■ THREE PHASE POWER QUALITY ANALYSER

# C.A 8332B
# C.A 8334B


ENGLISH

User's manual

CHAUVIN® ARNOUX

CHAUVIN ARNOUX GROUP

**MEANING OF SYMBOLS USED IN THE INSTRUMENT**

⚠ : 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 installation.

⏚ : Earth

⧈ : Double insulation

: Conform to WEEE 2002/96/EC standard

Thank you for acquiring a **C.A 8332B or C.A 8334B 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 ⚠

- Read carefully all the notes preceded by ⚠ symbol.
- If you don't use this instrument according the user's manual, you can compromise the safety, and you can go in dangerous situation.
- The safety of all the system which include this instrument is the system owner responsability.
- For your safety, use only tests leads delivered with the instrument : they are conform to EN 61010-031 (2002) standard.
- Before each use, check the good state of test leads.
- For your safety, use only accessories delivered with the instrument or approuved by the supplier.
- Respect the climatic conditions for use (see § 6).
- This instrument can be used on category-IV installations for voltages not exceeding 600V (AC or DC) in relation to the earth (as per EN 60664-1).
- The use of accessorie (sensor) with lower category (CAT III for example) reduce the set use (Instrument with sensor) at this category (CAT IV begin CAT III for example).
- Ensure the measurement leads and sensors are disconnected before removing the battery.
- Use battery packs supplied by the maker.

# INSTALLATION CATEGORIES

Definition of installation categories (cf IEC 664-1 publication) :

CAT III : CAT III circuits are power supply circuits that can support major transient overvoltage.
Example : industrial unit or machine power supply.

CAT IV : CAT IV circuits can support very hight transient overvoltage.
Exemple : power input.

# WARRANTY

Our guarantee is applicable for **three years** 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 8332B and C.A 8334B 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 480V (phase-to-neutral) or 960V (phase-to-phase) for two-wire, three-wire or four-wire networks.
- Measurement of alternating RMS currents up to 6500A rms.
- Measurement of the frequency of 50Hz, 60Hz (10Hz to 70Hz) 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 (three-phase networks only).
- Measurement of harmonic angles and rates (with respect to fundamental value) for voltage, current or power (C.A 8334B only), 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 .
  Total amount of energy generated and received from a moment 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 (C.A 8334B only).

# 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 (C.A 8334B only).

Harmonics:
- representation of the harmonic ratios of voltage, current and power (C.A 8334B only), 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.) (C.A 8334B only)

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),<br>- energy metering,<br>- 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,<br>- mains voltage stability check,<br>- management of power consumed and generated (most economical choice with energy distributor),<br>- monitoring of harmonic variations, |
| | Alarms: | - a list of the alarms recorded according to the thresholds programmed during configuration,<br>- logging of supply network interruption with half-period resolution (Vrms, Arms, Urms),<br>- determination of energy consumption overruns,<br>- 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).

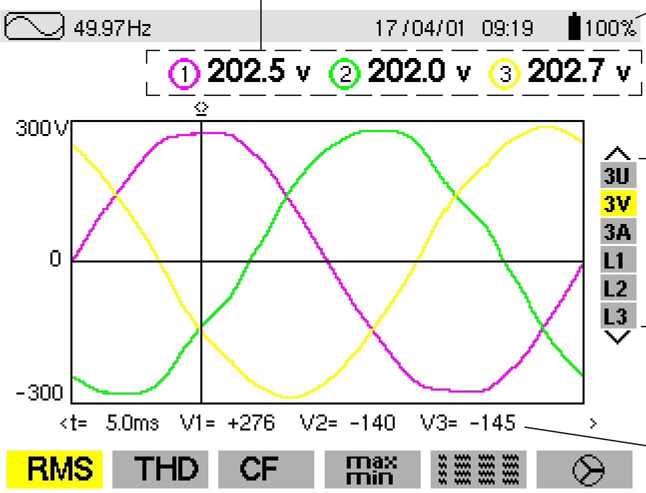
⑩ 4 voltage inputs situated on the top of the instrument

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

**Measurement values associated with curves**




**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.

<u>**Nota :**</u> the stability of the display requires the first measured magnitude of each selection.

**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**

**20%**

***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**

**20%**

***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.

## 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

**1**0/10/2000 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.

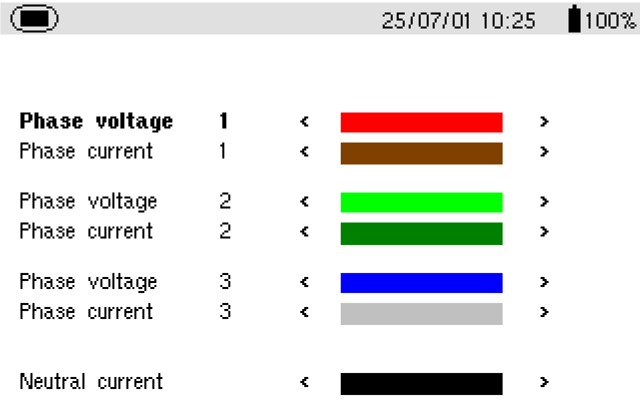
**Note:** The time and date systems may be chosen by the user.

### 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



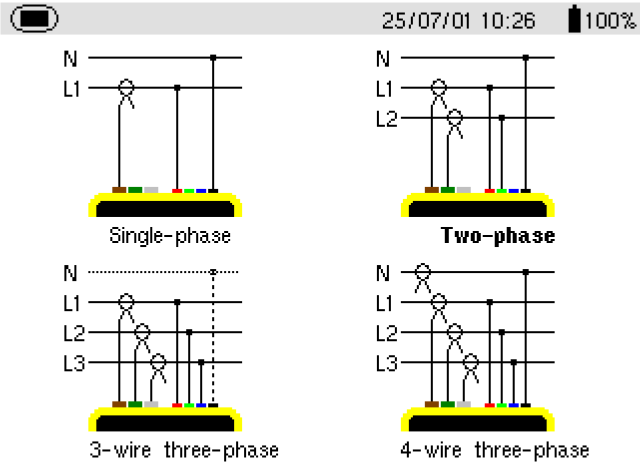

- Choose the channel concerned with the keys
- Choose the colour with the keys
- Validate the setting with the key, the Configuration menu will once again be displayed on the screen.

### 3.1.4 Calculation parameters

Reactive energy calculation < Without harmonics > — Choice of calculation with or without harmonics

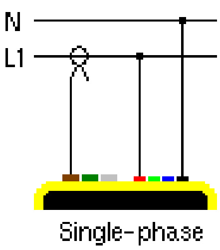
- Choose the method with the keys
- Validate the setting with the key, the Configuration menu will once again be displayed on the screen.

### 3.1.5 Connection

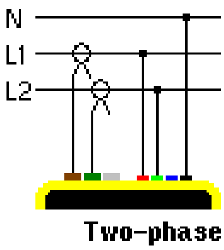



- Choose the connection with the ◄► and ▲▼ keys. Validate the setting with the ↵ key, the Configuration menu will once again be displayed on the screen.

⚠ **Single phase**

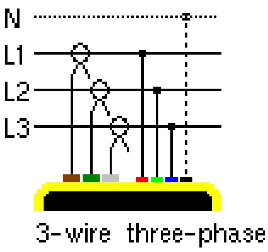



**or two-phase**




, the neutral current is not measured or calculated.

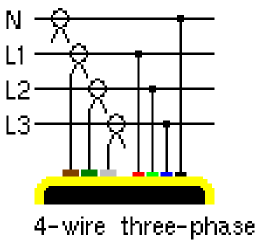
**3-wire, three phase**




:

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**



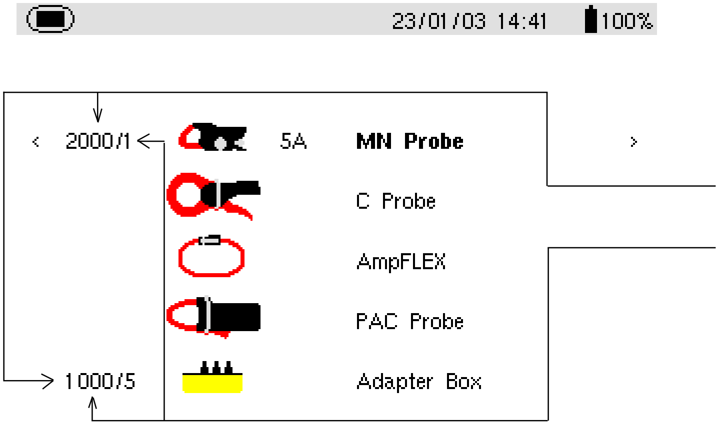

: the neutral current is calculated and its value and waveform are displayed.

⚠ 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.

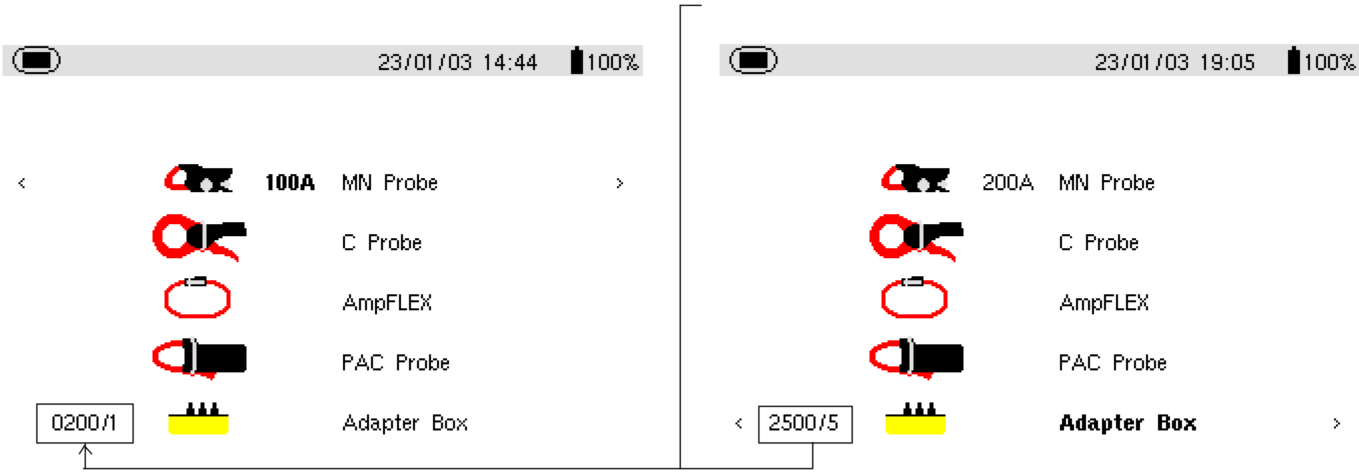
From 1 to 2999A, nominal value of primary current

Secondary current value (5A or 1A)

make the cursor appear/disappear and move.

allow the current required to be determined.

Current transducer ratio



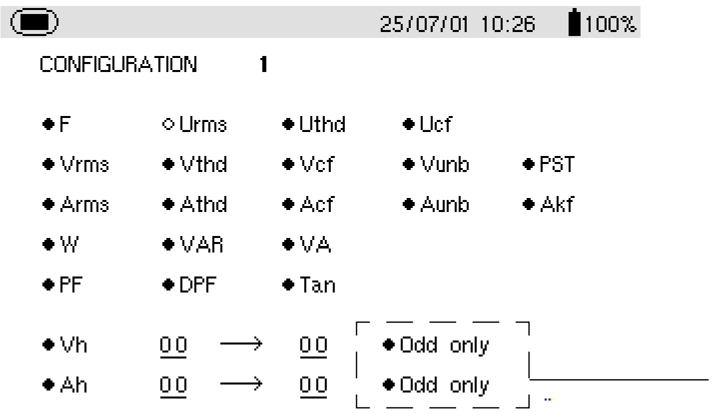

### 3.1.7 Communication

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.

