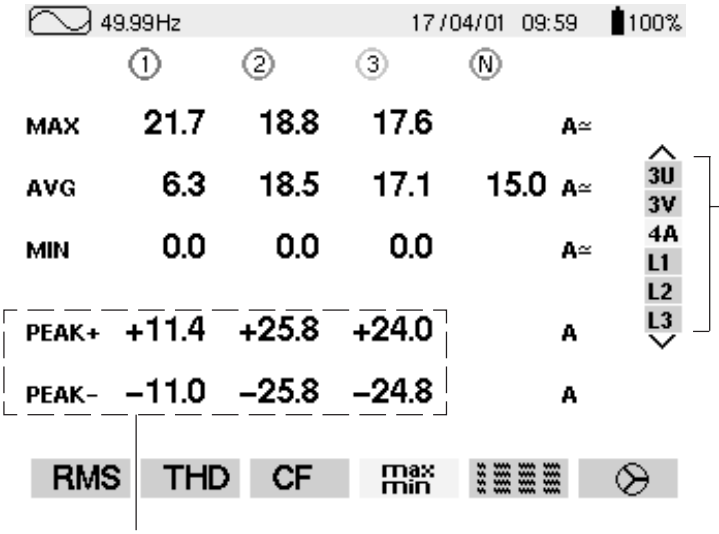
Selection of 4 A

■ **Measurement of overall harmonic factor on one phase**



Measurement of the crest factor

■ **Measurement of extreme and average current values**

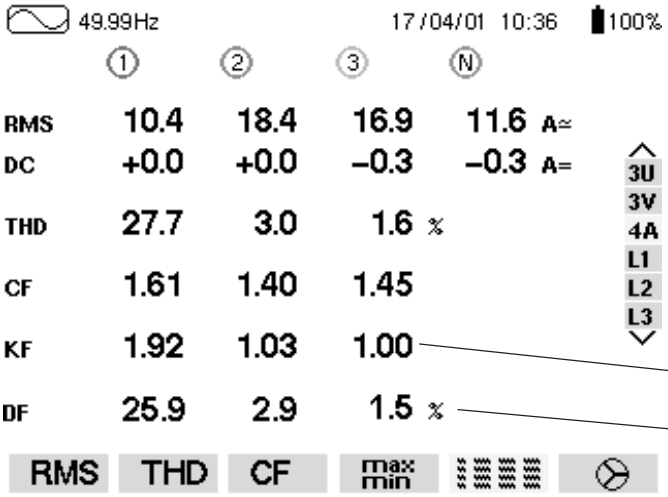


Select with 3 V or 4 A to obtain the Min, AVG, Max, peak + or peak – values for current or voltage (see p 37)

Crest values refreshed every 250ms

⚠ Max, AVG and Min values are measured from the power on or the last key pressed

■ **Simultaneous display of all the different current measurements**
Summary of RMS, DC, THD, CF and KF parameters

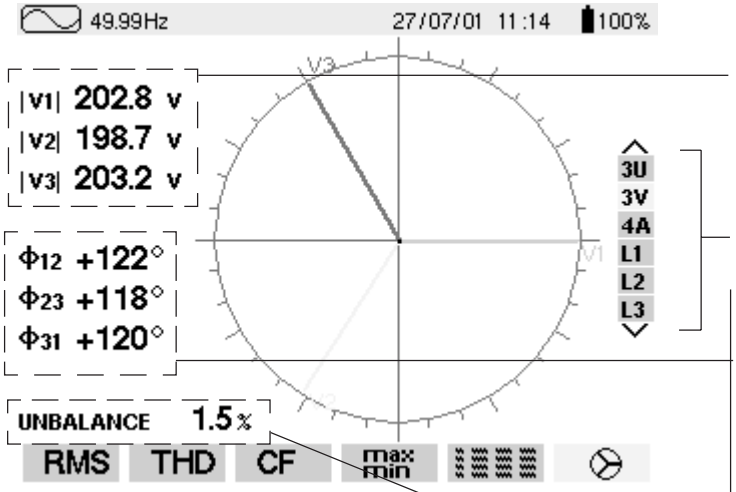


Calculation of the K factor for transformer downgrade

Distortion factor

Note: *The K factor only concerns current.*
Similarly, the flicker value only concerns voltage.
3V → PST, flicker calculated on short term
3A and 4A → KF factor
L1, L2 and L3 flicker and KF factor
DC current values only for the PAC 93 clamp

■ **Display of the Fresnel diagram or vector diagram**



Absolute value of voltage or current

Select the Fresnel diagram display choice

Φ12 corresponds to phase angle between channel 1 and channel 2
Φ23 corresponds to phase angle between channel 2 and channel 3
Φ31 corresponds to phase angle between channel 3 and channel 1
NB: This is valid for current (4A and 3A) and for single voltage (3V).
When the user chooses to look at a specific phase (L1, L2 or L3) ΦVA is the phase angle of V in relation to A.

Current unbalanced ratio:
For this 3 V selection, it is the voltage unbalanced value.

On each phase L1, L2, L3: display of Vn and An on a Fresnel diagram.

4.2 Harmonics Mode

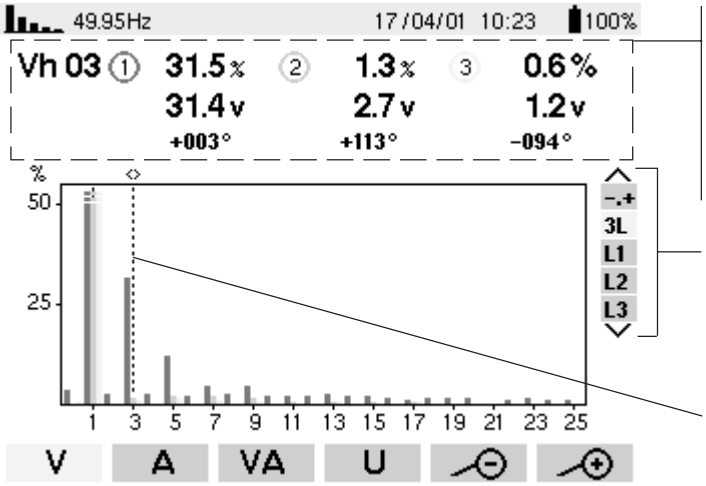
- Press on the display mode key
- The following screen is displayed:

Selection of harmonic analysis measurement using the variable function keys located directly under the screen:

V	Single phase voltage analysis
A	current analysis
VA	power and direction flow analysis
U	Phase to phase voltage analysis

The and keys allow the user to zoom in both directions (2%, 5%, 10%, 20%, 50% and 100%)

1. Harmonic analysis of the phase-phase or single voltages of the three phases of a three phase network V or U



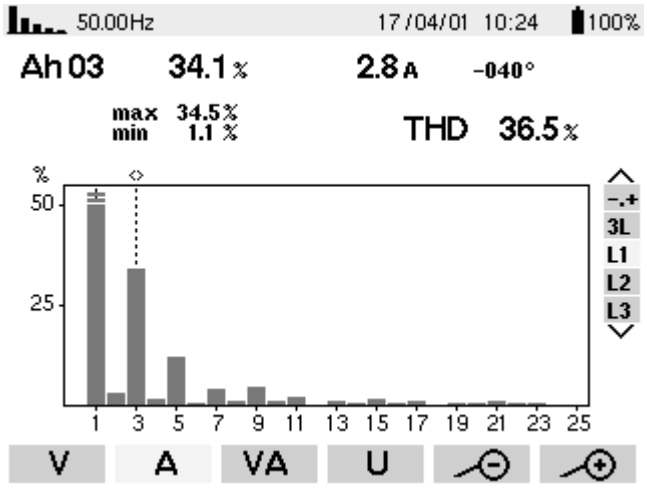
Values measured for each phase (harmonic N°3: Vh03):
- Percentage in relation to the fundamental
- RMS value,
- Phase angle in relation to the fundamental,

according to the measurement type chosen (V) with the variable function keys situated just below the screen.

Selection of expert mode **-0+** (see 4. in § 4.2), for the three phases **3L** or **L1**, **L2** or **L3** by pressing on the keys.

Cursor enabling selection up to harmonic order 50, with the keys, as soon as order 25 is reached, the 25 to 50 range appears (order 0 represents the DC component).

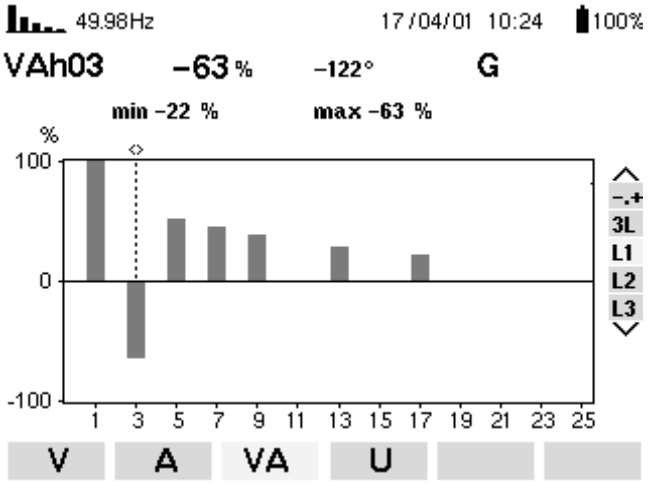
2. Harmonic analysis of the current of one of the phases of a three phase network A



On phases L1, L2, L3 display of:
- the total THD,
- the MIN, MAX instanteous values
- and the parameters concerning the harmonic order under consideration:
  - percentage in relation to the fundamental
  - RMS value and phase angle in relation to the fundamental component
- MIN, MAX instantaneous values for the selected current harmonic

⚠ Min max values are reset each time the cursor position is changed.

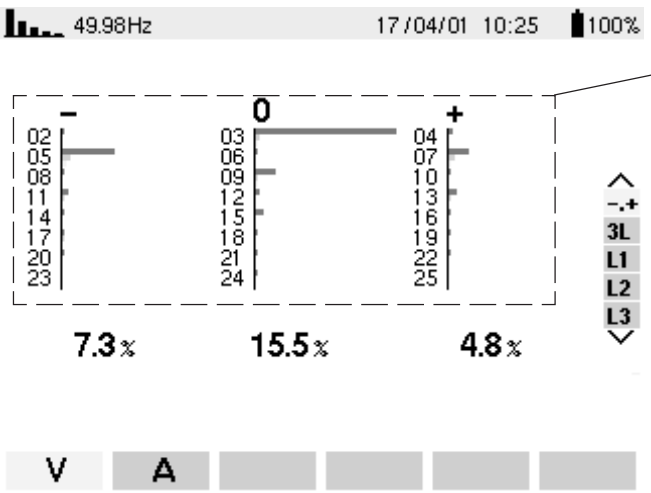
3. Harmonic analysis of the power of one of the phases of a three phase network VA



The bars representing the harmonics have signs.
Since the bar selected is negative, pictogram **G** indicates that it is a harmonic emitted (by convention, positive harmonics are received and negative harmonics emitted). The sign is only available in harmonic power measurement.

