THREE-PHASE ELECTRICAL
NETWORKS ANALYSER

C.A 8335
QUALISTAR+

ENGLISH

User's manual

CHAUVIN® ARNOUX
CHAUVIN ARNOUX GROUP

Thank you for purchasing a **C.A 8335 energy analyser (Qualistar+)**. To obtain the best service from your unit:

- **read** these operating instructions carefully,
- **comply** with the precautions for use.

⚠	WARNING, risk of DANGER! The operator agrees to refer to these instructions whenever this danger symbol appears.
⧈	Equipment protected by double insulation.
USB	USB socket.
⏚	Earth.
CE	The CE marking guarantees conformity with European directives.
WEEE	The rubbish bin with a line through it means that in the European Union, the product must undergo selective disposal for the recycling of electric and electronic material, in compliance with Directive WEEE 2002/96/EC.

Definition of measurement categories:

- Measurement category IV corresponds to measurements taken at the source of low-voltage installations.
  Example: power feeders, counters and protection devices.
- Measurement category III corresponds to measurements on building installations.
  Example: distribution panel, circuit-breakers, machines or fixed industrial devices.
- Measurement category II corresponds to measurements taken on circuits directly connected to low-voltage installations.
  Example: power supply to electro-domestic devices and portable tools.
- Measurement category I corresponds to measurements taken on circuits not directly connected to the network.
  Example: protected electronic circuits.

⚠ PRECAUTIONS FOR USE ⚠

Failure to comply with these precautions may result in an electric shock, explosion, or fire.

- This device may be used on category IV installations for voltages that do not exceed 600 V (AC or DC) with respect to earth (as per IEC standard 61010-1), or on category III installations for voltages that do not exceed 1000 V. Never use it on networks of which the voltage or category exceeds those mentioned.
- For your safety, use only the compatible leads and accessories delivered with the instrument, which comply with IEC standard 61010-031 (2002). When sensors or accessories having a lower voltage rating and/or category are connected to the instrument, the lower voltage and/or category applies to the system so constituted.
- Before each use, check that the leads, enclosures, and accessories are in perfect condition. Any lead, sensor or accessory of which the insulation is damaged (even partially) must be repaired or scrapped.
- The device must not be used if the “battery/SD Card” compartment cover is missing, damaged or incorrectly fitted.
- The safety of any system incorporating this instrument is the responsibility of the system assembler.
- Use only the mains power adaptor and battery pack supplied by the manufacturer. They include specific safety features.
- When removing and replacing the battery and/or the SD-Card, make sure that the device is disconnected and off.
- Comply with the environmental conditions (see § 15.3.1)
- We recommend using Personal Protection Equipment where required.
- Do not reach past the physical guards on the accessories and sensors. Keep your hands away from unused terminals.
- Some current sensors must not be placed on or removed from bare conductors at hazardous voltages: refer to the sensor manual and comply with the handling instructions.

CONTENTS

1. INTRODUCTION

The C.A 8335 (Qualistar+) is a three-phase AC+DC 1000 V_{RMS} category III or 600 V_{RMS} category IV (IEC 61010-1) network analyser with graphic display.

It plays three roles, and can be used:
- to measure the RMS values, powers, and perturbations of electric distribution networks
- to deliver a snapshot of the principal characteristics of a three-phase network
- to track the variations of various parameters over time.

The measurement uncertainty of the C.A 8335 is better than 1% (not including current sensor errors). The C.A 8335 is also very flexible, with a choice of sensors allowing measurements ranging from a few milliamperes (MN93A) to several kiloamperes (Amp*FLEX*™).

The device is compact and impact resistant. The ergonomics and simplicity of its interface make using it pleasant and intuitive.

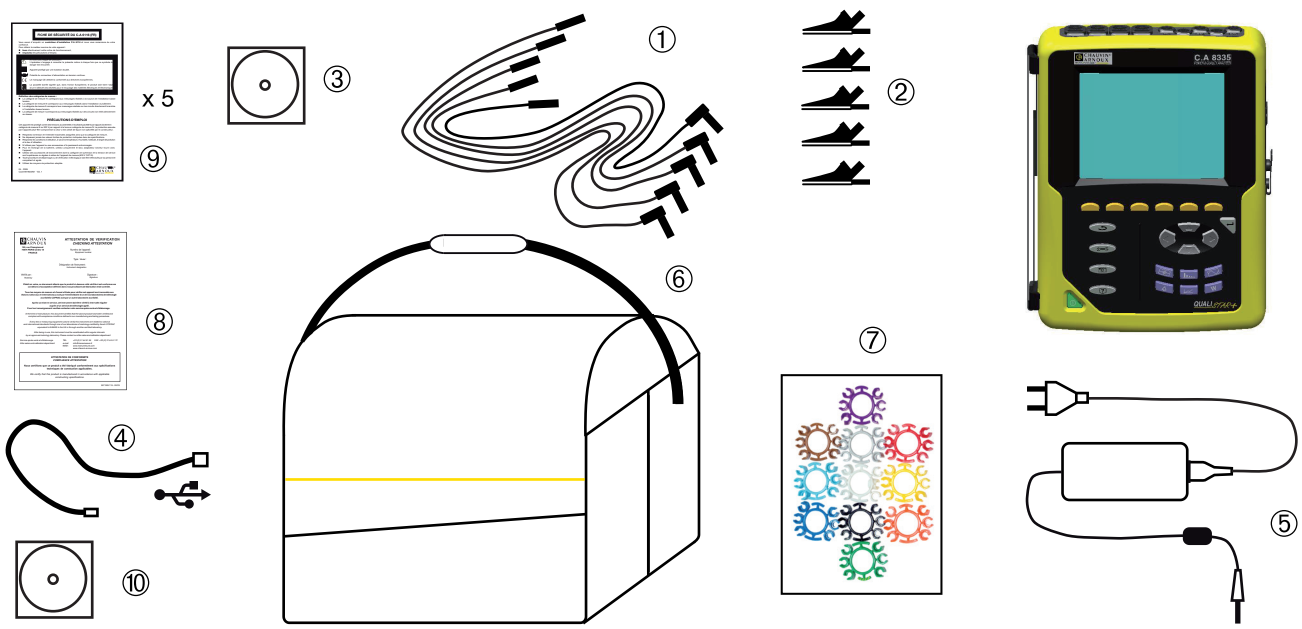
The C.A 8335 is intended for the technicians and engineers of electrical installation and network inspection and maintenance teams.

The principal measurements made are:
- The RMS values of AC voltages up to 1000 V between terminals. Using transformation ratios, the device can measure up to hundreds of gigavolts.
- The RMS values of AC currents up to 6500 amperes (neutral included). Using transformation ratios, the device can measure currents up to hundreds of kiloamperes.
- The DC components of voltages and currents (neutral included)
- Minimum and maximum half-cycle RMS voltage and current values (excluding neutral)
- Peak voltage and current values (neutral included)
- The frequency of 50 Hz and 60 Hz networks
- Current and voltage peak factors (excluding neutral)
- Calculation of the K factor (KF) (application to transformers in the presence of harmonic currents)
- Current and voltage distortion factors (DF) (excluding neutral)
- Current and voltage total harmonic distortion (THD) (excluding neutral).
- Active, reactive (capacitive and inductive), and apparent power, by phase and cumulative (excluding neutral).
- Power factors (PF) and displacement factors (DPF or cos Φ) (excluding neutral).
- Short-term voltage flicker (PST) (excluding neutral).
- Active, reactive (capacitive and inductive), and apparent energy (excluding neutral).
- Current and voltage harmonics (excluding neutral) up to order 50: RMS value, percentage referred to fundamental, minimum and maximum and sequence harmonics.
- Apparent power of each harmonic up to order 50 (excluding neutral): value, percentage referred to fundamental, minimum and maximum.
- Inrush currents (starting of motors).

2. DELIVERY CONDITION

Basic equipment

No.	Designation	Quantity
1	Safety cables, black, banana-banana, straight-straight	5
2	Black crocodile clips.	5
3	User’s manual on CD-ROM.	1
4	Type A-B USB cord.	1
5	Specific mains power unit (600 VRMS category IV) and mains cord.	1
6	No. 22 carrying bag	1
7	Phase colour coding inserts/rings for leads and current sensors.	12
8	Verification certificate	1
9	Safety sheet	5
10	Power Analyser Transfer (PAT) software	1



3. PRESENTATION

3.1. OVERALL VIEW

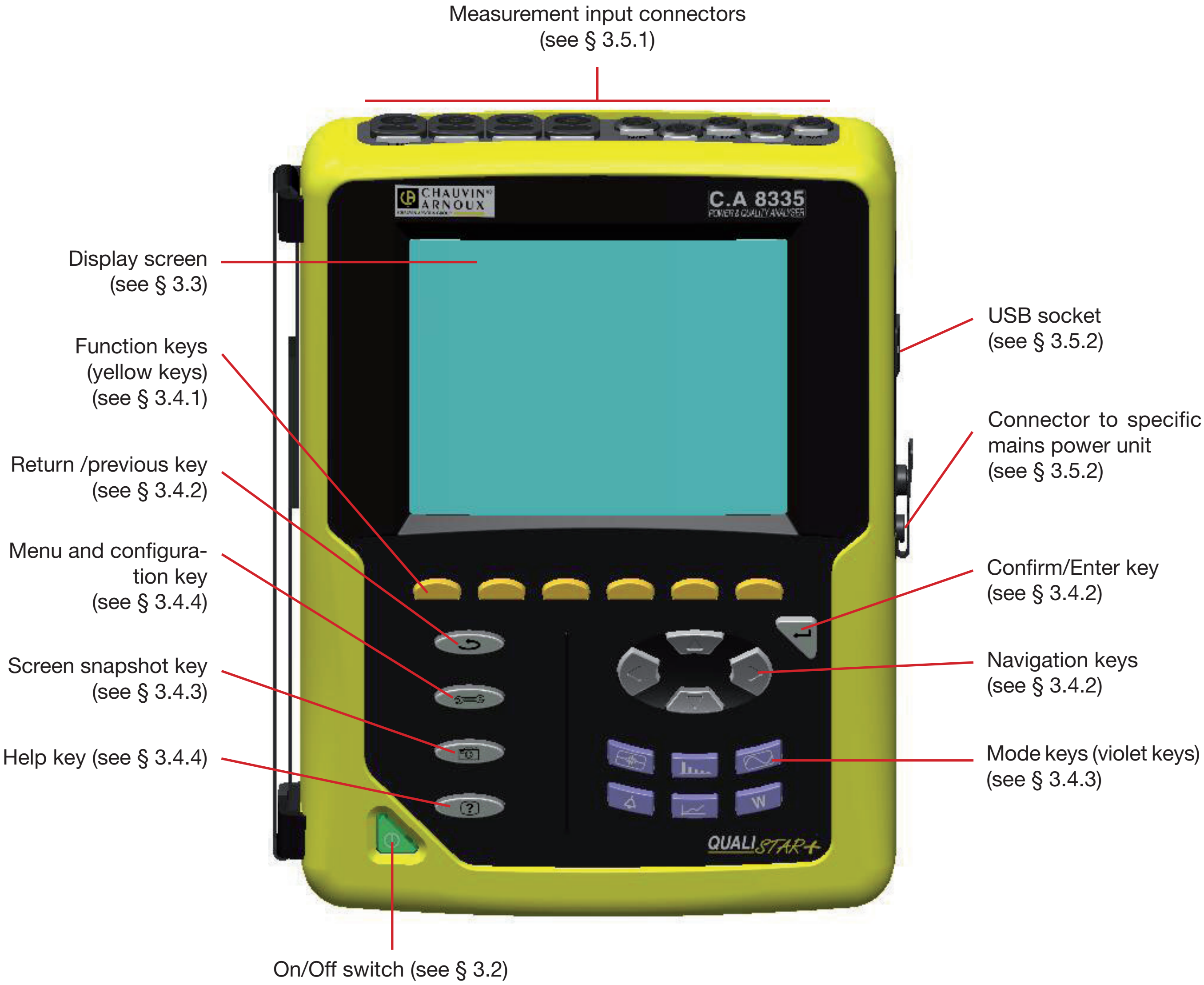


Figure 1: Overall view of C.A 8335 (Qualistar+)

3.2. ON/OFF KEY

Pressing the key starts the device.

The device can be powered by the battery alone (if it is adequately charged) or by a specific mains power supply unit (if, in this case, the battery is also present, the power supply unit charges it).

Pressing the key again turns the device off. Confirmation is required to turn it off if the device is in one of its recording modes or is searching for transients, alarms, and/or inrush current capture.

3.3. DISPLAY SCREEN

3.3.1. PRESENTATION

This backlit 320x240 pixel graphic liquid crystal screen displays all measurements with their curves, the parameters of the unit, the curves selected, the instantaneous values of the signals, and the type of measurement selected. When the C.A 8335 is powered up, it automatically displays the *Waveform screen*. Information about this screen can be found in § 8.

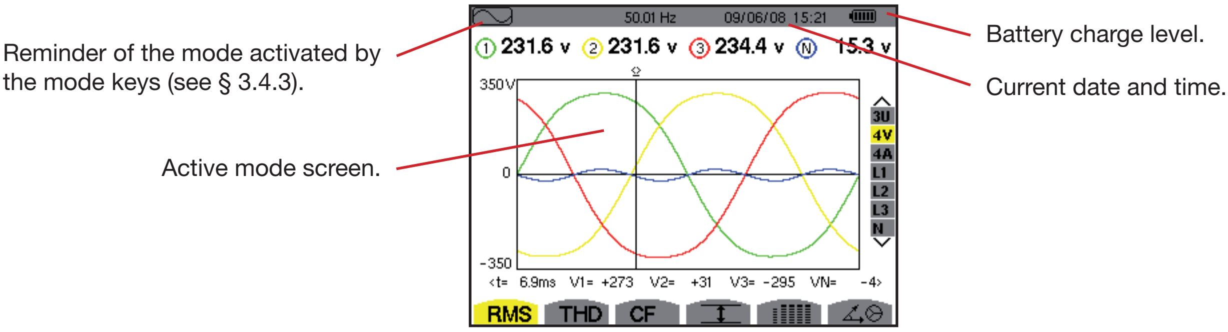


Figure 2: example of a display screen

Automatic switching off of display screen:
When an alarm campaign is initiated or a search for transients, an inrush current capture, or a trend recording is pending or in progress, if the device is powered by the battery alone (the On/Off switch is flashing), the display is powered down if no key is pressed for 5 minutes. Pressing any key reactivates the display..

3.3.2. ICONS

The display uses the following icons:

Icons	Designation
V	Phase-to-neutral voltage mode.
A	Phase-to-neutral current mode.
VA	Power mode.
U	Phase-to-phase voltage mode.
	Zoom in.
	Zoom out.
< >	Left/right arrow key prompt.
^ v	Up/down arrow key prompt.
PF…	Display of PF, cos Φ (DPF), tan Φ, and Φ_{VA}.
W…	Display of powers and energies values.
	Recording mode.
	Recording display and selection mode.
OK	Validation prompt.
	Shut down function in progress prompt.
	Display of current values and their extrema.
	Simultaneous display of all voltage and current measurements (rms, DC, THD, CF, PST, KF, DF).
	Display of Fresnel diagram of the signals.

Icons	Designation
	Energies consumed.
	Energies generated.
	Page screen 1 of the help function.
	Page screen 2 of the help function.
	Page screen 3 of the help function.
	Page screen 4 of the help function.
	Configuration 1.
	Configuration 2.
	Configuration 3.
	Configuration 4.
	Previous page screen.
	Next page screen.
>t=0<	Move cursor to transient triggering time.
>t=-T<	Move cursor to one signal period before the transient triggering date.
	Activate/deactivate selection of the transients list display filter.
	Bin to remove/delete items.

3.4. KEYPAD KEYS

3.4.1. FUNCTION KEYS (YELLOW KEYS)

These 6 keys activate the function or tool represented by the corresponding icon on the screen (see § 3.3.2).

3.4.2. NAVIGATION KEYS

A block of 4 arrow keys, a select key and a return key are used for navigation in the menus.

Item	Function
	Up direction or navigation key.
	Down direction or navigation key.
	Right direction or navigation key.
	Left direction or navigation key.
	Confirms the selection.
	Return key.

3.4.3. MODE KEYS

These give access to specific modes:

Item	Function	Voir
	Waveform acquisition mode, with two sub-modes: transients mode (blackouts, interference, etc.) and inrush current mode (starting of motor).	§ 6
	Harmonic curves display mode: representation of voltage, current, and power harmonics, order by order; determination of harmonic currents produced by nonlinear loads, analysis of problems caused by harmonics according to their order (overheating of neutrals, conductors, motors, etc.).	§ 7
	Display of voltage and current waveforms, display of maxima and minima, of summary tables, determination of phase rotation.	§ 8
	Alarm mode: listing of recorded alarms exceeding the thresholds programmed in the configuration; recording of network blackouts with half-cycle resolution (Vrms, Arms, Urms), determination of energy consumption overshoots, monitoring of compliance with a power supply quality contract.	§ 9
	Trend mode: recording of the parameters selected in the *Configuration* menu.	§ 10
	Display of power and energy measurements	§ 11
	Snapshot of current screen and retrieval of screens already stored.	§ 12

Three keys are real-time mode keys:
, and .
In each of these modes, the coloured circles on a white ground ①, in which the channel numbers or types are entered, are indicators of potential saturation of the channel: the ground of the circle is coloured when the channel measured may be saturated.

3.4.4. OTHER KEYS

The other keys have the following functions:

Item	Function	Voir
	Configuration key.	§ 5
	Help key: provides information about the functions and the symbols used for the current display mode.	§ 13

3.5. CONNECTORS

3.5.1. MEASUREMENT INPUT CONNECTORS

Located on the top of the device, these connectors are distributed as follows:

current input connectors for current sensors (MN clamp, C clamp, Amp*FLEX*™, PAC clamp, E3N clamp, etc.).

5 voltage input connectors.

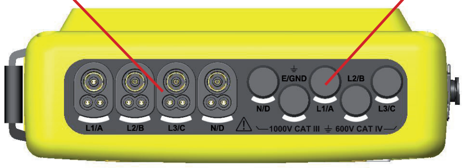
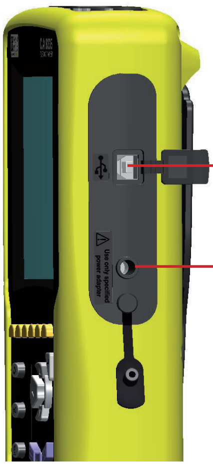


Figure 3: connectors on top of device

3.5.2. SIDE CONNECTORS

Located on the right side of the C.A 8335, these connectors are used as follows:



USB connector. For connection to a PC.

Mains power connector: Recharges the battery and allows operation with or without a battery.

Figure 4: connectors on the right side

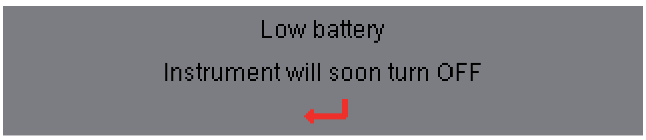
3.6. POWER SUPPLY

3.6.1. INDICATION OF BATTERY LEVEL

The battery icon in the top right corner of the screen shows the battery level. The number of bars is proportional to the charge level.

- Battery charged.
- Low battery.
- Mobile bars: battery charging.
- The C.A 8335 is powered by mains and pre-charged.

When the battery level is too low, the following message is displayed:



Press to acknowledge. If you do not reconnect the C.A 8335 to mains, it is switched off one minute after this message appears.

3.6.2. BATTERY LIFE

Battery life is 10 hours when the battery delivered with the device is fully charged, with the display screen on. If the display screen is off (saving energy), battery life is more than 25 hours.

3.6.3. RECHARGING THE BATTERY

See also § 18.2. The battery is recharged by the mains power unit provided, connected to the C.A 8335 by the jack (Figure 4).

Use only the mains power unit provided with the instrument.
Charging a fully discharged battery takes about 5 hours. When the battery is recharged, the device continues to use mains power and does not discharge the battery.

3.6.4. THE BATTERY

The C.A 8335 is powered by a specific 8-element battery (see below) having a nominal capacity of 4,000 mAh.

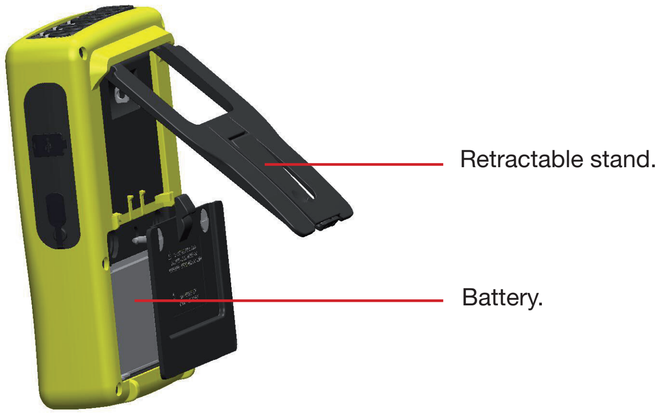


Figure 5: Battery compartment cover

3.6.5. MAINS OPERATION

The battery is not essential when the unit is running on mains power. However, if mains power is cut off, during the recording process, for example, data may be lost.

The On/Off button is lit continuously (green LED) when mains power is active.

3.7. THE STAND

A retractable stand (Figure 5) on the back of the Qualistar+ keeps the device at an angle of 53° from the horizontal.

3.8. SUMMARY OF FUNCTIONS

3.8.1. MEASUREMENT FUNCTIONS

- The RMS values of AC voltages up to 1000 V between terminals. Using transformation ratios, the device can measure up to hundreds of gigavolts.
- The RMS values of AC currents up to 6500 amps (neutral included). Using transformation ratios, the device can measure currents up to hundreds of kiloamperes.
- DC voltages and currents (neutral included).
- Minimum and maximum half-cycle RMS voltage and current (excluding neutral).
- Peak voltages and currents (neutral included).
- Frequency of 50 Hz and 60 Hz networks.
- Current and voltage peak factor (excluding neutral).
- Calculation of the K factor (KF) (application to transformers when current harmonics are present).
- Current and voltage distortion factor (DF) (excluding neutral)
- Current and voltage total harmonic distortion (excluding neutral).
- Active, reactive (capacitive and inductive), and apparent power, by phase and cumulative (excluding neutral).
- Power factors (PF) and displacement factors (DPF or cos Φ) (excluding neutral).
- Short-term flicker (PST) (excluding neutral).
- Active, reactive (capacitive and inductive), and apparent energy (excluding neutral).
- Current and voltage harmonics (excluding neutral) up to order 50: RMS value, percentages referred to fundamental, minimum and maximum, and sequence harmonics.
- Apparent power of each harmonic up to order 50: value, percentage referred to fundamental, minimum and maximum.
- Inrush currents (application to starting of motor).
- Selection of TI (or TC) transformation ratio for MN93A clamps (5A scale) and the 5 A adapter.
- Automatic recognition of types of current sensor (every second)

3.8.2. DISPLAY FUNCTION

- Display of waveforms (voltages and currents).
- Inrush Current function: displays parameters useful for study of the starting of a motor.
  - Instantaneous current and voltage at the instant designated by the cursor.
  - Maximum instantaneous current and voltage (over the entire starting time).
  - RMS value of the half-cycle (or lobe) of the current and voltage (excluding neutral) on which the cursor is positioned.
  - Maximum half-cycle RMS current (over the entire starting time).
  - Instantaneous network frequency at the instant designated by the cursor.
  - Maximum, mean, and minimum network frequencies (over the entire starting time).
  - Time at which starting of motor commenced.
- Screen captures (50 maximum).
- Transients function. Detection and recording of transients (up to 210) between user-defined start and stop dates and times. Recording of 4 complete cycles (one before the triggering event and three after) in the 8 acquisition channels.
- Trend recording ("data logging") function (2GB memory with date-stamping and user-defined start and stop dates for recording, with a maximum of 100 recordings). Display, in bar chart or curve form, of the means of many parameters vs. time, with or without minima and maxima.
- Alarm function. List of recorded alarms (up to 10,920) exceeding thresholds defined in the configuration menu. User-defined alarm monitoring start and stop times.