⚠ **For the transfer of data between Qualistar and a PC, the communication speeds must be identical at both ends.**

### 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

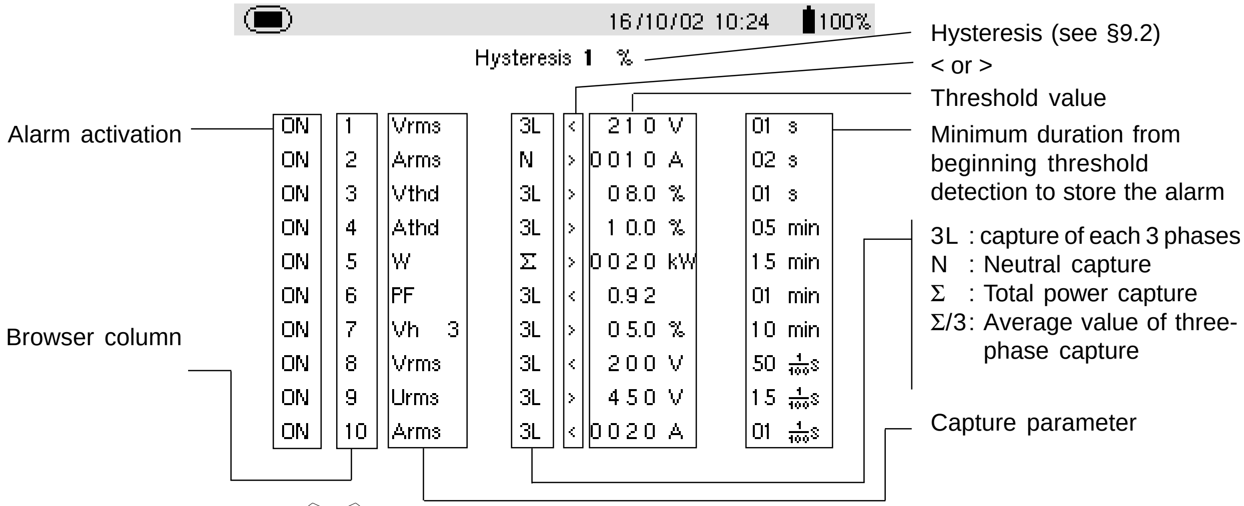
### 3.1.9 Alarm

**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**.

**NOTA :** Only alarms on **V**RMS, **U**RMS and **A**RMS (except for neutral current) can be programmed with a minimum threshold overrun duration of up to 1/100s.

### 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 8334B 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

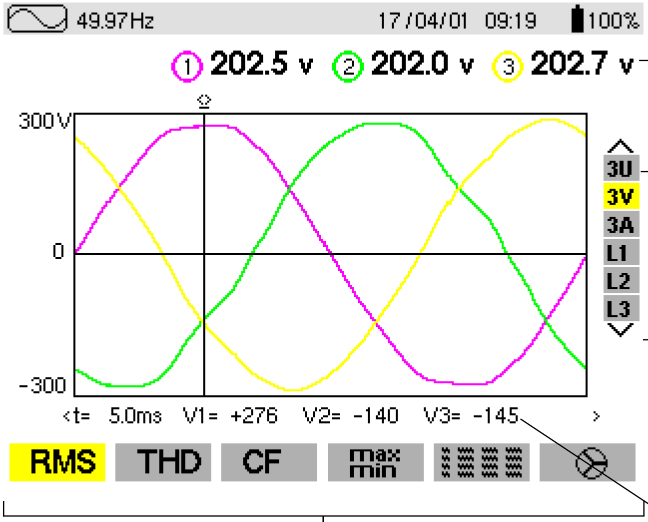
**This parameter determines the correction coefficients used for calculating power and energy, with Amp*Flex* sensor.**

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

## 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** and **L3** respectively display the current and voltage on phases 1, 2 and 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.

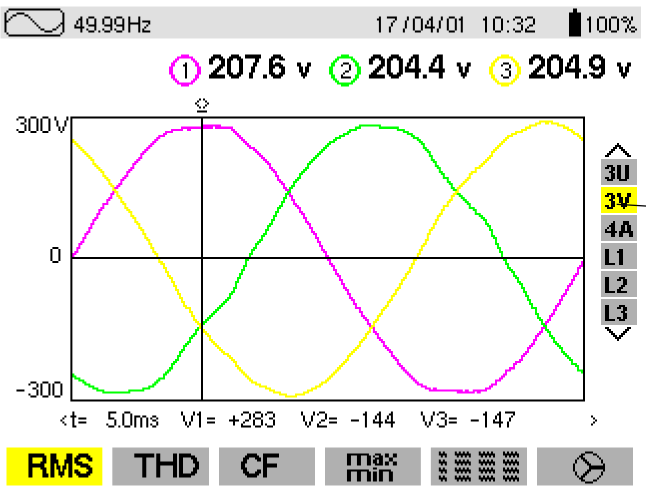
The measurement type is selected using the variable function keys ②, located beneath the screen.
All these measurements are valid in 3U, 3V, 3A, L1, L2, L3

**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)

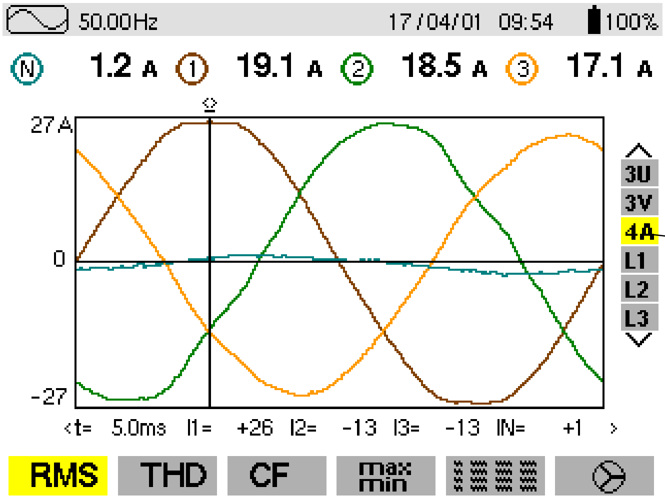
This comment is valid for all display modes.

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



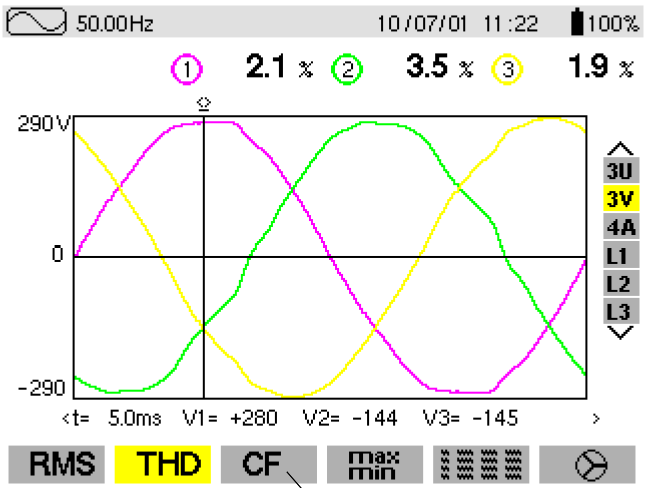

Selection of 3 V

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



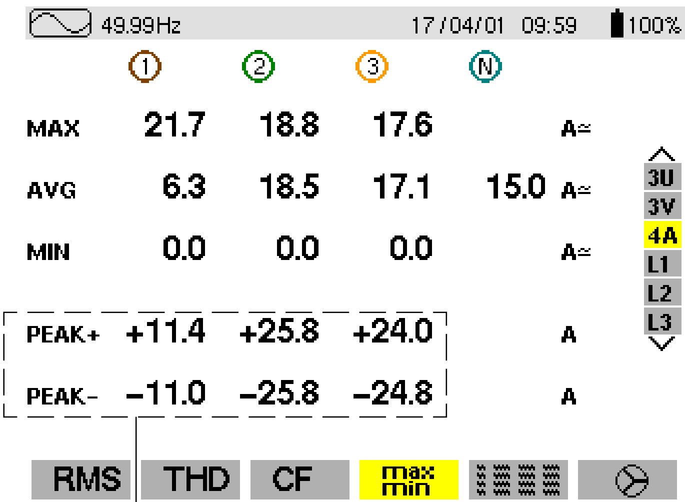

Selection of 4 A

■ **Measurement of overall harmonic distortion factors for voltage**




Measurement of the crest factor

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




Select with the ▲▼ keys 3 V or 4 A to obtain the Min, AVG, Max, peak + or peak – values for current or voltage (see §9.2)

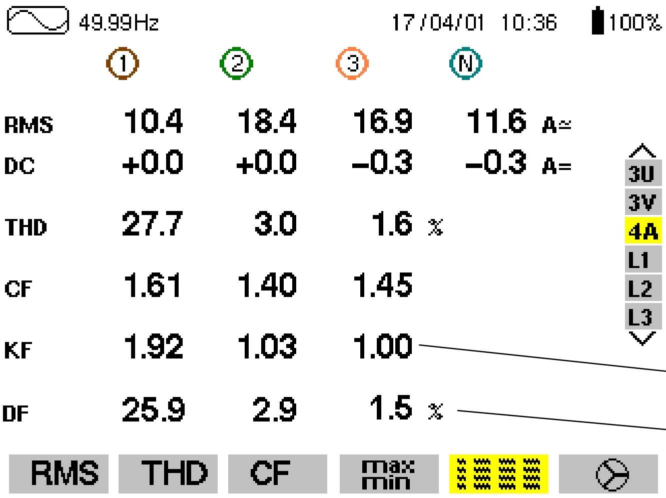
Peak values refreshed every 250ms but calculated every second.

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

**Nota : The Max and Min measurements are calculated every half period (e.g. : every 10ms for a 50Hz signal). The Avg measurements are calculated every second. However, the Max, Avg and Min measurements are refreshed every 250ms.**

■ **Simultaneous display of all the different current measurements**

Summary of RMS, DC, THD, CF and KF parameters

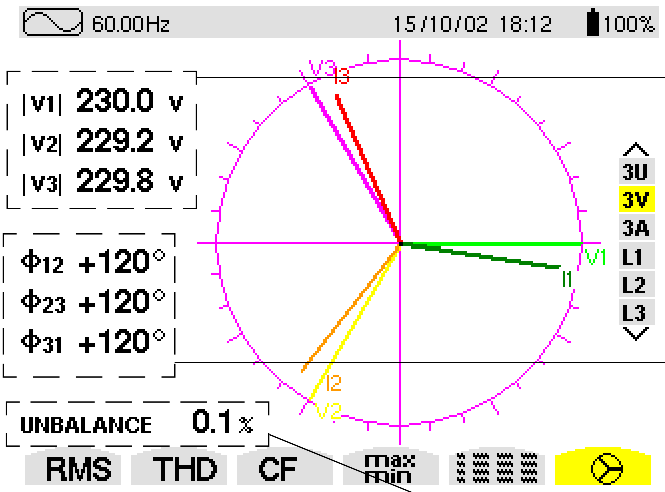



Calculation of the K factor for transformer downgrade

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 or modulus of voltage of current at fundamental frequency.