4. Harmonic analysis in expert mode (C.A 8334 only)

Press on the ◁▲▷ key to select "**-.+**" and on the variable function key V ; the following is displayed (ditto for A):



Note:
- in the first column, the harmonics inducing a negative sequence are indicated,
- in the second column, those inducing a nil sequence (added into the neutral)
- in the third column, those inducing a positive sequence.

The influence of harmonics on heating of the neutral or on rotating machines can thus be analysed.

Expert function is possible in **V** and **A**

4.3 Power / Energy Mode W

- Press on the display mode key W
The instrument enables:
- The measurement of the active power: produced and consumed
- Measurement of reactive power: capacitive or inductive
- Measurement of apparent power:

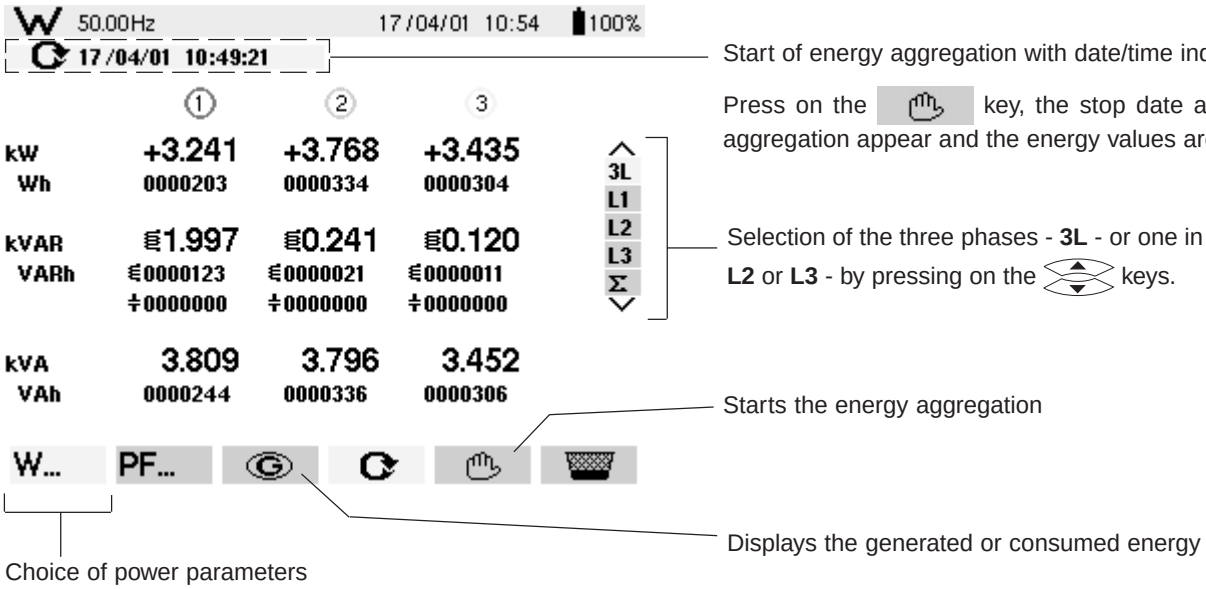
- To start energy aggregation, press , the date and time appear on the top, left of the screen

- To stop energy aggregation, press , the date and time appear on the top, right of the screen

- To reset the counters to zero, press on

■ **Starting and stopping energy aggregation**

The following screen presents the principal values characterising power and energy



Start of energy aggregation with date/time indication

Press on the key, the stop date and time of the aggregation appear and the energy values are then set.

Selection of the three phases - **3L** - or one in particular - **L1**, **L2** or **L3** - by pressing on the keys.

Starts the energy aggregation

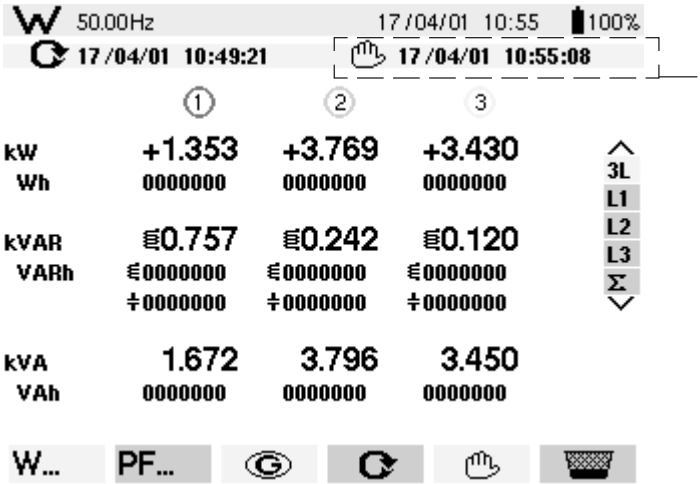
Displays the generated or consumed energy

Choice of power parameters

Note: *The display is automatically adjusted for a display in W, VA, VAR or kW, kVA, kVAR*
It is possible to switch to other display modes without stopping the aggregation.

■ **Key**

This function key is used to display produced or consumed power or energy on each type: active, reactive and apparent.

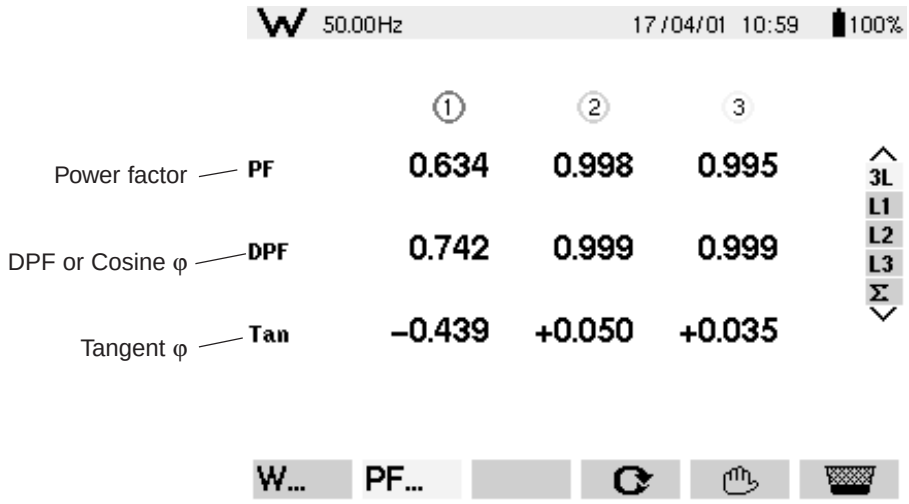


Press on the key, the stop date and time of the aggregation appear and the energy values are fixed.

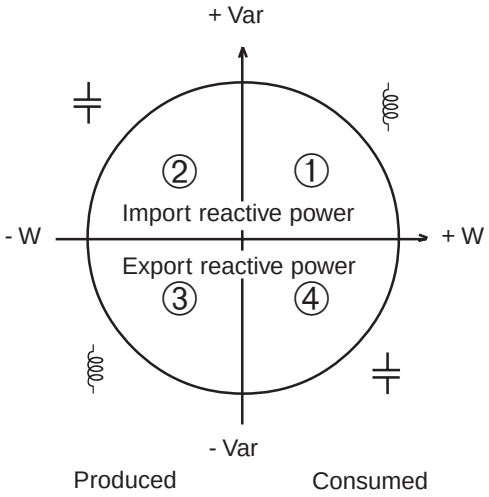
If this key is selected, the energy produced is obtained (from load to source), otherwise, the energy consumed is obtained (from source to load).

■ **Key** PF...

In **3L** display mode, the PF, DPF (Displacement Power Factor) or cos φ values and the tangent can be displayed by pressing on the **PF** function key phase by phase (on all 3) and total.



Nota:
Four quadrants power diagram



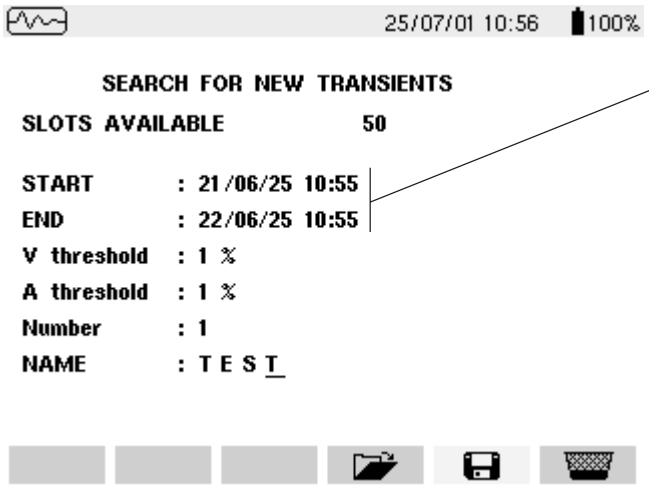
4.4 Transient mode (on C.A 8334 only)

Press on the display mode key
Transients are displayed in the form of curves. All the 6 channels are stored in memory for each transient.
Up to 50 transients can be captured.

The function keys enable the user to:

- capture search programming for a new transient with
- display a captured transient with
- delete a captured transient with

■ The screen below, accessed with the key, shows the programming to capture a new transient (if a search is currently in process, the user can stop it by pressing on)



Transient recording start and end time

Press on the keys to select the parameters and on the keys to modify them.

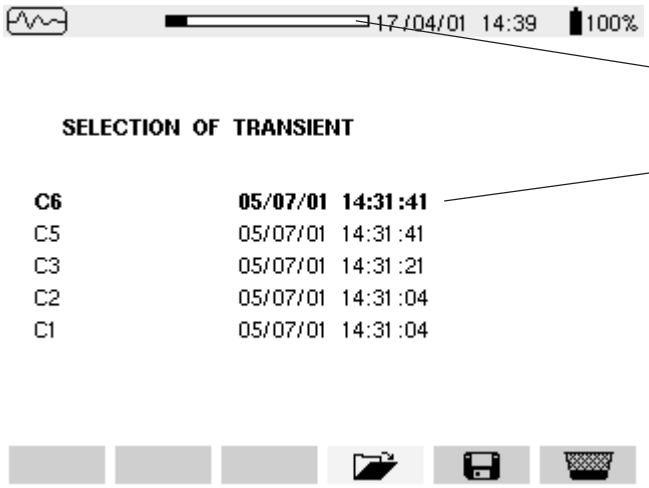
- Setting trigger thresholds S: 1%, 2%, 5%, 10%, 20%, 50%, 100%, for voltage and current.
- Choice of the name and number of transients with the keys:
  - selection of the character place (a maximum of 7 characters)
  - selection of the alphanumeric value

Validate with the key

The storing of transient is trigger on each current and voltage threshold and all wave-forms are stored.