3.8.3. CONFIGURATION FUNCTION

- Date and time settings.
- Screen brightness and contrast settings.
- Choice of curve colours.
- Choice of reactive power and energy calculation mode (with or without harmonics).
- Choice of connection (single-phase, two-phase, three-phase with or without neutral).
- Configuration of alarm and transient recordings.
- Erasure of data (total or partial).
- Display of software and hardware version numbers.
- Choice of language.
- Display of current sensors detected and voltage and current ratio settings.

3.9. ABBREVIATIONS

Meanings of the symbols and abbreviations used:

Symbol	Designation
≃	AC and DC components.
~	AC component only.
═	DC component only.
Φ	Phase shift of phase-to-neutral voltage with respect to phase-to-neutral current.
(inductive symbol)	Inductive phase shift.
(capacitive symbol)	Capacitive phase shift.
°	Degree.
-.+	Expert mode.
| |	Absolute value.
Σ	Sum of values.
$\bar{x}$	Mean value (arithmetic mean).
L	Phase (Line).
%	Percentage.
Φ_{VA}	Phase shift of voltage with respect to current.
A	Current; also Ampere (unit).
Acf	Crest (peak) factor of current.
Ah	Current harmonic.
Akf	K Factor of current (for transformers).
Arms	True RMS current.
Athd	Total harmonic distortion of current.
Aunb	Current unbalance.
AVG	Mean value (arithmetic mean).
CF	Peak factor (current or voltage).
cos Φ	Cosine of the phase shift of voltage with respect to current (DPF)
DC	DC component (current or voltage).
DF	Distortion factor (THD-R)
DPF	Displacement factor (cos Φ).
Hz	Frequency of network studied.
KF	See Akf.
MAX	Maximum value.
MIN	Minimum value.
ms	Millisecond (unit).
PEAK or PK	Maximum (+) or minimum (-) peak instantaneous value of the signal.
PF	Power factor.
PST	Short-term flicker.
RMS	True RMS value (current or voltage)
t	Relative date of time cursor.
tan Φ	Tangent of the phase shift of voltage with respect to current.
THD	Total harmonic distortion (THD-F).
U	Phase-to-Phase voltage.
Ucf	Phase-to-Phase voltage crest factor.
Uh	Phase-to-phase voltage harmonic.
Urms	True RMS phase-to-phase voltage.
Uthd	Total phase-to-phase voltage harmonic distortion.
Uunb	Phase-to-phase voltage unbalance.
V	Phase-to-neutral voltage; also Volt (unit)
VA	Apparent power.
VAh	Apparent energy; also apparent harmonic power.
VAR	Reactive power.
VARh	Reactive energy .
Vcf	Voltage crest (peak) factor.
Vh	Phase-to-neutral voltage harmonic.
Vrms	True RMS phase-to-neutral voltage.
Vthd	Total harmonic distortion of phase-to-neutral voltage.
Vunb	Voltage unbalance.
W	Active power.
Wh	Active energy.

Prefixes of International System (SI) units

Prefix	Symbol	Multiplies by
milli	m	10^{-3}
kilo	k	10^{3}
Mega	M	10^{6}
Giga	G	10^{9}
Tera	T	10^{12}
Peta	P	10^{15}
Exa	E	10^{18}

4. USE

The C.A 8335 must be configured in accordance with § 5 before any measurements are made.

The following precautions for use must be complied with:

- Do not connect to any voltage exceeding 1,000 VRMS with respect to earth.
- When connecting and disconnecting the battery, make sure that the measuring leads are disconnected.

4.1. START-UP

Press the key on the keypad to start the C.A 8335. The check light (green LED) lights when it is pressed, then goes out. The home page is displayed while the software application is being loaded. The version number of the software application and the serial number of the C.A 8335 are indicated in the bottom left corner of the screen.

Figure 90: home page at start-up

After about 5 seconds, the *Waveform screen* is displayed.

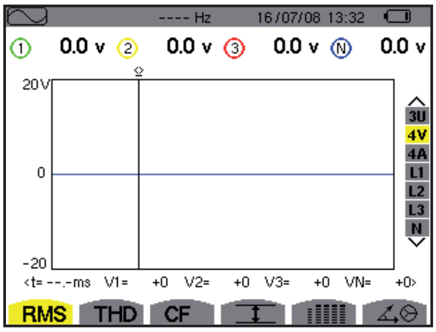


Figure 91: Waveform screen

The C.A 8335 is battery powered only if the battery is adequately charged. If not, the alarm message "*Low battery, the device will cease operating shortly*" is displayed (see § 3.6). The device can be used with the mains power unit supplied with it connected to the jack (Figure 4); there is no need of the battery in this case.

The Start button check light remains lit when the device operates on mains power. When the check light flashes, it indicates that the device is on but the display screen has been switched off (automatically; see § 3.3.1 for the conditions under which this occurs).

4.2. CONFIGURATION

To configure the C.A 8335, proceed as follows:

- With the device on, press . The configuration screen appears.
- Press or to select the parameter to be modified. Press to enter the selected sub-menu.

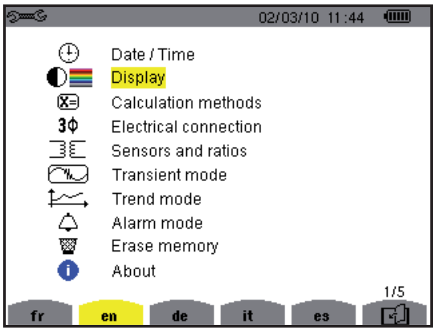


Figure 92: Configuration screen

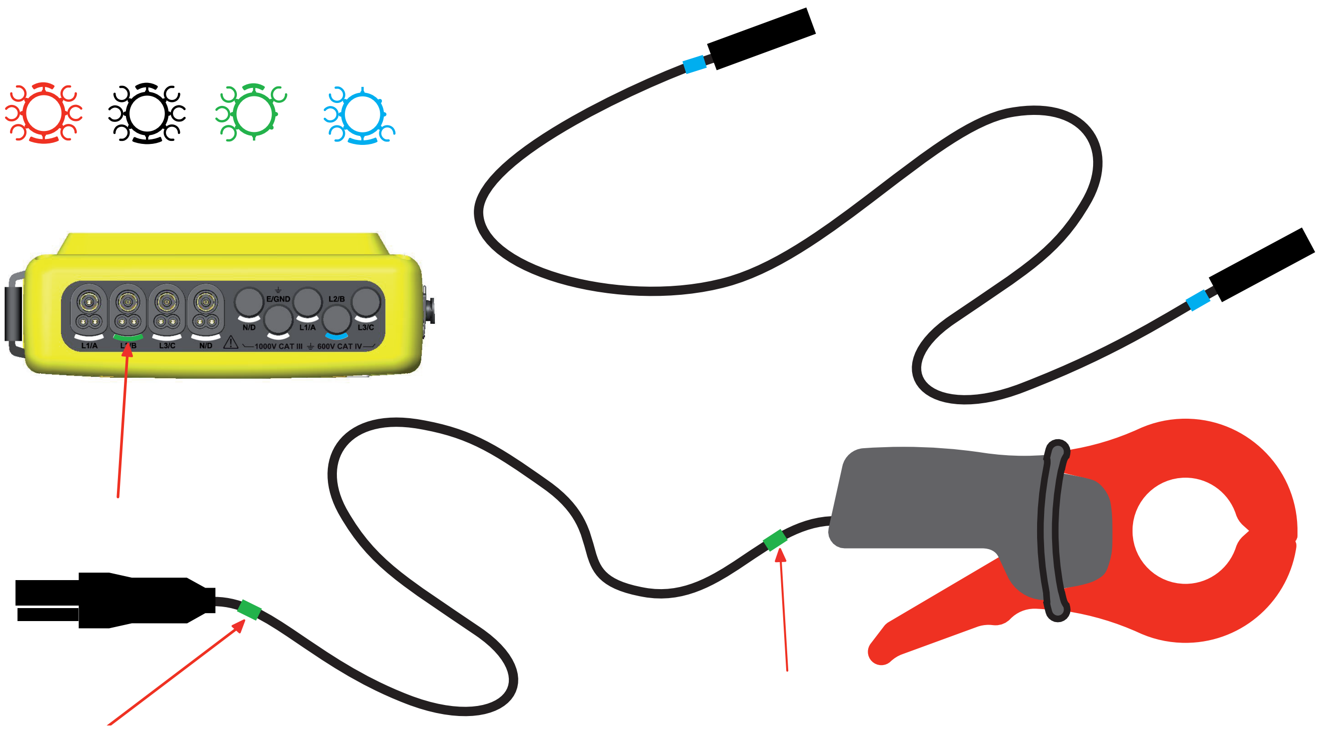
Press ▲ or ▼ and ▶ or ◀ to browse and ↵ to confirm in the displayed sub-menu. See §§ 5.3 – 5.10 for details.

Note: The following points must be checked or adapted for each measurement:
- Define the parameters of the calculation methods. (see § 5.5)
- Select the type of connection (single- phase to three-phase, five-wire). (see § 5.6)
- Programming of the current and voltage ratios according to the type of current sensor connected. (see § 5.7).
- Transient triggering levels (transients mode). (see § 5.8)
- Values to be recorded (trend mode). (see § 5.9)
- Definition of alarm thresholds. (see § 5.10)

Press ↩ to return to the *Configuration* screen.

4.3. INSTALLATION OF LEADS

To identify the leads and input terminals, you may mark them in accordance with the usual phase/neutral colour code using the coloured rings and inserts supplied with the C.A 8335.
- Detach the insert and place it in the hole provided for it near the terminal (large hole for a current terminal; small hole for a voltage terminal°.



- Clip rings of the same colour to the ends of the lead you will be connecting to the terminal.

Twelve sets of rings and inserts of different colours are provided to enable you to harmonize the C.A 8335 with any of the phase/neutral colour codes in force.

Insert the leads as follows:

4 current input connectors for current sensors (clamp MN, clamp C, AmpFLEX™, clamp PAC, etc.).

5 voltage input connectors.

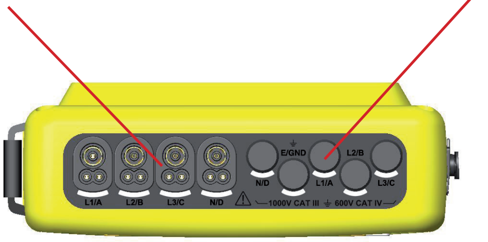


Figure 93: connectors on top of device

Connect the measuring leads to the C.A 8335 as follows:

- Current measurement: 4-point connector. Do not forget to define the transformation ratio if necessary (see § 5.7).
- Voltage measurement: L1/A, L2/B, L3/C & N/D terminals. Do not forget to define the transformation ratio if necessary (see § 5.7).

The measuring leads must be connected to the circuit to be studied as shown by the following diagrams.

4.3.1. SINGLE-PHASE NETWORK

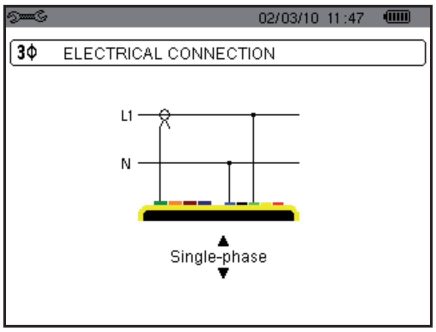


Figure 94: single-phase connection

4.3.2. SPLIT-PHASE NETWORK

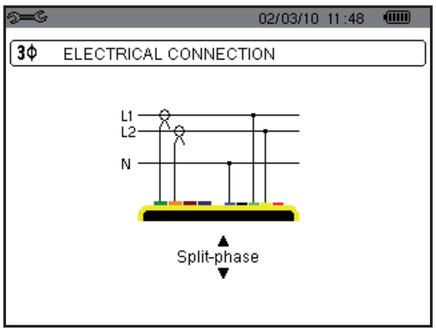


Figure 95: split-phase connection

4.3.3. 3- OR 4-WIRE THREE-PHASE NETWORK

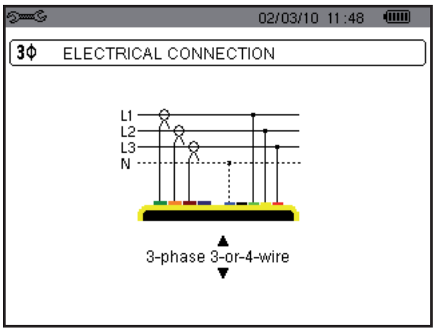


Figure 96: 3- or 4-wire three-phase connection

4.3.4. 5-WIRE THREE-PHASE NETWORK

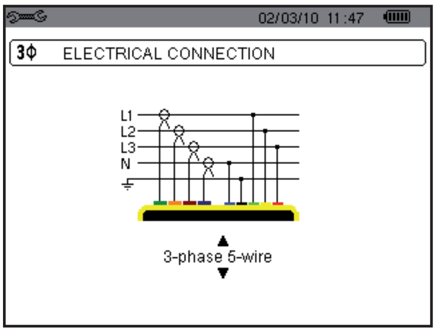


Figure 97: 5-wire three-phase connection

4.3.5. CONNECTION PROCEDURE

- Switch the instrument on.
- Configure the device for the measurement to be made and the type of network concerned.
- Connect the leads and current sensors to the unit.
- Connect the earth and/or neutral lead to the network earth and/or neutral (when distributed) and connect the corresponding current sensor.
- Connect the L1 phase lead to the network L1 phase and connect the corresponding current sensor.
- If applicable, repeat the procedure for phases L2, L3, and N.

Note: complying with this procedure reduces connection errors to a minimum and avoids wasting time.

Disconnection procedures:
- Proceed in the reverse of the order of connection, always finishing by disconnecting the neutral (when distributed).
- Disconnect the leads and switch the device off.

4.4. WAVEFORM CAPTURE

Reminder: any screen can be saved (screen snapshot) by pressing the key (see § 12).

With the C.A 8335 powered up and connected to the network (voltage measurement leads and current sensors), press .

4.4.1. DISPLAY OF THE TRANSIENTS MODE

See § 6.2.

4.4.2. DISPLAY OF THE INRUSH CURRENT MODE

See § 6.3.

4.5. DISPLAY OF HARMONICS

Reminder: any screen can be saved (screen snapshot) by pressing the key (see § 12).

With the C.A 8335 powered up and connected to the network (voltage measurement leads and current sensors), press .

4.5.1. PHASE-TO-NEUTRAL VOLTAGE DISPLAY

See § 7.2.

4.5.2. CURRENT DISPLAY

See § 7.3.

4.6. WAVEFORM MEASUREMENTS

Reminder: any screen can be saved (screen snapshot) by pressing the key (see § 12).

With the C.A 8335 powered up and connected to the network (voltage measurement leads and current sensors), press .

4.6.1. DISPLAY OF TRUE RMS MEASUREMENTS

See § 8.2.

4.6.2. DISPLAY OF MEASUREMENTS OF TOTAL HARMONIC DISTORTION

See § 8.3.

4.6.3. DISPLAY OF PEAK FACTOR MEASUREMENTS

See § 8.4.

4.6.4. DISPLAY OF EXTREME AND MEAN VALUES (VOLTAGE AND CURRENT)

See § 8.5.

4.6.5. SIMULTANEOUS DISPLAY

See § 8.6.

4.6.6. DISPLAY OF FRESNEL DIAGRAM

See § 8.7.

4.7. ALARM RECORDING

Reminder: any screen can be saved (screen snapshot) by pressing the key (see § 12).

With the C.A 8335 powered up and connected to the network (voltage measurement leads and current sensors), press .

4.7.1. CONFIGURATION OF ALARM MODE

Configure the values to be monitored as described in § 9.2.

4.7.2. PROGRAMMING OF AN ALARM CAMPAIGN

See § 9.3.

4.7.3. AUTO STOPPAGE

The alarm recording campaign is stopped automatically at the *Stop* date and time programmed by the operator.

4.7.4. MANUAL STOPPAGE

Use the function as described in § 9.3.3.

4.7.5. VIEWING THE ALARM LOG

See § 9.4.

4.7.6. DELETING THE ALARM LOG

See § 9.5.

4.8. TREND RECORDING

Reminder: any screen can be saved (screen snapshot) by pressing the key (see § 12).

With the C.A 8335 powered up and connected to the network (voltage measurement leads and current sensors), press .

4.8.1. CONFIGURING A RECORDING

See § 10.3.

4.8.2. PROGRAMMING A RECORDING

See § 10.2.

4.9. ENERGY MEASUREMENTS

Reminder: any screen can be saved (screen snapshot) by pressing the key (see § 12).

With the C.A 8335 powered up and connected to the network (voltage measurement leads and current sensors), press W.

4.9.1. MEASUREMENT OF ENERGIES CONSUMED

See § 11.2.

4.9.2. MEASUREMENT OF ENERGIES GENERATED

See § 11.6.

4.10. TRANSFER OF DATA TO THE PC

The PAT transfer software automatically defines the data rate between the PC and the C.A 8335. All measurements made by the Qualistar+ are saved. These measurements may be transferred to a PC for future reference.

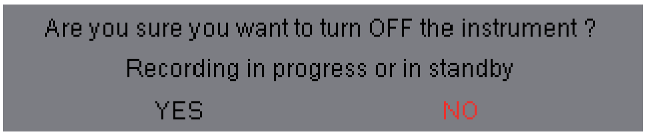
Note: The transfer does not delete the data. However, it is possible to instruct the PAT transfer software to delete some data from the memory of the C.A 8335.

4.11. DELETING DATA

Stored data may be deleted prior to a new test campaign, to free memory. See § 5.11.

4.12. TURNING OFF

Press the key to turn the C.A 8335 off.
The C.A 8335 cannot be turned off during recording without confirmation. The following message appears:



Select **Yes** or **No** using the or key and press to validate.

- If **No** is selected, recording will continue.
- If **Yes** is selected, the data recorded until that point are saved and the device is turned off.

4.13. POWER SUPPLY

4.13.1. RECHARGING THE BATTERY

See § 3.6.3.

4.13.2. MAINS OPERATION

See § 3.6.5.

5. CONFIGURATION KEY

The key is used to configure the C.A 8335. Before using the instrument, and thereafter as necessary, you must parameterize it. The stored configuration is retained when the instrument is switched off.

5.1. AVAILABLE SUB-MENUS

Select the sub-menu using the and keys and confirm by pressing .

To return to the main screen, press .

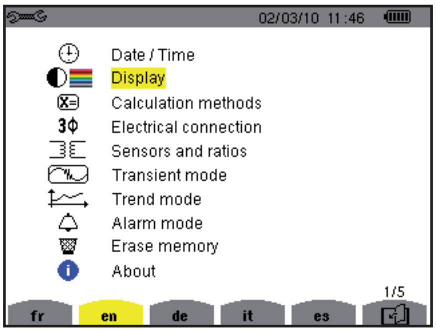


Figure 6: the sub-menu display screen

Name	Sub-menu	See
Date/Time	Date and time settings	§ 5.3
Display	Screen contrast and brightness settings. Definition of voltage curve and current curve colours	§ 5.4.1 § 5.4.2
Calculation method	Choice of reactive parameters (with or without harmonics)	§ 5.5
Connection	Choice of type of connection to the network (attention: some calculations depend upon the type of connection).	§ 5.6
Sensor and ratios	Configuration of the ratios of the current sensors (MN93A clamp, 5 A range, or adapter). Configuration of voltage ratios.	§ 5.7.1 § 5.7.2
Transient mode	Choice of current thresholds to be detected. Choice of voltage thresholds to be detected.	§ 5.8.1 § 5.8.2
Trend mode	Choice of parameters to be recorded for .	§ 5.9
Alarm Mode	Definition of alarms to be detected.	§ 5.10
Erase data	Choice of total or partial deletion of user data	§ 5.11
About	Serial number, software and hardware version numbers, and capacity of on-board memory card	§ 5.12

5.2. DISPLAY LANGUAGE

To select the display language, press the yellow key under the corresponding icon on the screen (Figure 6). The active language is identified by the icon on the yellow ground.

5.3. DATE/TIME

The parameter defines the system date and time. The display is as follows:

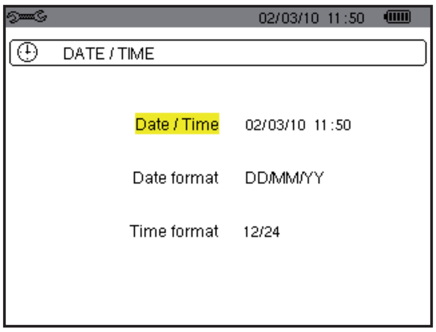


Figure 77: Date/Time menu

The Date/Time field is highlighted in yellow.

- To change the date/time, press . The arrows show which value can be changed. To change a value, press or .
  To move from one field to another, press or . To confirm, press .
- To modify the dating system, position the yellow cursor on the field using the or key. Press . The arrows show which value can be changed.
  Select DD/MM/YY or MM/DD/YY, press or , then confirm by pressing .
- To modify the time system, position the yellow cursor on the field using the or key, then confirmed by pressing . The arrows show which value can be changed.
  To select the 12/24 or AM/PM mode, press or , then confirm by pressing .

Note: 12/24: display of time in 24-hour format.
AM/PM: display of time in 12-hour format. The time is followed by AM or PM.

- To return to the *Configuration* menu, press .

5.4. DISPLAY

5.4.1. CONTRAST/BRIGHTNESS

The menu is used to define the contrast and brightness of the display unit. The display is as follows:

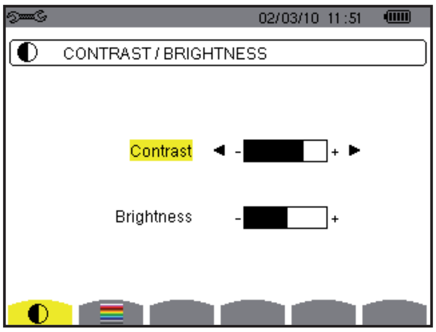


Figure 8: the Contrast/Brightness menu

The selected field is highlighted in yellow.

- To modify the contrast, press or .
- To move to the next field, press or .
- To change the brightness, press or .
- To return to the Configuration menu, press .

5.4.2. COLOURS

The menu is used to define the colours of the voltage and current curves. The colours available are: green, dark green, yellow, orange, pink, red, brown, blue, turquoise blue, dark blue, light grey, grey, dark grey, and black.

The display is as follows:

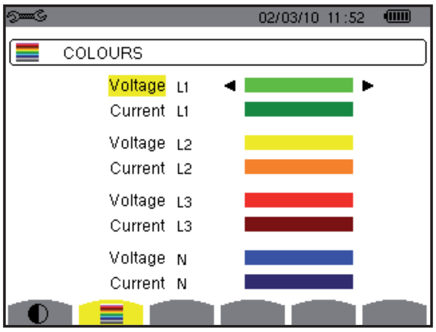


Figure 9: the Colours menu

The selected field is highlighted in yellow.

- To select the colour of the voltage and current curves, press or .
- To move to the next field, press or .
- To return to the *Configuration* menu, press .

5.5. CALCULATION METHODS

determines whether or not harmonics are used in calculating the reactive parameters (powers and energies).

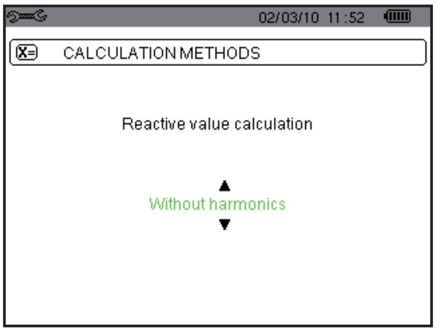


Figure 10: the Calculation methods menu

To select *With harmonics* or *Without harmonics*, press or .

- *With harmonics*: harmonics are taken into account when calculating reactive quantities.
- *Without harmonics*: only the fundamental is used in calculations of the reactive quantities.

To confirm, press . Return to the *Configuration* menu is immediate. The parameters are applied only if confirmed.

5.6. CONNECTION

The 3ϕ menu is used to define how the C.A 8335 is connected, according to the type of network.