Select the Fresnel diagram display choice

Φ12 corresponds to the phase shift of channel 1 compared to 2
Φ23 corresponds to the phase shift of channel 2 compared to 3
Φ31 corresponds to the phase shift of channel 3 compared to 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.

| Display Filter (RH vertical menu) | Reference vector for the **Fresnel** diagram |
|---|---|
| 3U | U1 |
| 3V / 2V | V1 |
| 4A / 3A / 2A | A1 |
| L1 | A1 |
| L2 | A2 |
| L3 | A3 |

## 4.2 Harmonics Mode

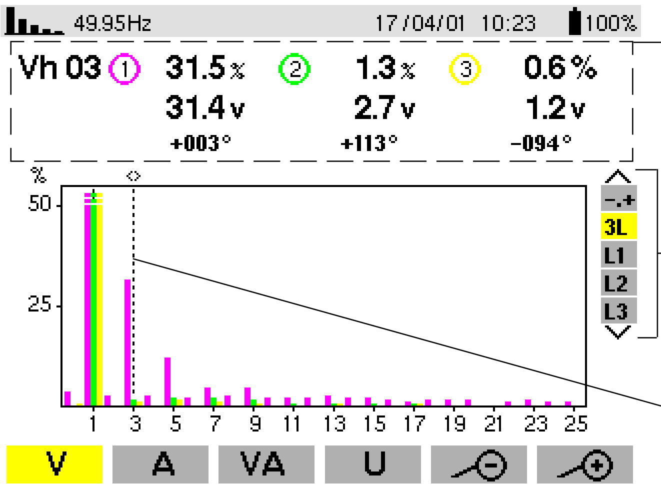
- Press on the display mode key
- The following screen is displayed:

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

| | |
|---|---|
| **V** | Single phase voltage analysis |
| **A** | current analysis |
| **VA** | apparent energy analysis |
| **U** | Phase to phase voltage analysis |

The [zoom +] and [zoom −] 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**



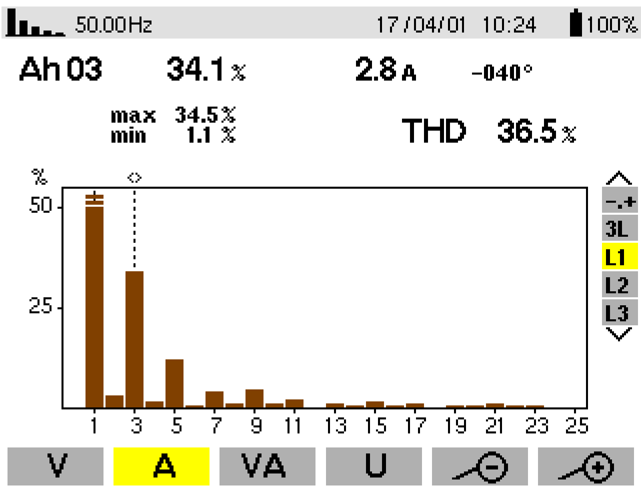

Values measured for each phase (harmonic N°3: Vh03):
- Percentage in relation to the fundamental
- RMS value,
- Phase angle in relation to the fundamental,

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).

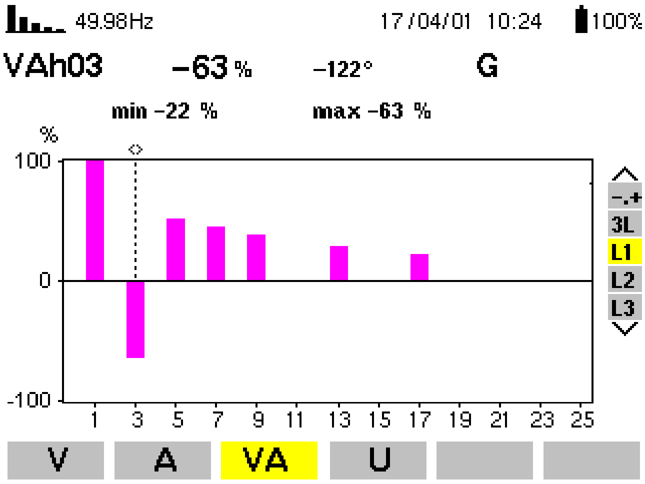
**2. Harmonic analysis of the current of one of the phases of a three phase network** **A**




On phases L1, L2, L3 display of:
- the THD,
- 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 and MAX values of the percentage to fundamental

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

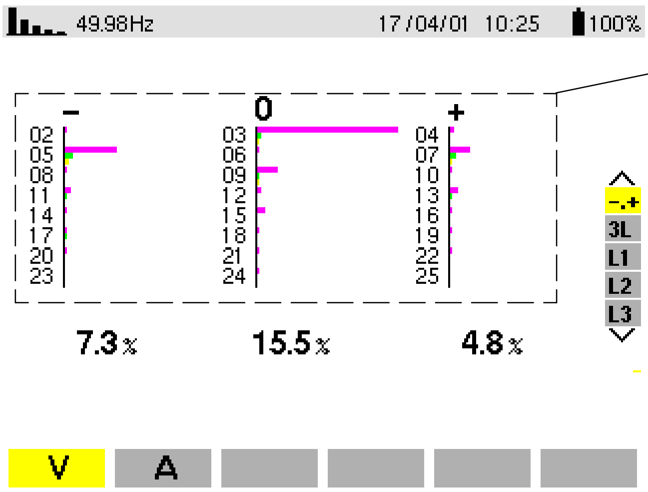
**3. Harmonic analysis of the power of one of the phases of a three phase network** VA (C.A 8334B only).




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 8334B 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

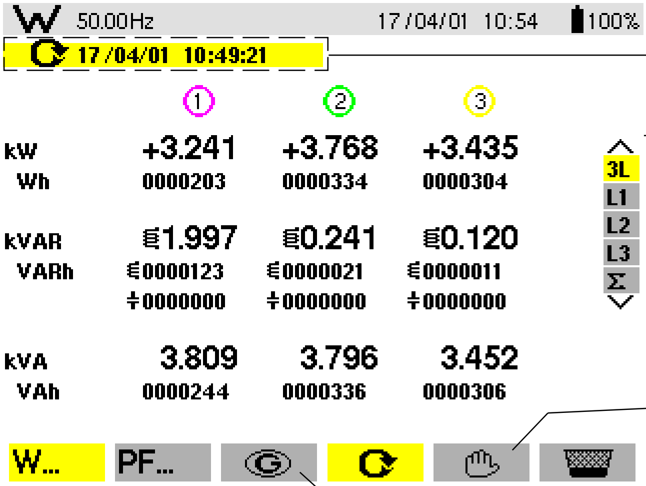
- Press on the display mode key W

The instrument enables:
- Active energy measurement : produced and consumed (negative and positive)
- 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

After pressing a key the indication of the date and time of accumulation start appears.

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

Energy accumulation stoppage.

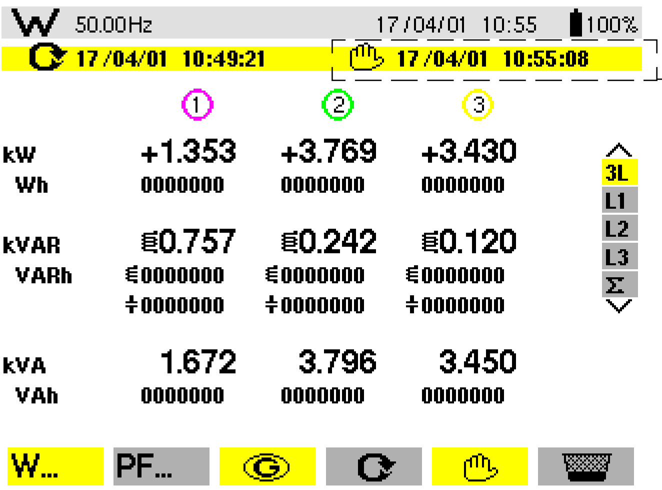
Displays the generated or consumed energy

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.




After a key is pressed, the indication of the date and time of accumulation stoppage appears, the energy values are then frozen for once and for all.

It will necessary to press the key again to recover the possibility of starting another accumulation of energy (by pressing the key).

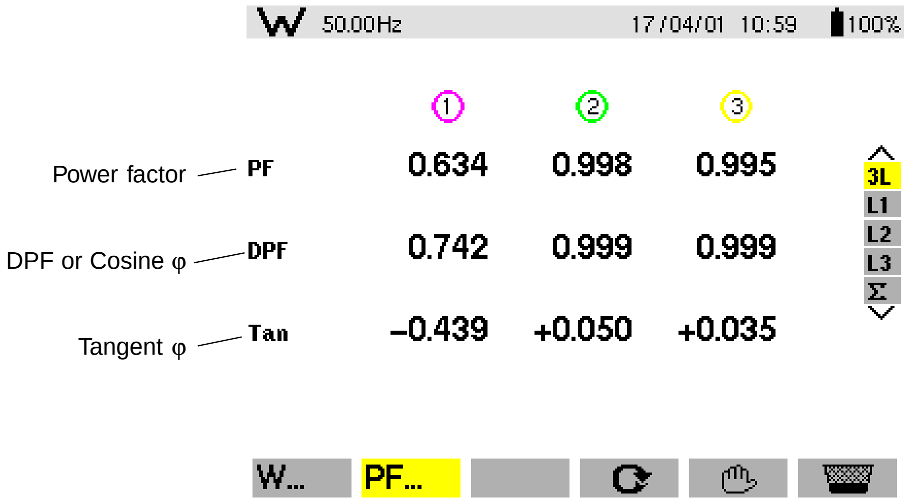
If the G key is pressed, the energy is produced (from load to source); othewise, the energy consumed is produced (from source to load). The accumulated energy is therefore given on 8 different meters (per channel) :

- active energy consumed
- reactive inductive energy consumed
- reactive capacitive energy consumed
- apparent energy consumed

- active energy produced
- reactive inductive energy produced
- reactive capacity energy produced
- apparent energy produced

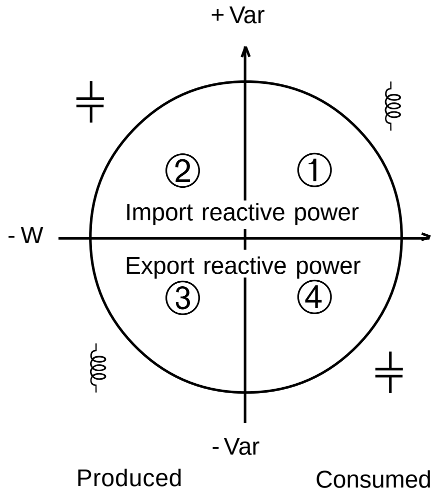
## ■ Key PF...

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.




+ W

**Nota:**
Four quadrants power diagram




⚠ When the active energy is negative the reactive energy polarity generates "inverted" physical behaviour (inductive or capacitive).

## 4.4 Transient mode (on C.A 8334B only)

Press on the display mode key

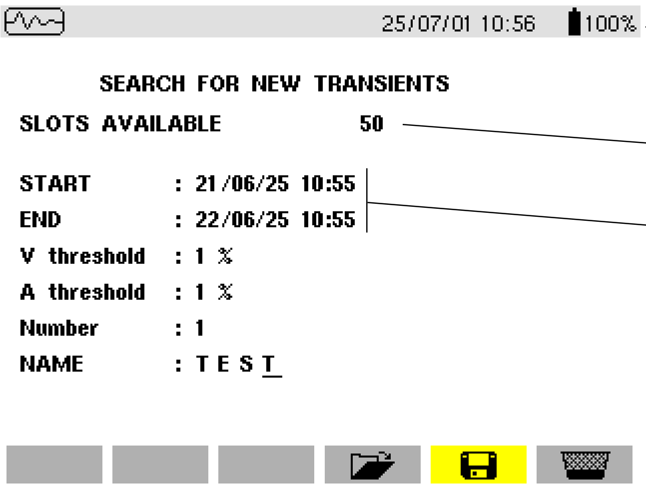
Transient states can be displayed as curves. All the channels (**6**) are stored in memory for each transient state (irrespective of the connection configuration).

It is possible to capture up to a maximum of **50** transient states.

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 )




When scanning for transient states, a progression bar is displayed, indicating the ratio between the number os transient states already found and the programmed number of transient states.