	Thresholds						
	100%	50%	20%	10%	5%	2%	1%
MN clamp	200 A	100 A	40 A	20 A	10 A	4 A	2 A
C clamp	1000 A	500 A	200 A	100 A	50 A	20 A	10 A
AmpFLEX	2900 A	1400 A	580 A	290 A	140 A	58 A	29 A
PAC clamp	1000 A	500 A	200 A	100 A	50 A	20 A	10 A
2999 A ratio adapter	3000 A	150θ A	600 A	300 A	150 A	60 A	30 A
1 A ratio adapter	1 A	0,5 A	0,2 A	0,1 A	0,05 A	0,02 A	0,01 A
Voltage	480 V	240 V	96 V	48 V	24 V	9,6 V	4,8 V

■ The screen below can be accessed with the key and displays a transient previously stored in the memory.



Displays the memory occupied by transients stored

Transient time and date recording
Press on the keys to select the transient and validate with the key

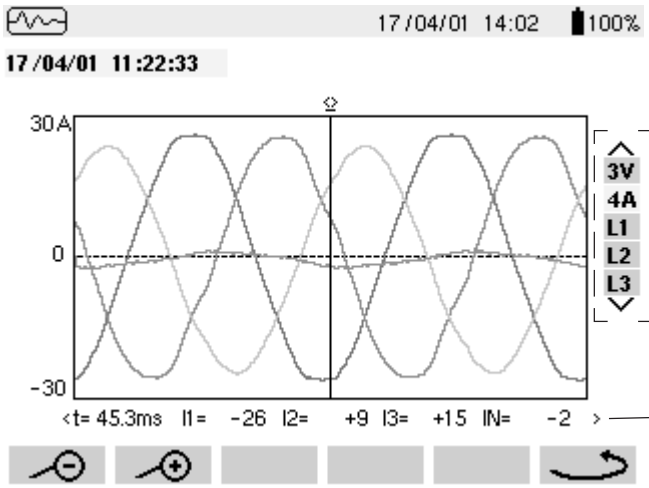
The keys are also used to select a transient to be deleted ( ); then validate with .

■ **Storing trigger**

The threshold T in percent, define an envelope width over and under the last cycle of signal V or A. Its width W is calculated with the nominal measurement range R for a channel (depending of the selected current sensor).

$$W = T \times R$$

■ The screen below displays the transient selected on the previous screen:



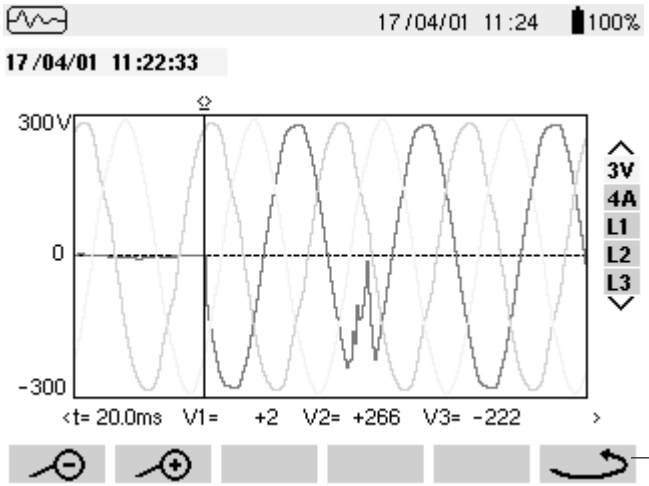
- Representation on the screen of 4 periods of 256 counts/periods with 1 cycle before the trigger and 3 cycles after
- Display of the date and time the transient was recorded

The curves to be displayed are selected by pressing on the keys:

- **3V** displays the three single voltages during the transient,
- **4A** displays the three currents and the neutral current during the transient,
- **L1**, **L2** or **L3** display the single current and voltage in turn on phase 1, 2 or 3.

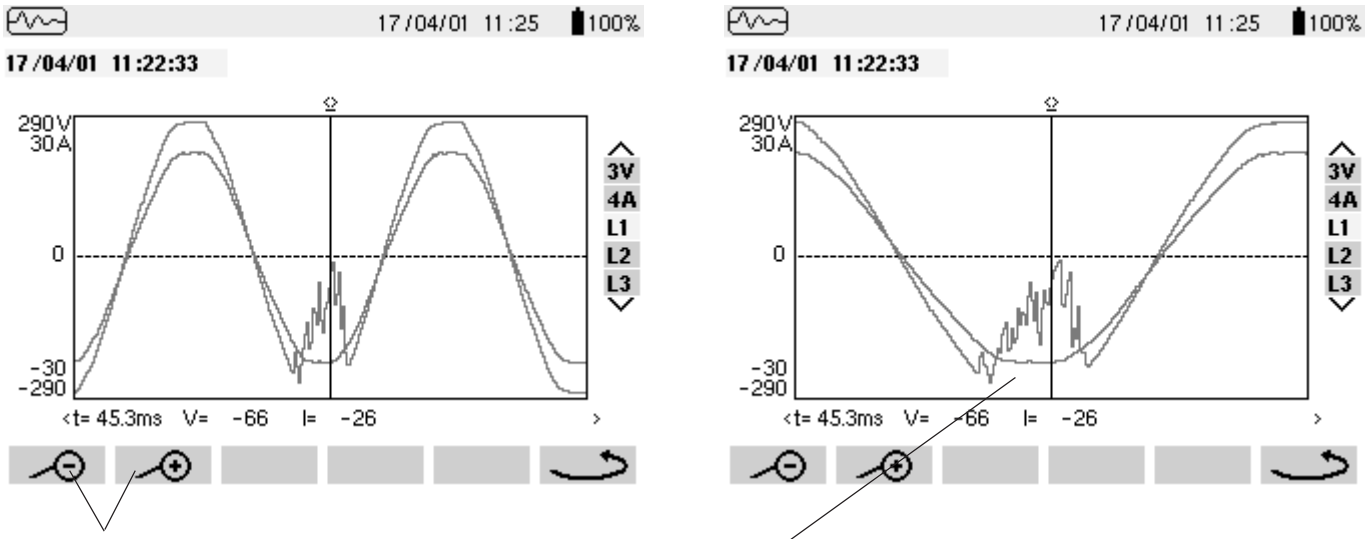
Instant values of signals at an instant "t", in relation to the cursor on the time scale with the keys

■ **After selecting 3V**



This key allows the user to return to the transient selection screen

■ **After selecting L1**



These keys allow the user to change the time scale (screen display of 4, 2 or 1 periods) centered on the cursor, which can be moved with the ◁▷ keys, giving, for example, the next screen by pressing on ⊕.

All the transients stored can be exported to a PC equipped with the “QualiStarView” operating software.

4.5 Alarms Mode

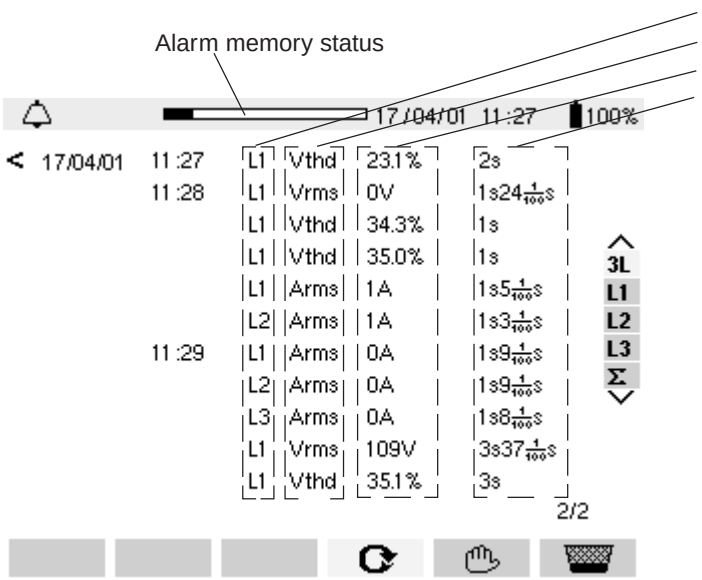
- Press on the display mode key
- The next screen presents the various alarms stored.

Note: The threshold values must first have been programmed in the mode

GO launches alarm capture

stop alarm capture

poub deletes all stored alarms



Selection of alarms with the ◁▷ keys

Display of alarms within a period of time with the ◁▷ keys

Note: *All the alarms recorded can be exported to a PC with the operating software. Up to 4096 alarms can be captured.*

⚠ **The Alarm values for PF, DPF, tan φ, W, VAR, are absolute values.**

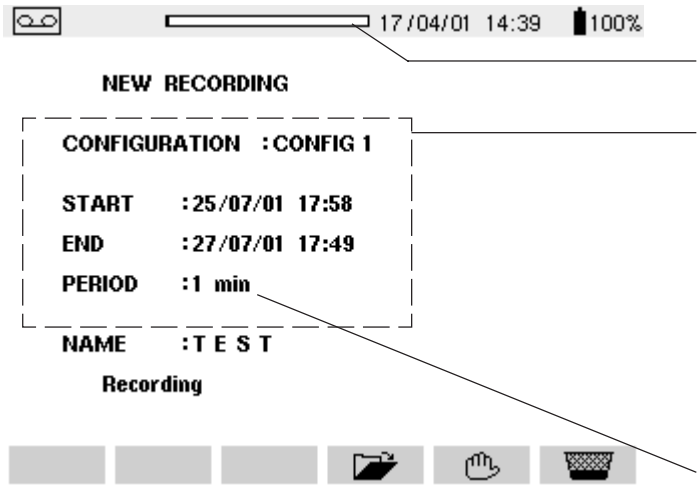
4.6 Recording Mode

This mode enables all the parameters previously configured in the mode to be recorded.

The function keys available in this mode enable:

- a new record to be made with
- an record to be displayed with
- an record to be deleted with

■ Saving selected parameters



This scale allows a current record to be displayed

Press on the keys to select the parameters and on the keys to modify them.

- Modification of the configuration number with the keys (CONFIG 1, 2, 3 or 4)
- Modification of the dates with the keys
- Entering of the record name with the keys which scroll through the alphabet and numbers

Validate with the key

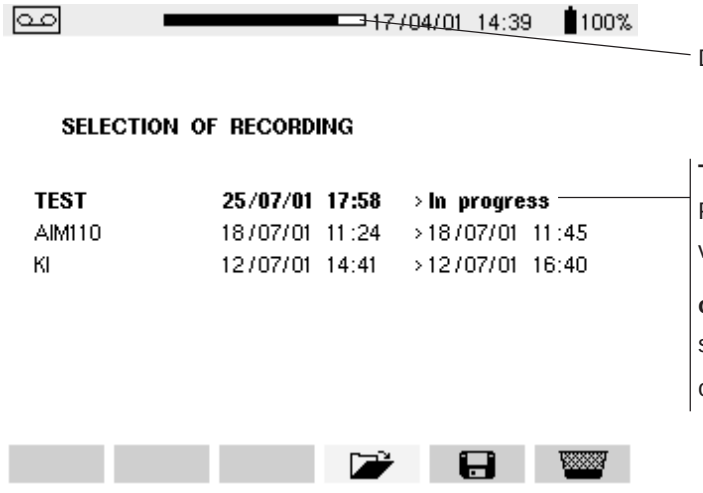
The possible averaging integration periods are:
1 sec, 5 secs, 20 secs,
1 min. 2 mins or 5 mins

Note: *the start and end dates are adjusted according to the chosen period of integration.*

■ Selecting or deleting a record

Press the mode key:

The screen below can be accessed with the key and displays a record previously stored in the memory.