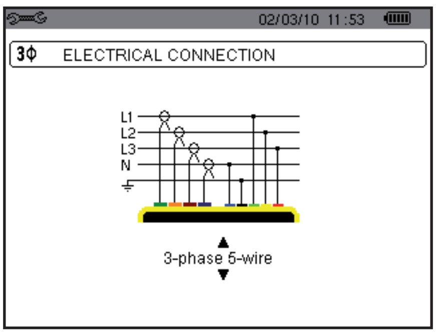
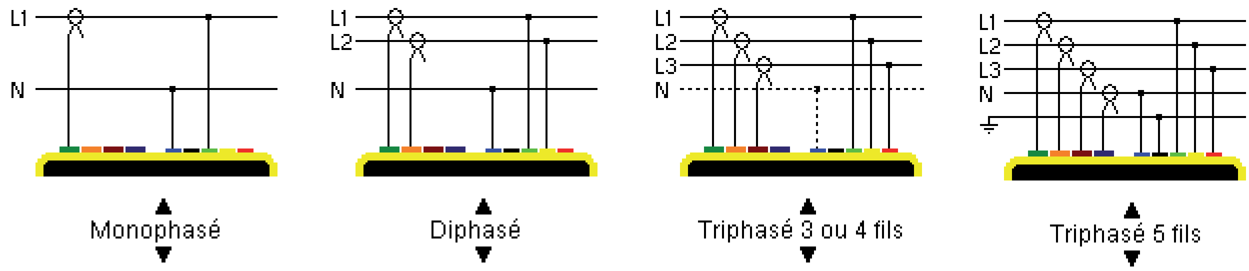


Figure 11: the Connection menu

Several electrical diagrams can be selected:



To configure the type of connection, proceed as follows:

- Select *Single-Phase*, *Split-Phase*, *3- or 4-wire Three-Phase*, or *5-wire Three-Phase* by pressing or .
- Validate by pressing (the parameters are applied only if confirmed). Return to the *Configuration* menu is immediate.

5.7. SENSORS AND RATIOS

5.7.1. CURRENT SENSORS AND RATIOS

A first screen is used to define the current sensors and ratios. It automatically displays the current sensor models detected by the device. It can also be used to define the transformation ratio (sensitivity) of certain current sensors (E3N clamp).

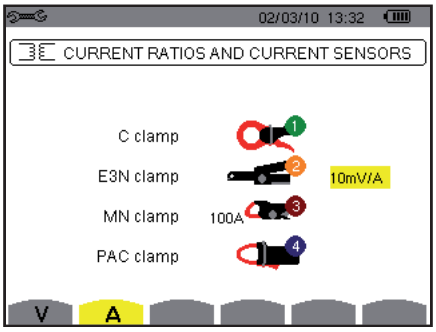


Figure 12: Current clamp and ratios screen in the Sensors and ratios menu

The possibilities are:

	MN93 clamp: 200 A.
	MN93A clamp: 100 A or 5 A.
	C193 clamp: 1000 A.
	Amp*FLEX*™ A193: 6500 A.
	Mini*FLEX* MA193: 6500 A.
	PAC93 clamp: 1000 A.
	E3N clamp: 100 A (sensitivity 10 mV/A).
	E3N clamp: 10 A (sensitivity 100 mV/A).
	Three phase adapter: 5 A.

If an *MN93A clamp*, 5A range, or an *Adapter* is used, the current ratio setting is proposed automatically. The parameterizing is done as follows:

- To parameterize the primary circuit current (1 A to 60,000A)/secondary circuit current (1 A, 2 A, or 5 A) transformation ratio, press . To select the fields, use the or .
  To select the values, use the or . Proceed in the same way for the primary and secondary circuit currents.

- To validate, press (the parameters are applied only if confirmed).

The primary current cannot be less than the secondary current.

5.7.2. VOLTAGE RATIOS

A second screen, invoked by the V icon, defines the voltage ratios.

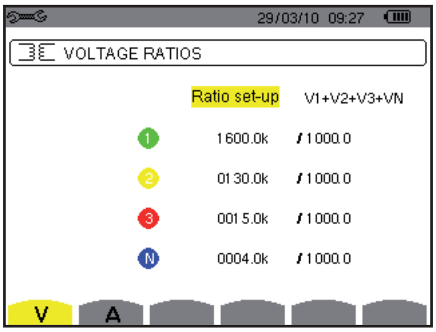


Figure 13: the Voltage Ratios screen in the Sensors and ratios menu

The ratios programmed may be the same in all channels, or different in some or all of them.

- To configure the ratios, press , then use the or key and validate by pressing .
- To select the fields, use the or key. To select the values, use the or key. To validate, press (the parameter must be validated to be applied).
- To return to the *Configuration* menu, press .

For the primary voltage (in kV) and the secondary voltage (in V), it is possible to specify the use of the multiplier 1/√3. If the phase-to-neutral voltage ratios of phases 1, 2 and 3 are not identical, then all measurements and curves concerning the phase-to-phase voltages are suppressed.

5.8. TRANSIENT MODE

The mode is used to configure the voltage and current thresholds.

5.8.1. CURRENT THRESHOLDS

A first screen defines the current thresholds for each current sensor recognized.
The thresholds programmed can be the same for all channels or different for some or all of them.
Below: an example of programming of four independent thresholds:

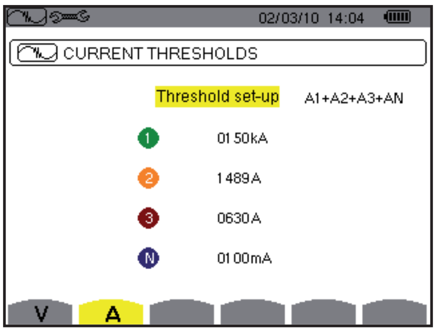


Figure 14: the Current thresholds screen in the Transient Mode menu

To program the current threshold for the search for a transient, proceed as follows:

- Select the *Configuration of thresholds field*, highlighted in yellow, by pressing . The arrows appear in the field. Use the or key to go from one type of configuration to another.
- Press to validate the choice of configuration.
- Select the field of the first threshold using the or key. The selected field is highlighted in yellow. Press to enter the values. The arrows appear in the field.

Use the or key to increment or decrement a value and or to go to the next item.

- Press to validate the programming of the threshold.

It is possible to configure the current thresholds in mA, A, or kA.

5.8.2. VOLTAGE THRESHOLDS

A second screen, displayed by pressing the V icon, is used to define the voltage thresholds.
The thresholds programmed can be the same for all channels or different for some or all of them.

Below: an example of programming of four independent thresholds:

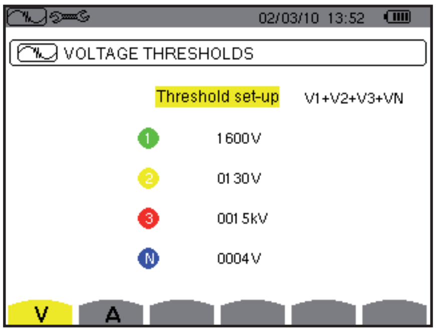


Figure 15: the Voltage thresholds screen in the Transient Mode menu

To program the voltage threshold for the search for a transient, proceed as follows:

- Select the *Configuration of thresholds* field, highlighted in yellow, by pressing . The arrows appear in the field. Use the or key to go from one type of configuration to another.
- Press to validate the choice of configuration.
- Select the field of the first threshold using the or key. The selected field is highlighted in yellow. Press to enter the values. The arrows appear in the field.

  Use the or key to increment or decrement a value and or to go to the next item.
- Press to validate the programming of the threshold. Proceed in the same way for the fields of the other thresholds.

To return to the *Configuration* screen, press .

The voltage thresholds can be configured in V or in kV.

5.9. TREND MODE

The C.A 8335 has a recording function – key - (see § 10) for recording measured and calculated values (Urms, Vrms, Arms, etc.). Four independent configurations can be parameterized, depending on needs.

To select the desired configuration, press the yellow key corresponding to the , , , icon. The active configuration is identified by the icon with a yellow background.

A configuration example is shown below:

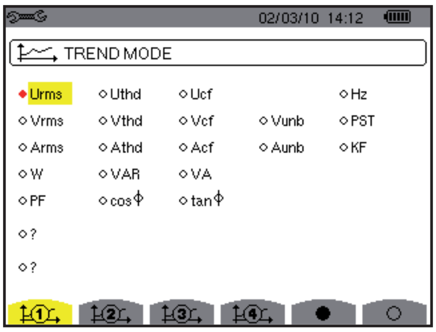


Figure 16: In this example, only the Urms values are recorded in configuration 1

- To define configuration 1, press the yellow key on the keypad corresponding to the icon. The icon appears on a yellow ground.
- To select the values, move the yellow cursor using the or and or . Press to validate. Confirmation is indicated by the red mark.
- To select all of the values, press the yellow key on the keypad corresponding to the ● icon. All of the values are confirmed and marked in red. Move the yellow cursor with the or and or keys. Press to remove the validation.
- To deactivate the validation of the values, press the yellow key on the keypad corresponding to the ○ icon. The values are no longer validated. Move the yellow cursor with the or and or keys. Press to activate the validation.

The recordable values are:

Unit	Designation
Urms	RMS phase-to-phase voltage.
Vrms	RMS phase-to-neutral voltage.
Arms	RMS current.
Uthd	Total harmonic distortion of the phase-to-phase voltage (THD-F).
Vthd	Total harmonic distortion of the phase-to-neutral voltage (THD-F).
Athd	Total harmonic distortion of the current (THD-F).
Ucf	Crest (peak) factor of phase-to-phase voltage.
Vcf	Crest factor of phase-to-neutral voltage.
Acf	Crest factor of current.
W	Active power.
VAR	Reactive power.
VA	Apparent power.
PF	Power factor.
cos Φ	Cosine of the phase shift of the voltage with respect to the current (displacement factor – DPF).
tan Φ	Tangent of the phase shift of the voltage with respect to the current.
Vunb	Phase-to-neutral voltage unbalance.
Aunb	Current unbalance.
Hz	Network frequency.
PST	Short-term flicker.
KF	K factor.
?	See comment below.

Features specific to the last two lines
These are recalled below:

o ?
o ?

Figure 17: These two lines involve harmonics

These two lines involve the recording of the harmonics of VAh, Ah, Vh and Uh. You can select a range of orders of the harmonics to be recorded (between 0 and 50) for each of these quantities, and within this range, if desired, only odd harmonics. Proceed as follows:

- **To enter the value to be recorded:** with line o ? highlighted in yellow, press . The arrows appear. Select the value (VAh, Ah, Vh, and Uh) for which harmonics are to be recorded by pressing or . The red mark identifies your selection. Confirm by pressing . The values field is highlighted in yellow.

  Press to go to the next field.

- **To select the starting harmonic order:** with the field highlighted in yellow, press . The arrows appear. Select the order from which the harmonics are to be recorded by pressing or , then validate by pressing .

Press to go to the next field.

- **To select the last harmonic:** with the second field (greater than or equal to the starting harmonic order) highlighted in yellow, press . Select the highest harmonic order to be recorded by pressing or , then validate by pressing .

  Press to go to the next field.

- **Odd harmonics only:** to select or deselect this function, press . The red mark identifies your selection:
  - *selected*, only odd harmonics between the two orders of harmonics specified in the previous points are recorded.
  - *Not selected*, all harmonics (even and odd) between the two orders of harmonics specified in the previous points are recorded.

■	Vh	00	→	50	■ odd only
■	Ah	00	→	50	■ odd only

To return to the *Configuration* menu, press .

Proceed in the same way to define the other configurations.

5.10. ALARM MODE

The screen defines the alarms used by the *Alarm Mode* function (see § 8). You can configure 40 different alarms.

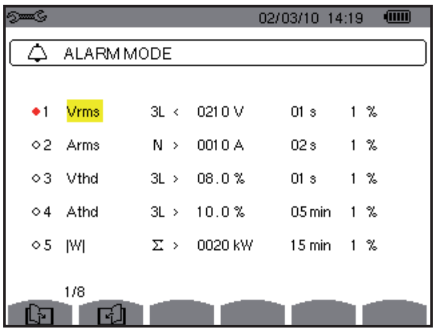


Figure 18: the Alarm mode menu

- Use the or and keys to browse vertically in the fields.
- To select the field, press . The arrows appear.
- To select the values (Vah, Ah, Uh, etc., see table in § 5.9), press or , then confirm with . The field is highlighted in yellow.
- To navigate horizontally in the fields, use the or keys, then confirm by pressing . The arrows appear. Enter the values by pressing or , then confirm by pressing . Do the same for all values to be entered in the fields.

  For each alarm to be defined, select:
  - The type of alarm (Vrms, Urms, Arms, PST, Vcf, Ucf, Acf, Vunb, Aunb, Hz, KF, Vthd, Uthd, Athd, |W|, |VAR|, VA, |cos Φ|, |PF|, |tan Φ|, Vh, Uh, Ah et |VAh| – see the table of abbreviations in § 3.9).
  - The orders of harmonics (between 0 and 50, for Vah, Ah, Uh and Vh).
  - The alarm filter (3L: 3 phases monitored individually or N: monitoring of neutral or Σ: monitoring of sum or $\bar{x}$: monitoring of the arithmetic mean).
  - The direction of the alarm (> or < for Arms, Urms, Vrms, Hz only; otherwise only one direction is possible).
  - The triggering threshold of the alarm (the prefix of the unit of the alarm can be set in the following cases: W, VAR, |W|, |VAR|, and VA).
  - The triggering delay, or minimum duration above or below the alarm threshold (in minutes or seconds or, in the case of Vrms, Urms and Arms – excluding the neutral - in hundredths of a second).
  - The hysteresis (difference, expressed as a percentage, between the alarm threshold and the value at which the alarm is cut off - 1, 2, 5, or 10% - See § 17.2).
  - Activation of the alarm (red mark) or deactivation (see above).

- To activate the configured alarm, place the yellow cursor on the first column of the list using the key and press . Activation is indicated by the red mark. The alarm can be triggered during a campaign.
- To display different alarm screen pages, press the yellow buttons corresponding to the icons.
- To return to the *Configuration* menu, press .

5.11. ERASE MEMORY

The menu partially or totally deletes the data recorded in the device (set-up, transients, inrush current, alarms detected, snapshots, and recordings).

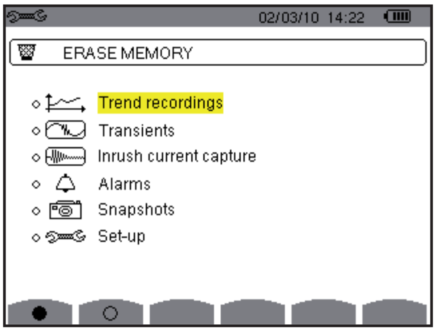


Figure 19: Erase memory menu

- **For a partial deletion:**
  - Select the parameters you want to delete by pressing the or key. The selected field is highlighted in yellow.
  - Validate the selection by pressing . The red mark confirms validation.

Note: If the *Configuration* is selected, the message "after the configuration is deleted, the device will be turned off" appears on the screen.

  - Press the yellow button on the keypad corresponding to the icon , then press to confirm. The deletion is performed.

To return to the *Configuration* menu, press .

- **To delete everything:**
  - Select All parameters by pressing the yellow key on the keypad corresponding to the ● icon. The selection is identified by the red marks.

Note: Since the *Configuration* is selected, the message "after the configuration is deleted, the device will be turned off" appears on the screen.

  - Press the yellow button on the keypad corresponding to the icon , then press to confirm. The deletion is performed.

To uncheck all items selected, press the yellow key on the keypad corresponding to the ○ icon.

To return to the *Configuration* menu, press .

5.12. ABOUT

The ⓘ screen displays the serial number of the device, the firmware version, the loader version, the basic card version, and the CPLD (Complex Programmable Logic Device) version.

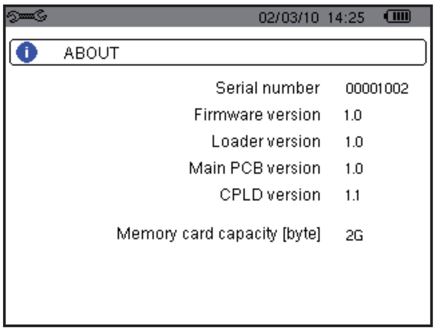


Figure 20: the About menu

To return to the *Configuration* menu, press ↩.

6. WAVEFORM CAPTURE KEY

The [waveform capture icon] mode is used to display and record transients and current waveforms.

6.1. AVAILABLE SUB-MODES

The sub-modes are listed in the screen below and covered individually in the paragraphs that follow.

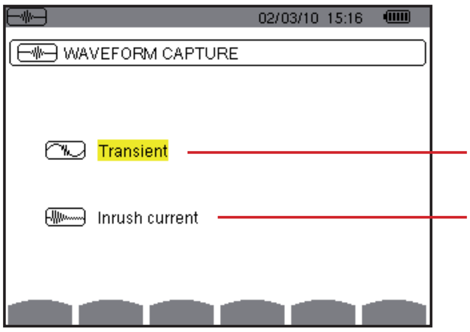


Figure 21: the screen when the Waveform Capture mode is entered

To enter the sub-modes, proceed as follows:

- Select the mode by using the ▲ or ▼ key. The selected field is highlighted in yellow.
- Confirm by pressing ↵.

To return to the *Waveform capture* screen, press ↩.

6.2. TRANSIENT MODE

The [transient icon] mode is used to record transients, view the list of recorded transients, and if necessary delete them. You can record up to 210 transients.

Note: when the Transients mode is invoked, which screen is displayed will depend on the following conditions:

If ...	... then
no recording has been made	the *Detection schedule* screen is displayed.
transients have been recorded	the *List of transients* screen is displayed.

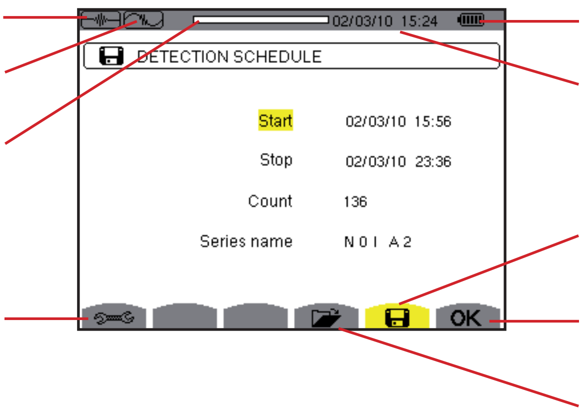


Figure 22: the Detection schedule screen in Transients mode

6.2.1. PROGRAMMING AND STARTING A SEARCH

To program a search for a transient, select the submenu by pressing the yellow key corresponding to the icon. The *Detection schedule* screen is displayed.

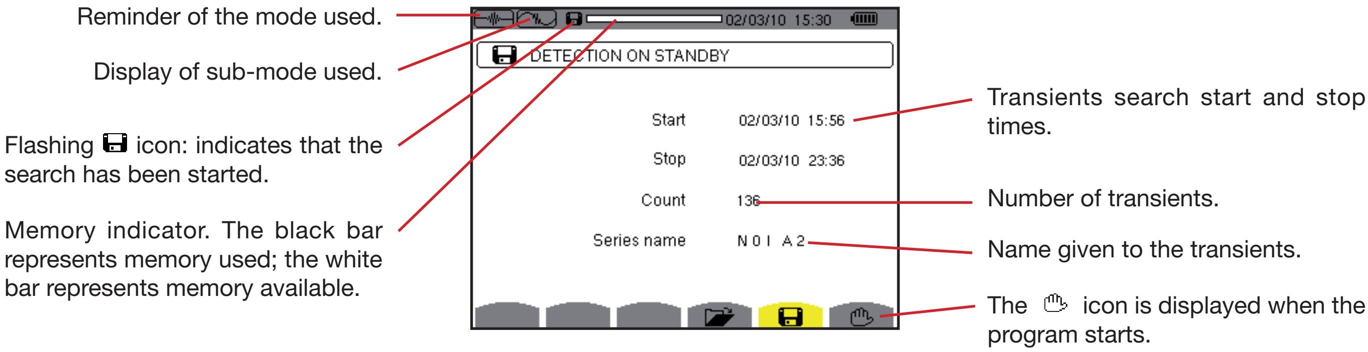


Figure 23: the Detection in progress screen (in this example the search has been started)

6.2.1.1. Stage 1: parameterizing of characteristics

Proceed as follows:

- Select the ***Start*** field using the or key. The selected field is highlighted in yellow. Press to enter the values. The arrows appear in the start date and time field of the programming of a campaign.

  Press or to increment or decrement a value and or to go to the next item.

Note: The start date and time must be later than the current date and time.

- Press to validate the programmed ***Start*** date and time.
- Select the ***Stop*** field using the or key. The selected field is highlighted in yellow. Press to enter the values. The arrows appear in the Stop date and time field of the programming of a campaign.

  Press or to increment or decrement a value and or to go to the next item.

Note: The stop date and time must be later than the start date and time.

- Press to validate the programming of the Stop date and time.

Proceed in the same way for the ***Count*** and ***Series*** name fields.

To configure the voltage thresholds and current thresholds, press the yellow shortcut key to return to the *Configuration* menu.

To return to the *Waveform capture* screen, press .

6.2.1.2. Stage 2: starting the program

To begin monitoring between the start and stop times you have defined, press the yellow key on the keypad corresponding to the **OK** icon.

- The **OK** icon disappears and the icon appears instead.
- The message *Detection on standby* is displayed until the start time is reached and the icon flashes in the screen's top display bar.
- When the start time is reached the message *Detection in progress* is displayed.
- When the stop time is reached, the *Detection schedule* screen with the **OK** icon (bottom right-hand corner of the screen) is displayed again. It is then possible to program another search.

Note: voltage and/or current transients are recorded according to the activation thresholds configured. If an activation occurs on the current threshold, the current and voltage waveforms are recorded.

To return to the *Waveform capture screen*, press .

6.2.1.3. Intentional transients campaign stoppage

The search can be stopped deliberately before the stop date and time by pressing the yellow key on the keypad corresponding to the icon (bottom right corner of screen). The **OK** icon then reappears in the same place.

6.2.2. DISPLAYING A TRANSIENT

To display the recorded transients, proceed as follows:

- Select the submenu by pressing the yellow key corresponding to the icon. The *Transient list* screen is displayed.

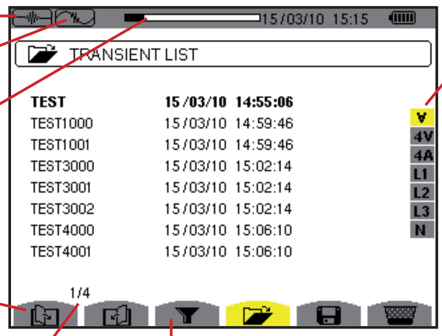
Reminder of the mode used.

Display of sub-mode used.

Memory indicator. The black bar represents memory used; the white bar represents memory available.

The icons let you browse through the previous and next screen pages. Press the yellow keys corresponding to these icons to display the pages.

The value displayed (1/4 in this example) indicates the page number and the number of pages.



The icon is used to activate or deactivate the choice of a transient list display filter.

Selection of transients in the list to be displayed:
∀: all transients are displayed.
4 V: the transients triggered by an event in one of the 4 voltage channels are displayed.
4 A: the transients triggered by an event in one of the 4 current channels are displayed.
L1, L2, or L3: the transients triggered by an event on a particular phase are displayed (voltage or current).
N: the transients triggered by an event on the neutral current or neutral voltage are displayed

Figure 24: the Transient list screen

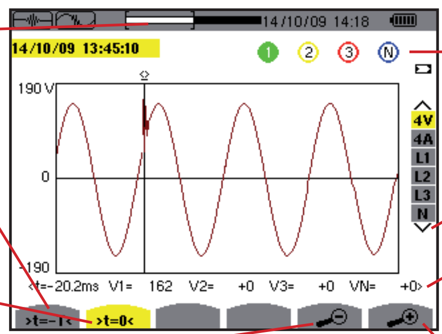
- Select the line of the transient to be displayed using the or key. The selected field is bolded. Confirm by pressing . The screen displays the transients in the form of curves.