Number of transient states that can still be recorded (refreshed in real time).

Transient search start and end time

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

- Setting trigger thresholds : 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)

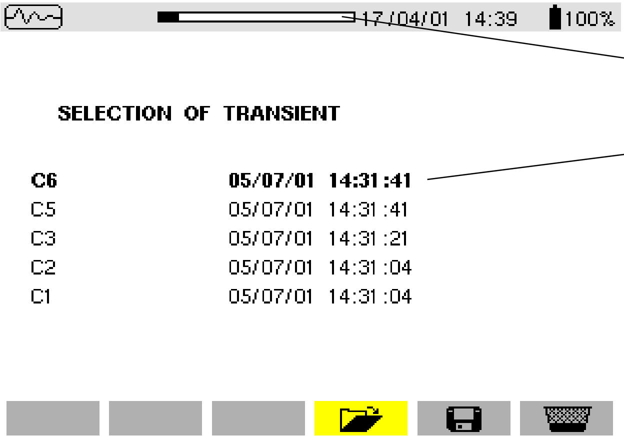
selection of the alphanumeric value

Validate with the key

If tripping is on current, a recording of the voltage and current waveform is made on all the measurement channels (6 in all).

| | THRESHOLD | | | | | | |
|---|---|---|---|---|---|---|---|
| | 100% | 50% | 20% | 10% | 5% | 2% | 1% |
| MN 200A clamp meter | 200 | 100 | 40 | 20 | 10 | 4 | 2 |
| MN 100A clamp meter | 100 | 50 | 20 | 10 | 5 | 2 | 1 |
| Clamp meter C | 1000 | 500 | 200 | 100 | 50 | 20 | 10 |
| AmpFLEX | 2900 | 1400 | 580 | 290 | 140 | 58 | 29 |
| Clamp meter PAC | 1000 | 500 | 200 | 100 | 50 | 20 | 10 |
| Clamp meter MN 5A<br>Adaptator 5A | [(Primary × 5) ÷ (Secondary)] × (Percentage ÷ 100) | | | | | | |
| | | | | | | | |
| Voltage | 480 | 240 | 96 | 48 | 24 | 9,6 | 4,8 |

■ 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

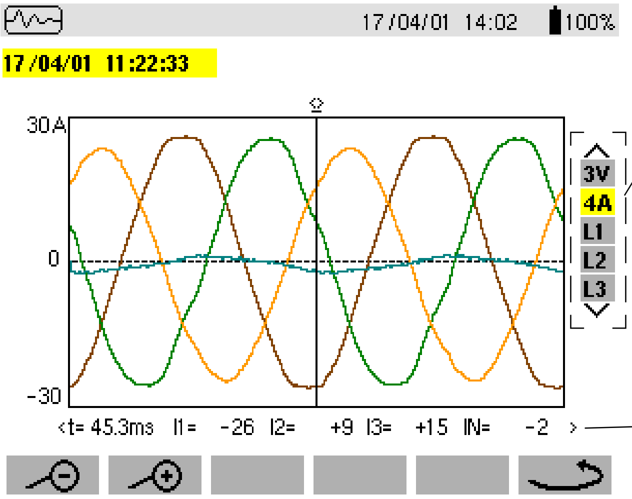
The keys are also used to select a transient to be deleted ( ); then validate with .

■ **Storing trigger**

The threshold T in percent, define an envelope width over and under the last cycle of signal V and A.

Let **S(t)** depend on a **T**-periodic signal and **L** be the half-width of the selected tube.
The sample having value **S(t₀)** is then considered to be “transient state recording triggering” if and only if
**S(t₀)** ∉ **] S(t₀-T) - L; S(t₀-T) + L [** and the apparatus is not already processing a transient state.

■ 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

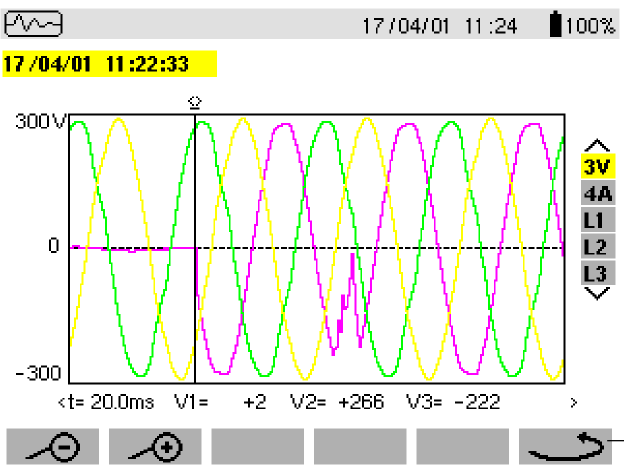
The curves to be displayed are selected by pressing on the keys:

- **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

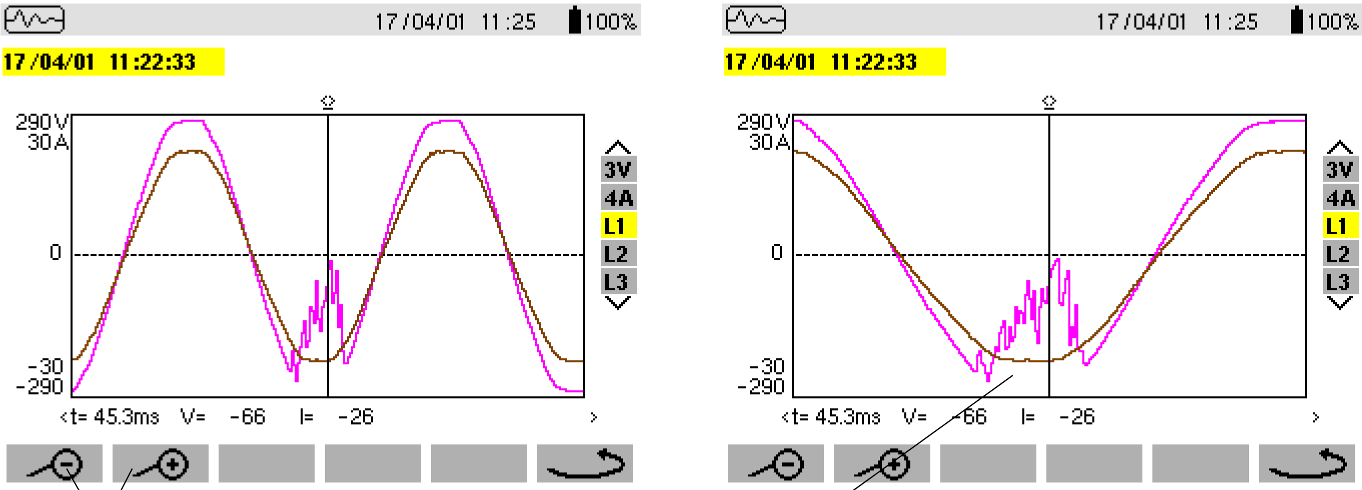
NB : The “Trigger” sample is included within the time interval **[0 ; T/8[** (where **T** is the signal period).

■ **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 [zoom-in key].

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

## 4.5 Alarms Mode

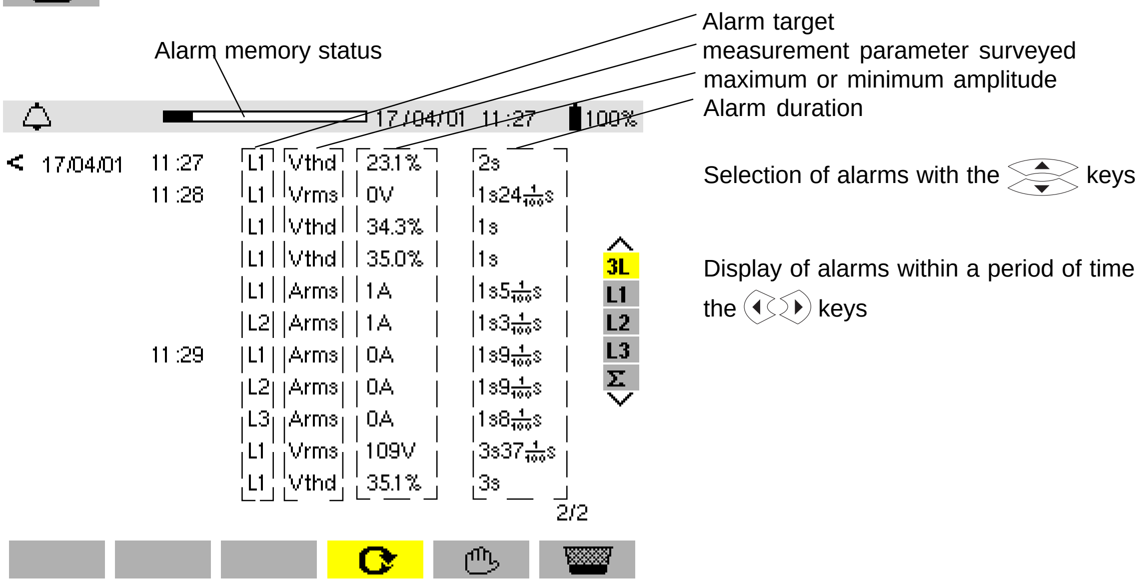
- Press on the display mode key
- The next screen presents the various alarms stored.

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

[GO key] GO launches alarm capture

[hand key] stop alarm capture

[bin key] 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 recorded in **W**, **VAR**, **PF**, **DPF** and **Tan**? are in absolute values.

***Note :*** ***The type of connection selected in the [setup] mode has no influence on the possibilities of choosing the alarm target and monitored parameter. The user is responsible for making pertinent choices.***

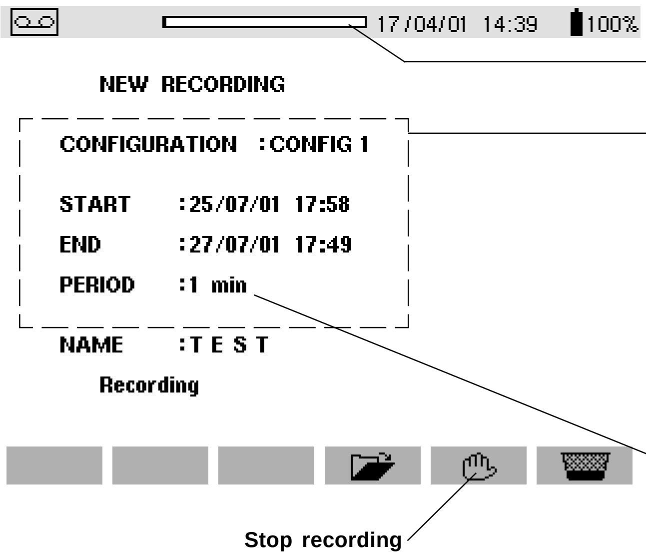
## 4.6 Recording Mode

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

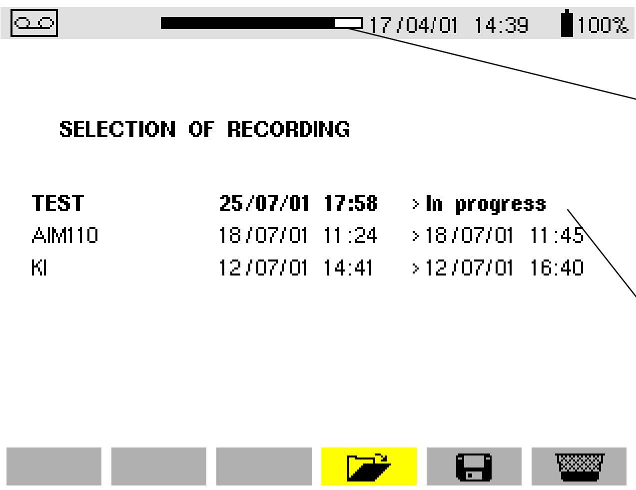
The possible recording integration periods are:
1s, 5s or 20s and 1, 2, 5,10 or 15min