Displays the memory occupied by previous records

To select:

Press on the keys to select the record required and validate with the key

or to delete:

select the record to be deleted with the keys and press on , validate with

Tip!: *It is possible to display a measurement being recorded by selecting the name of the recording. To refresh the screen, press the mode key (caution: loss of cursor position and zoom).*

The instrument automatically makes a correction if the programmed dates and times do not match:
- the current date
- the current time
- the set integration period

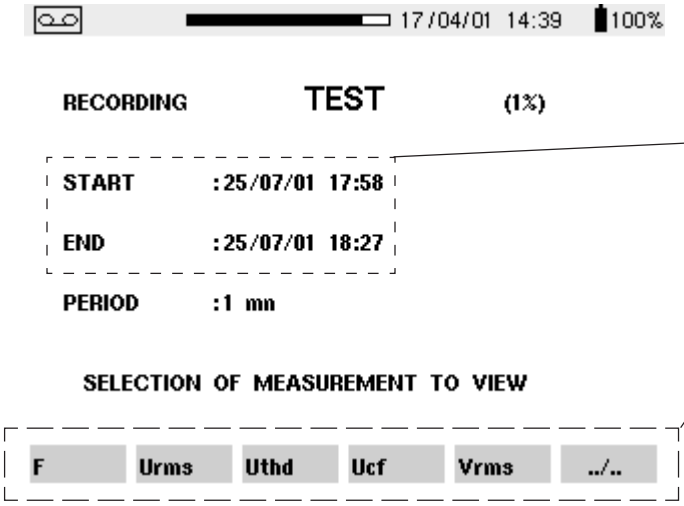
It is recommended to set multiple times:
- of 2 for 2 mins
- of 5 for 5 mins

Note: *the instrument automatically corrects the start and end time in order to improve the readability of the time scales of the recording mode (graph representation).*

■ Selecting a graphic display for recorded measurements

Recordings of measurements are displayed in graphic form

Selecting the STATION 1 record (see “selecting a record”) gives access to the screen below which allows the selection of the measurement to be displayed:

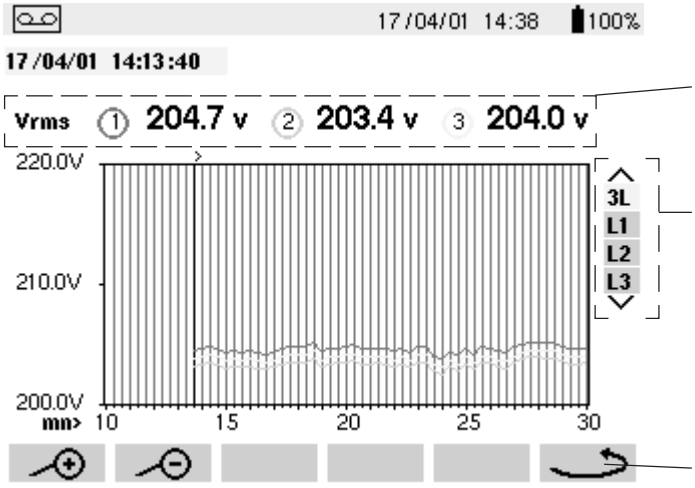


Indication of recording conditions

These keys enable direct selection of the measurement to be displayed.
A series of short presses on the “**../..**” key enables the user to scroll through the measurements selected when this record was programmed.

■ An example of the graphic display of V RMS measurements

- When the **V RMS** key is pressed, the following screen is displayed:

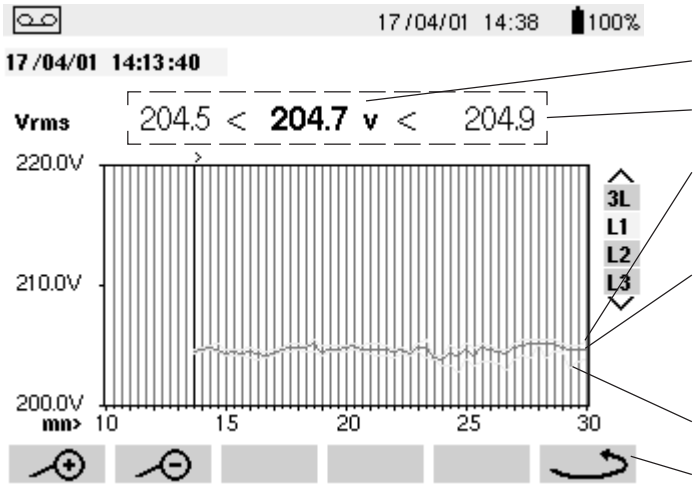


Display of the average voltage for each of the 3 voltages, hour-by-hour by moving the cursor with the ◄► keys.

Selection of the 3 phases or each phase separately with the ▲▼ keys

Returns the user to the screen where the measurement to be displayed is selected

- When the **L1** phase is selected, the following screen is displayed:



Average value on the display period

Extremes and average values over the display period

Max. value

Average value

Min. value

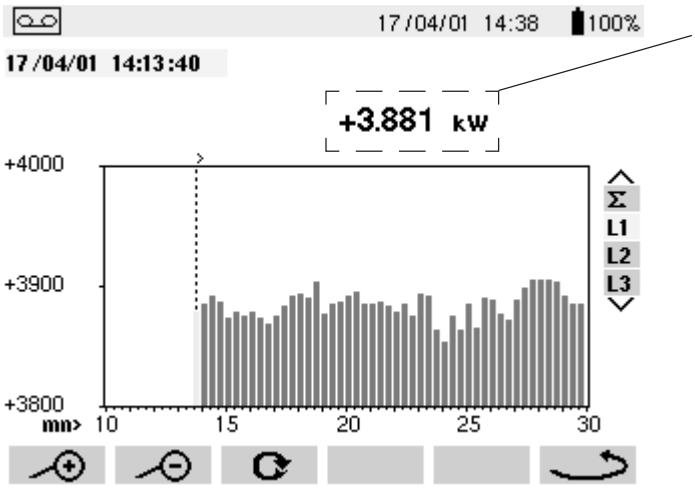
Returns the user to the “Selection of the measurement to view"

⚠ When the display period is different from the averaging integration period:

- The average value is calculated with the sum of each integration period stored.
- The extreme values are the minimum and the maximum integration period during the display period selected with the cursor.

■ Graphic display of average power

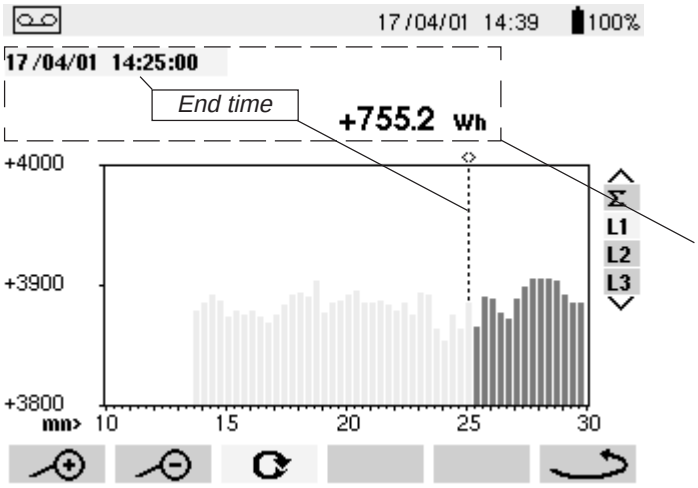
After returning to the “Selection of the measurement to view” screen with the **../..** key and pressing on the **W** key, the user obtains:



Average value of the active power on the **L1** phase, by moving the cursor with the keys:

Note: Hold the selected key down to switch to fast forward

■ Energy measurement for a determined period



The energy over a selected period can be deduced from the average power records:

- Press on the function key when the cursor is positioned on the start instant of the energy calculation
- Move the cursor with the keys to select the end instant

The energy value is displayed, with **end dates and times**.

In this way, it is possible to make an energy measurement over several recording ranges in the 4 quadrants.

Note: *All the data concerning a recording campaign can be exported to a PC using the software «QualiStarView».*

The and keys allow the integration period of the displayed measurement and the graph time-scale to be changed.

Display averaging period	Graph scale
2 hours	over 5 days
1 hour	over 2 1/2 days
15 minutes	over 15 hours
10 minutes	over 10 hours
5 minutes	over 5 hours
1 minute	over 1 hour
20 seconds	over 20 minutes
5 seconds	over 5 minutes
1 second	over 1 minute

Note: *The minimum integration period is limited by the recording period*

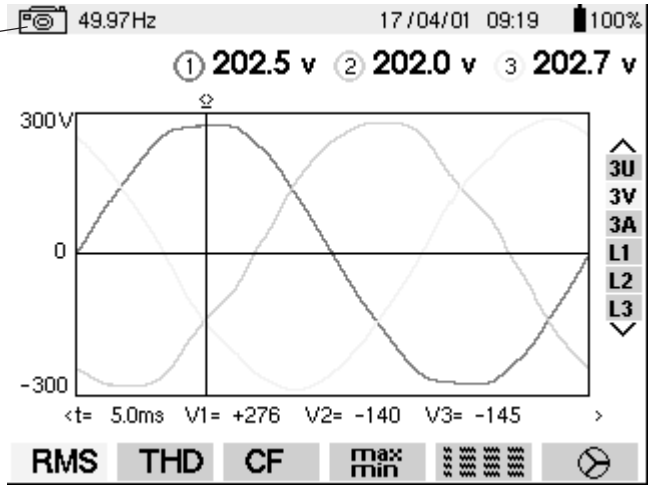
4.7 Screen Memorisation

The key allows 8 or 12 displays to be saved (according to the instrument model) for recall or display later on.