Location in the record of the zone displayed

Move the cursor to one period of the signal before the transient triggering time.

Move the cursor to the transient triggering time.

Zoom out. To zoom out, press the yellow key on the keypad corresponding to the icon.



Reminder of the number assigned to the curve displayed; here, identification disc 1 is filled in (coloured) to indicate that channel V1 triggered capture of the transient.

Selection of curves to be displayed.

Instantaneous value of the signals according to the position of the cursor on the scale. To move the cursor use the or keys.

Zoom in. To zoom in press the yellow key on the keypad corresponding to the icon.

Figure 25: example of display of transients in the form of curves with a 5-wire three-phase connection

To return to the *Transient list* screen, press .

6.2.3. DELETE A TRANSIENT

The icon is displayed only if a record has been made.

To delete a transient, proceed as follows:

- Select the submenu by pressing the yellow key corresponding to the icon.

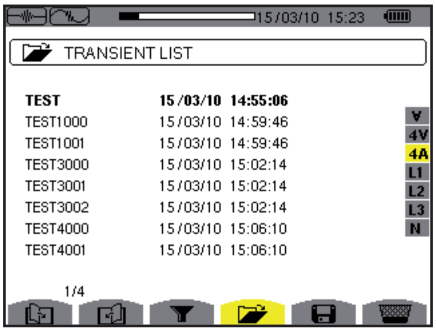


Figure 26: Delete transient screen

- Select the transient to be deleted using the or key. The selected field is bolded.
- Press to confirm the deletion.

Note: The icons let you browse through the previous and next screens. Press the yellow keys corresponding to these icons to display the pages.

To exit from this screen without deleting, press one of the mode keys (W, , , , or).

To return to the *Waveform* capture screen, press the key.

6.3. INRUSH CURRENT MODE

The mode is used to capture (record) inrush currents (voltage and current waveforms, network frequency, half-cycle RMS voltages and currents except for the neutral) and to view and delete the recordings. In capture display mode, two sub-menus, RMS and PEAK, are available (see § 6.3.2). The C.A 8335 keeps in memory only a single current inrush capture.

Note: when the Inrush current mode is invoked, which screen is displayed will depend on the following conditions:

If ...	... then
no capture has been made	the *Capture schedule* screen is displayed.
a capture has been made	the *Capture characteristics* screen is displayed.

6.3.1. PROGRAMMING THE CAPTURE

To program the capture of an inrush current, select the submenu by pressing the yellow key of the keypad corresponding to the icon. The *Capture schedule screen* is displayed.

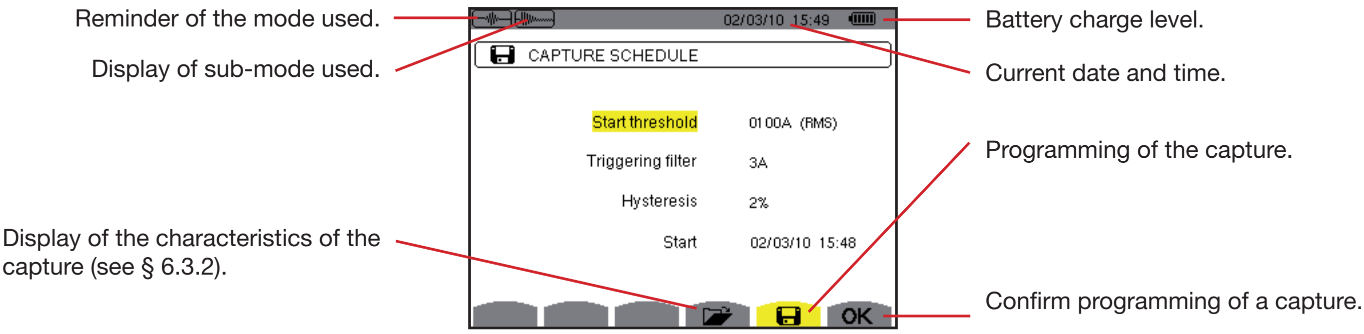


Figure 27: the Capture schedule screen in Inrush current mode

6.3.1.1. Stage 1: configuration of characteristics

Proceed as follows:

- Select the **Start threshold** field using the ▲ or ▼ key. The selected field is highlighted in yellow. Press ↵ to enter the type of values. The arrows appear in the *Start threshold* field.

  Press ▲ or ▼ to increment or decrement a value and press ► or ◄ to go to the next item.
- Press ↵ to confirm programming of the activation threshold.

Proceed in the same manner for the **Triggering filter**, **Hysteresis** and **Start** fields.

Note: for more information on the hysteresis, refer to § 17.2. For more information on the triggering filter, refer to § 17.6.

The start threshold can be configured in mA, A, or kA.

Note: configuring the hysteresis at 100% is equivalent to not having a stop threshold. See § 17.6.

6.3.1.2. Stage 2: starting the capture

To start the capture program at the start date and time you have defined press the yellow key on the keypad corresponding to the **OK** icon.

- The **OK** icon disappears and the icon appears instead.
- The message *capture pending* is displayed until the start time is reached and the icon flashes in the screen's upper display bar.
- When the start conditions are met and the start time is reached, the message *Capture in progress* is displayed and the memory occupation indicator appears at the top of the screen as follows:

The indicator is displayed **only** during the capture, and disappears when the capture is completed.

- If the capture is completed with a stop event (see conditions in § 17.6) or if the recording memory of the C.A 8335 is full, the capture stops automatically.

Note: the C.A 8335 can keep in memory only a single inrush current capture. If you wish to make another capture, first delete the previous one.

To return to the *Waveform capture* screen, press ↩.

6.3.1.3. Intentional stoppage of capture

A capture can be stopped deliberately by pressing the yellow key on the keypad corresponding to the icon (bottom right corner of the screen).

6.3.2. DISPLAYING THE CHARACTERISTICS OF THE CAPTURE

To display the characteristics of the capture, proceed as follows:

- Select the submenu by pressing the yellow key corresponding to the icon. The *Capture parameters* screen is displayed.

Display in PEAK mode (see § 6.3.4).

Display in RMS mode (see § 6.3.3).

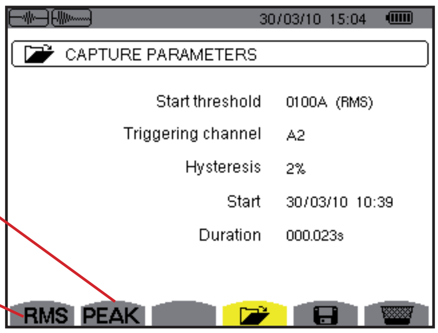


Figure 28: the Capture parameters screen

Details: start time and duration of the inrush current capture, current channel that triggered the capture, and reminder of the programmed triggering threshold and hysteresis.

- Choose the type of display, **RMS** or **PEAK**, by pressing the yellow key corresponding to the icon. The C.A 8335 displays curves on which you can move the time cursor and zoom in and out.

In the PEAK display, the available information is:
- The instantaneous current and voltage at the time indicated by the cursor (in a “waveform” representation).
- The maximum instantaneous current and voltage in the half-cycle indicated by the cursor (in an “envelope” representation).
- The maximum instantaneous absolute value of the current and voltage (over the entire capture).

In the RMS display, the available information is:
- The instantaneous frequency at the time indicated by the cursor.
- The minimum, mean, and maximum instantaneous values of the frequency over the entire capture.
- The RMS current and voltage in the half-cycle (or lobe) on which the cursor is positioned.
- The maximum half-cycle RMS current and voltage (over the entire capture).

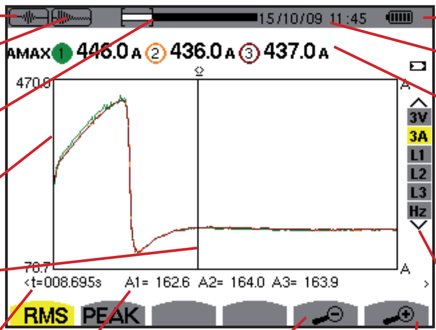
Caution: The voltage must be present before the inrush current proper for a stable and correct frequency lock.

6.3.3. TRUE RMS CURRENT AND VOLTAGE

The **RMS** mode displays the record of the trend of the true half-cycle RMS current and voltage and the frequency trend curve.

6.3.3.1. The 3A RMS display screen

The following information is displayed:



Reminder of the mode used.

Display of sub-mode used.

Location of the zone displayed in the record.

Scale of values in amperes.

Time cursor. Use the ▷ or ◁ and keys to move the cursor.

t: relative time position of the cursor (t=0 corresponds to the start of the inrush current capture).

A1, A2, A3: RMS values of currents 1, 2, and 3 in the half-cycle at the position of the cursor.

Zoom out. To zoom out press the yellow key on the keypad corresponding to the icon.

Zoom in. To zoom in press the yellow key on the keypad corresponding to the icon.

Battery charge level.

Current date and time.

MAX: maximum half-cycle RMS value of the inrush current capture. Reminder of number assigned to the curve displayed. Here, identification disc 1 is filled in (coloured), indicating that channel A1 triggered the inrush current capture.

Selection of curves to be displayed:
3 V: displays the 3 voltages during the inrush current capture.
3 A: displays the 3 currents during the inrush current capture.
L1, L2, L3: display the current and voltage in phases 1, 2, and 3, respectively.
Hz: displays the evolution of the network frequency vs. time

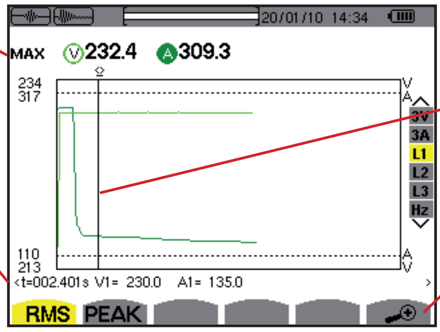
Figure 29: the 3A RMS display screen

6.3.3.2. The L1 RMS display screen

The following information is displayed:

MAX: maximum half-cycle RMS value of the inrush current capture.
V: measured voltage.
A: measured current.

t: relative time position of the cursor (t=0 corresponds to the start of the current inrush capture).
V1: RMS value of voltage 1 in the half-cycle at the position of the cursor.
A1: RMS value of current 1 in the half-cycle at the position of the cursor.



Time cursor of the curve. Use the or keys to move the cursor.

Zoom in. To zoom in press the yellow key on the keypad corresponding to the icon.

Figure 30: the L1 RMS display screen

Note: Filters L2 and L3 display the trend of the true half-cycle RMS current and voltage of phases 2 and 3. The screen is identical to the one displayed for filter L1.

6.3.4. INSTANTANEOUS INRUSH CURRENT

The PEAK mode is used to display the envelopes and waveforms of the inrush current capture.

6.3.4.1. The 4A PEAK display screen

The peak display of an inrush current capture provides two possible types of representation: envelope and waveform. Switching between the two types is automatic, and is determined by the zoom. In the case shown, there is enough zoom in to force the waveform type of representation. The display filters along the right edge of the screen depend on the type of representation, and so on the zoom.

The following information is displayed:

Reminder of the mode used.

Display of sub-mode used.

|AMAX|: absolute value.

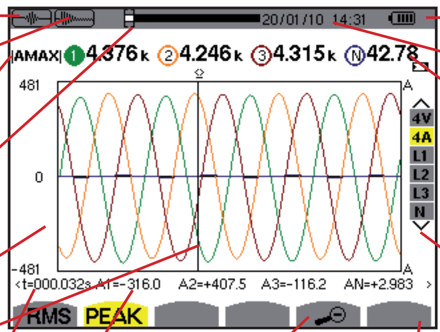
Location of the zone displayed in the record.

Scale of values in amperes.

Time cursor. Use the or and keys to move the cursor.

t: relative time position of the cursor (t=0 corresponds to the start of the current inrush capture).

A1, A2, A3: instantaneous values of currents 1, 2, and 3 at the position of the cursor.



Zoom out. To zoom out press the yellow key on the keypad corresponding to the icon.

Zoom in. To zoom in press the yellow key on the keypad corresponding to the icon.

Battery charge level.

Current date and time.

Reminder of the number assigned to the curve displayed; here, identification disc 1 is filled in (coloured) to indicate that channel A1 triggered capture of the inrush current.

Selection of curves to be displayed:
4 V: displays the 4 voltages during the inrush current capture.
4 A: displays the 4 currents during the inrush current capture.
L1, L2, or L3: display the voltage and current of phases 1, 2, and 3, respectively
N: displays the neutral current and neutral voltage during the inrush current capture.

Figure 31: the 4A PEAK display screen

6.3.4.2. The A1 PEAK display screen

In the case shown, there is enough zoom out (maximum zoom out) to force the envelope type of representation.

The following information is displayed:

|MAX|: maximum instantaneous absolute value of the inrush current capture.

t: relative time position of the cursor (t=0 corresponds to the start of the current inrush capture).

A1: maximum instantaneous current of the half-cycle identified by the cursor.

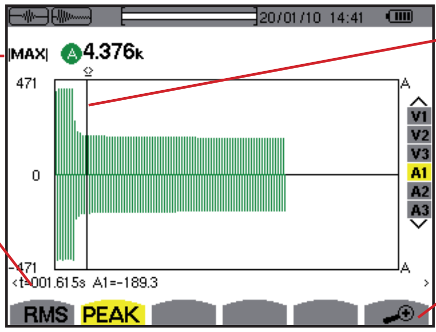


Figure 32: the A1 PEAK display screen

Time cursor of the curve. Use the ▷ or ◁ keys to move the cursor.

Zoom in. To zoom in press the yellow key on the keypad corresponding to the icon.

Note: Filters A2 and A3 display the record of the current envelope of phases 2 and 3. The screen is identical to the one displayed for filter A1.

7. HARMONICS KEY

The key displays a representation of the harmonic levels of the voltage, current, and apparent power, order by order. It can be used to determine the harmonic currents produced by nonlinear loads and analyze problems caused by harmonics according to their order (overheating of neutrals, conductors, motors, etc.).

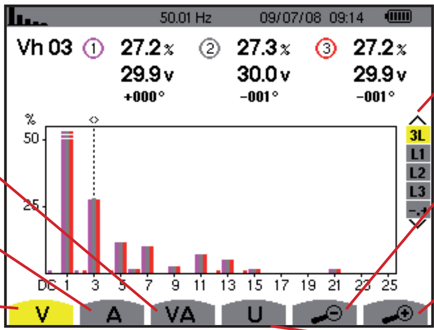
7.1. AVAILABLE SUB-MENUS

The submenus are listed on the screen below and described individually in the paragraphs that follow.
The measurement type is selected using the yellow keys of the keypad below the screen.

Analysis of the apparent power of the harmonics (see § 7.4).

Analysis of harmonics of the current (see § 7.3).

Analysis of harmonics of the phase-to-neutral voltage (see § 7.2).



Analysis of the harmonics of the phase-to-phase voltage (see § 7.5).

Zoom out. To zoom out press the yellow key on the keypad corresponding to the icon.

Zoom in. To zoom in press the yellow key on the keypad corresponding to the icon.

Select the filters and the expert mode (see § 7.6). Use the or key to select the display.

Figure 33: Harmonics mode screen

7.2. PHASE-TO-NEUTRAL VOLTAGE

The V sub-menu displays the harmonics of the phase-to-neutral voltage.

Note: The choice of curves to be displayed depends on the type of connection (see § 5.6):

- Single-phase: no choice (L1)
- Split-phase: 2L, L1, L2
- Three-phase, 3-, 4-, or 5-wire: 3L, L1, L2, L3, -,+

The screen snapshots shown as examples were obtained with a three-phase connection. This observation also applies to the other sub-menus.

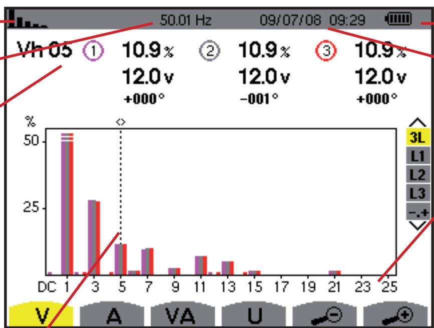
7.2.1. THE 3L PHASE-TO-NEUTRAL VOLTAGE HARMONICS DISPLAY SCREEN

The following information is displayed:

Reminder of the mode used.

Instantaneous frequency.

This information concerns the harmonic under the cursor.
Vh 05: harmonic number.
%: ratio of the harmonic to the fundamental.
V: RMS voltage of the harmonic in question.
+000°: phase shift with respect to the fundamental (order 1).



Battery charge level.

Current date and time.

The horizontal axis indicates the orders of the harmonics (odd marking).
Display of the level of the harmonics as a percentage of the fundamental (order 1).
DC: DC component.
1 to 25: harmonics of order 1 to 25. When the cursor exceeds order 25, order 26 to 50 appears.

Harmonic selection cursor. Use the or keys to move the cursor.

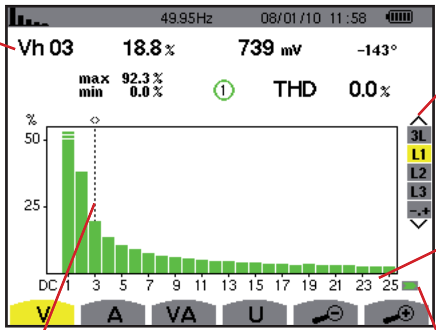
Figure 34: example of 3L phase-to-neutral voltage harmonics display (harmonic no. 5: Vh05)

On the right-hand side, display in expert mode (three-phase connection only - See § 7.6) of the 3 phases (3L) or of L1, L2 or L3. To select the display press the ▲ or ▼ key.

7.2.2. THE L1 PHASE VOLTAGE HARMONICS DISPLAY SCREEN

The following information is displayed:

This information concerns the harmonic under the cursor.
Vh 03: harmonic number.
%: ratio of the harmonic to the fundamental.
V: RMS voltage of the harmonic in question.
+000°: phase shift with respect to the fundamental (order 1).
max – min: maximum and minimum levels of the harmonic in question (reset when the harmonic number is changed or the ↵ key is pressed).
THD: total harmonic distortion.



Display in expert mode (three-phase connection only - See § 7.6) of the 3 phases (3L) or of L1, L2, or L3. To select the display, press the ▲ or ▼ key.

The horizontal axis indicates the orders of the harmonics (odd marking). Display of the level of the harmonics as a percentage of the fundamental (order 1).
DC: DC component.
1 to 25: harmonics of order 1 to 25. When the cursor exceeds order 25, order 26 to 50 appears.

Harmonic selection cursor. Use the ▶ or ◀ keys to move the cursor.

Indicator of the presence of non-zero harmonics of order higher than 25.

Figure 35: example of display of harmonics of L1 phase-to-neutral voltage (harmonic n° 3: Vh03)

Note: Filters L2 and L3 display the harmonics of the phase-to-neutral voltage for phases 2 and 3, respectively. The screen is identical to the one displayed for filter L1.

7.3. CURRANT

The A sub-menu displays the harmonics of the current.

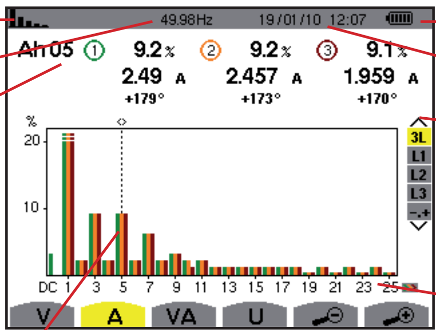
7.3.1. THE 3L CURRENT HARMONICS DISPLAY SCREEN

The following information is displayed:

Reminder of the mode used.

Instantaneous frequency.

This information concerns the harmonic under the cursor.
Ah 05: harmonic number.
%: ratio of the harmonic to the fundamental.
A: RMS current of the harmonic in question.
+000°: phase shift with respect to the fundamental (order 1).



Battery charge level.

Current date and time.

Display in expert mode (three-phase connection only - See § 7.6) of the 3 phases (3L) or of L1, L2, or L3. To select the display, press the ▲ or ▼.

The horizontal axis indicates the orders of the harmonics (odd marking). Display of the level of the harmonics as a percentage of the fundamental (order 1).
DC: DC component.
1 to 25: harmonics of order 1 to 25. When the cursor exceeds order 25, order 26 to 50 appears.

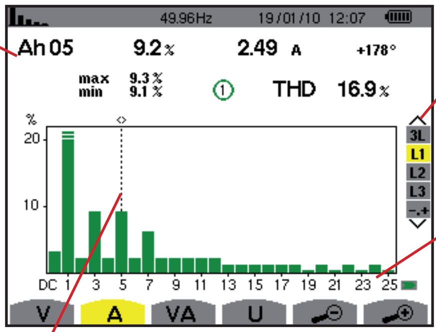
Harmonic selection cursor. Use the ▶ or ◀ keys to move the cursor.

Figure 36: example of 3L display of current harmonics (harmonic no. 5: Ah05)

7.3.2. THE L1 CURRENT HARMONICS DISPLAY SCREEN

The following information is displayed:

This information concerns the harmonic under the cursor.
Ah 05: harmonic number.
%: ratio of the harmonic to the fundamental.
A: RMS current of the harmonic in question.
+000°: phase shift with respect to the fundamental (order 1).
max – min: maximum and minimum levels of the harmonic in question (reset when the harmonic number is changed or the key is pressed).
THD: total harmonic distortion.



Display in expert mode (three-phase connection only - See § 7.6) of the 3 phases (3L) or of L1, L2, or L3. To select the display, press the or .

The horizontal axis indicates the orders of the harmonics (odd marking). Display of the level of the harmonics as a percentage of the fundamental (order 1).
DC: DC component.
1 to 25: harmonics of order 1 to 25. When the cursor exceeds order 25, order 26 to 50 appears.

Harmonic selection cursor. Use the or keys to move the cursor.

Figure 37: example of L1 display of harmonics of current (harmonic n° 5: Ah05)

Note: Filters L2 and L3 display the current harmonics of phases 2 and 3, respectively. The screen is identical to the one displayed for filter L1.

7.4. APPARENT POWER

The VA sub-menu displays the harmonics of the apparent power.

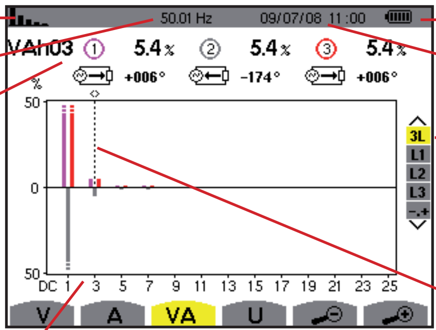
7.4.1. THE 3L APPARENT POWER HARMONICS DISPLAY SCREEN

The information is:

Reminder of the mode used.

Instantaneous frequency.

This information concerns the harmonic under the cursor.
Vah03: harmonic number.
%: ratio of the harmonic to the fundamental (order 1).
+000°: phase shift of the voltage harmonic with respect to the current harmonic for the order in question.
: Indicator of energy generated for this harmonic.
: Indicator of energy consumed for this harmonic.



Battery charge level.

Current date and time.

Display in expert mode (three-phase connection only - See § 7.6) of the 3 phases (3L) or of L1, L2, or L3. To select the display, press the or .

Harmonic selection cursor. Use the or keys to move the cursor.

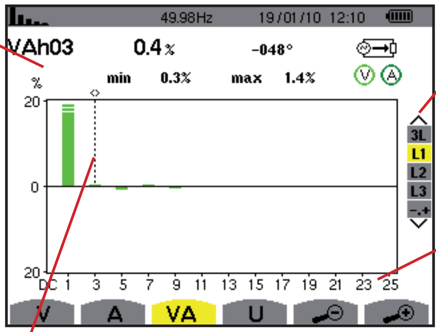
The horizontal axis indicates the orders of the harmonics (bars of the bar chart above the horizontal centreline signify harmonic power consumed, those below it harmonic power generated).
Display of the level of the harmonics as a percentage of the fundamental (order 1).
DC: DC component.
1 to 25: harmonics of order 1 to 25. When the cursor exceeds order 25, order 26 to 50 appears.