***Note:** the start and end dates are adjusted according to the chosen recording integration period.*
*"PERIOD"* does not refer to a sampling period but to an integration period (average).
***Note :** The device calculates in real time the storage needs of the recording and if necessary displays the message “Not enough memory».*

### ■ 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).*

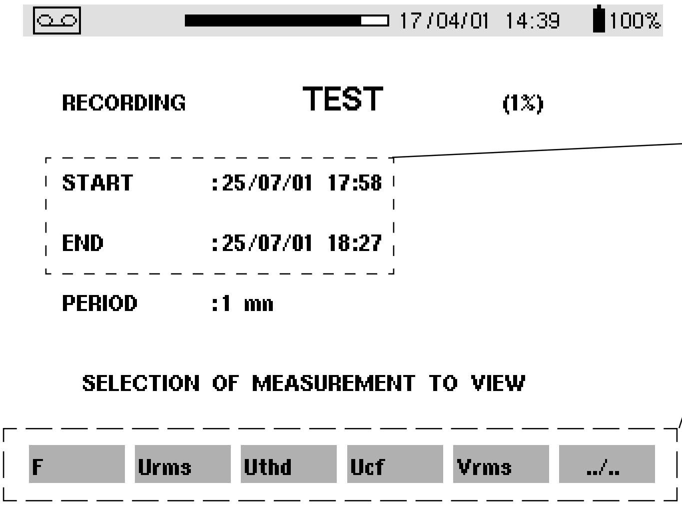
The following screen opened using a key, is a way of consulting a recording previously stored in memory.
The device makes an automatic correction if the programming dates and times do not match:
- the current date
- the current time
- the set recording integration period (it is advisable to set times that are multiples of the integration period).

***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 "TEST" record (see “selecting a record”) gives access to the screen below which allows the selection of the measurement to be displayed:

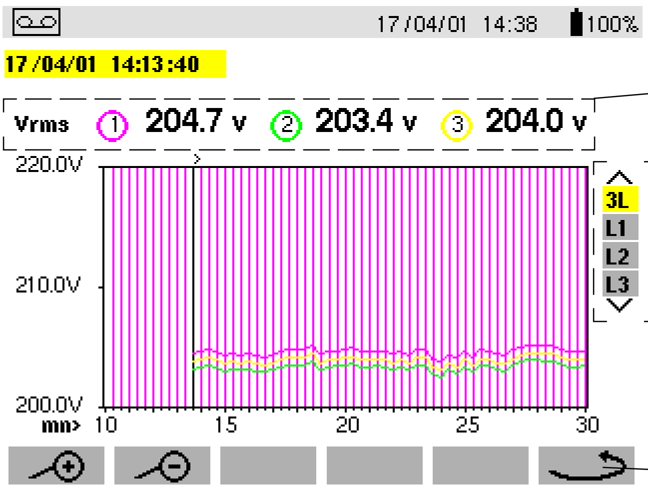



Indication of recording conditions

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.

***Note : It is possible to scroll through the measurements using the ◁▷ keys.***

■ **An example of the graphic display of V RMS measurements**



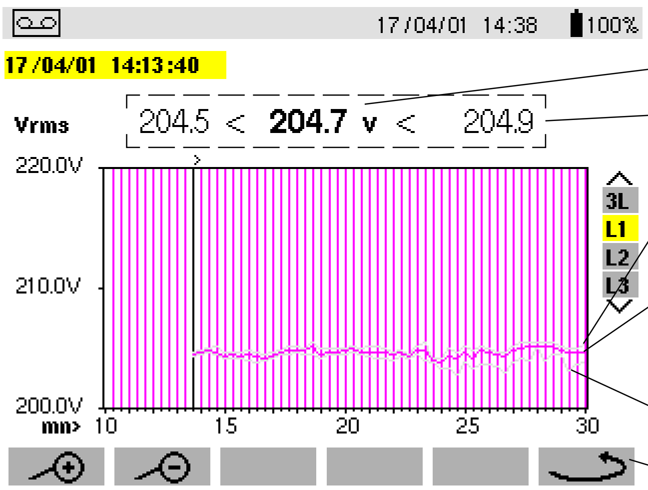

- When the **V RMS** key is pressed, the following screen is displayed:

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

3 phases or each individual phase can be selected using 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:




The average value is calculated for the display integration period

Extremes and average values over the display integration period

Max. value

Average value

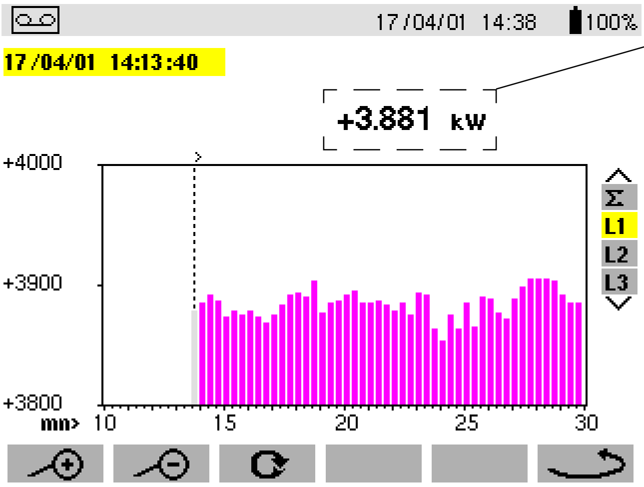
Min. value

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

⚠ When the display integration period is different from the recording integration period:
- The displayed **Avg** value is the average of the measurements for each recording integration period in a display integration period
- The extreme values are the minimum and maximum recording integration periods in a display integration period.

## ■ Graphic display of average power

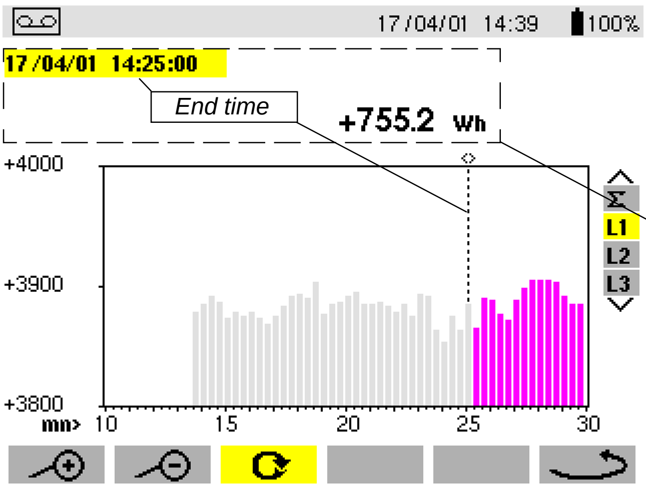
After returning to the “Selection of the measurement to view” screen with the **../..** key and pressing on the **W** key, the user obtains:




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».*

***Note:*** The and keys are used for changing the display integration period of the displayed measurement and the time scale of the graphics.

| Display integration 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 display integration period is limited by the recording integration period.*
*The recording integration period of 2 minutes is a special case. In this case, only the following display integration periods are possible: 10 minutes, 1 hour and 2 hours.*

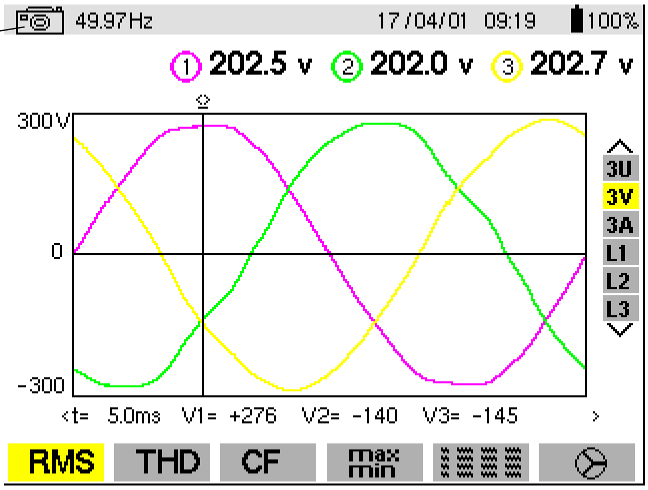
## 4.7 Screen Memorisation

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:

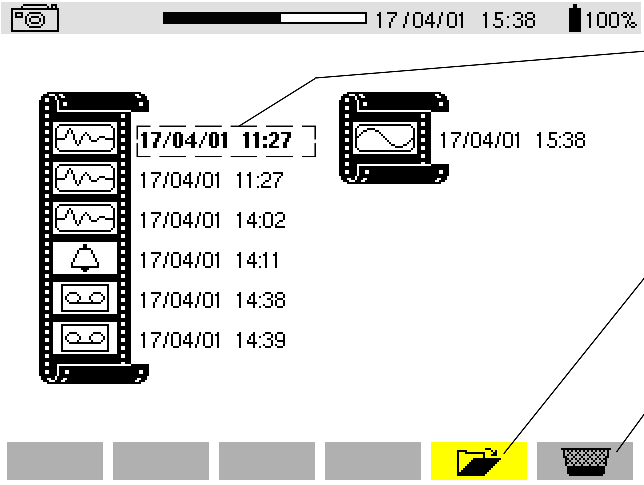
The icon is displayed as soon as the operation has finished.

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 selection of the screen to be displayed (or erased) is carried out using the and 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.

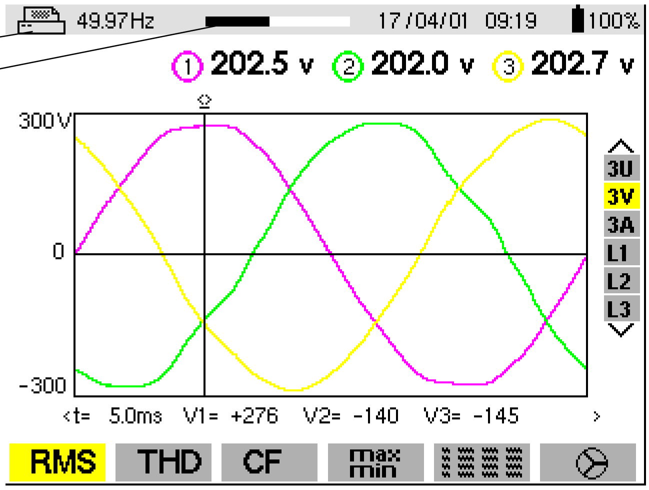
**To exit from the display of the recorded screen and return to the display of the recorded screen menu, press the key again.**

***Important note:*** the various storage spaces of **C.A 8332B** and **C.A 8334B** are of a fixed size and are completely independent of one another (partitioned). There are **4** spaces for **C.A 8334B** (alarms, photographs, transient states and recordings) versus **3** for **C.A 8332B** (less the transient states).

## 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 kbps.*

The dedicated printer for the Qualistar is "DPU 414 - SEIKO" (see § 9.3)

## 4.9 Help

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

| (?) | 27/07/01 15:34 100% |
|---|---|
| **PF...** | Display of PF, DPF and Tan |
| **W** | Active power |
| **Wh** | Active energy consumed |
| **VAR** | Reactive power |
| **VARh** | Reactive energies consumed |
| **VA** | Apparent power |
| **VAh** | Apparent energy consumed |
| | Start of cumulated energy metering |
| | End of cumulated energy metering |
| | Reinitialization of cumulated energy metering |
| △ ▽ | Choice of measurement target (3L,L1,L2,L3,Sigma) |

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

## 4.10 QualistarView software

The QualistarView software is running on Windows 9x, NT4, Me, 2000 and XP.