■ **A long press** (about 3 s) on this key freezes the current screen:

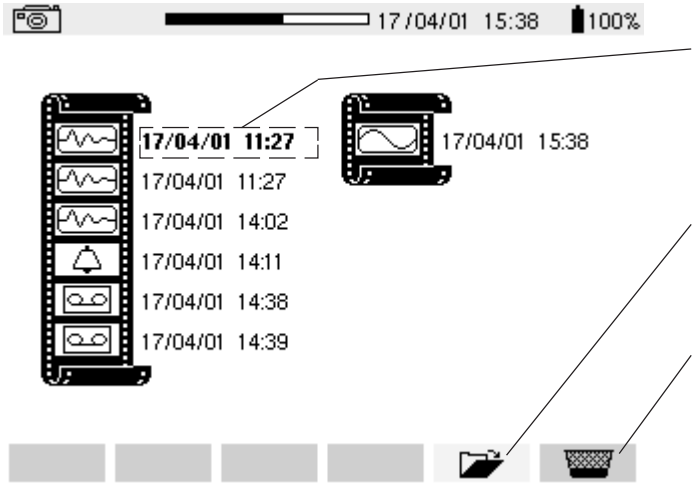
The icon is displayed as soon as the operation has finished.

This icon is replaced by if there is no space left in the memory to record the photo.



Note: *These screens can be stored on a PC via the QualiStartView operating software.*

■ **A short press** (about 1 s) on this key gives access to the menu of screens already saved:



The screen to be displayed is selected with the keys

To display the screen selected, press on then on the validation key.

To delete the screen selected, press on then on the validation key.

After displaying the screen saved, press on the key again to return to the saved screen menu.

Note: *The C.A. 8332 has a maximum of 8 screens → the film is displayed over one column*
The C.A. 8334 has a maximum of 12 screens → the film is displayed over two columns

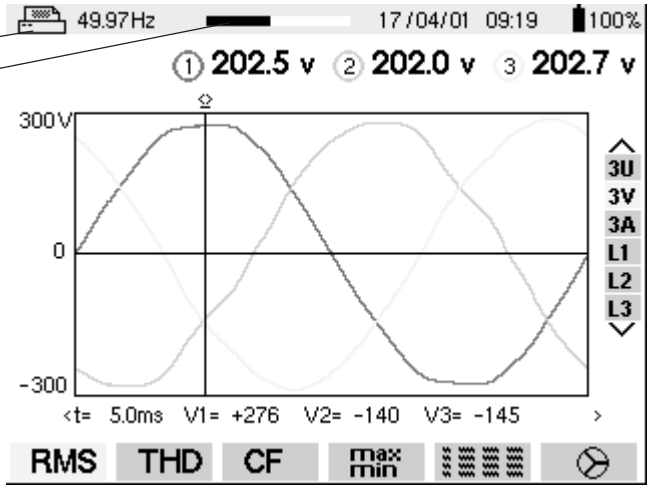
4.8 Printing

The key allows a screen to be printed immediately on a dedicated printer connected to output ⑨

In the example opposite, one press on the key freezes the current screen, in this case, the icon replaces , a bargraph indicates the progress of the data being transferred.

The original icon reappears when the operation has finished.

The current operation can be stopped – in the event of an error, for example – by pressing on the key again during the data transfer process.

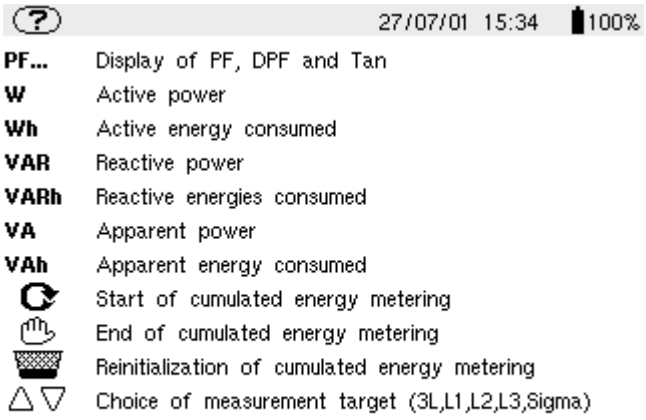


Note:
It will take a few seconds for the icon to appear.
The fixed print transmission speed is 19.2 kb.

The dedicated printer for the Qualistar is "DPU 414 - SEIKO" (see p 41)

4.9 Help

The key allows the user to obtain help in the selected language for the current display mode.



Example:

While the display is in use, one press on the key displays the information opposite.

⚠ **To exit Help mode, press once on the key.**

4.10 QualistarView software

The QualistarView software is running on Windows 9x, NT4, M e.

Run Setup.exe

Setup of serial communication:
- On the Qualistar (see Setup mode)
- On the QualistarView software (option / communication)

Nota: *the communication speed must be the same on the Qualistar and the "QualistarView" software.*

5. GENERAL SPECIFICATIONS

5.1 Dimensions and weight

■ 240 x 180 x 55 mm ■ 2,1 kg with batteries

5.2 Power supply

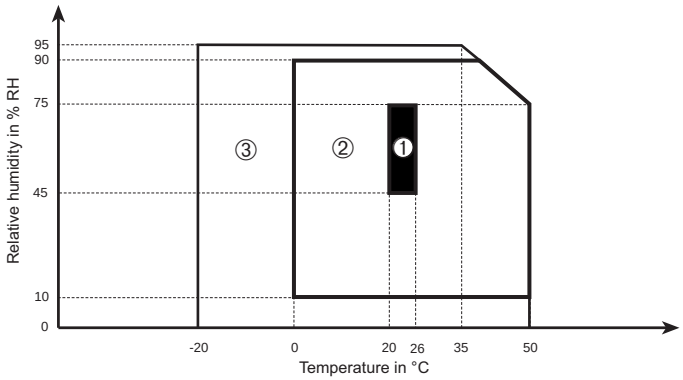
■ **AC mains supply**
With an internal mains adaptor
Range for use: 230 V AC ±20% and 110 V AC ±20%
Max. power: 30 VA

■ **Battery power**
Allows the instrument connected to the AC supply to be used in the event of a power interruption.
Type: NiMH 3800 mAh
Output: 4-wire (2 for temperature probe)
Rated voltage: 9.6 V
Charge time: approx. 3 hrs 30 mins
Temperature for use: +10°...+50°C
Recharging temperature: 0°...+40°C
Storage temperature: -20°...+50°C

The battery starts to charge when the mains supply adaptor is connected.
When the battery is charged, the instrument uses the current supplied via the mains supply without drawing on the battery.

5.3 Climatic conditions

5.3.1 Environmental conditions



① Reference range
② Range for use
③ Storage range

5.3.2 Altitude

Use: 0..0.2000 m
Storage: 0...10 000 m

5.4 Compliance with international standards

5.4.1 Electrical safety (as per NF EN 61010-1)

- Double insulation: ⧈
- Measurement category: III
- Pollution level: 2
- Assigned voltage: 600 V RMS

5.4.2 Electromagnetic compatibility and sensitivity

- Immunity: as per NF EN 61236 - 1 amend.1
- Radiation field resistance: as per IEC 1000-4-3
- Electric shock resistance: as per IEC 1000-4-5
- Emission as per NF EN 61236 - 1 amend.1 - class A
- Electrostatic discharges: as per IEC 1000-4-2
- Fast transients resistance: as per IEC 1000-4-4
- Conducted RF interference: as per IEC 1000-4-6

5.4.3 Mechanical protection

- Operating position: Indifferent
- Impacts: as per NF EN 61010-1
- Impermeability: IP 50 as per NF EN 60529 *(electrical IP2X for the terminals)*
- Rigidity: as per NF EN 61010-1
- If dropped: as per NF EN 61010-1

6. FUNCTIONAL CHARACTERISTICS

6.1 Reference conditions

Influence parameter	Reference conditions
Ambient temperature	23°C ± 3K
Humidity	45% RH
Atmospheric pressure	860 to 1060 hPa
Phase voltage	230 V rms and 110 V rms ±2% without DC
Clamp current circuit input voltage	0.01 V ≤ I ≤ In = 1 V rms without DC (< 0.5%)
Ampflex current circuit input voltage	3.9mV ≤ I ≤ In = 118 mV rms without DC (< 0.5%)
Current input voltage detection threshold	0.001 In
Frequency of electricity network	50 and 60 Hz ±0.1 Hz
V/I phase shift	0 degree or 90 degrees
Harmonics	< 0.1%

The uncertainties given for power and energy measurements are maximum for Cos φ = 1 or Sin φ = 1 and are typical for the other phase shifts.

6.2 Electrical specifications

Sampling frequency: 12.8 kHz per channel at 50 Hz (256 samples per period)

6.2.1 Voltage inputs

■ Operating range: - phase – phase: 830 V RMS
- phase – neutral: 480 V RMS

■ Input impedance : 340 kΩ between phase and neutral

■ Admissible overload : 1.2 Vn permanently
2 Vn for 1 sec

6.2.2 Current inputs

- Operating range: 0- 1 V
- Input impedance: 100 kΩ for the clamp circuit and 12.4 kΩ for the Amp***FLEX*** circuit
- Admissible overload: 1.7 V

6.2.3 Characteristics, excluding current sensors

Measurement	Measuring range	Display resolution	Error in the reference range
Frequency	40...69 Hz	0.01 Hz	±0.01 Hz
Single RMS voltages (V RMS, Vdem)	6 V...480 V	0.1 V	±0.5%
RMS composite voltages (U RMS, Udem)	10 V...830 V	0.1 V	±0.5%
DC voltage component	6V…100V	0.1 V	±1%
Single Peak voltages (Vpp, Vpm)	6 V...680 V	1 V	±(1% +5 V)
Peak composite voltages (Upp, Upm)	10 V...1360 V	1 V	±(1% +5 V)
Amp*FLEX* circuit RMS currents (A RMS, Adem)	Imax/1000…Imax	0.1 A if I < 1000 A 1 A if I ≥ 1000 A	±0.5%
Amp***FLEX*** circuit RMS currents (Arms, Adem)	Imax/1000…Imax	0.1 A si I < 1000 A 1 A si I ≥ 1000 A	±(0.5% +1A)
DC current component	Imax/1000…Imax/10	0.1 A	±(1% +1A)
Peak Current (App, Apm)	0…2 x Imax	1A	±(1% +Imax/200)
Peak factor (Vcf, Ucf, Acf)	1.00…9.99	0.01	±(1% +0.02)
Active Powers (W) Clamp and Amp*FLEX* Clamp Amp*FLEX*	0...9999 kW Cos Φ ≥ 0.8 0.2 ≤ Cos Φ < 0.8 0.5 ≤ Cos Φ < 0.8	4 digits (10000 counts)	 ±1% ±(1.5% +10 counts) ±(1.5% +10 counts)