Figure 38: example of 3L apparent power harmonics display (harmonic no. 3: VAh03)

7.4.1.1. The L1 apparent power harmonics display screen

The information is:

This information concerns the harmonic under the cursor.
Vah 03: harmonic number.
%: ratio of the harmonic to the fundamental.
+000°: phase shift of the voltage harmonic with respect to the current harmonic for the order in question.
min – max: maximum and minimum levels of the harmonic in question (reset when the harmonic number is changed or the key is pressed).



Display in expert mode (three-phase connection only - See § 7.6) of the 3 phases (3L) or of L1, L2, or L3. To select the display, press the or .

The horizontal axis indicates the orders of the harmonics (odd marking). Display of the level of the harmonics as a percentage of the fundamental (order 1).
DC: DC component.
1 to 25: harmonics of order 1 to 25. When the cursor exceeds order 25, order 26 to 50 appears.
: Indicator of energy consumed for this harmonic.

Harmonic selection cursor. Use the or keys to move the cursor.

Figure 39: example of L1 apparent power of harmonics display (harmonic no. 3: VAh03)

Note: Filters L2 and L3 display the apparent power of the harmonics for phases 2 and 3, respectively. The screen is identical to the one displayed for filter L1.

7.5. PHASE-TO-PHASE VOLTAGE

The U sub-menu is available only for three-phase connections, when the voltage ratios of phases 1, 2, and 3 are equal. This sub-menu displays the harmonics of the phase-to-phase voltage.

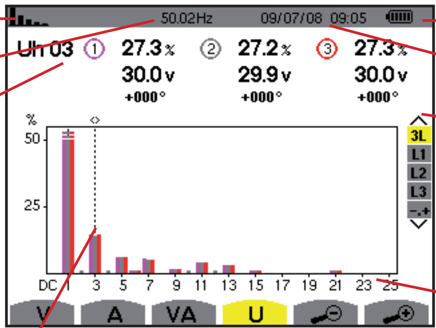
7.5.1. THE 3L PHASE-TO-PHASE VOLTAGE HARMONICS DISPLAY SCREEN

The following information is displayed:

Reminder of the mode used.

Instantaneous frequency.

This information concerns the harmonic under the cursor.
Uh 03: harmonic number.
%: ratio of the harmonic to the fundamental.
V: RMS voltage of the harmonic in question.
+000°: phase shift with respect to the fundamental (order 1).



Battery charge level.

Current date and time.

Display in expert mode (three-phase connection only - See § 7.6) of the 3 phases (3L) or of L1, L2, or L3. To select the display, press the or .

The horizontal axis indicates the orders of the harmonics (odd marking). Display of the level of the harmonics as a percentage of the fundamental (order 1).
DC: DC component.
1 to 25: harmonics of order 1 to 25. When the cursor exceeds order 25, order 26 to 50 appears.

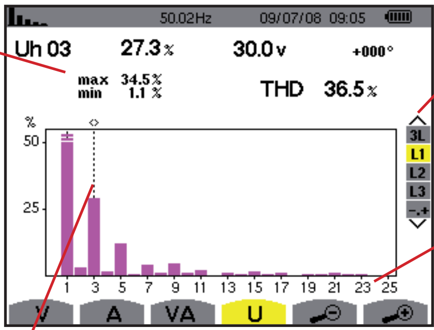
Harmonic selection cursor. Use the or keys to move the cursor.

Figure 40: example of 3L phase-to-phase voltage harmonics display (harmonic no. 03: Uh03)

7.5.2. THE L1 PHASE-TO-PHASE VOLTAGE HARMONICS DISPLAY SCREEN

The following information is displayed:

This information concerns the harmonic under the cursor.
Uh 03: harmonic number.
%: ratio of the harmonic to the fundamental.
V: RMS voltage of the harmonic in question.
+000°: phase shift with respect to the fundamental (order 1).
max – min: maximum and minimum levels of the harmonic in question (reset when the harmonic number is changed or the key is pressed).
THD: total harmonic distortion.



Display in expert mode (three-phase connection only - See § 7.6) of the 3 phases (3L) or of L1, L2, or L3. To select the display, press the or .

The horizontal axis indicates the orders of the harmonics (odd marking). Display of the level of the harmonics as a percentage of the fundamental (order 1).
DC: DC component.
1 to 25: harmonics of order 1 to 25. When the cursor exceeds order 25, order 26 to 50 appears.

Harmonic selection cursor. Use the or keys to move the cursor.

Figure 41: example of L1 phase-to-phase voltage harmonics display (harmonic no. 03: Uh03)

Note: Filters L2 and L3 display the phase-to-phase voltage harmonics for phases 2 and 3, respectively. The screen is identical to the one displayed for filter L1.

7.6. EXPERT MODE

The -.+ mode is available with a three-phase connection only, when the ratios of the three phases are equal. It is used to display the influence of the harmonics on the heating of the neutral and on rotating machines. To display expert mode press the or keys of the keypad. The selection is highlighted in yellow and the screen simultaneously displays the expert mode.

From this screen, two sub-menus, V and A, are available (see next page).

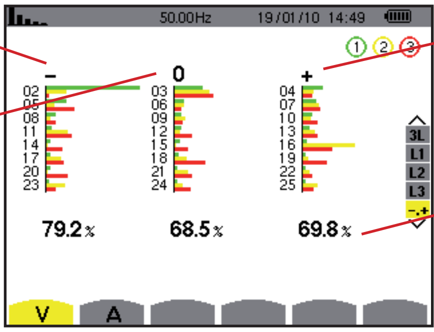
7.6.1. THE PHASE-TO-NEUTRAL VOLTAGE EXPERT MODE DISPLAY SCREEN

The V sub-menu displays the influence of the harmonics of the phase-to-neutral voltage on the heating of the neutral and on rotating machines.

The following information is displayed:

Harmonics inducing a negative sequence.

Harmonics inducing a zero sequence.



Harmonics inducing a positive sequence.

%: ratio of the harmonic to the fundamental.

Figure 42: the phase-to-neutral voltage expert mode screen

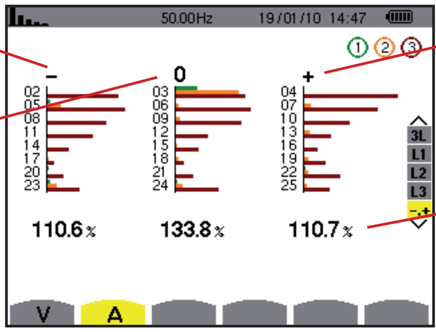
7.6.2. THE CURRENT EXPERT MODE DISPLAY SCREEN

The A sub-menu displays the influence of the harmonics of the current on the heating of the neutral and on rotating machines.

The following information is displayed:

Harmonics inducing a negative sequence.

Harmonics inducing a zero sequence.



Harmonics inducing a positive sequence.

%: ratio of the harmonic to the fundamental.

Figure 43: the current expert mode screen

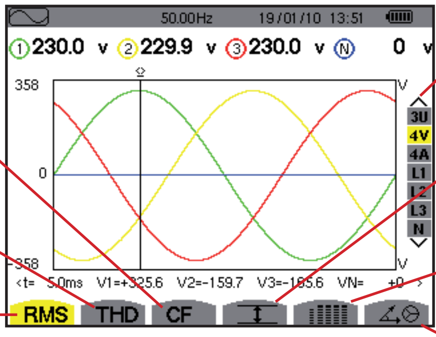
8. WAVEFORM KEY

The key is used to display the current and voltage curves, along with the values measured and those calculated from the voltages and currents (except for power, energy, and harmonics).

8.1. AVAILABLE SUB-MENUS

The sub-menus are listed on the screen below and described individually in the paragraphs that follow.

The type of measurement is selected using the yellow keys of the keypad below the screen.



Measurement of the peak factor (see § 8.4).

Measurement of total harmonic distortion (see § 8.3).

Measurement of the true RMS value (see § 8.2).

Selection of the display filters. Use the ▲ or ▼ key to select the display.

Display of the maximum and minimum RMS values and of the peak values (see § 8.5).

Simultaneous display of the following measurements: RMS, DC, THD, DF, CF, PST and KF (see § 8.6).

Display of the Fresnel diagram of the signals (see § 8.7).

Figure 44: Waveform mode screen

8.2. MEASUREMENT OF TRUE RMS VALUE

The RMS sub-menu displays the waveforms over one period of the signals measured and the true RMS voltage and current.

The choice of curves to be displayed depends on the type of connection (see § 5.6):

- Single-phase: no choice (L1)
- Split-phase: 2V, 2A, L1, L2
- Three-phase, 3- or 4-wire: 3U, 3V, 3A, L1, L2, L3
- Three-phase, 5-wire:
  - For THD, CF and Fresnel diagram key: 3U, 3V, 3A, L1, L2 and L3
  - For RMS, min/max key and simultaneous display key: 3U, 4V, 4A, L1, L2, L3 and N

The screen snapshots shown as examples are those obtained with a three-phase 5-wire connection.

8.2.1. THE 3U RMS DISPLAY SCREEN

This screen displays the three phase-to-neutral voltages of a three-phase system when the voltage ratios of phases 1, 2, and 3 are equal.

The following information is displayed:

Reminder of the mode used.

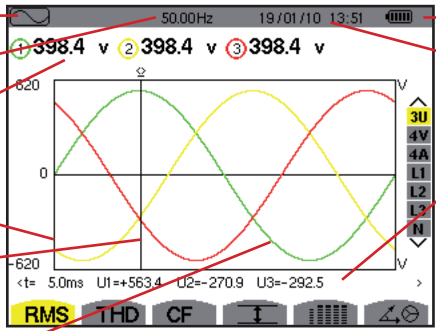
Instantaneous network frequency.

RMS phase-to-phase voltages.

Voltage axis with automatic scaling.

Instantaneous value cursor. Use the ▷ or ◁ keys to move the cursor.

Display of the phase-to-phase voltage waveforms.



Battery charge level.

Current date and time.

Instantaneous value of the signals at the intersection of the cursor and the curves.

t: time relative to the start of the period (in milliseconds).

U1: instantaneous phase-to-phase voltage between phases 1 and 2 (U_{12}).

U2: instantaneous phase-to-phase voltage between phases 2 and 3 (U_{23}).

U3: instantaneous phase-to-phase voltage between phases 3 and 1 (U_{31}).

Figure 45: the 3U RMS display screen

8.2.2. THE 4V RMS DISPLAY SCREEN

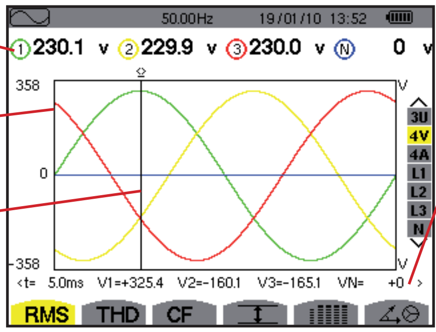
This screen displays the three phase-to-neutral voltages and the neutral-to-earth voltage of a three-phase system.

The following information is displayed:

RMS phase-to-neutral voltages.

Voltage axis with automatic scaling.

Instantaneous value cursor. Use the ▷ or ◁ keys to move the cursor.



Instantaneous values of the signals at the intersection of the cursor and of the curves.

t: time relative to the start of the period (in milliseconds).

V1: instantaneous phase-to-neutral voltage of curve 1.

V2: instantaneous phase-to-neutral voltage of curve 2.

V3: instantaneous phase-to-neutral voltage of curve 3.

VN: instantaneous neutral voltage.

Figure 46: the 4V RMS display screen

8.2.3. THE 4A RMS DISPLAY SCREEN

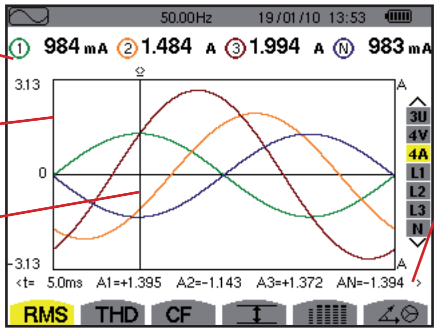
This screen displays the three phase currents and the neutral current of a three-phase system.

The following information is displayed:

RMS currents.

Current axis with automatic scaling.

Instantaneous value cursor. Use the ▷ or ◁ keys to move the cursor.



Instantaneous values of the signals at the intersection of the cursor and of the curves.
t: time relative to the start of the period (in milliseconds).
A1: instantaneous current of phase 1.
A2: instantaneous current of phase 2.
A3: instantaneous current of phase 3.
AN: instantaneous neutral voltage.

Figure 47: the 4A RMS display screen

8.2.4. THE RMS DISPLAY SCREEN FOR THE NEUTRAL

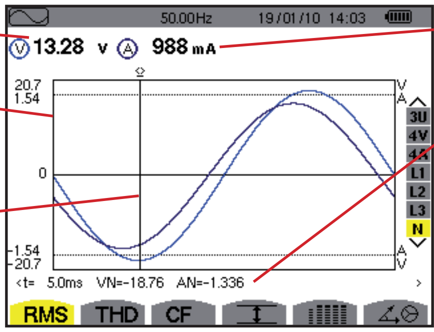
This screen displays the neutral voltage with respect to earth and the neutral current.

The following information is displayed:

RMS voltage.

Current and voltage axis with automatic scaling.

Instantaneous value cursor. Use the ▷ or ◁ keys to move the cursor.



RMS current.

Instantaneous values of the signals at the intersection of the cursor and of the curves.
t: time relative to the start of the period (in milliseconds).
VN: instantaneous neutral voltage.
AN: instantaneous neutral current.

Figure 48: the RMS display screen for the neutral

Note: Filters L1, L2, and L3 display the current and voltage in phases 1, 2, and 3, respectively. The screen is identical to the one displayed for the neutral.

8.3. MEASUREMENT OF TOTAL HARMONIC DISTORTION

The THD sub-menu displays the waveforms of the signals measured over one full cycle and the total voltage and current harmonic distortion.

8.3.1. THE 3U THD DISPLAY SCREEN

This screen displays the phase-to-phase voltage waveforms for one period and the total harmonic distortion values.

The following information is displayed:

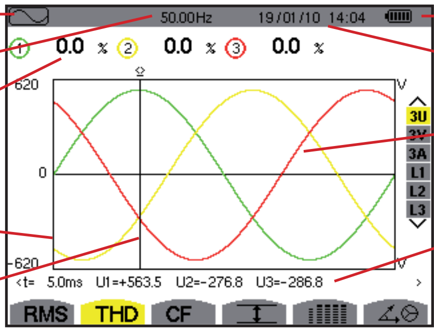
Reminder of the mode used.

Instantaneous frequency of network.

Harmonic distortion for each curve.

Voltage axis with automatic scaling.

Instantaneous value cursor. Use the ▷ or ◁ keys to move the cursor.



Battery charge level.

Current date and time.

Display of the phase-to-phase voltage waveforms.

Instantaneous values of the signals at the intersection of the cursor and of the curves.

t: time relative to the start of the period (in milliseconds).

U1: instantaneous phase-to-phase voltage between phases 1 and 2 (U_{12}).

U2: instantaneous phase-to-phase voltage between phases 2 and 3 (U_{23}).

U3: instantaneous phase-to-phase voltage between phases 3 and 1 (U_{31}).

Figure 49: the 3U THD display screen en 3U

8.3.2. THE 3V THD DISPLAY SCREEN

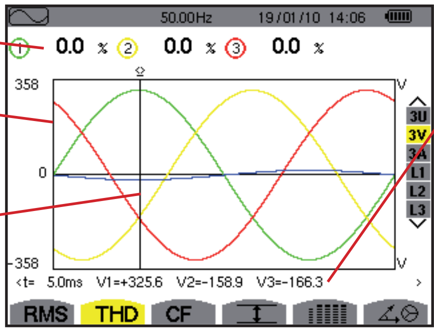
This screen displays the phase-to-neutral voltage waveforms for one period and the total harmonic distortion values.

The following information is displayed:

Harmonic distortion for each curve.

Voltage axis with automatic scaling.

Instantaneous value cursor. Use the ▷ or ◁ keys to move the cursor.



Instantaneous values of the signals at the intersection of the cursor and of the curves.

t: time relative to the start of the period (in milliseconds).

V1: instantaneous phase-to-neutral voltage of phase 1.

V2: instantaneous phase-to-neutral voltage of curve 2.

V3: instantaneous phase-to-neutral voltage of curve 3.

Figure 50: the 3V THD display screen

8.3.3. THE 3A THD DISPLAY SCREEN

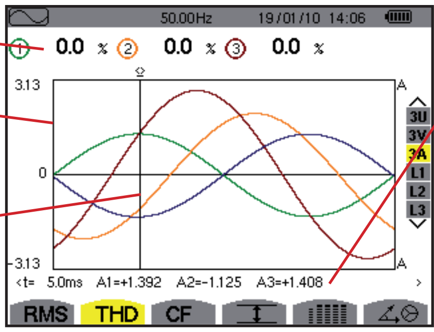
This screen displays the phase current waveforms for one period and the total harmonic distortion values.

The following information is displayed:

Harmonic distortion for each curve.

Current axis with automatic scaling.

Instantaneous value cursor. Use the ▷ or ◁ keys to move the cursor.



Instantaneous values of the signals at the intersection of the cursor and of the curves.

t: time relative to the start of the period (in milliseconds).

A1: instantaneous current of phase 1.

A2: instantaneous current of phase 2.

A3: instantaneous current of phase 3.

Figure 51: the 3A THD display screen

Note: Filters L1, L2, and L3 display the total current and voltage harmonic distortion for phases 1, 2, and 3, respectively.

8.4. MEASUREMENT OF THE PEAK FACTOR

The CF sub-menu displays the waveforms of the signals measured over one period and the voltage and current peak factors.

8.4.1. THE 3U CF DISPLAY SCREEN

This screen displays the phase-to-phase voltage waveforms of one period and the peak factors.

The following information is displayed:

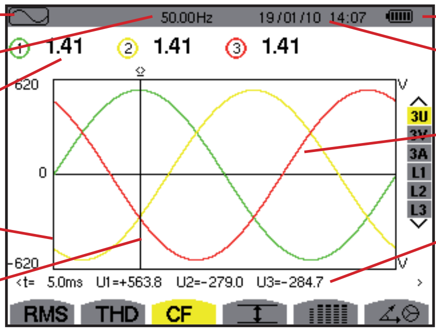
Reminder of the mode used.

Instantaneous frequency of network.

Peak factor for each curve.

Voltage axis with automatic scaling.

Instantaneous value cursor. Use the ▷ or ◁ keys to move the cursor.



Battery charge level.

Current date and time.

Display of the phase-to-phase voltage waveforms.

Instantaneous values of the signals at the intersection of the cursor and of the curves.
t: time relative to the start of the period (in milliseconds).
U1: voltage peak factor between phases 1 and 2 (U_{12}).
U2: voltage peak factor between phases 2 and 3 (U_{23}).
U3: voltage peak factor between phases 3 and 1 (U_{31}).

Figure 52: the 3U CF display screen

8.4.2. THE 3V CF DISPLAY SCREEN

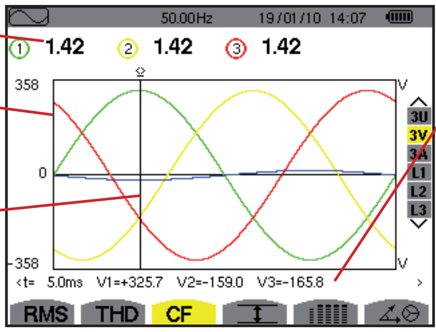
This screen displays the phase-to-neutral voltage waveforms of one period and the peak factors.

The following information is displayed:

Peak factor for each curve.

Voltage axis with automatic scaling.

Instantaneous value cursor. Use the ▷ or ◁ keys to move the cursor.



Instantaneous values of the signals at the intersection of the cursor and of the curves.
t: time relative to the start of the period (in milliseconds).
V1: instantaneous phase-to-neutral voltage of phase 1.
V2: instantaneous phase-to-neutral voltage of phase 2.
V3: instantaneous phase-to-neutral voltage of phase 3.

Figure 53: the 3V CF display screen

8.4.3. THE 3A CF DISPLAY SCREEN

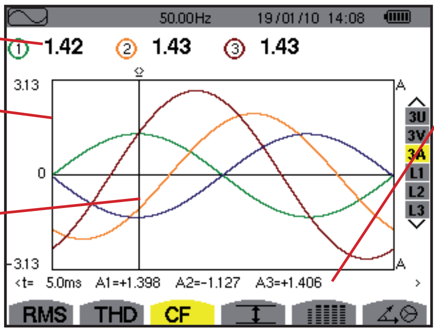
This screen displays the current waveforms of one period and the peak factors.

The following information is displayed:

Peak factor for each curve.

Current axis with automatic scaling.

Instantaneous value cursor. Use the or keys to move the cursor.



Instantaneous values of the signals at the intersection of the cursor and of the curves.
t: time relative to the start of the period (in milliseconds).
A1: instantaneous current of phase 1.
A2: instantaneous current of phase 2.
A3: instantaneous current of phase 3.

Figure 54: the 3A CF display screen

Note: L1, L2, and L3 display the current and voltage peak factors for phases 1, 2, and 3, respectively.

8.5. MEASUREMENT OF EXTREME AND MEAN VOLTAGE AND CURRENT

The sub-menu displays the one-second mean and half-cycle maximum and minimum RMS voltage and current and the instantaneous positive and negative peak voltage and current.

8.5.1. THE 3U MAX.-MIN. DISPLAY SCREEN

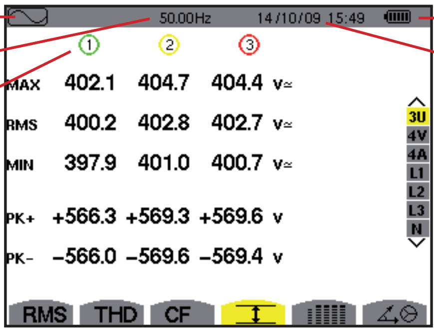
This screen displays the one-second mean and half-cycle maximum and minimum RMS values and the instantaneous positive and negative phase-to-phase voltage peaks.

The following information is displayed:

Reminder of the mode used.

Instantaneous frequency of network.

Columns of values for each curve (1, 2, and 3).



Battery charge level.

Current date and time.

MAX: maximum RMS phase-to-phase voltage since the switching on of the C.A 8335 or since the last time the key was pressed.
RMS: true RMS phase-to-phase voltage
MIN: minimum RMS phase-to-phase voltage since the switching on of the C.A 8335 or since the last time the key was pressed.
PK+: maximum (positive) peak phase-to-phase voltage since the switching on of the C.A 8335 or since the last time the key was pressed.
PK-: minimum (negative) peak phase-to-phase voltage since the switching on of the C.A 8335 or since the last time the key was pressed.

Figure 55: the 3U Max.-Min. display screen

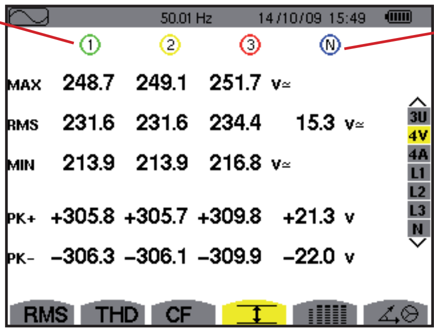
Note: The MAX. and MIN. RMS measurements are calculated every half cycle (i.e. every 10 ms for a 50-Hz signal). The measurements are refreshed every 250 ms.

8.5.2. THE 4V MAX.-MIN. DISPLAY SCREEN

This screen displays the one-second mean and half-cycle maximum and minimum RMS values and the instantaneous positive and negative peaks of the phase-to-neutral voltages and of the neutral.

The following information is displayed:

Columns of values for each voltage curve (1, 2 and 3).
MAX: maximum RMS phase-to-neutral voltage since the switching on of the C.A 8335 or since the last time the key was pressed.
RMS: true RMS phase-to-neutral voltage.
MIN: minimum RMS phase-to-neutral voltage since the switching on of the C.A 8335 or since the last time the key was pressed.



Column of values for the neutral: RMS, PEAK+ and PEAK- parameters.