Run Setup.exe

**Setup of serial communication:**
- On Qualistar (**Setup** mode)
- On the software **"Qualistar View"** (Submenus : Options > Communication)
***Nota:*** *the communication speed must be the same on the Qualistar and the "QualistarView" software.*
Once the speed has been configured start retrieving the **Qualistar** configuration (Submenu: Options > Setup **Qualistar**) to see how the serial communication works.
The data imports from **Qualistar** (to the PC) generate backups of files specific to **Qualistar View** of which the extensions are as follows:
- **".mon"** (for a recording)
- **".trs"** (for a transient state)
- **".bmp"** (for a screenshot)
- **".ala"** (for a complete or customized alarms log)
- **".per"** (for the recording of a measurement and a data channel to which a display integration period is assigned other than the recording integration period of **Qualistar)**
- **".trt"** (for a recording to which a voltage transformer ratio of **1** to **2999** has been applied)

# 5. GENERAL SPECIFICATIONS

## 5.1 Dimensions and weight

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

## 5.2 Power supply

- **AC mains supply**

With an internal mains adaptor
Range for use: 85-265V 50/60Hz
Max. power: 40VA

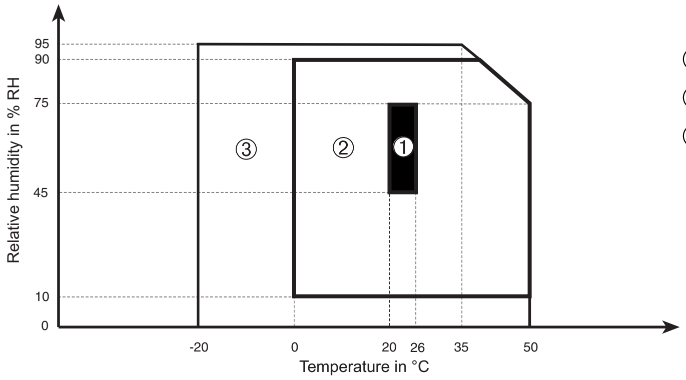
- **Battery power**

Allows the instrument connected to the AC supply to be used in the event of a power interruption.
Type: NiMH 3500mAh
Output: 4-wire (2 for temperature probe)
Rated voltage: 9.6V
Charge time: approx. 5hrs
Temperature for use : 0°...+50°C
Recharging temperature : +10°...+40°C
Storage temperature : **-20°C...+50°C (** duration ≤ **30** days**) -20°C...+40°C (** duration form **30** to **90** days**) -20°C...+30°C (** duration from **90ays to** 1 **year**).

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 : 2001)

- Double insulation: ▣
- Measurement category: IV
- Pollution level: 2
- Assigned voltage: 600 V RMS
- Inside use

### 5.4.2 Electromagnetic compatibility

- Immunity: as per NF EN 61236 - 1 amend.1, 2 and 3
- 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, 2 and 3 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
- Voltage interruption as per IEC 1000-4-11

### 5.4.3 Mechanical protection

- Operating position: Indifferent
- If dropped: as per NF EN 61010-1
- Impermeability: IP 50 as per NF EN 60529 A1 *(electrical IP2X for the terminals)*
- Rigidity: 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 |
| Current circuit input voltage other than Amp***Flex*** | 0.03 V ≤ I ≤ In = 1 V rms without DC (< 0.5%) |
| Amp***Flex*** current circuit input voltage | 11.8mV ≤ I ≤ In = 118 mV rms without DC (< 0.5%) |
| 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: 960 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 circuit other than Amp***Flex*** and 12.4 kΩ for circuit Amp***FLEX***
- Admissible overload: 1.7 V

### 6.2.3 Characteristics of the device alone (without the current sensors)

| Measurement | | Measuring Range | | Dislplay Resolution | Error in the reference range |
|---|---|---|---|---|---|
| | | Minimum | Maximum | | |
| Frequency | | 40Hz | 69Hz | 0,01Hz | ±(0,01Hz) |
| Single TRMS Voltages | | 6V | 480V | 0,1V | ±(0,5%+0,2V) |
| TRMS Composite Voltages | | 10V | 960V | 0,1V | ±(0,5%+0,2V) |
| DC Voltages | | 6V | 680V | 0,1V | ±(1%+0,5V) |
| TRMS Current | Other than Amp***FLEX*** | $I_{nom}$ ÷ 1000 [A] | 1,2 × $I_{nom}$ [A] | 0,1A I < 1000A | ±(0,5%+0,2A) |
| | | | | 1A I ≥ 1000A | ±(0,5%+1A) |
| | Amp***FLEX*** | 10A | 6500A | 0,1A I < 1000A | ±(0,5%+1A) |
| | | | | 1A I ≥ 1000A | |
| DC Currents (clamp meter PAC) | | 1A | 1700A(1) | 0,1A I < 1000A | ±(1%+1A) |
| | | | | 1A I ≥ 1000A | |

(1) $1,2\times1000\times\sqrt{2}=1700A$

| Measurement | | Measuring range | | Display Resolution | Error in the reference range |
|---|---|---|---|---|---|
| | | Minimum | Maximum | | |
| Peak Current | Other than Amp*FLEX* | 0A | 1,7 × $I_{nom}$ [A](1) | 0,1A<br>I < 1000A | ±(1%+1A) |
| | Amp*FLEX* | | 9190A(2) | 1A<br>I ≥ 1000A | |
| TRMS half period current(5) | Other than Amp*FLEX* | $I_{nom}$ ÷ 100 [A] | 1,2 × $I_{nom}$ [A] | 0,1A<br>I < 1000A | ±(1%+0,5A) |
| | | | | 1A<br>I ≥ 1000A | ±(1%+1A) |
| | Amp*FLEX* | 100A | 6500A | 0,1A<br>I < 1000A | ±(1,5%+4A) |
| | | | | 1A<br>I ≥ 1000A | |
| Single Peak voltages | | 6V | 680V(3) | 0,1 V | ±(1%+0,5V) |
| Peak composite voltage | | 10V | 1360V(4) | 0,1V<br>U < 1000V | ±(1%+0,5V) |
| | | | | 1V<br>U ≥ 1000V | |
| TRMS half period phase to phase voltage(5) | | 6V | 480V | 0,1V | ±(0,8%+0,5V) |
| TRMS half period phase to ground voltage(5) | | 10V | 960V | 0,1V | ±(0,8%+0,5V) |
| Peak factor | | 1 | 9,99 | 0,01 | ±(1%+0,02) |

1) 1.2 x $I_{nom}$ x √2 = 1.7 x $I_{nom}$

2) 6500 x √2 = 9190A

3) 480 x √2 = 680V

4) 960 x √2 = 1360V

5) Caution : The absolute offset value must not exceed 14% of the peak amplitude.

In other words, s(t) = S x sin (ωt) + O, giving us IOI ≤ 0.14 x S (with positive S).

The half period values are the MAX and MIN values of the waveform mode and the $V_{RMS}$, $U_{RMS}$ and $A_{RMS}$ values (other than the neutral current) are used in the Alarm mode.

| Measurement | | Etendue de mesure – Minimum | Etendue de mesure – Maximum | Résolution d'affichage | Erreur dans le domaine de référence |
|---|---|---|---|---|---|
| **Active Powers** | **Other than Amp*FLEX*** | 0W | 9999kW | 4 digits | ±(1%)<br>Cos φ ≥ 0,8 |
| | | | | | ±(1,5%+10pts)<br>0,2 ≤ Cos φ < 0,8 |
| | **Amp*FLEX*** | 0W | 9999kW | 4 digits | ±(1%)<br>Cos φ ≥ 0,8 |
| | | | | | ±(1,5%+10pts)<br>0,5 ≤ Cos φ < 0,8 |
| **Reactive Powers** | **Other than Amp*FLEX*** | 0VAR | 9999kVAR | 4 digits | ±(1%)<br>Sin φ ≥ 0,5 |
| | | | | | ±(1,5%+10pts)<br>0,2 ≤ Sin φ < 0,5 |
| | **Amp*FLEX*** | 0VAR | 9999kVAR | 4 digits | ±(1,5%)<br>Sin φ ≥ 0,5 |
| | | | | | ±(2,5%+20 pts)<br>0,2 ≤ Sin φ < 0,5 |
| **Apparent power** | | 0 | 9999kVA | 4 digits | ±(1%) |
| **Power factor** | | -1 | 1 | 0,001 | ±(1,5%)<br>Cos φ ≥ 0,5 |
| | | | | | ±(1,5%+0,01)<br>0,2 ≤ Cos φ < 0,5 |
| **Tangent<br>VA ≥ 50VA** | | -32,76 | 32,76 | 0,001<br>Tan φ < 10 | ±(1°) sur φ |
| | | | | 0,01<br>Tan φ ≥ 10 | |

<table>
<tr><th colspan="2" rowspan="2">Measurement</th><th colspan="2">Measuring range</th><th rowspan="2">Display Resolution</th><th rowspan="2">Error in the reference range</th></tr>
<tr><th>Minimum</th><th>Maximum</th></tr>
<tr><td rowspan="4">Active energy</td><td rowspan="2">Other than AmpFLEX</td><td rowspan="2">0Wh</td><td rowspan="2">9999MWh</td><td rowspan="2">4 digits</td><td>±(1%)<br>Cos ϕ ≥ 0,8</td></tr>
<tr><td>±(1,5%)<br>0,2 ≤ Cos ϕ < 0,8</td></tr>
<tr><td rowspan="2">AmpFLEX</td><td rowspan="2">0Wh</td><td rowspan="2">9999MWh</td><td rowspan="2">4 digits</td><td>±(1%)<br>Cos ϕ ≥ 0.8</td></tr>
<tr><td>±(1,5%)<br>0,5 ≤ Cos ϕ < 0,8</td></tr>
<tr><td rowspan="4">Energies réactives</td><td rowspan="2">Other than AmpFLEX</td><td rowspan="2">0VARh</td><td rowspan="2">9999MVARh</td><td rowspan="2">4 digits</td><td>±(1%)<br>Sin ϕ ≥ 0,5</td></tr>
<tr><td>±(1,5%)<br>0,2 ≤ Sin ϕ < 0,5</td></tr>
<tr><td rowspan="2">AmpFLEX</td><td rowspan="2">0VARh</td><td rowspan="2">9999MVARh</td><td rowspan="2">4 digits</td><td>±(1,5%)<br>Sin ϕ ≥ 0,5</td></tr>
<tr><td>±(2,5%)<br>0,2 ≤ Sin ϕ < 0,5</td></tr>
<tr><td colspan="2">Apparent energy</td><td>0VAh</td><td>9999MVAh</td><td>4 digits</td><td>±(1%)</td></tr>
<tr><td colspan="2">Unbalance<br>(three phase system)</td><td>0%</td><td>100%</td><td>0,1%</td><td>±(1%)</td></tr>
<tr><td colspan="2">Phase angle</td><td>-179°</td><td>180°</td><td>1°</td><td>±(2°)</td></tr>
</table>

| Measurement | Measuring range | | Display Resolution | Error in the reference range |
|---|---|---|---|---|
| | Minimum | Maximum | | |
| **Harmonics ratios** **($V_{RMS}$ > 50V)** **($I_{RMS}$ > $I_{nom}$ ÷ 100)** **rang ∈ [1 ; 50]** | **0 %** | **999 %** | **0,1%** | **±(1%+0,5%)** |
| **Harmonics angles** **($V_{RMS}$ > 50V)** **($I_{RMS}$ > $I_{nom}$ ÷ 100)** | **-179°** | **-180°** | **1°** | **±(3°)** **rang ∈ [1 ; 25]** |
| | | | | **±(10°)** **rang ∈ [26 ; 50]** |
| **Total harmonics ration** **rang £ 50** | **0 %** | **999 %** | **0,1%** | **±(1%+0,5%)** |
| **Factor K** | **1** | **99,99** | **0,01** | **±(5%)** |

### 6.2.4 Nominal range of use

Frequency : 40 to 70Hz
Harmonics: THD (I) : 0 to 40%
THD (U) : 0 to 20%
Magnetic field: 0 to 400A/m
Electrical field: 0 to 3V/m
Relative humidity : 10 to 90%, free of condensation.