Measurement	Measuring range	Display resolution	Error in the reference range
Reactive Powers (VAR) Clamp	0...9999 kVAR Sin Φ ≥ 0.5 0.2 ≤ Cos Φ < 0.5	4 digits	 ±1% ±(1.5% +10 counts)
Reactive Powers (VAR) Amp*FLEX*	0...9999 kVAR Sin Φ ≥ 0.5 0.2 ≤ Cos Φ < 0.5	4 digits	 ±1.5% ±(2.5% +20 counts)
Apparent Power (VA)	0...9999 kVA	4 digits	±1%
Power factor (PF, DPF)	-1.000…1.000 Cos Φ ≥ 0,5 0.2 ≤ Cos Φ < 0.5	0.001	 ±1,5% ±(1.5% +0.01)
Tangent (Tan)	-1.732…1,732 for S > 50 VA	0.001	±1°
Active Energies (Wh) Clamp and Amp*FLEX* Clamp Amp*FLEX*	0...9999 MWh Cos Φ ≥ 0.8 0.2 ≤ Cos Φ < 0.8 0.5 ≤ Cos Φ < 0.8	4 digits (10000 counts)	 ±1% ±1.5% ±1.5%
Reactive Energies (VARh) Clamp	0...9999 MVARh Sin Φ ≥ 0.5 0.2 ≤ Cos Φ < 0.5	4 digits	 ±1% ±1.5%
Reactive Energies (VAR) Amp*FLEX*	0...9999 MVARh Sin Φ ≥ 0.5 0.2 ≤ Cos Φ < 0.5	4 digits	 ±1.5% ±2.5%
Apparent Energy (Vah)	0...9999 MVAh	4 digits	±1%
Unbalance (Vunb, Aunb)	three phase supply	0.1%	±1%
Phase angle (V/I; I/I; V/V)	-179°…+180°	1°	±2°
Harmonics ratios F = 40 to 69 Hz (V RMS > 50 V) (RMS > Imax/100)	orders 1..50	0.1%	±1% +5 pt
Harmonics angles F = 40 to 69 Hz (V RMS > 50 V) (RMS > Imax/100)	orders 1..25 orders 26..50	1°	±3° ±10°
Total harmonics ratio (Vthd, Athd, Uthd)	Limited harmonics at order 50	0.1%	±1% +5 pt
Current K factor (Akf)	1..99.99	0.01	±5%
Voltage flicker (Vflk)	0.00..9.99	0.01	±5% +5 pt

6.2.4 Nominal range of use

Harmonics: THD (I) : 40%
THD (U) : 20%
Magnetic field: 0 to 400 A/m
Electrical field: 0 to 3 V/m

6.3 Specifications of the sensors (with C.A 8332/34)

■ **Specifications of the C193 sensors (Accessories)**

- Nominal range: 1000 A AC for f ≤ 1 kHz
- Measurement range: 3 A to 1200 A AC (I > 1000 A not permanent)
- Input/Ouput ratio: 1 mV AC/ A AC
- Maximum clamping capacity: 52 mm
- NF EN 61010-2-032, 600 V, CAT III, POLL 2

■ Reference conditions

Ambiant temperature	23°C ±3 K
Humidity	20% to 75 % of RH
Frequency	48...65 Hz
Distortion factor	< 1% without superimposed DC current
Magnetic field of external origin	< 40 A/m (earth's magnetic field)

■ Error in the reference conditions *

Primary current (in A AC)	3...10 A	10...100 A	100...1200 A
Accuracy (as % of the ouput signal)	≤ 0.8%	≤ 0.3%	≤ 0.2%
Phase shift (in °)	≤ 1°	≤ 0.5°	≤ 0.3°

* Make a logarithmic interpolation between each specified value

■ Variations in the nominal working range (as % of the ouput signal)

Ambiant temperature from -10°C to +50°C	≤ 200 ppm/K or 0.2% per 10 K
Humidity from 10 to 90%	< 0.1%
Frequency in relation to accuracy	30...48 Hz : < 0.5% 65...1000 Hz : < 1% 1...5 kHz : < 2%
Positions of the cable in the jaws	< 0.1% for f ≤ 400 Hz
Adjacent conductor carrying a 50 Hz AC current	≤ 0.5 mA/A
Distortion of crest factor ≤ 6 and current ≤ 3000 A peak	< 1%
Distortion DC current ≤ 15 A superimposed on the nominal current	< 1%

■ Overloads : Frequency derating beyond 1 kHz :

$$I\,max \leq 1000\ A \times \frac{1}{f\ (kHz)}$$

■ **Specifications of the MN93 sensors (accessories)**

■ Nominal range: 200 A AC for f ≤ 1 kHz

■ Measurement range: 2 A to 240 A AC (I > 200 A not permanent)

■ Input/Ouput ratio: 5 mV AC/ A AC

■ Maximum clamping capacity: 20 mm

■ NF EN 61010-2-032, 600 V, CAT III, POLL 2

■ Reference conditions

Ambiant temperature	23°C ±3 K
Humidity	20% to 75 % of RH
Frequency	48...65 Hz
Distortion factor	< 1% without superimposed DC current
Magnetic field of external origin	< 40 A/m (earth's magnetic field)

■ Error in the reference conditions

Primary current (in A AC)	2...10 A	10...40 A	40...100 A	100...240 A
Accuracy (as % of the ouput signal)	≤ 5% +5 mV	≤ 2.5% +5 mV	≤ 2% +5 mV	≤ 1% +5 mV
Phase shift (in °)	≤ 15°	≤ 3°	≤ 3°	≤ 2°

■ Variations in the nominal working range (as % of the ouput signal)

Ambiant temperature from -10°C to +50°C	≤150 ppm/K or 0.15% per 10 K
Humidity from 10 to 90%	<0.2%
Frequency in relation to accuracy	40 Hz...1 kHz : < 3% 1...10 kHz : < 12%
Positions of the cable in the jaws	<0.5% to 50/60 Hz
Adjacent conductor carrying a 50 Hz AC current	≤ 15 mA/A
Distortion DC current < 20 A superimposed on the nominal current	< 5%
Distortion of crest factor ≤ 3 and peak current = 200 A	≤ 3%

■ Overloads : Frequency derating beyond 1 kHz :

$$I\ max \leq 1000\ A \times \frac{1}{f\ (kHz)}$$

■ Specifications of the Amp*FLEX* A193 (accessories)

- Nominal range : 3000 A AC
- Measurement range: 10 A to 3000 A AC
- Input/Ouput ratio : 140 mV AC/3000 A AC at 50 Hz
  Note : the ouput is proportional to the amplitude and the frequency of the measured current
- Diameter of the sensor: 140 mm Ø / length 450 mm or 250 mm Ø / length 800 mm
- NF EN 61010-1 and 2 (electrical safety) 1000 V, CAT III, POLL 2
- Reference conditions

Ambient temperature	18°C à 28°C
Humidity	20% to 75% of RH
Position of conductor in the sensor	centered
Continuous magnetic field	< 40 A/m (earth's magnetic field)
External alternative magnetic field	none present
External electric field	none present
Frequency	from 10 Hz to 100 Hz
Type of signal measured	sinusoidal

■ Error in the reference conditions

Primary current (in A AC)	10 A...100 A	100 A...3000 A
Accuracy (as % of the ouput signal)	≤ 3%	≤ 2%
Phase shift at 50 Hz (in °)	≤ 1°	≤ 0.5°

■ Variations in the nominal working range (as % of the ouput signal)

Influencing factors	Influence range	Error
Temperature	-20°C to +60°C	0.2% per 10 K
Relative humidity	10% to 90% RH	0.5%
Frequency response	10 Hz...20 kHz	0.5%
Position of conductor in clamp	Any position on the internal perimeter of the undeformed sensor	2% (4% near the latching system)
Adjacent conductor carrying an AC current	Conductor in contact with the sensor	1% (2% near the latching system)

■ Characteristics of PAC93 sensors (accessories)

- Rated calibre: 1000 A AC, 1400 A DC
- Measurement range: 10 A to 1000 A AC, 10 A to 1300 A_{PEAK} AC+DC
- Input/output ratio: 1 mV/A
- Maximum clamping capacity: one 39 mm Ø cable (two 25 mm Ø cables), a 50 x 12 mm busbar section
- NF EN 61010-2, 600 V, CAT III, POLL 2 or 300 V, CAT IV, POL 2

■ Reference conditions

Temperature	18°C to 28°C
Relative humidity ratio	20% to 75% RH
Battery voltage	9 V ±0.1 V
Position of the conductor in the sensor	centered on the clamp marks
Magnetic field	DC magnetic field
AC external magnetic field	none
External electrical field:	none
Frequency range	≤ 65 Hz
Type of signal measured	sinusoidal

■ Intrinsic error in the reference range

Primary current	10 A...100 A	100...800 A	800...1000 A AC 800...1300 A PEAK
Accuracy	≤ 1.5% +1 mV	≤ 3%	≤ 4%

Primary current	10...200 A	200...1000 A
Phase angle	≤ 2°	≤ 2°

■ Variation in the rated utilisation range (to be added to the reference range error)

Influence parameter	Influence range	Error
Temperature for use	18°C….28°C	ZERO: ≤ 0.2 A/K
		SCALE: ≤ 300 ppm/K or 0.3%/10 K
Battery voltage	6.5 V to 10 V	≤ 1 A/V
	10% and 90% RH	≤ 0.5% of the reading
Position of a 20 mm Ø 20 conductor	DC at 440 Hz DC at 1 Hz DC at 2 Hz DC at 5 Hz	< 0.5% of the reading < 1% of the reading < 3% of the reading < 10% of the reading
Live adjacent conductor	50 and 60 Hz	< 10 mA/A AC (23 mm from the clamp)
External field	400 A/m	< 1.3 A
Rejection in common mode (in AC)	50 to 400 Hz	> 65 dB
Remanence in DC	+1300 A DC at -1300 A DC	< 4 mA/A
Frequency of the measurement signal	65 Hz to 440 Hz 440 Hz to 1 kHz 1 kHz to 10 kHz	-2% -5% -4 dB

■ **MAINTENANCE AND CALIBRATION OF CAPTORS**

- Clean with a sponge moistened with soapy water and rinse in the same way with clean water, then dry it quickly.
- Keep the jaw gaps of the clamps (MN93, C193 and PAC 93) perfectly clean using a cloth; slightly oil the visible metal parts to avoid rust.
- Check the calibration every 2 years.

7. MAINTENANCE

⚠ **For maintenance, use only specified spare parts. The manufacturer will not be held responsible for any accident occuring following a repair done other than by its After Sales Service or approved repairers.**

7.1 Recharging the battery

The instrument's batteries are charged when it is connected to the AC mains supply.

⚠ **For safety and trouble-free operation of the charger, the battery must be changed when de-energised with the equipment turned off and there must be a delay of at least one minute without the battery being connected.**

⚠ **Do not dispose of the battery on a fire.**

Do not expose the battery to heat exceeding 100°C.

Do not short circuit the battery terminals.

7.2 Cleaning the housing

Clean the unit with a cloth and a little soapy water. Clean off with a damp cloth.

⚠ **Do not use solvents.**

7.3 Calibration testing

⚠ **It is essential that all measuring instruments are regularly calibrated.**

We advise you to check this instrument at least once a year.
For checking and calibration of your instrument, please contact our accredited laboratories (list on request) or the Chauvin Arnoux subsidiary or Agent in your country.

7.4 Repairs

Repairs under or out of guarantee
Please return the product to your distributor.