PK+: maximum peak phase-to-neutral voltage since the switching on of the C.A 8335 or since the last time the key was pressed.
PK-: minimum peak phase-to-neutral voltage since the switching on of the C.A 8335 or since the last time the key was pressed.

Figure 56: the 4V Max.-Min. display screen

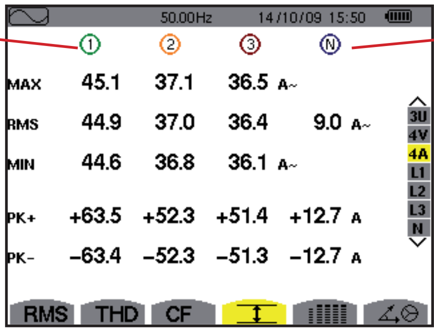
Note: The Max. and Min. RMS measurements are calculated every half cycle (i.e. every 10 ms for a signal at 50 Hz). The measurements are refreshed every 250 ms.

8.5.3. THE 4A MAX.-MIN. DISPLAY SCREEN

This screen displays the one-second mean and half-cycle maximum and minimum RMS values and the positive and negative instantaneous peak values of the phase and neutral currents.

The following information is displayed:

Columns of values for each current curve (1, 2 and 3).
MAX: maximum RMS current since the switching on of the C.A 8335 or since the last time the key was pressed.
RMS: true RMS current.
MIN: minimum RMS current since the switching on of the C.A 8335 or since the last time the key was pressed.



Column of values relative to the neutral: RMS, PK+ and PK- parameters.

PK+: maximum peak current since the switching on of the C.A 8335 or since the last time the key was pressed.
PK-: minimum peak current since the switching on of the C.A 8335 or since the last time the key was pressed.

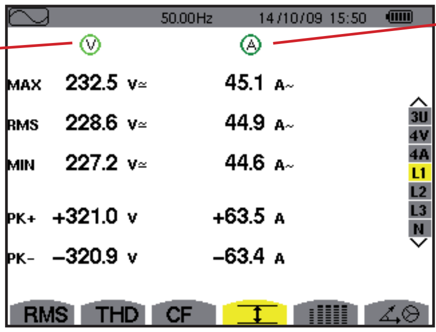
Figure 57: the 4A Max.-Min. display screen

Note: The Max. and Min. RMS measurements are calculated every half cycle (i.e. every 10 ms for a signal at 50 Hz). The measurements are refreshed every 250 ms.

8.5.4. THE L1 MAX.-MIN. DISPLAY SCREEN

This screen displays the one-second mean and half-cycle maximum and minimum RMS values and the instantaneous positive and negative peaks of the phase-to-neutral voltage and of the current of phase 1.

The following information is displayed:



Column of voltage values.

MAX: maximum RMS phase-to-neutral voltage since the switching on of the C.A 8335 or since the last time the key was pressed.

RMS: true RMS phase-to-neutral voltage.

MIN: minimum RMS phase-to-neutral voltage since the switching on of the C.A 8335 or since the last time the key was pressed.

PK+: phase-to-neutral maximum peak voltage since the switching on of the C.A 8335 or since the last time the key was pressed.

PK-: phase-to-neutral minimum peak voltage since the switching on of the C.A 8335 or since the last time the key was pressed.

The same information as for the phase-to-neutral voltage, but for the current.

Figure 58: the L1 Max.-Min. display screen

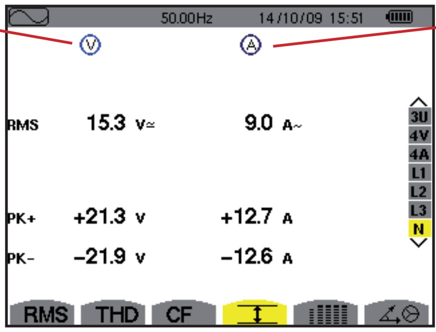
Note: The Max. and Min. RMS measurements are calculated every half cycle (i.e. every 10 ms for a signal at 50 Hz). The measurements are refreshed every 250 ms.

L2 and L3 display the RMS, maximum, minimum, and mean values and the positive and negative peak instantaneous values of the phase-to-neutral voltage and of the current for phases 2 and 3, respectively.

8.5.5. THE NEUTRAL MAX.-MIN. DISPLAY SCREEN

This screen displays the RMS values and the positive and negative instantaneous peaks of the neutral relative to earth.

The following information is displayed:



Column of voltage values.

RMS: true RMS voltage.

PK+: maximum peak voltage since the switching on of the C.A 8335 or since the last time the key was pressed.

PK-: minimum peak voltage since the switching on of the C.A 8335 or since the last time the key was pressed.

The same information as for the voltage, but for the current.

Figure 59: the neutral Max.-Min. display screen

8.6. SIMULTANEOUS DISPLAY

The sub-menu displays all of the voltage and current measurements (RMS, DC, THD, DF, CF, PST and KF).

8.6.1. 3U SIMULTANEOUS DISPLAY SCREEN

This screen displays the RMS, DC, THD, DF, and CF values of the phase-to-phase voltages.

The following information is displayed:

Reminder of the mode used.

Instantaneous frequency of network.

Column of phase-to-phase voltages (phases 1, 2, and 3).
RMS: true RMS value calculated over 1 second.
DC: DC component.
THD: total harmonic distortion.
DF: distortion factor.
CF: peak factor calculated over 1 second.

Battery charge level.

Current date and time.

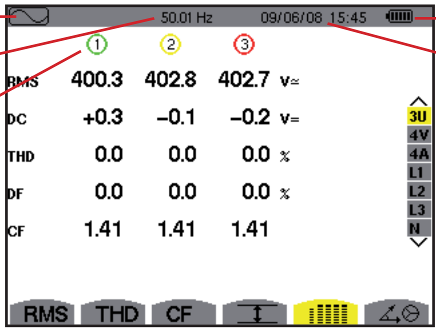


Figure 60: 3U Simultaneous display screen

8.6.2. 4V SIMULTANEOUS DISPLAY SCREEN

This screen displays the RMS, DC, THD, DF, CF and PST values of the phase-to-neutral voltages and of the neutral.

The following information is displayed:

Column of phase-to-neutral voltages (phases 1, 2, and 3).
RMS: true RMS value calculated over 1 second.
DC: DC component.
THD: total harmonic distortion.
DF: distortion factor.
CF: peak factor calculated over 1 second.
PST: short-term flicker calculated over 10 minutes.

Column of RMS and DC values for the neutral.

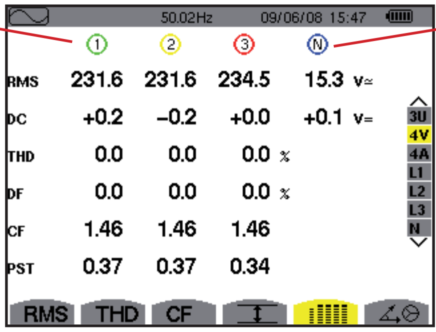


Figure 61: 4V simultaneous display screen

8.6.3. 4A SIMULTANEOUS DISPLAY SCREEN

This screen displays the RMS, DC, THD, DF, CF, and KF values of the phase and neutral currents.

The following information is displayed:

Column of current values (phases 1, 2 and 3).
RMS: true effective value calculated over 1 second.
DC: direct component.
THD: total harmonic distortion.
DF: distortion factor.
CF: peak factor calculated over 1 second.
KF: K factor. For oversizing of transformers to allow for harmonics.

Column of RMS values and (if the current sensor allows) DC values of the neutral.

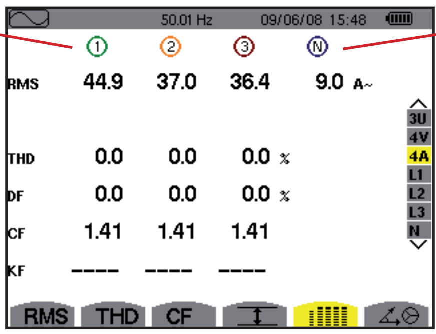
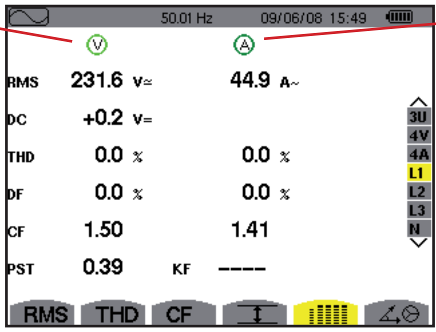


Figure 62: 4A Simultaneous display screen

8.6.4. L1 SIMULTANEOUS DISPLAY SCREEN

This screen displays the RMS, THD, DF, and CF values of the phase-to-neutral voltage and of the current, the DC and PST parameters of the phase-to-neutral voltage, and the DC value (if the current sensor allows) and KF of the current for phase 1. The following information is displayed:

Phase-to-neutral voltages column.
RMS: true effective value calculated over 1 second.
DC: direct component.
THD: total harmonic distortion.
DF: distortion factor.
CF: peak factor calculated over 1 second.
PST: short-term flicker calculated over 10 minutes.



Current column.
RMS, THD, DF, CF, and (if the current sensor allows) DC values.
KF: K factor. For oversizing of transformers to allow for harmonics.

Figure 63: L1 Simultaneous Display screen

Note: L2 and L3 provide the simultaneous display of the current and voltage for phases 2 and 3, respectively.

8.6.5. SCREEN FOR SIMULTANEOUS DISPLAY OF NEUTRAL

This screen displays the RMS voltage and current of the neutral, the DC component of the neutral voltage, and (if the current sensor allows) the DC component of the neutral current.

8.7. DISPLAY OF FRESNEL DIAGRAM

The sub-menu displays a vector representation of the fundamentals of the voltages and currents. It indicates their associated quantities (modulus and phase of the vectors) and the unbalances of the voltages and currents.

Note: To allow the display of all vectors, those of which the modulus is too small to be pictured are shown even so, but their identification label is marked with an asterisk (*).

8.7.1. THE 3V FRESNEL DIAGRAM DISPLAY SCREEN

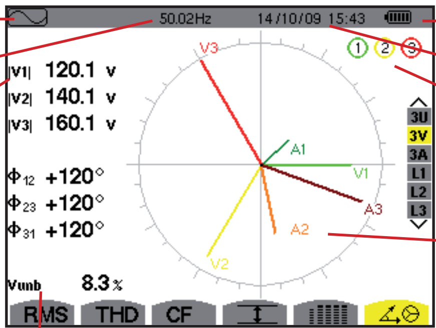
This screen displays a vector representation of the fundamentals of the phase-to-neutral voltages and of the currents. It indicates their associated quantities (modulus and phase of the phase-to-neutral voltage vectors) and the voltage unbalance. The reference vector of the representation (at 3 o'clock) is V1.

The following information is displayed:

Reminder of the mode used.

Instantaneous frequency of network.

Column of values for each vector (1, 2, and 3).
|V1|, |V2| and |V3|: moduli of the vectors of the fundamentals of the phase-to-neutral voltages (phases 1, 2 and 3).
Φ_{12}: phase angle of the fundamental of phase 1 with respect to the fundamental of phase 2.
Φ_{23}: phase angle of the fundamental of phase 2 with respect to the fundamental of phase 3.
Φ_{31}: phase angle of the fundamental of phase 3 with respect to the fundamental of phase 1.



Battery charge level.

Current date and time.

Discs indicating potential saturation of the channel.

Fresnel diagram.

Vunb: voltage unbalance.

Figure 64: the screen Displaying the Fresnel diagram in 3V

8.7.2. THE 3U FRESNEL DIAGRAM DISPLAY SCREEN

This screen displays a vector representation of the fundamentals of the phase-to-phase voltages and of the currents. It indicates their associated quantities (modulus and phase of the phase-to-phase voltage vectors) and the voltage unbalance. The reference vector of the representation (at 3 o'clock) is U1.

The information displayed is identical to that described in § 8.7.1 but relative to the phase-to-phase voltage.

8.7.3. THE 3A FRESNEL DIAGRAM DISPLAY SCREEN

This screen displays a vector representation of the fundamentals of the phase-to-neutral voltages and of the currents. It indicates their associated quantities (modulus and phase of the current vectors) and the current unbalance. The reference vector of the representation (at 3 o'clock) is A1.

The displayed information is identical to that described in § 8.7.1 but relative to the current.

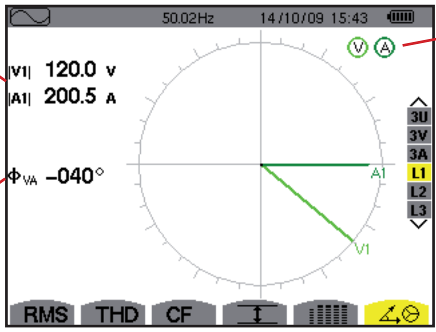
8.7.4. THE L1 FRESNEL DIAGRAM DISPLAY SCREEN

This screen displays a vector representation of the fundamentals of the phase-to-neutral voltages and the currents of one phase. It indicates their associated quantities (modulus and phase of the current and phase-to-neutral voltage vectors). The reference vector of the representation (at 3 o'clock) is the current vector.

The following information is displayed:

|V1|: modulus of the vector of the fundamental of the phase-to-neutral voltage of phase 1.
|A1|: modulus of the vector of the fundamental of the current of phase 1.

Φ_{VA}: phase angle of the fundamental of the phase-to-neutral voltage of phase 1 relative to the fundamental of the current of phase 1.



Discs indicating potential saturation of the channel.

Figure 65: the L1 Fresnel diagram display screen

Note: L2 and L3 display vector representations of the fundamentals of the phase-to-neutral voltages and the currents of phases 2 and 3, respectively. They indicate their associated quantities (modulus and phase of the current and phase-to-neutral voltage vectors of phases 2 and 3, respectively). The reference vector of the representation (at 3 o'clock) is the current vector (A2 and A3, respectively).

9. ALARM MODE KEY

The mode detects overshoots of thresholds (Vrms, Urms, Arms, PST, Vcf, Ucf, Acf, Vunb, Aunb, Hz, KF, Vthd, Uthd, Athd, |W|, |VAR|, VA, |cos Φ|, |PF|, |tan Φ| Vh, Uh, Ah, and |VAh|) programmed in the configuration mode.

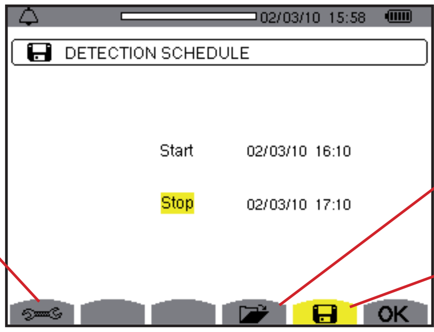
The values to be monitored:
- were defined by the *Configuration / Alarm mode* screen (see § 5.10).
- must be active (visible red mark) on that same screen.

Stored alarms can subsequently be transferred to a PC via the PAT application (see corresponding manual). You can capture over 10,000 alarms.

9.1. AVAILABLE SUBMENUS

The submenus are listed on the screen below and described individually in the paragraphs that follow.
The sub-menus are selected using the yellow keys on the keypad below the screen.

Access to Alarm mode configuration (see § 9.2).



Alarm log (see § 9.4).

Programming an alarm campaign (see § 9.3).

Figure 66: the Alarm Mode screen

The **OK** and icons have the following functions:
- **OK**: Validating the programming of a campaign and starting the alarm campaign (see § 9.3.2).
- : Voluntary stoppage of alarm campaign (see § 9.3.3).

9.2. ALARM MODE CONFIGURATION

The submenu displays the list of alarms configured (see § 5.10). This shortcut key lets you define or change alarm configurations.
The following information is displayed:

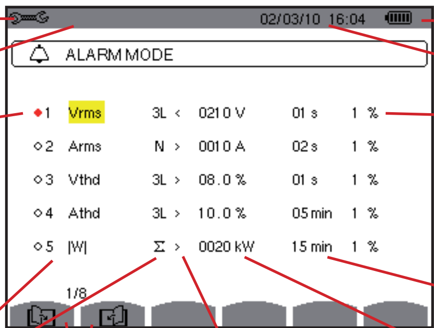
Reminder of the mode used.

Reminder of the submenu used.

Activation of alarm (red mark) or deactivation.
Type of alarm (Vrms, Urms, Arms, PST, Vcf, Ucf, Acf, Vunb, Aunb, Hz, KF, Vthd, Uthd, Athd, |W|, |VAR|, VA, |cos Φ|, |PF|, |tan Φ|, Vh, Uh, Ah and |VAh| - see § 3.9).

Order of harmonics (between 0 and 50, for Vh, Uh, Ah and |VAh|).

Alarm filter (3L: 3 phases monitored individually, or N: monitoring of neutral, or Σ: monitoring of the sum, or $\bar{x}$: monitoring of the arithmetic mean).



Icon for browsing in the 8 screen pages. Press the yellow keys corresponding to these icons to display the pages.

Alarm direction (> or < for Arms, Urms, Vrms, and Hz individually; otherwise only one direction).

Battery charge level.

Current date and time.

The hysteresis (difference, expressed as a percentage, between the alarm threshold and the value at which the alarm is cut off - 1, 2, 5, or 10%).

The minimum duration above or below the threshold required for alarm validation (in minutes or seconds or, in the case of Vrms, Urms, and Arms only, in hundredths of a second).

Alarm triggering threshold (it is possible to set the prefix of the unit for Vrms, Urms, Arms, |W|, |VAR|, and VA).

Figure 67: Alarm mode configuration screen

Reminder: Use the or keys to browse vertically in the fields. Use the or keys to browse horizontally in the fields.

Proceed as follows to configure an alarm:
- Select the field by pressing . The arrows appear.
- Enter values by pressing or , then validate via . The field is highlighted in yellow. Do the same for all values to be entered in the fields.
- Activate the configured alarm by placing the yellow cursor on the browsing column and pressing . Activation is indicated by the red mark. The alarm can be triggered.

Note: To deactivate the alarm, repeat the last step.

Press to return to the *Programming a campaign* screen.

9.3. PROGRAMMING AN ALARM CAMPAIGN

The submenu is used to specify the start and stop times for an alarm campaign.

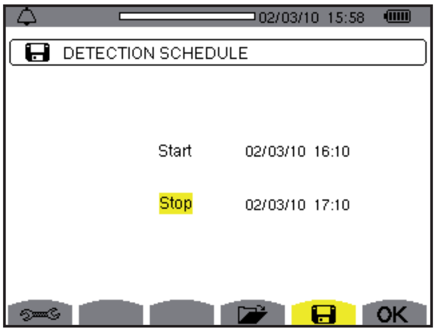


Figure 68: Example of an alarm campaign programming screen

9.3.1. STAGE 1: PROGRAMMING THE START/STOP TIMES

Proceed as follows:
- Select the ***Start*** field using the or key. The selected field is highlighted in yellow. Press to enter the values. The arrows appear in the start date and time campaign programming field.

  Press or to increment or decrement a value and or to move to the next item.

Note: The start date and time must be after the current date and time.

- Press to validate the programming of the ***Start*** date and time.
- Select the ***Stop*** field using the or key. The selected field is highlighted in yellow. Press to enter the values. The arrows appear in the Stop date and time campaign programming field.

  Press or to increment or decrement a value and or to move to the next item.

Note: The Stop date and time must be after the start date and time.

- Press to validate the programming of the Stop date and time.

9.3.2. STAGE 2: STARTING THE ALARM CAMPAIGN

Press the yellow key corresponding to the **OK** icon to start the alarm campaign between the start and stop times you specified.
- The **OK** icon disappears and the icon appears in its place.
- The *Campaign on standby* message is displayed while awaiting the start time and the icon blinks in the screen's top display bar.
- The *Campaign running* message is displayed when the Start time is reached.
- The *Campaign schedule* screen and **OK** icon (bottom right-hand corner of the screen) are displayed when the Stop time is reached. You can then program another campaign.

9.3.3. VOLUNTARY STOPPAGE OF ALARM CAMPAIGN

The alarm campaign can be voluntarily stopped before the Stop date and time by pressing the yellow key corresponding to the icon (bottom right-hand corner of the screen). The **OK** icon then reappears in its place.

Alarms in progress (not yet ended) are recorded in the log if their duration is equal to or greater than their programmed minimum duration.

9.4. VIEWING THE ALARM LOG

The submenu displays the alarm log. The log can contain up to 10,920 alarms. Press the yellow key corresponding to the icon to view this alarm log.

Note: the type of connection selected in the mode does not affect which alarm filters can be chosen and which parameters monitored. Users are responsible for these choices.

The following information is displayed:

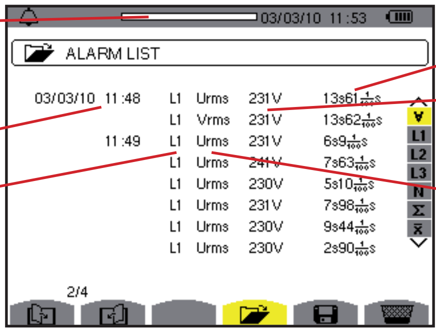


Figure 69: Alarm list screen

Reminder: Stored alarms can be transferred to a PC via the PAT application (see corresponding manual).

9.5. DELETING THE ALARM LOG

The submenu is used to delete the whole log. To do this, proceed as follows:

- Select the submenu by pressing the yellow key corresponding to the icon.
- Press to delete the whole alarm log. The log is empty.

Press to quit this submenu without deleting the stored data.

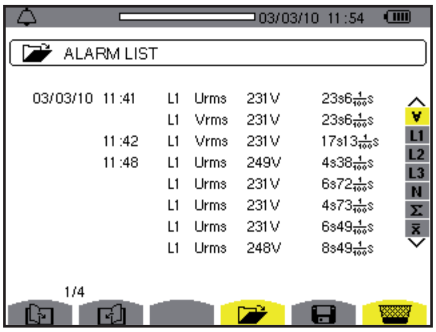


Figure 70: Alarm list screen in delete mode

10. TREND MODE KEY

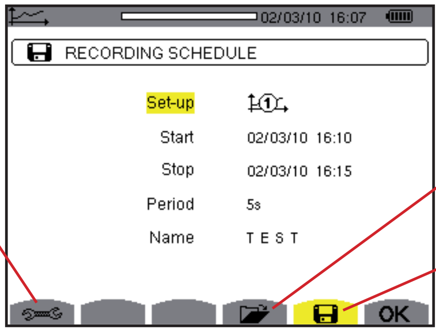
The mode records changes to parameters previously specified in the *Configuration / Trend mode* screen (see § 5.9).

10.1. AVAILABLE SUB-MENUS

The sub-menus are listed in the screen below and described individually in the paragraphs that follow.

The sub-menus are selected using the yellow keys on the keypad below the screen.

Access to *Trend mode* configuration (see § 10.3).



List of records (see § 10.4).

Programming a recording (see § 10.2).

Figure 71: Trend mode screen

The **OK** icon confirms the programming of a recording (see § 10.2).

10.2. PROGRAMMING AND STARTING RECORDING

The submenu specifies the characteristics of a new recording campaign.

Memory card usage.

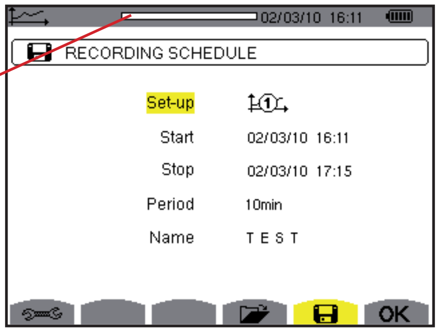


Figure 72: Example of Recording schedule screen (configuration 1)

10.2.1. STAGE 1: PROGRAMMING OF CHARACTERISTICS

Proceed as follows:

- Select the ***Configuration*** field using the or keys. The selected field is highlighted in yellow. Press to enter the type of configuration. The arrows appear.
- Select the configuration to be used by browsing using the or keys. Press to validate.

Reminder: Configurations to were defined in the *Configuration / Trend mode* screen (see § 5.9). The configuration procedure is also described in § 10.3.

- Select the ***Start*** field using the or keys. The selected field is highlighted in yellow. Press to enter the values. The arrows appear in the recording start date and time programming field.

  Press or to increment or decrement a value and or to move to the next item.