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

■ **Sensor characteristics C193 (Accessories)**

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

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

- Error in the reference conditions *

| Primary current (in A AC) | 3...10A | 10...100A | 100...1200A |
|---|---|---|---|
| Precision (in % of the input 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 field of use (to be added to the error under reference conditions)

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

■ Overloads : Frequency derating beyond 1kHz :

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

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

- Nominal range : 3000A AC
- Measurement range : 10A to 6500A AC
- Input/Ouput ratio : 140mV AC/3000A AC at 50Hz
  Note : the ouput is proportional to the amplitude and the frequency of the measured current
- Diameter of the sensor: 140mm Ø / length 450mm or 250mm Ø / length 800mm
- NF EN 61010-1 and 2 (electrical safety) 1000V CAT III or 600V CAT IV, POL 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 | < 40A/m (earth's magnetic field) |
| External alternative magnetic field | none present |
| External electric field | none present |
| Frequency | from 10Hz to 100Hz |
| Type of signal measured | sinusoidal |

■ Error in the reference conditions

| | | |
|---|---|---|
| Primary current (in A AC) | 10A...100A | 100A...6500A |
| Precision (in % of the input signal) | ≤ 3% | ≤ 2% |
| Phase shift at 50 Hz (in °) | ≤ 1° | ≤ 0.5° |

■ Variations in the nominal working range (to be added to the error under reference conditions)

| 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 | 10Hz...20kHz | 0.5% |
| Position of conductor in clamp | Any position on the internal perimeter of the undeformed sensor | 2%<br>(4% near the latching system) |
| Adjacent conductor carrying an AC current | Conductor in contact with the sensor | 1%<br>(2% near the latching system) |

## ■ Characteristics of PAC93 sensors (accessories)

- Rated calibre: 1000A AC, 1400A DC
- Measurement range: 10A to 1000A AC, 10A to 1400A PEAK AC+DC
- Input/output ratio: 1mV/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, 600V CAT III, POL 2 or 300V CAT IV, POL 2

⚠ **Using C.A 8332B / C.A 8334B (600V CAT IV) with PAC 93 sensors (600V CAT III or 300V CAT IV) involve the set 600V CAT III or 300V CAT IV.**

■ Reference conditions

| | |
|---|---|
| Temperature | 18°C to 28°C |
| Relative humidity ratio | 20% to 75% RH |
| Battery voltage | 9V ±0.1V |
| 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 | ≤ 65Hz |
| Type of signal measured | sinusoidal |

■ Error in the reference range

| Primary current | 10...100A | 100...800A | 800...1000A AC<br>800...1400A PEAK |
|---|---|---|---|
| Accuracy | ≤ 1.5% +1A | ≤ 3% | ≤ 5% |

| Primary current | 10...100A | 100...1000A |
|---|---|---|
| Phase angle | ≤ 2° | ≤ 1.5° |

■ 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: ≤ 0.2A/K |
| | | SCALE: ≤ 300ppm/K or 0.3%/10K |
| Battery voltage | 6.5V to 10V | ≤ 1A/V |
| | 10% and 90% RH | ≤ 0.5% of the reading |
| Position of a 20 mm Ø 20 conductor | DC at 440Hz<br>DC at 1Hz<br>DC at 2Hz<br>DC at 5Hz | < 0.5% of the reading<br>< 1% of the reading<br>< 3% of the reading<br>< 10% of the reading |
| Live adjacent conductor | 50 and 60Hz | < 10mA/A AC (23 mm from the clamp) |
| External field | 400A/m | < 1.3A |
| Rejection in common mode (in AC) | 50 to 400Hz | > 65dB |
| Remanence in DC | +1400A DC at<br>-1400A DC | < 4mA/A |
| Frequency of the measurement signal | 65Hz to 440Hz<br>440Hz to 1kHz<br>1kHz to 10kHz | -2%<br>-5%<br>-4dB |

■ **OVERLOADS**

Derating in frequency beyond 1kHz
Imax ≤ 1000A x 1 / f (kHz)

■ **Specifications of the MN93A sensors (accessories)**

■ Maximum clamping capacity: 20 mm

■ NF EN 61010-2-032, 600V CAT III, POL 2 or 300V CAT IV, POL 2

⚠ **Using C.A 8332B / C.A 8334B (600V CAT IV) with MN 93A sensors (600V CAT III or 300V CAT IV) involve the set 600V CAT III or 300V CAT IV.**

■ Reference conditions

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

■ Error in the reference conditions

**Calibre 100A**

- Nominal current : 100A AC
- Measurement range : 100mA to 120A AC
- Input / Output ratio : 10mV AC / A AC

| Primary current (A AC) | 100mA...1A | 1A...120A |
|---|---|---|
| Accuracy (as % of the input signal) | ≤ 0.7% + 2mA | ≤ 0.7% |
| Phase shift | ≤ 1.5° | ≤ 0.7° |

**Calibre 5A**

- Nominal current : 5A AC
- Measurement range : 5mA to 6A AC
- Input / Output ratio : 200mV AC / A AC

| Primary current (A AC) | 5mA...50mA | 50mA...500mA | 500mA...6A |
|---|---|---|---|
| Accuracy (as % of the input signal) | ≤ 1% + 0.1mA | ≤ 1% | ≤ 0.7% |
| Phase shift | ≤ 1.7° | ≤ 1° | ≤ 1° |

■ **Variation in the nominal working range (to be added to the error under reference conditions)**

| Influencing factor | Measurement influencing |
|---|---|
| Ambiant temperature | ≤ 200ppm/K or 0.2%/10K |
| Humidity (10 ... 90%) | < 0.2% |
| Frequency (40Hz ... 1kHz) | < 0.7% |
| Frequency (1kHz ... 3kHz) | < 2% |
| Position of conductor in clamp | < 0.5% to 50/60Hz |
| Adjacent conductor carrying a 50Hz AC current | < 15mA/A |

■ Overloads : Continuous maximum current from 100A to frequency ≤ 1kHz
Frequency derating beyond 1 kHz :

$$\mathbf{I\ max \leq 100\ A\ x\ \frac{1}{f\,(kHz)}}$$

Output maximal voltage (saturated secondary) from 8V max. peak.

## ■ Specifications of the adapter box 5A (accessories)

■ Nominal range : 5 A
■ Measurement range : 1 mA to 6 A
■ Input / Output ratio : 0,2 mV AC / mA AC
■ NF EN 61010-2, 300V CAT III or 150V CAT IV, POL 2

⚠ **Using C.A 8332B / C.A 8334B (600V CAT IV) with adapter box 5A (300V CAT III or 150V CAT IV) involve the set 300V CAT III or 150V CAT IV.**

■ Reference of conditions

| | |
|---|---|
| Ambiant temperature | 23°C ± 3K |
| Humidity | 50% to 85% of HR |
| Frequency | 48 to 500 Hz |
| Magnetic field of external origin | < 40 A /m (earth's magnetic field) |
| Other channels | No connected |

■ Error in the reference conditions

| Primary current (A AC) | 1mA … 50mA | 50mA … 6A |
|---|---|---|
| Accuracy (as % of the input signal) | ≤ 1% | ≤ 0,5% |
| Phase shift | ≤ 1° | ≤ 0,2° |

■ Variation in the nominal working range (to be added to the error under reference conditions)

| Influencing factor | Measurement influencing |
|---|---|
| Ambient temperature | ≤ 0,1% / 25K |
| Frequency (30 Hz ... 48 Hz) | < 0,2% + 0,2° |
| Frequency (48 Hz ... 500 Hz) | < 0,1% + 0,1° |
| Frequency (500 Hz ... 1 kHz) | < 0,3% + 0,2° |
| Frequency (1 kHz ... 5 kHz) | < 0,5% + 1° |

■ Permanent Overload : 10 A

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

- Nominal range: 200A AC for f ≤ 1kHz
- Measurement range: 2A to 240A AC (I > 200A not permanent)
- Input/Ouput ratio: 5mV AC/ A AC
- Maximum clamping capacity: 20mm
- NF EN 61010-2-032, 600V CAT III or 300V CAT IV, POL 2

⚠ **Using C.A 8332B / C.A 8334B (600V CAT IV) with MN 93 sensors (600V CAT III or 300V CAT IV) involve the set 600V CAT III or 300V CAT IV.**

- 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...100 A | 100...240 A |
|---|---|---|---|
| Accuracy (as % of the input signal) | ≤ 3% +1A | ≤ 2.5% +1A | ≤ 1% +5 mV |
| Phase shift (in °) | ≤ 6° | ≤ 3° | ≤ 2° |

- Variations in the nominal working range (to be added to the error under reference conditions)

| | |
|---|---|
| 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%<br>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 :

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

■ **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 (MN93A, 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 B ☐☐ ☐☐ ☐☐ ☐
C A 8 3 3 4 B ☐☐ ☐☐ ☐☐ ☐

*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 93A clamps (100 A - 5 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.**1605.01B**
Power Quality Analyser C.A 8334-F with MN clamp ........................................ P01.**1606.01B**
Power Quality Analyser C.A 8332-F with Amp***FLEX*** ........................................ P01.**1605.02A**
Power Quality Analyser C.A 8334-F with Amp***FLEX*** ........................................ P01.**1606.02A**
Power Quality Analyser C.A 8332-Int with MN clamp ........................................ P01.**1605.03B**
Power Quality Analyser C.A 8334-Int with MN clamp ........................................ P01.**1606.03B**
Power Quality Analyser C.A 8332-Int with Amp***FLEX*** ........................................ P01.**1605.04A**
Power Quality Analyser C.A 8334-Int with Amp***FLEX*** ........................................ P01.**1606.04A**

■ **Accessories**

Set of 3 x C 193-F clamps ........................................ P01.**1203.27B**
Set of 3 x MN 93A-F clamps ........................................ P01.**1204.31B**
Set of 3 Amp***FLEX*** A193 - F Ø 450 mm ........................................ P01.**1205.35B**
Set of 3 Amp***FLEX*** A193 - F Ø 800 mm ........................................ P01.**1205.36B**
Set of 3 x PAC 93-F clamps ........................................ P01.**1200.76B**
Set of 3 x C 193-Int clamps ........................................ P01.**1203.21B**
Set of 3 x MN 93A-Int clamps ........................................ P01.**1204.32B**
Set of 3 Amp***FLEX*** A 193 - Int Ø 450 mm ........................................ P01.**1205.23B**
Set of 3 Amp***FLEX*** A 193 - Int Ø 800 mm ........................................ P01.**1205.24B**
Set of 3 x PAC 93-Int clamps ........................................ P01.**1200.77B**
5A C.A 833x adaptor unit ........................................ P01.**1019.59**
5A C.A 833x secura adaptor unit ........................................ P01.**1019.90**
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.**1203.22B**
C 193 BK clamp ........ P01.**1203.23B**
C 193 GN clamp ........ P01.**1203.24B**
C 193 YE clamp ........ P01.**1203.25B**
C 193 BL clamp ........ P01.**1203.26B**

MN 93A RD clamp ........ P01.**1204.33B**
MN 93A BK clamp ........ P01.**1204.34B**
MN 93A GN clamp ........ P01.**1204.35B**
MN 93A YE clamp ........ P01.**1204.36B**
MN 93A BL clamp ........ P01.**1204.37B**

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

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

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

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

RS232 DB9F optical lead ........ P01.**2951.90**
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**

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

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

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

NechDemPer : number of samples in the "lobe" in question (between two consecutive zeros)
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]),
Umax [i] = max (Udem [i]), Umin [i] = min (Udem [i]),
Amax [i] = max (Adem [i]), Amin [i] = min (Adem [i]), (Avg calculation over 1 s : cf "1s rms values...")