8. TO ORDER

■ **Power Quality Analyser :**	C	A	8	3	3	2						
C	A	8	3	3	4						

Instrument comes complete (as per grill) with:
- *1 QualiStarView software*
- *1 DB9F standard optical lead*
- *4 x 3m leads fitted with banana plugs*
- *4 crocodile clips*
- *1 mains lead*
- *and these operating instructions*

■ **Versions**

French	F	R
International	I	N

■ **Current sensors in a shoulder bag**

None	X	X
Set of 3 x C 193 clamps (1000 A - Ø 52 mm)	C	X
Set of 3 x Amp***FLEX*** A 193 (3000 A - Ø 140 mm / 450 mm long)	A	1
Set of 3 x Amp***FLEX*** A 193 (3000 A - Ø 250 mm / 800 mm long)	A	2
Set of 3 x MN 93 clamps (240 A - Ø 20 mm)	M	N
Set of 3 x PAC 93 clamps (1400 A - Ø 42 mm)	P	A

■ **Languages of operating instructions**

French	F	R
English (by default)	G	B
German	A	L
Italian	I	T
Spanish	E	S
Portuguese	P	T

■ **Mains lead 2P**

French, German or Spanish (by default)	F
English	G
Italian	I
Swiss	C

Or:

Power Quality Analyser C.A 8332-F with MN clamp	P01.**1605.01**
Power Quality Analyser C.A 8334-F with MN clamp	P01.**1606.01**
Power Quality Analyser C.A 8332-F with Amp***FLEX***	P01.**1605.02**
Power Quality Analyser C.A 8334-F with Amp***FLEX***	P01.**1606.02**
Power Quality Analyser C.A 8332-Int with MN clamp	P01.**1605.03**
Power Quality Analyser C.A 8334-Int with MN clamp	P01.**1606.03**
Power Quality Analyser C.A 8332-Int with Amp***FLEX***	P01.**1605.04**
Power Quality Analyser C.A 8334-Int with Amp***FLEX***	P01.**1606.04**

■ **Accessories**

Set of 3 x C 193-F clamps	P01.**1203.27**
Set of 3 x MN 93-F clamps	P01.**1204.22**
Set of 3 Amp***FLEX*** A193 - F Ø 450 mm	P01.**1205.35**
Set of 3 Amp***FLEX*** A193 - F Ø 800 mm	P01.**1205.36**
Set of 3 x PAC 93-F clamps	P01.**1200.76**
Set of 3 x C 193-Int clamps	P01.**1203.21**
Set of 3 x MN 93-Int clamps	P01.**1204.23**
Set of 3 Amp***FLEX*** A 193 - Int Ø 450 mm	P01.**1205.23**
Set of 3 Amp***FLEX*** A 193 - Int Ø 800 mm	P01.**1205.24**
Set of 3 x PAC 93-Int clamps	P01.**1200.77**
5 A C.A 833x adaptor unit	P01.**1019.59**
Shoulder bag for N°6 cable	P01.**2980.51**
Shoulder bag for instrument N°21	P01.**2980.55**

■ **Spare parts**

4 Leads with banana plug RD + BL + GN + YE P01.**2951.91**
4 Leads with banana plugs RG + NR + BL + BC P01.**2951.33**
Crocodile clips RD + BL + GN + YE P01.**1019.62**
Crocodile clips RG + NR + BL + BC + VJ P01.**1018.49A**
Carrying bag N°22 ..... P01.**2980.56**
C.A 833x strap P01.**2980.57**
C 193 RD clamp P01.**1203.22**
C 193 BK clamp P01.**1203.23**
C 193 GN clamp P01.**1203.24**
C 193 YE clamp P01.**1203.25**
C 193 BL clamp P01.**1203.26**

MN 93 RD clamp P01.**1204.24**
MN 93 BK clamp P01.**1204.25**
MN 93 GN clamp P01.**1204.26**
MN 93 YE clamp P01.**1204.27**
MN 93 BL clamp P01.**1204.28**

PAC 93 RD clamp P01.**1200.78**
PAC 93 BK clamp P01.**1200.79**
PAC 93 GN clamp P01.**1200.80**
PAC 93 YE clamp P01.**1200.81**
PAC 93 BL clamp P01.**1200.82**

Amp***FLEX*** A193 Ø 450 mm RD P01.**1205.25**
Amp***FLEX*** A193 Ø 450 mm BK P01.**1205.26**
Amp***FLEX*** A193 Ø 450 mm GN P01.**1205.27**
Amp***FLEX*** A193 Ø 450 mm YE P01.**1205.28**
Amp***FLEX*** A193 Ø 450 mm BL P01.**1205.29**

Amp***FLEX*** A193 Ø 800 mm RD P01.**1205.30**
Amp***FLEX*** A193 Ø 800 mm BK P01.**1205.31**
Amp***FLEX*** A193 Ø 800 mm GN P01.**1205.32**
Amp***FLEX*** A193 Ø 800 mm YE P01.**1205.33**
Amp***FLEX*** A193 Ø 800 mm BL P01.**1205.34**

RS232 DB9F optical lead P01.**2951.90**
Ni-MH 20 Wh battery pack P01.**2960.23**
Ni-MH 35 Wh battery pack P01.**2960.24**
2P EUR mains lead P01.**2951.74**
Printer DPU 414 - SEIKO P01.**1029.03A**

9. APPENDIX

9.1 Front view of the instrument

9.2 Mathematical formulae used to compute the various parameters

■ **Half-period voltage and current RMS values**

$$Vdem[i] = \sqrt{\frac{2}{NECHPER} \cdot \sum_{n:Zéro}^{Zéro\ suivant} V[i][n]^2}$$ Single rms voltage half-period i + 1 phase

$$Udem[i] = \sqrt{\frac{2}{NECHPER} \cdot \sum_{n:Zéro}^{Zéro\ suivant} U[i][n]^2}$$ Compound rms voltage half-period i + 1 phase

$$Adem[i] = \sqrt{\frac{2}{NECHPER} \cdot \sum_{n:Zéro}^{Zéro\ suivant} A[i][n]^2}$$ Rms current half-period i + 1 phase

NECHPER : number of samples by cycle
n : sample (0; 255) i : phase (0; 1; 2)

■ **Min / max values for voltage and current**

$Vmax[i] = \max(\ Vdem[i]\ )$, $Vmin[i] = \min(\ Vdem[i]\ )$, Vavg = 1/6000 Σ Vdem [i]

$Umax[i] = \max(\ Udem[i]\ )$, $Umin[i] = \min(\ Udem[i]\ )$, Aavg = 1/6000 Σ Adem [i]

$Amax[i] = \max(\ Adem[i]\ )$, $Amin[i] = \min(\ Adem[i]\ )$ (Avg calculation on 1 s)

■ **Peak values for voltage and current**

$Vpp[i] = \max(\ V[i][n]\ )$, $Vpm[i] = \min(\ V[i][n]\ )$ $n \in [0..NECHPER-1]$

$Upp[i] = \max(\ U[i][n]\ )$, $Upm[i] = \min(\ U[i][n]\ )$ $n \in [0..NECHPER-1]$

$App[i] = \max(\ A[i][n]\ )$, $Apm[i] = \min(\ A[i][n]\ )$ $n \in [0..NECHPER-1]$

■ **Peak factors for current and voltage.**

$$Vcf[i] = \frac{\max(Vpp[i], Vpm[i])}{\sqrt{\frac{1}{NECHPER} \cdot \sum_{n=0}^{NECHPER-1} V[i][n]^2}}$$ Peak factor single voltage i+1 phase

$$Ucf[i] = \frac{\max(Upp[i], Upm[i])}{\sqrt{\frac{1}{NECHPER} \cdot \sum_{n=0}^{NECHPER-1} U[i][n]^2}}$$ Peak factor phase-phase voltage i+1 phase

$$Acf[i] = \frac{\max(App[i], Apm[i])}{\sqrt{\frac{1}{NECHPER} \cdot \sum_{n=0}^{NECHPER-1} A[i][n]^2}}$$ Peak factor current i+1 phase

■ **1 sec RMS values for voltage and current**

$$Vrms[i] = \sqrt{\frac{1}{NechSec} \cdot \sum_{n=0}^{NechSec-1} V[i][n]^2}$$ Single rms voltage i + 1 phase

$$Urms[i] = \sqrt{\frac{1}{NechSec} \cdot \sum_{n=0}^{NechSec-1} U[i][n]^2}$$ Compound rms voltage i + 1 phase

$$\mathrm{Arms}[i] = \sqrt{\frac{1}{NechSec} \cdot \sum_{n=0}^{NechSec-1} A[i][n]^2}$$ Rms current i + 1 phase

$$\mathrm{Arms}[3] = \sqrt{\frac{1}{NechSec} \cdot \sum_{n=0}^{NechSec-1} (A[0][n] + A[1][n] + A[2][n])^2}$$ Neutral rms current

NsamSec: Number of samples in a second (multiple of NSAMPER)

■ **Voltage and current unbalance**

$V_+ = \frac{1}{3}(VF[0] + a \cdot VF[1] + a^2 \cdot VF[2])$ Direct voltage (complex notation : $a = e^{j\frac{2\pi}{3}}$)

$V_- = \frac{1}{3}(VF[0] + a^2 \cdot VF[1] + a \cdot VF[2])$ Reverse voltage

$$\mathrm{Vunb} = \frac{|\mathrm{Vrms}_-|}{|\mathrm{Vrms}_+|} \ , \ \mathrm{Aunb} = \frac{|\mathrm{Arms}_-|}{|\mathrm{Arms}_+|}$$

■ **THD calculation**

$$\mathrm{Vthd}[i] = \frac{\sqrt{\sum_{n=2}^{50} Vharm[i][n]^2}}{Vharm[i][1]} \ , \ \mathrm{Uthd}[i] = \frac{\sqrt{\sum_{n=2}^{50} Uharm[i][n]^2}}{Uharm[i][1]} \ , \ \mathrm{Athd}[i] = \frac{\sqrt{\sum_{n=2}^{50} Aharm[i][n]^2}}{Aharm[i][1]}$$

i : phase (0; 1; 2) n : rang (2...50)

■ **Calculation of harmonic bins** ***(see p 11 FT/2)***

By FFT (16 bits) 1024 samples on 4 cycles without windowing (CEI 1000-4-7). From real and imaginary parts, each bin ratio is calculated on each phase Vharm[3][51], Uharm[3][51] and Aharm[3][51] in proportion to the fundamental value and the phase angles Vph[3][51], Uph[3][51] et Aph[3][51] between each bin and the fundamental.
This calculation is done with the following principle:

module in % : $\mathrm{mod}_k = \frac{c_k}{c_1} \times 100$ angle in degree: $\varphi_k = \arctan\left(\frac{a_k}{b_k}\right)$

with
$$\begin{cases} c_k = |b_k + j a_k| = \sqrt{a_k^2 + b_k^2} \\ b_k = \frac{1}{512} \sum_{s=0}^{1024} F_s \times \sin\left(\frac{k\pi}{512} s + \varphi_k\right) \\ a_k = \frac{1}{512} \sum_{s=0}^{1024} F_s \times \cos\left(\frac{k\pi}{512} s + \varphi_k\right) \\ c_0 = \frac{1}{1024} \sum_{s=0}^{1024} F_s \end{cases}$$

ck is the amplitude of the component with a frequency $f_k = \frac{k}{4} f_1$

Fs sampled signal

co is the DC component

k is the ordinal number (spectral bin)