Note: The start date and time must be later than the current date and time and must be a multiple of the recording period (if not, then at the time of validation – OK – the device automatically proposes an acceptable start date and time).

- Press to validate the programming of the ***Start*** date and time.

- Select the ***Stop*** field using the or keys. The selected field is highlighted in yellow. Press to enter the values. The arrows appear in the recording stop date and time programming field.

  Press or to increment or decrement a value and or to move to the next item.

Note: The stop date and time must be later than the start date and time and must be a multiple of the recording period (if not, then at the time of validation – ***OK*** – the device automatically proposes an acceptable stop date and time).

- Press to validate the programming of the Stop date and time.
- Select the ***Period*** field using the or keys and press to enter the value. The arrows appear.
  Press or to increment or decrement the possible values (1 s, 5 s, 20 s, 1 min, 2 min, 5 min, 10 min, or 15 min). Press to validate.

Note: The recording integration period is the time over which the measurements of each recorded value are averaged (arithmetic mean).

Note: if there is too little memory left for the selected set-ups, the device will so indicate.

- Press again to highlight the Name box in yellow and press to enter edit mode. Enter the name of the recording (not more than 8 characters). Several recordings may have the same name.
  The available alphanumeric characters are the uppercase letters from A to Z and the digits from 0 to 9. Use the or keys to display a character and or to move to the adjacent character.
- Press to validate the name.

10.2.2. STAGE 2: STARTING A PROGRAMMED RECORDING

- Press the yellow key corresponding to the **OK** icon (bottom right-hand corner of the screen) to begin recording between your specified start and stop times.
- The **OK** icon disappears and the icon appears in its place.
- The *Recording on standby* message is displayed while awaiting the start time and the icon blinks in the screen's top display bar.
- The *Recording running* message is displayed when the start time is reached.

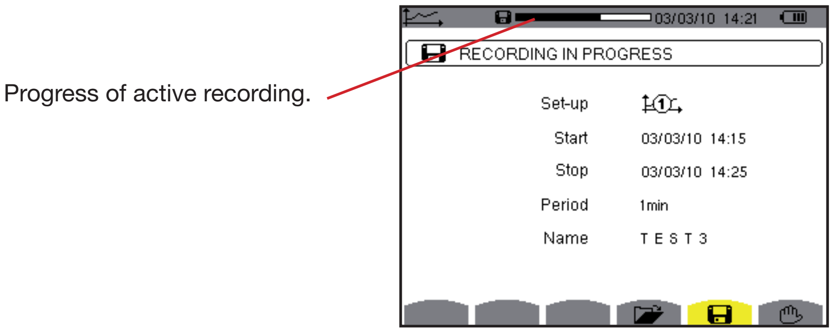


Figure 73: Display screen while recording is in progress

- The *Recording schedule* screen and **OK** icon (bottom right-hand corner of the screen) reappear when the stop time is reached. You can then program another recording.

10.2.3. VOLUNTARY STOPPAGE OF RECORDING IN PROGRESS

Recording can be voluntarily stopped before the stop date and time by pressing the yellow key corresponding to the icon (bottom right-hand corner of the screen). The **OK** icon then reappears in its place.

10.3. TREND MODE CONFIGURATION

The submenu displays the list of trend recording configurations (see § 5.9). This shortcut key lets you specify or modify the trend recording configurations.

The following information is displayed:

Reminder of the mode used.

Rappel du sous-menu utilisé.

VAh, Ah, Vh, and Uh harmonics recording configuration.

List of parameters to be recorded (Urms, Vrms, W, PF, etc.).

Battery charge level.

Current date and time.

Type of configuration icons (1 to 4). Press the yellow keys corresponding to these icons to display the screen pages.

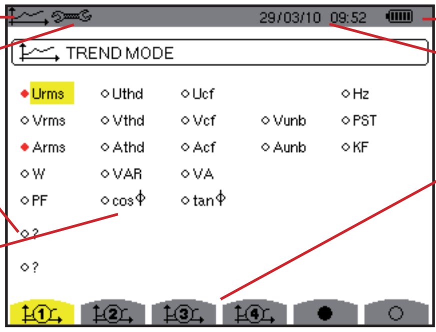


Figure 74: Trend mode configuration screen

Proceed as follows to configure a recording:
Example for configuration 1:

- Press the yellow key corresponding to the 1 icon. It is displayed on a yellow ground.
- Select values by moving the yellow cursor using the ▲ or ▼ and ▶ or ◀ keys, then press ↵ to validate. The red mark indicates validation.

Reminder: You can record the following values:

Unit	Designation
Urms	RMS phase-to-phase voltage.
Vrms	RMS phase-to-neutral voltage.
Arms	RMS current.
Uthd	Total harmonic distortion of the phase-to-phase voltage (THD-F).
Vthd	Total harmonic distortion of the phase-to-neutral voltage (THD-F).
Athd	Total harmonic distortion of the current (THD-F).
Ucf	Crest (peak) factor of phase-to-phase voltage.
Vcf	Crest factor of phase-to-neutral voltage.
Acf	Crest factor of current.
W	Active power.
VAR	Reactive power.
VA	Apparent power.
PF	Power factor.
cos Φ	Cosine of the phase shift of the voltage with respect to the current (displacement factor – DPF).
tan Φ	Tangent of the phase shift of the voltage with respect to the current.
Vunb	Phase-to-neutral voltage unbalance.
Aunb	Current unbalance.
Hz	Network frequency.
PST	Short-term flicker.
KF	K factor.
?	See comment below.

Features specific to the last two lines
These are recalled below:

o ?
o ?

Figure 75: These two lines involve harmonics

These two lines involve the recording of VAh, Ah, Vh and Uh variable harmonics. You can select the ranks of harmonics to be recorded (between 0 and 50) for each of these harmonics and odd only harmonics within this range. Proceed as follows:

- **To enter the value to be recorded:** with line **o ?** highlighted in yellow, press . The arrows appear. Select the value (VAh, Ah, Vh, and Uh) for which harmonics are to be recorded by pressing or . The red mark identifies your selection. Confirm by pressing . The values field is highlighted in yellow.

  Press to go to the next field.

- **To select the starting harmonic order:** with the field highlighted in yellow, press . The arrows appear. Select the order from which the harmonics are to be recorded by pressing or , then validate by pressing .

  Press to go to the next field.

- **To select the last harmonic:** with the second field (greater than or equal to the starting harmonic order) highlighted in yellow, press . Select the highest harmonic order to be recorded by pressing or , then validate by pressing .

  Press to go to the next field.

- **For the odd harmonics only:**
  To select or deselect this function, press . The red mark identifies your selection:
  - *selected*, only odd harmonics between the two orders of harmonics specified in the previous points are recorded.
  - *not selected*, all harmonics (even and odd) between the two orders of harmonics specified in the previous points are recorded.

10.4. VIEWING THE RECORDING LIST

The submenu displays recordings already made. Press the yellow key corresponding to the icon to see the list.

The following data is displayed:

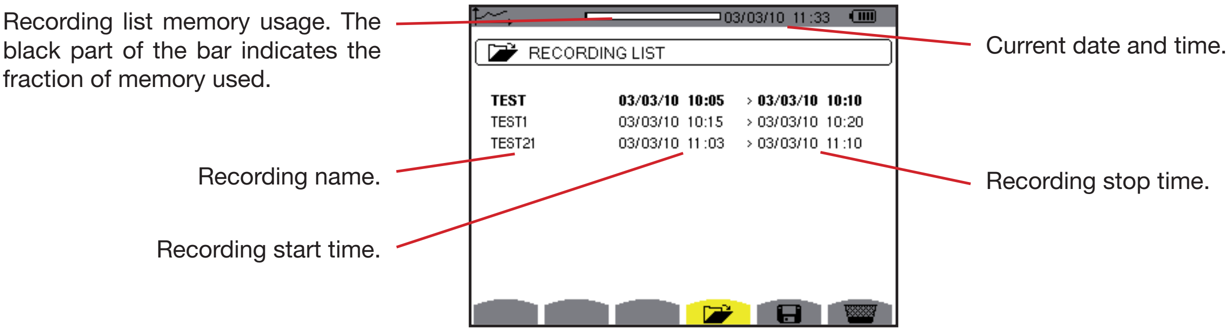


Figure 76: Recording list display screen

10.5. DELETING RECORDINGS

The submenu is used to delete recordings. Proceed as follows:

- Select the submenu by pressing the yellow key corresponding to the icon.
- Select the recording to be deleted using the or keys. The selected field is bolded.
- Press to validate the deletion.

Press to quit this submenu without deleting the stored data.

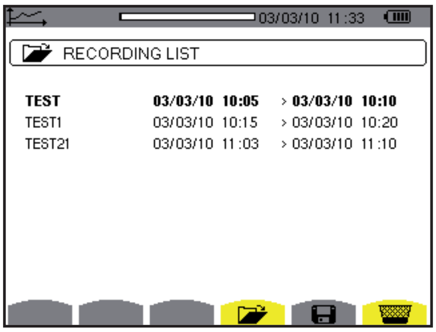


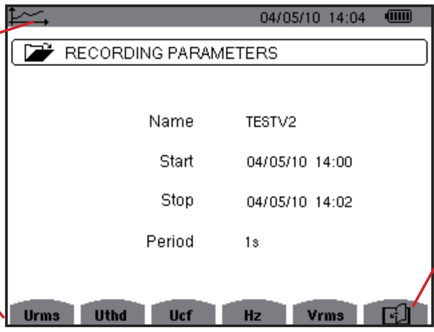
Figure 77: Recording list screen in delete mode.

10.6. VIEWING THE RECORDS

10.6.1. CHARACTERISTICS OF THE RECORD

Reminder of the mode used.

Types of measurement chosen in the configuration used.



The icon is used to navigate in the following screen pages. It is also possible to use the and keys.

Figure 99: characteristics of the record sub-menu

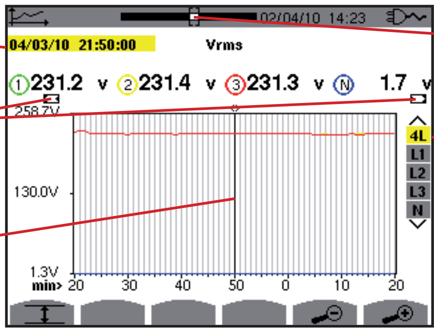
If the measurements concerning the current (Arms, Athd, Acf, W, VAR, VA, PF, cos Φ, tan Φ, Aunb, Ah and VAh) do not appear in the types of measurement, it means that no current sensor has been connected.

10.6.2. TREND CURVES

Date of the cursor.

This screen is a partial view of the trend curve. There are other screens before and after the visible part.

To move the cursor, use the or key.



Position of the viewing window in the record.

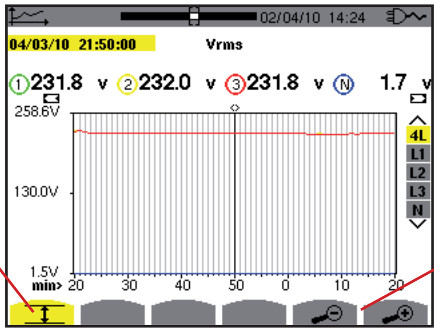
To select the display filter, press the or key.

Figure 100: Vrms (4L) without MIN-AVG-MAX

The display period of this curve is one minute. Since the period of the record is one second, each point of this curve corresponds to a value recorded in a one-second window once a minute. There is therefore a substantial loss of information (59 values out of 60), but the display is rapid.

Remark: Values of the cursor in red indicate saturated values.
Dashes - - - - indicate errors or missing values in the record.

The MIN-AVG-MAX mode has been activated.



To change the scale of the display between 1 minute and 5 days.

Figure 101: Vrms (4L) with MIN-AVG-MAX

The display period of this curve is one minute. But with the MIN-AVG-MAX mode activated, each point of this curve represents the arithmetic mean of 60 values recorded every second. This display is therefore more precise, because there is no loss of information, but slower (see the table on page 67).

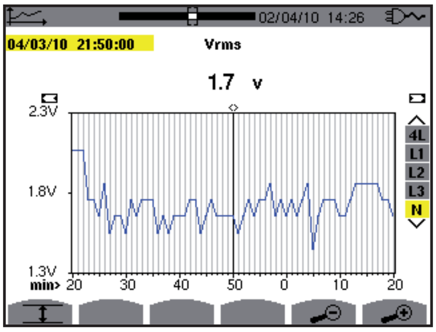
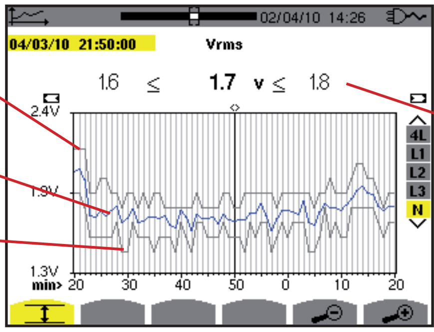


Figure 102: Vrms (N) without MIN-AVG-MAX

Curve of the maxima.

Curve of the mean.

Curve of the minima.



Values of the cursor (minimum, mean, and maximum).

Figure 103: Vrms (N) with MIN-AVG-MAX Le mode MIN-AVG-MAX a été activé.

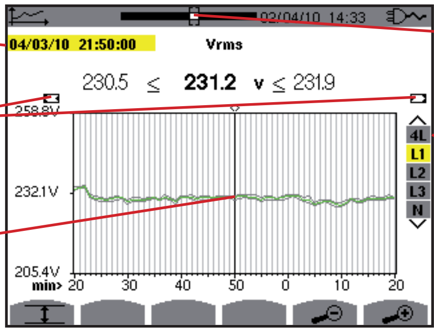
The display period of this curve is one minute. Each point of the mean curve represents the arithmetic mean of 60 values recorded every second. Each point of the curve of the maxima represents the maximum of the 60 values recorded every second. Each point of the curve of the minima corresponds to the minimum of the 60 values recorded every second.

This display is therefore more precise than the previous one, but the curve of Vrms (N) without MIN-AVG-MAX is still contained within the envelope formed by the curves of the maxima and of the minima of Vrms (N) with MIN-AVG-MAX.

Date of the cursor.

This screen is a partial view of the trend curve. There are other screens before and after the visible part.

To move the cursor, use the ▷ or ◁ key.



Position of the viewing window in the record.

To select the display filter, press the △ or ▽ key.

Figure 104: Vrms (L1) without MIN-AVG-MAX

For each of the phases (L1, L2, and L3), at each recording of a value over one second (recording period), the device also records the minimum half-cycle RMS value over one second and the maximum half-cycle RMS value over one second. These are the three curves shown in the figure above.

The MIN-AVG-MAX mode has been activated.

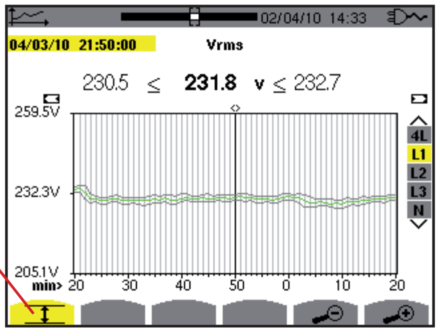


Figure 105: Vrms (L1) with MIN-AVG-MAX

This curve differs slightly from the previous one because, with the MIN-AVG-MAX mode, there is no loss of information.

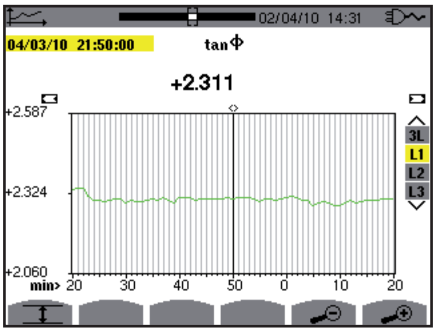


Figure 106: tan Φ *(L1) without MIN-AVG-MAX*

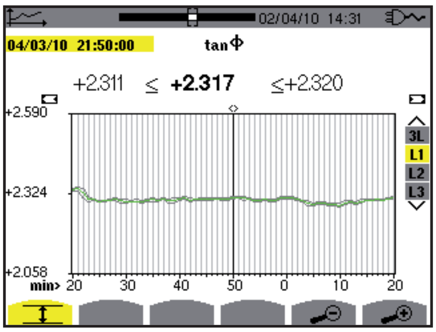
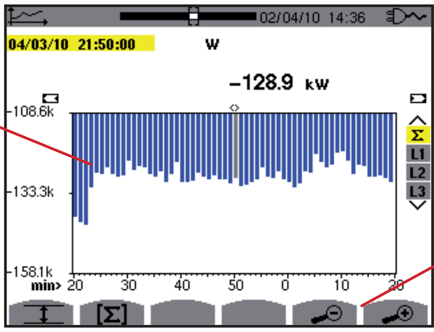


Figure 107: tan Φ *(L1) with MIN-AVG-MAX*

The sum of the powers of the three phases (Σ) is presented in bargraph form.



To change the scale of the display between 1 minute and 5 days.

Figure 108: W (Σ) without MIN-AVG-MAX Date du curseur.

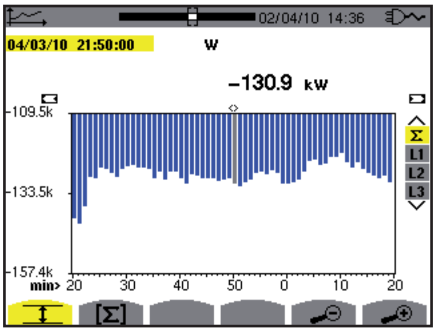
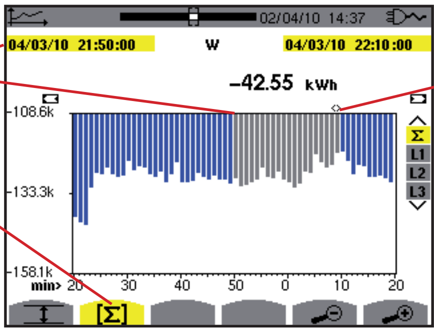


Figure 109: W (Σ) with MIN-AVG-MAX

This curve differs slightly from the previous one because, with the MIN-AVG-MAX mode, there is no loss of information.

Starting date of the selection.

Energy calculation mode. Pressing this key lets you define the start of the selection.



Date of the cursor (ending date of the selection). To move the cursor, use the ▷ or ◁ key.

Figure 110: Wh (Σ) without MIN-AVG-MAX

The display period of this bar chart is one minute. Since the recording period is one second, each bar of this bar chart represents a value recorded in a one-second window once a minute.
The energy calculation mode determines the sum of the powers on the selected bars.

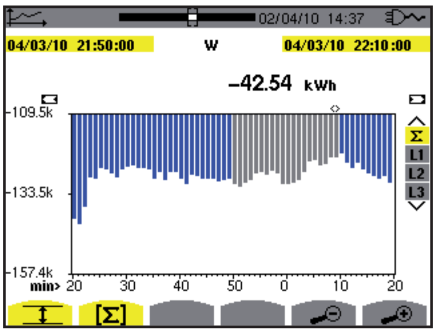


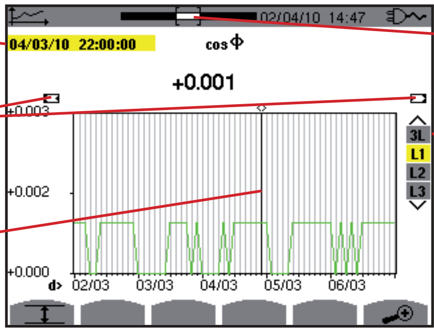
Figure 111: Wh (Σ) with MIN-AVG-MAX

With the MIN-AVG-MAX mode activated, the display differs slightly from the previous one because there is no loss of information.

Date of the cursor.

This screen is a partial view of the trend curve. There are other screens before and after the visible part.

To move the cursor, use the ◁ or ▷ key.



Position of the viewing window in the record.

To select the display filter, press the △ or ▽ key.

Figure 112: cos Φ (L1) without MIN-AVG-MAX

The period of display of this curve is two hours. Since the recording period is one second, each point of this curve represents a value recorded every second taken every two hours. There is therefore a substantial loss of information (7199 out of 7200), but the display is rapid.

The MIN-AVG-MAX mode has been activated.

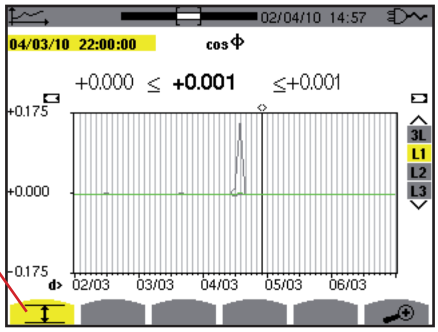


Figure 113: cos Φ (L1) with MIN-AVG-MAX

This curve differs considerably from the previous one; the MIN-AVG-MAX mode is activated. Each point of the mean curve represents the arithmetic mean of 7.200 values recorded every second. Each point of the curve of the maxima represents the maximum of the 7.200 values recorded every second. Each point of the curve of the minima corresponds to the minimum of the 7.200 values recorded every second.
This display is therefore more precise, because there is no loss of information, but slower (see the table on page 67).

The user can stop the loading of the recorded values at any time by pressing this key.

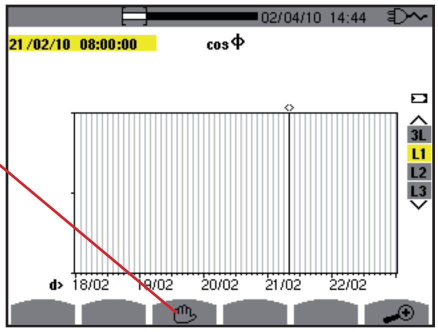
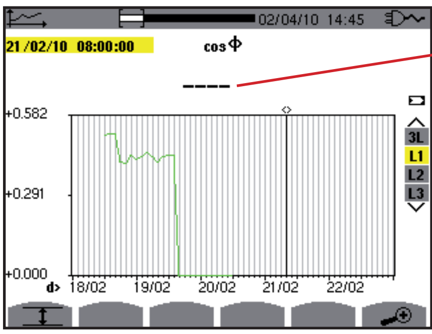


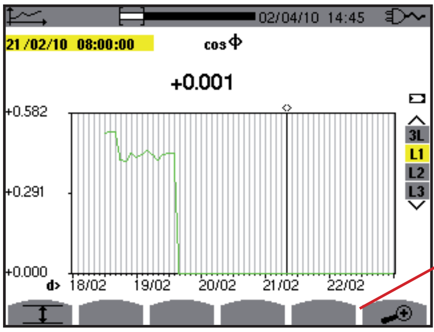
Figure 114: cos Φ (L1) loading/calculation of values.



The dashes indicate that the value is not available at the cursor position.

Figure 115: cos Φ (L1) loading/calculation of values aborted.

Display of the record is not complete because reading was stopped before the end.



To change the scale of the display between 1 minute and 5 days.

Figure 116: cos Φ (L1) loading/calculation of complete values without MIN-AVG-MAX.

The display has not been stopped and is therefore complete.

The following table indicates the time needed to display the curve on screen as a function of the width of the display window for a recording period of one second:

Width of display window (60 points or increments)	Grid increment	Typical waiting time for display with the MIN-AVG-MAX mode deactivated	Typical waiting time for display with the MIN-AVG-MAX mode activated
5 days	2 hours	11 seconds	10 minutes
2,5 days	1 hour	6 seconds	5 minutes
15 hours	15 minutes	2 seconds	1 minute 15 seconds
10 hours	10 minutes	2 seconds	50 seconds
5 hours	5 minutes	1 second	25 seconds
1 hour	1 minute	1 second	8 seconds
20 minutes	10 seconds	1 second	2 seconds
5 minutes	5 seconds	1 second	1 second
1 minute	1 second	1 second	1 second

These times can be long, so it has been made possible to stop the display at any time by pressing the key.

It is also possible, at any time:
- to press the or key to change the scale of the display,
- to press the or key to move the cursor,
- to press the or key to change the display filter.

But note that this may restart the loading/calculation of the values from the beginning.

11. POWER AND ENERGY KEY

The W key displays power- and energy-related measurements.