■ **Peak values for voltage and current (updated on each waveform refresh)**

Vpp [i] = max (V [i] [n]), Vpm [i] = min (V [i] [n]) n ∈ [0 ... NECHPER-1]
Upp [i] = max (U [i] [n]), Upm [i] = min (U [i] [n]) n ∈ [0 ... NECHPER-1]
App [i] = max (A [i] [n]), Apm [i] = min (A [i] [n]) n ∈ [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**

$$Vrms\,[\,i\,] = \sqrt{\frac{1}{NechSec} \times \sum_{n:\,Zéro}^{NechSec\,-\,1} V[i]\,[n]^{2}}$$ Single rms voltage i + 1 phase; Vavg [i] = Vrms [i]

$$Urms\,[\,i\,] = \sqrt{\frac{1}{NechSec} \times \sum_{n:\,Zéro}^{NechSec\,-\,1} U[i]\,[n]^{2}}$$ Compound rms voltage i + 1 phase; Uavg [i] = Urms [i]

$$\text{Arms}[i] = \sqrt{\frac{1}{NechSec} \times \sum_{n:\,Zéro}^{NechSec-1} A[i][n]^2}$$ Effective current phase i + 1; Aavg [i] = Arms [i]

$$\text{Arms}[3] = \sqrt{\frac{1}{NechSec} \times \sum_{n:\,Zéro}^{NechSec-1} (A[0][n] + A[1][n] + A[2][n])^2}$$ Neutral rms current; Aavg [3] = Arms [3]

## Voltage and current unbalace

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

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

$$Vunb = \frac{|Vrms_-|}{|Vrms_+|},\ Aunb = \frac{|Arms_-|}{|Arms_+|}$$

## Calculation of the total harmonic distorsion factor (THD)

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

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 % : $mod_k = \frac{c_k}{c_1} \times 100$ angle in degree: $\varphi_k = \arctan\left(\frac{a_k}{b_1}\right)$

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

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

$F_S$ sampled signal

$c_O$ is the DC component

k is the ordinal number (spectral bin)

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

***Nota :*** Available only for C.A 8334B

## ■ 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.

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

## ■ K factor

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

## ■ Different power levels 1 sec

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

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

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

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

| | |
|---|---|
| W [3] = W [0] + W [1] + W [2] | Total active power |
| VA [3] = VA [0] + VA [1] + VA [2] | Total apparent power |
| VAR [3] = VAR [0] + VAR [1] + VAR [2] | Total reactive power |

## ■ Various ratios

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

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

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

$$\cos(\phi[i]) = \frac{\sum_{n=0}^{NechSec-1} VF[i][n] . AF[i][n]}{\sqrt{\sum_{n=0}^{NechSec-1} VF[i][n]^2} . \sqrt{\sum_{n=0}^{NechSec-1} AF[i][n]^2}}$$ 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**

1st case : consumed energies (W[i] ≥ 0)

$$Wh[0][i] = \sum_{Tint} \frac{W[i]}{3600}$$ Active energy consumed i + 1 phase

$$VAh[0][i] = \sum_{Tint} \frac{VA[i]}{3600}$$ Apparent energy consumed i + 1 phase

$$VARhL[0][i] = \sum_{Tint} \frac{VAR[i]}{3600}$$ for VAR [i] > or = to 0 Recative inductive energy consumed i + 1 phase

$$VARhC[0][i] = \sum_{Tint} \frac{-VAR[i]}{3600}$$ for VAR [i] < or = to 0 Reactive capacitive energy consumed i + 1 phase

Total active energy consumed

Wh [0][3] = Wh [0] [0] + Wh [0][1] + Wh [0] [2]

Total apparent energy consumed

VAh [0][3] = VAh [0] [0] + VAh [0][1] + VAh [0] [2]

Total reactive capacitive energy consumed

VARhC [0][3] = VARhC [0] [0] + VARhC [0][1] + VARhC [0] [2]

Total reactive inductive energy consumed

VARhL [0][3] = VARhL [0] [0] + VARhL [0][1] + VARhL [0] [2]

2nd case : generated energies (W[i] ≥ 0)

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

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

$$VARhL[1][i] = \sum_{Tint} \frac{-VAR[i]}{3600}$$ for VAR [i] < or = to 0 Reactive inductive energy generated phase i + 1

$$VARhC[1][i] = \sum_{Tint} \frac{VAR[i]}{3600}$$ for VAR [i] > or = to 0 Reactive capacitive energy generated phase i + 1 phase

Total active energy generated

Wh[1][3] = Wh[1][0] + Wh[1][1] + Wh[1][2]

Total apparent energy generated

VAh[1][3] = VAh[1][0] + VAh[1][1] + VAh[1][2]

Total reactive capacitive energy generated

VARhC[1][3] = VARhC[1][0] + VARhC[1][1] + VARhC[1][2]

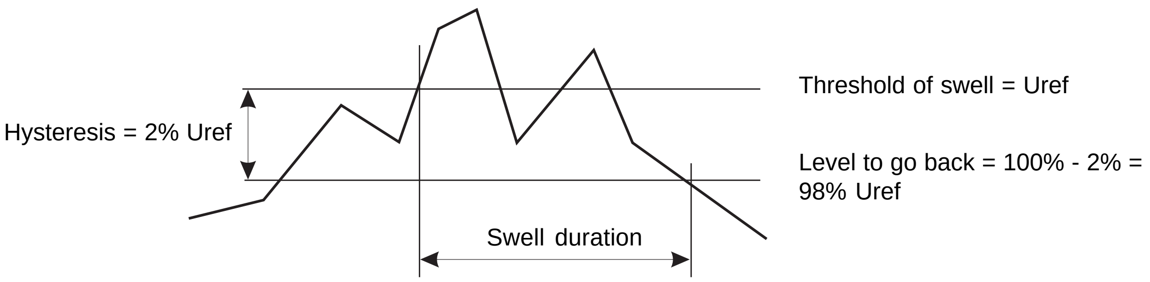
Total reactive inductive energy generated

VARhL[1][3] = VARhL[1][0] + VARhL[1][1] + VARhL[1][2]

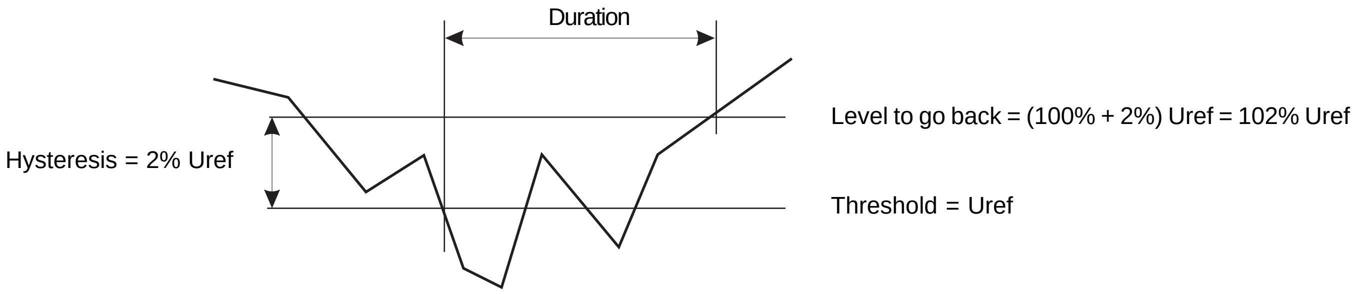
## ■ Hysteresis

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**




# Minimum scale values (in waveform mode) and minimum displayed values.

| Current sensor type | Minimum displayed current value[A] | Minimum current scale value [A] |
|---|---|---|
| AmpFLEX 3000A | 9 | 60 |
| 1000A PAC clamp | 1 | 10 |
| 1000A C clamp | 0,5 | 10 |
| 200A MN 93 clamp | 0,5 | 2 |
| 100A MN 93A clamp | 0,2 | 1 |
| 5A MN 93A clamp | (Primary × 5) ÷ (Secondary × 1000) | (Primary × 5 × 10) ÷ (Secondary × 1000) |
| 5A Adaptor | (Primary × 5) ÷ (Secondary × 1000) | (Primary × 5 × 10) ÷ (Secondary × 1000) |

For all types of current sensors :

$$A_{RMS} \leq \text{[Minimum value of displayed current]} \Rightarrow A_{RMS} = 0$$

For the MN93A clamp (rating 5A) and adaptor 5A :

- **Primary ∈ [1 ; 2999]**
- **Secondary ∈ {1 ; 5}**

$$\text{[Minimum displayed current value]} \leq 0{,}2 \Rightarrow \text{[Minimum displayed current value]} = 0{,}2$$
$$\text{[Minimum current scale value]} \leq 1 \Rightarrow \text{[Minimum current scale value]} = 1$$

The minimum displayed voltage value is 5V

$$\mathbf{V_{RMS} \leq 5V \Rightarrow V_{RMS} = 0}$$
$$\mathbf{U_{RMS} \leq 5V \Rightarrow U_{RMS} = 0}$$

## 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 !!
```

08 - 2007
Code 689142E01 - Ed 2


**DEUTSCHLAND - Chauvin Arnoux GmbH**
Straßburger Str. 34 - 77694 Kehl / Rhein
Tel: (07851) 99 26-0 - Fax: (07851) 99 26-60

**ESPAÑA - Chauvin Arnoux Ibérica SA**
C/ Roger de Flor N° 293, Planta 1- 08025 Barcelona
Tel: 93 459 08 11 - Fax: 93 459 14 43

**ITALIA - Amra SpA**
Via Sant'Ambrogio, 23/25 - 20050 Bareggia di Macherio (MI)
Tel: 039 245 75 45 - Fax: 039 481 561

**ÖSTERREICH - Chauvin Arnoux Ges.m.b.H**
Slamastrasse 29/3 - 1230 Wien
Tel: 01 61 61 961-0 - Fax: 01 61 61 961-61

**SCANDINAVIA - CA Mätsystem AB**
Box 4501 - SE 18304 TÄBY
Tel: +46 8 50 52 68 00 - Fax: +46 8 50 52 68 10

**SCHWEIZ - Chauvin Arnoux AG**
Einsiedlerstraße 535 - 8810 Horgen
Tel: 044 727 75 55 - Fax: 044 727 75 56

**UNITED KINGDOM - Chauvin Arnoux Ltd**
Waldeck House - Waldeck Road - Maidenhead SL6 8BR
Tel: 01628 788 888 - Fax: 01628 628 099

**MIDDLE EAST - Chauvin Arnoux Middle East**
P.O. BOX 60-154 - 1241 2020 JAL EL DIB (Beirut) - LEBANON
Tel: (01) 89 04 25 - Fax: (01) 89 04 24

**CHINA - Shanghai Pu-Jiang - Enerdis Instruments Co. Ltd**
3 F, 3 rd Building - N° 381 Xiang De Road - 200081 SHANGHAI
Tel: +86 21 65 21 51 96 - Fax: +86 21 65 21 61 07

**USA - Chauvin Arnoux Inc - d.b.a AEMC Instruments**
200 Foxborough Blvd. - Foxborough - MA 02035
Tel: (508) 698-2115 - Fax: (508) 698-2118

**www.chauvin-arnoux.com**

190, rue Championnet - 75876 PARIS Cedex 18 - FRANCE
Tél.: +33 1 44 85 44 85 - Fax : +33 1 46 27 73 89 - info@chauvin-arnoux.fr
Export : Tél. : +33 1 44 85 44 86 - Fax : +33 1 46 27 95 59 - export@chauvin-arnoux.fr