■ Distortion factor calculation (DF)

Two global values giving the relative quantity of harmonics are computed: the THD in proportion to the fundamental and the DF in proportion to the RMS value.

$$\mathrm{Vthd}[i]=\frac{\sqrt{\sum_{n=2}^{50} Vharm[i][n]^2}}{Vharm[i][1]},\ \mathrm{Uthd}[i]=\frac{\sqrt{\sum_{n=2}^{50} Uharm[i][n]^2}}{Uharm[i][1]},\ \mathrm{Athd}[i]=\frac{\sqrt{\sum_{n=2}^{50} Aharm[i][n]^2}}{Aharm[i][1]}$$

$$\mathrm{Vdf}[i]=\frac{\sqrt{\frac{1}{2}\sum_{n=2}^{50} Vharm[i][n]^2}}{Vrms[i]},\ \mathrm{Udf}[i]=\frac{\sqrt{\frac{1}{2}\sum_{n=2}^{50} Uharm[i][n]^2}}{Urms[i]},\ \mathrm{Adf}[i]=\frac{\sqrt{\frac{1}{2}\sum_{n=2}^{50} Aharm[i][n]^2}}{Arms[i]}$$

Multiplying the voltage harmonic factor with the current harmonics factor gives the power harmonic factor. Differentiating voltage harmonic phase angle with current harmonic phase angle gives power harmonic phase angle.
VAharm[3][51] , VAph[3][51]

■ K factor

$$\mathrm{Akf}[i] = \frac{\sum_{n=1}^{n=50} n^2 \cdot Aharm[i][n]^2}{\sum_{n=1}^{n=50} Aharm[i][n]^2}$$ K factor for the i + 1 phase

■ Different power levels 1 sec

$$\mathrm{W}[i]=\frac{1}{NechSec}\cdot\sum_{n=0}^{NechSec-1} V[i][n]\cdot A[i][n]$$ Active power i + 1 phase

$$\mathrm{VA}[i]=\mathrm{Vrms}[i]\cdot\mathrm{Arms}[i]$$ Apparent power i + 1 phase

$$\mathrm{VAR}[i]=\frac{1}{NechSec}\cdot\sum_{n=0}^{NechSec-1} VF[i][n-NECHPER/4]\cdot AF[i][n]$$ Reactive power i + 1 phase

ou $\mathrm{VAR}[i]=\sqrt{\mathrm{VA}[i]^2-\mathrm{W}[i]^2}$ if computation method with harmonics

■ Various ratios

$\mathrm{PF}[i]=\frac{\mathrm{W}[i]}{\mathrm{VA}[i]}$ i + 1 phase power factor

$\mathrm{DPF}[i]=\cos(\phi[i])$ i + 1 phase displacement factor

$\mathrm{Tan}[i]=\tan(\phi[i])$ i + 1 phase tangent

$$\cos(\phi[i])=\frac{\sum_{n=0}^{NechSec-1} VF[i][n]\cdot AF[i][n]}{\sqrt{\sum_{n=0}^{NechSec-1} VF[i][n]^2}\cdot\sqrt{\sum_{n=0}^{NechSec-1} AF[i][n]^2}}$$ Cosine angle between voltage fundamental and i + 1 phase current

$$PF[3] = \frac{PF[0] + PF[1] + PF[2]}{3}$$ Total power factor

$$DPF[3] = \frac{DPF[0] + DPF[1] + DPF[2]}{3}$$ Total shift factor

$$Tan[3] = \frac{Tan[0] + Tan[1] + Tan[2]}{3}$$ Total tangent

■ Various types of energy

$$Wh[i] = \sum_{Tint} \frac{W[i]}{3600}$$ Active energy i + 1 phase

$$VAh[i] = \sum_{Tint} \frac{VA[i]}{3600}$$ Active energy i + 1 phase

$$VARhL[i] = \sum_{Tint} \frac{VAR[i]}{3600} \text{ pour } VAR[i] \geq 0$$ Reactive inductive energy i + 1 phase

$$VARhC[i] = \sum_{Tint} \frac{VAR[i]}{3600} \text{ pour } VAR[i] \leq 0$$ Reactive capacitive energy i + 1 phase

Wh[3] = Wh[0] + Wh[1] + Wh[2] total active energy

VAh[3] = VA[0] + VA[1] + VA[2] total apparent energy

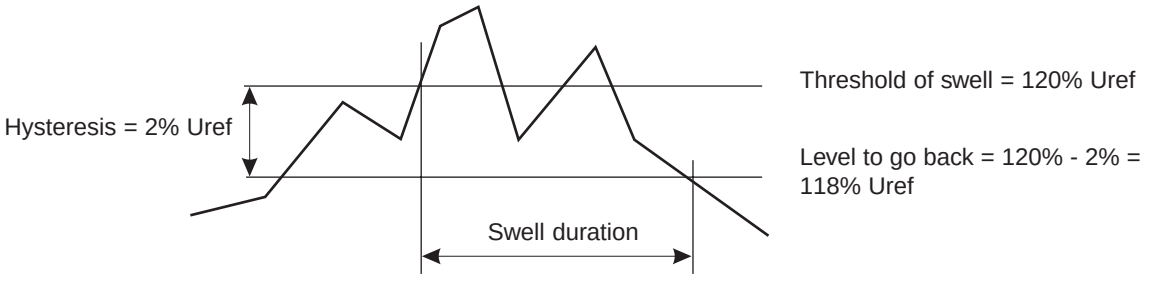
VARhC[3] = VARhC[0] + VARhC[1] + VARhC[2] total reactive capacitive energy

VARhL[3] = VARhL[0] + VARhL[1] + VARhL[2] total reactive inductive energy

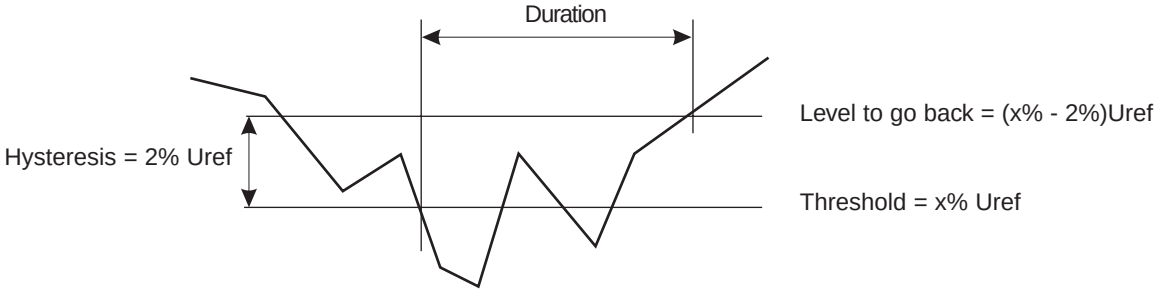
■ Hysteresis

Hysteresis is a filter principle often used after threshold detection stage. A correct setting of hysteresis value avoid repeated state changing when the measure is varying close to the threshold.
The event detection is activate when the measure is going over the threshold but it can only be deactivated if the measure goes under the threshold minus the value of the hysteresis.
The default hysteresis value is 2% of the reference voltage but it may be set in the range of [1%, 5%] depending of the voltage stability on the network.

- Swell detection



- Sag or interruption detection



9.3 Setup DPU 414 printer

To setup the DPU414 printer, press ON and On Line at the same time.

```
Continue ? : Push 'On-line SW'
Write ?    : Push 'Paper feed SW'

Dip SW-1

  1 (OFF) : Input = Serial

  2 (ON ) : Printing Speed = High

  3 (ON ) : Auto Loading = ON

  4 (OFF) : Auto LF = OFF

  5 (ON ) : Setting Command = Enable

  6 (OFF) : Printing

  7 (ON ) :   Density

  8 (ON ) :   = 100 %

Continue ? : Push 'On-line SW'
Write ?    : Push 'Paper feed SW'

Dip SW-2

  1 (ON ) : Printing Columns = 40

  2 (ON ) : User Font Back-up = ON

  3 (ON ) : Character Select = Normal

  4 (ON ) : Zero = Normal

  5 (ON ) : International

  6 (OFF) :   Character

  7 (ON ) :   Set

  8 (ON ) :   = France

Continue ? : Push 'On-line SW'
Write ?    : Push 'Paper feed SW'

Dip SW-3

  1 (ON ) : Data Length = 8 bits

  2 (ON ) : Parity Setting = No

  3 (OFF) : Parity Condition = Even

  4 (ON ) : Busy Control = H/W Busy

  5 (OFF) : Baud

  6 (ON ) :   Rate

  7 (ON ) :   Select

  8 (OFF) :   = 19200 bps

Continue ? : Push 'On-line SW'
Write ?    : Push 'Paper feed SW'

DIP SW setting complete !!
```

CHAUVIN ARNOUX

03 - 2002

Code 689 142 C01 - Ed. 1

Deutschland : CA GmbH - Straßburger Str. 34 - 77694 Kehl / Rhein - Tel : (07851) 99 26-0 - Fax : (07851) 99 26-60
España : CA Iberica - C/Roger de Flor N° 293 - 08025 Barcelona - Tel : (93) 459 08 11 - Fax : (93) 459 14 43
Italia : AMRA MTI - via Sant' Ambrogio, 23/25 - 20050 Bareggia Di Macherio (MI) - Tel : (039) 245 75 45 - Fax : (039) 481 561
Österreich : CA Ges.m.b.H - Slamastrasse 29 / 3 - 1230 Wien - Tel : (1) 61 61 9 61 - Fax : (1) 61 61 9 61 61
Schweiz : CA AG - Einsiedlerstrasse 535 - 8810 Horgen - Tel : (01) 727 75 55 - Fax : (01) 727 75 56
UK : CA UK Ltd - Waldeck House - Waldeck road - Maidenhead SL6 8BR - Tel : (01628) 788 888 - Fax : (01628) 628 099
USA : CA Inc - 99 Chauncy Street - Boston MA 02111 - Tel : (617) 451 0227 - Fax : (617) 423 2952
USA : CA Inc - 15 Faraday Drive - Dover NH 03820 - Tel : (603) 749 6434 - Fax : (603) 742 2346

190, rue Championnet - 75876 PARIS Cedex 18 - FRANCE
Tél. (33) 01 44 85 44 85 - Fax (33) 01 46 27 73 89 - http://www.chauvin-arnoux.com