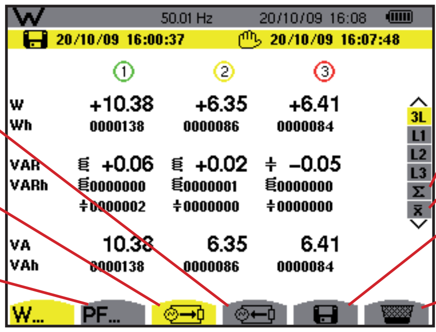
11.1. AVAILABLE SUB-MENUS

The sub-menus are listed in the screen below and described individually in the paragraphs that follow.
The sub-menus are selected using the yellow keys on the keypad below the screen.

Display of energy generated (see § 11.6).

Display of energy consumed (see § 11.2).

Display of PF, cos Φ, tan Φ and Φ_{VA} (see § 11.3).



Σ: Display of sum of values (see § 11.4).

x̄: Display of mean of values (see § 11.5).

Start of energy metering (see § 11.7).

Reset of energy meter (see § 11.9).

Figure 78: the Power and energy mode screen

11.2. ENERGY CONSUMED

The sub-menu displays the active power, the reactive powers (capacitive and inductive), the apparent power, and all associated energies consumed.

11.2.1. THE ENERGIES CONSUMED SCREEN FOR THE 3 PHASES (3L)

This screen displays the following information:

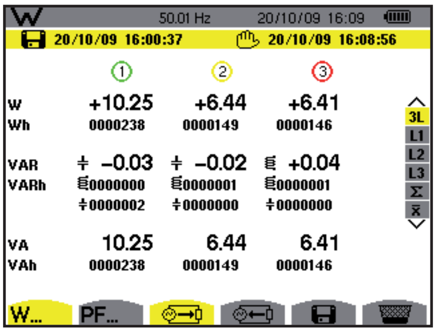


Figure 79: the energies consumed screen for the 3 phases (3L)

Unit	Designation
W	Active power.
Wh	Active energy consumed.
VAR	Reactive power, inductive or capacitive.
VARh	Reactive energies consumed: ▪ inductive ▪ capacitive
VA	Apparent power.
VAh	Apparent energy consumed.

11.2.2. THE ENERGIES CONSUMED SCREEN FOR PHASE L1

This screen displays the following information:

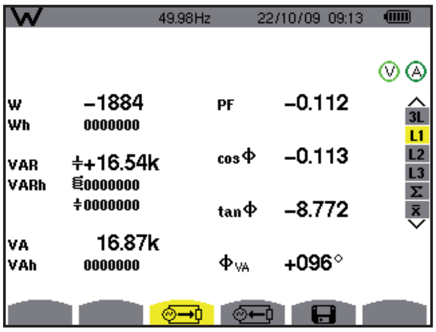


Figure 80: the energies consumed screen for phase L1

Unit	Designation
W	Active power.
Wh	Active energy consumed.
VAR	Reactive power, inductive or capacitive.
VARh	Reactive energies consumed: ■ inductive ■ capacitive
VA	Apparent power.
VAh	Apparent energy consumed.
PF	Power factor.
cos Φ	Cosine of the phase shift of the voltage with respect to the current (DPF - displacement factor).
tan Φ	Tangent of the phase shift of the voltage with respect to the current.
$Φ_{VA}$	Phase shift of phase-to-neutral voltage with respect to current.

Note: Filters L2 and L3 display the same information for phases 2 and 3.

11.3. OTHER POWER PARAMETERS DISPLAY SCREEN

This screen page is available only with the 3L filter. To display the information, press the yellow key on the keypad corresponding to the PF... icon.

The following data is displayed:

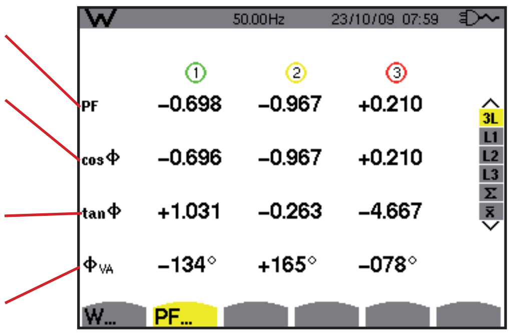


Figure 81: the Power factor screen for the 3 phases (3L)

11.4. THE SUMS OF ENERGIES CONSUMED DISPLAY SCREEN

To display the information, select the Σ icon of the right-hand filter. This screen displays the following information:

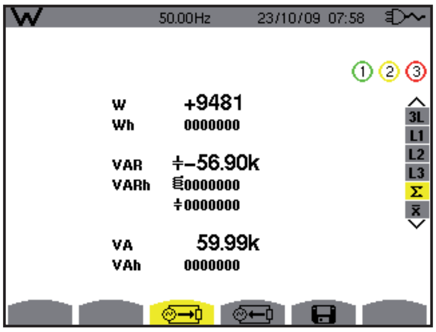


Figure 82: the sums of energies consumed display screen

Unit	Designation
W	Total active power.
Wh	Total active energy consumed.
VAR	Total reactive power, inductive or capacitive.
VARh	Total reactive energies consumed: ■ inductive ■ capacitive
VA	Total apparent power.
VAh	Total apparent energy consumed.
PF	Power factor.

11.5. THE MEAN VALUES OF OTHER POWER PARAMETERS DISPLAY SCREEN

To display the information, select the $\bar{x}$ icon of the right-hand filter.

This screen displays the following information:

Arithmetic mean of the absolute values of the power factor on each phase.

Arithmetic mean of the absolute values of the cosine of the phase shift of the phase-to-neutral voltage with respect to the current on each phase.

Arithmetic mean of the absolute values of the tangent of the phase shift of the phase-to-neutral voltage with respect to the current on each phase.

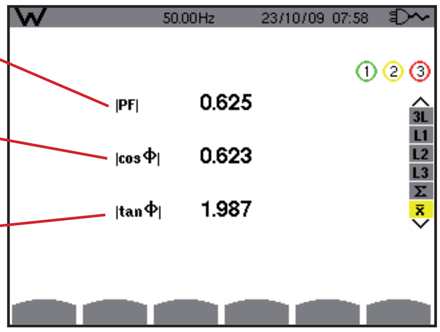


Figure 83: the mean values of other power parameters display screen

11.6. ENERGIES GENERATED

The sub-menu displays the active power, the reactive powers (capacitive and inductive), the apparent power, and all associated energies generated.

11.6.1. THE ENERGIES GENERATED SCREEN FOR THE 3 PHASES (3L)

This screen displays the following information:

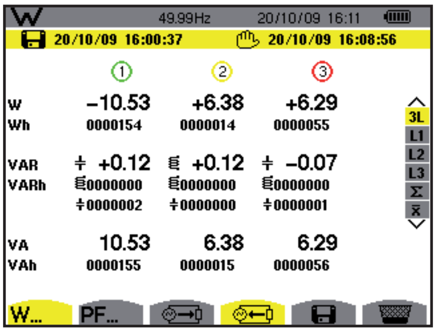


Figure 84: the Energies generated screen for the 3 phases (3L)

Unit	Designation
W	Active power.
Wh	Active energies generated.
VAR	Total reactive power, inductive or capacitive.
VARh	Total reactive energies consumed: ▪ inductive ▪ capacitive
VA	Total apparent power.
VAh	Total apparent energy consumed.

11.6.2. THE ENERGIES GENERATED DISPLAY FOR PHASE L1

This screen displays the following information:

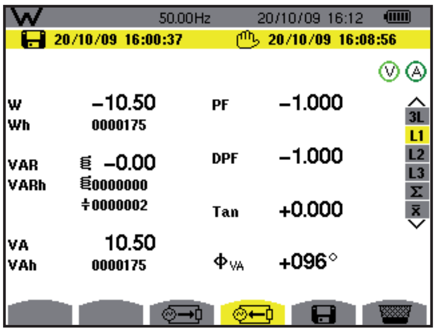


Figure 85: the energies generated display for phase L1

Unit	Designation
W	Active power.
Wh	Active energies generated.
VAR	Total reactive power, inductive or capacitive.
VARh	Total reactive energies consumed: ■ inductive ■ capacitive
VA	Total apparent power.
VAh	Total apparent energy consumed.
PF	Power factor.
cos Φ	Cosine of the phase shift of the voltage with respect to the current (DPF - displacement factor).
tan Φ	Tangent of the phase shift of the voltage with respect to the current.
Φ_{VA}	Phase shift of phase-to-neutral voltage with respect to current.

Note: Filters L2 and L3 display the same information for phases 2 & 3.

11.6.3. THE SUMS OF ENERGIES GENERATED DISPLAY SCREEN

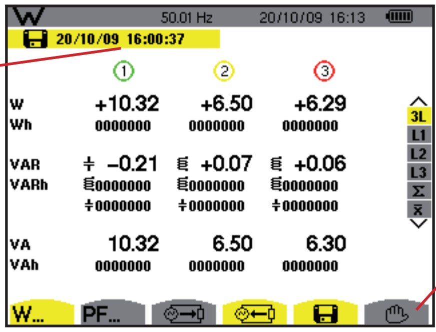
To display the information, select the Σ icon.

This page displays:
- The total active power,
- The total active energy generated,
- The total reactive power, inductive or capacitive,
- The total reactive energies generated (inductive and capacitive),
- The total apparent power,
- The total apparent energy generated.

11.7. STARTING ENERGY METERING

The key starts energy metering.
To start metering, press the yellow key on the keypad corresponding to the icon:

The date and time at which metering starts appear in the top left corner of the screen.

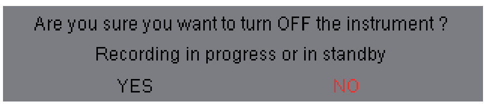


The icon appears on the screen (bottom right corner).

Figure 86: the Powers and energies mode screen when energy metering is started

11.8. STOPPING ENERGY METERING

To stop energy metering, press the yellow key on the keypad corresponding to the icon.
The date and time at which metering stops appear in the top right corner of the screen:



Note: a stoppage of metering is not definitive. It can be resumed by pressing the icon again. All of energy meters resume totalizing.

11.9. RESET OF ENERGY METERING

To reset metering, press the yellow key on the keypad corresponding to the icon, then the key to confirm.
All energy values (consumed and generated) are reset.

Note: refer to the 4-quadrant power diagram in § 17.4.

12. SCREEN SNAPSHOT KEY

The key can be used to:

- Capture a maximum of 50 screens for future reference (see § 12.1).
- Display previously saved screen snapshots (see § 12.2).

Saved screens may then be transferred to a PC using the PAT application (Power Analyser Transfer).

12.1. SCREEN SNAPSHOTS

Press for approx. 3 seconds to shoot any screen (including the , , , , , and mode screens).
During the capture, the icon appears in the top left corner of the screen instead of the icon for the active mode (, , , , ,). The active mode icon reappears when you release the key: the C.A 8335 has saved the image.

Reminder: the C.A 8335 can save a maximum of 50 screen snapshots. If the user attempt to take a 51st screen snapshot, the icon will appear in the top left corner of the screen instead of the icon.

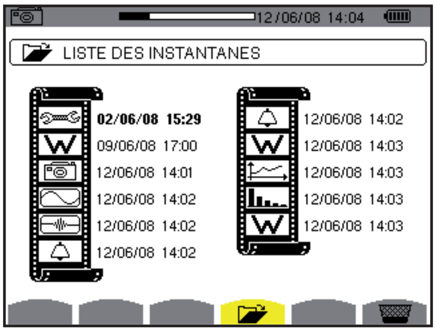


Figure 87: the snapshot list display screen

12.2. HANDLING OF SCREEN SNAPSHOTS

This handling concerns stored screen snapshots, i.e.:

- **Display** of the list of screen snapshots (see § 12.2.2).
- **Viewing** of one of the screen snapshots (see § 12.2.3).
- **Deletion** of one or more of the screen snapshots (see § 12.2.4).

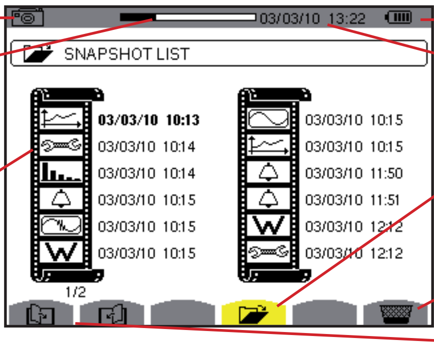
12.2.1. AVAILABLE FUNCTIONS

To enter screen snapshot mode, briefly press the key.
Reminder: holding the key down for approximately 3 seconds triggers the screen snapshot function (See § 12.1).

Reminder of the mode used.

Indicator of available image memory. The black bar represents memory used; the white bar represents memory available.

List of saved snapshots:
The icons (the same as the mode key icons) identify the type of snapshot saved (recordings, alarms, waveforms, etc.). The date and time of each screen snapshot are shown to the right of the icon.



Battery charge level.

Current date and time.

Display sub-menu for the list of screen snapshots (current sub-menu).

Delete a screen snapshot sub-menu.

Icon for browsing in screen pages. To display pages, press the yellow keys on the keypad corresponding to these icons.

Figure 88: example of the snapshot list display screen

12.2.2. VIEWING THE LIST OF SNAPSHOTS

Press briefly to display this list. The screen presents the list of snapshots (see figure 88).

12.2.3. VIEWING A SNAPSHOT FROM THE LIST

To view a snapshot, proceed as follows:

- Press . The icon is active and the snapshot list screen is displayed (see figure 88).
- Select the snapshot to be viewed using the or and or keys. The date and time of the selected snapshot are bolded.
- Press to display the selected snapshot. The top left corner of the screen displays the icon, alternating with the icon corresponding to the active mode ((, , , , , ,).

Press to return to the list of screen snapshots.

12.2.4. DELETING A SNAPSHOT FROM THE LIST

To delete a snapshot, proceed as follows:

- From the list of snapshots (see Figure for example), select the sub-menu (bottom of the screen) by pressing the yellow key below this icon.
- Select the snapshot to be deleted using the or and or keys. The date and time of the selected snapshot are bolded.
- Press to delete the selected snapshot. The snapshot is deleted from the list.

Press to return to the list of screen snapshots without deleting the snapshot.

13. HELP KEY

The ? key provides information about the functions and symbols used in the current display mode.

The following information is displayed:

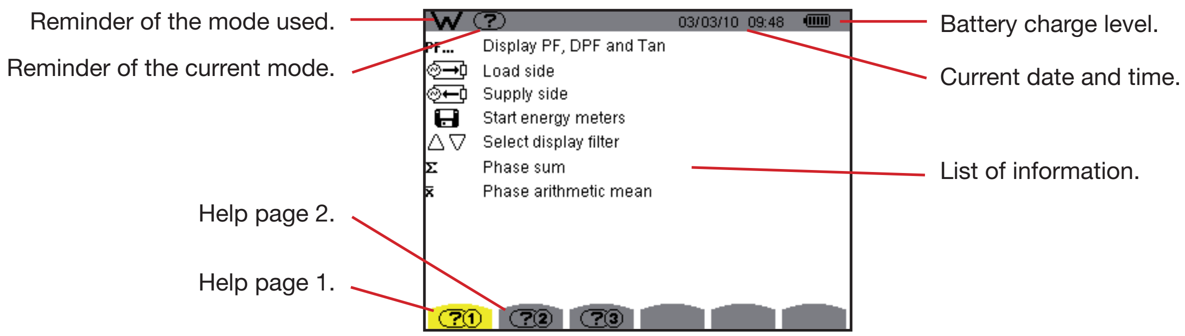


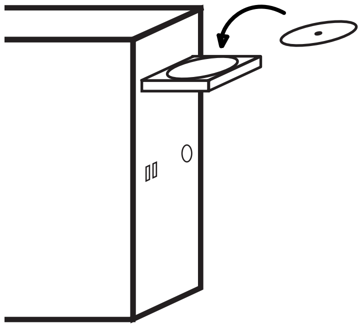
Figure 89: example of the help page for the powers and energies mode, page 1

14. DATA EXPORT SOFTWARE

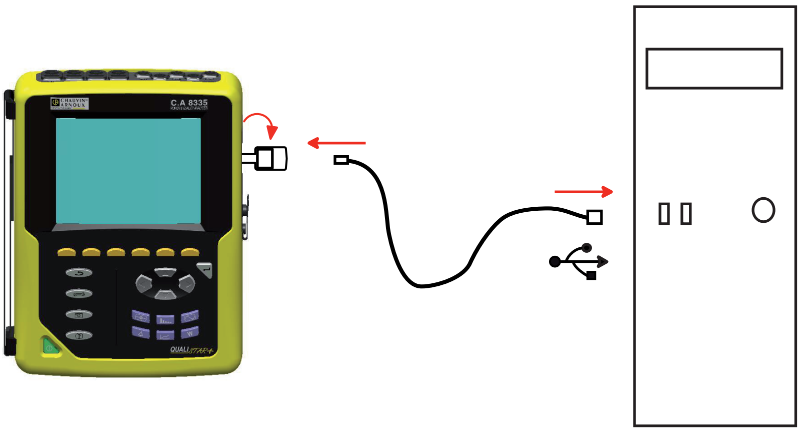
There are two data export software programs:

- PAT (Power Analyser Transfer), supplied with the C.A 8335, used to transfer the data recorded in the device to a PC.
- Dataview, optional, also used to transfer the data, which are then presented in the form of a report compliant with your country's standards.

To install a program, use the CD, then follow the on-screen instructions.



Then connect the device to the PC using the USB cord supplied with the C.A 8335, after removing the cover that protects the USB port on the device.



Switch the device on by pressing the key and wait for your PC to detect it.

For directions for using the data export software, us its Help function or refer to its user manual.

15. GENERAL SPECIFICATIONS

15.1. HOUSING

Housing	rigid shell overmoulded with a yellow thermo-adhesive elastomer.
Connectors	5 voltage measurement sockets.
	4 special current connectors (automatic recognition of current sensors).
	one connector for the specific mains power unit.
	one connector for the USB link.
	one connector for the SD memory card. This connector is located in the battery compartment on the back of the C.A 8335.
Keys	function, navigation, and mode. Can be used with gloves on.
Metal ring	located on the back of the C.A 8335, used to padlock the device.
Stand	to hold the device in an inclined position.
Battery cover	to access the battery, on the back of the instrument.
Dimensions	Overall: 200 mm x 250 mm x 70 mm. Screen: 320 pixels x 240 pixels; 118 mm x 90 mm; diagonal 148 mm.
Weight	1950 g (with battery).

15.2. POWER SUPPLY

15.2.1. MAINS POWER SUPPLY

Type	specific external mains power supply unit: 600 V_{RMS}, category IV – 1000 V_{RMS}, category III.
Range for use	230 V ± 10 % @ 50 Hz and 120 V ± 10 % @ 60 Hz.
Maximum input power	65 VA.

15.2.2. BATTERY POWER SUPPLY

The C.A 8335 can be used without a connection to mains power. The battery also makes it possible to use the Qualistar+ during power outages.

Battery	8 NiMH storage cells.
Capacity	4000 mAh nominal.
Nominal voltage	1,2 V per cell, or a total of 9.6 V.
Life	at least 300 charge-discharge cycles.
Charging current	1 A.
Charging time	approx. 5 hours
Service T°	[0 °C ; 50 °C].
Charging T°	[10 °C ; 40 °C].
Storage T°	storage ≤ 30 days: [-20 °C ; 50 °C].
	storage for 30 to 90 days: [-20 °C ; 40 °C].
	storage for 90 days to 1 year: [-20 °C ; 30 °C].

15.2.3. CONSUMPTION

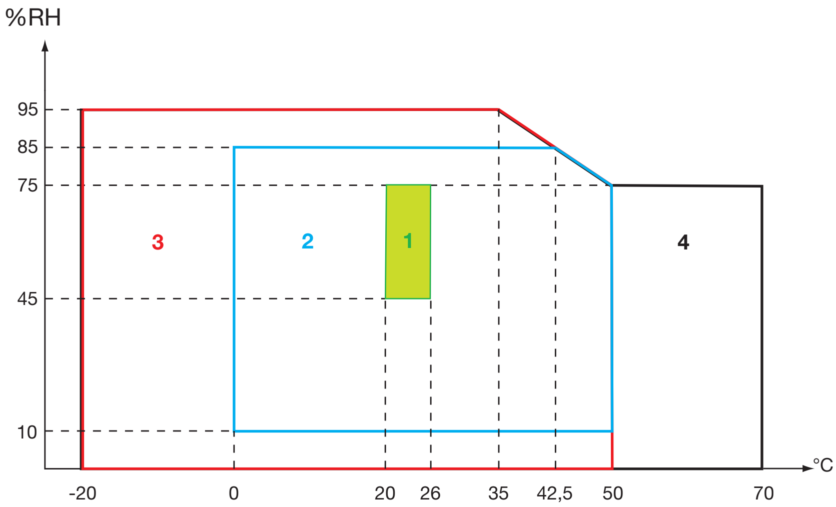
At 50% luminosity	320 mA
In display-off stand-by mode	130 mA

15.3. RANGE FOR USE

15.3.1. ENVIRONMENTAL CONDITIONS

15.3.1.1. Climatic conditions

The following chart shows conditions relating to ambient temperature and humidity:



1 = Reference range.
2 = Range for use.
3 = Range for storage with batteries.
4 = Range for storage without batteries.

Caution: at temperatures above 40°C, the device must be powered by the battery alone **OR** by the mains power unit alone; use of the device with both the battery **AND** the mains power unit is **prohibited**.

15.3.1.2. Altitude

Use: [0 m ; 2 000 m]
Storage: [0 m ; 10 000 m]

15.3.2. MECHANICAL CONDITIONS

Under IEC 61010-1, the C.A 8335 is regarded as a **PORTABLE DEVICE (HAND-CARRIED)**.

- Operating position: any position.
- Reference position in operation: on a horizontal plane, resting on its stand or lying flat.
- Rigidity (IEC 61010-1): force of 30 N applied to any part of the housing, the device being supported (at 40°C).
- Fall (IEC 61010-1): 1 m in presumed worst-case position; the requirement is no permanent mechanical damage and no functional degradation.
- Tightness: IP 50 as per NF EN 60529 A1 (IP2X electrical protection for the terminals).

15.3.3. ELECTROMAGNETIC COMPATIBILITY

15.3.3.1. Immunity as per IEC 61326:1-2006

- Immunity to electrostatic discharges (as per IEC 61000-4-2)

1st level:	Severity:	4 kV in contact
	Requirements:	CRITERION A
2nd level:	Severity:	8 kV in air
	Requirements:	CRITERION A

- Immunity to radiated fields (as per IEC 61000-4-3 and IEC 61000-4-8)
  Severity: 10 $V.m^{-1}$
  Requirements: CRITERION B (influence on the THDA: ± 2.5% for the standard current system and ± 5% for the Rogowski current system).

- Immunity to rapid transients (IEC 61000-4-4)
  Severity: 2 kV on voltage inputs and power supply
  1 kV on current input
  Requirements: CRITERION A

- Immunity to electric shocks (as per IEC 61000-4-5)
  Severity: 2 kV on voltage inputs in differential mode
  1 kV on voltage inputs in common mode
  Requirements: CRITERION A

- Conducted RF interference (as per IEC 61000-4-6)
  Severity: 3 V on voltage inputs and power supply
  Requirements: CRITERION A

- Voltage interruption (as per IEC 61000-4-11)
  Severity: 100% loss over one period of the power supply
  Requirements: CRITERION A

15.3.3.2. Emissions as per IEC 61326:1-2006

Class A equipment.

15.4. USER SAFETY

- Application of safety rules as per IEC standard 61010-1 (protective impedances on voltage inputs).
- Pollution type 2.
- Installation category IV* and service voltage 600 Vrms.
- Double insulation on I/O with respect to earth (⧈ symbol).
- Double insulation between the voltage inputs and power supply and the other I/O (⧈ symbol).
- Indoor use.

(*) Caution: the assigned voltage and measurement category of the “device + current sensor” system may differ from those of the device alone.

- the use of AmpFLEX™ or of MiniFLEX or C clamps keeps the “device + current sensor” system at 600 V category IV or 1000 V category III.
- the use of PAC, MN93, MN93A, or E3N clamps downgrades the “device + current sensor” system to 300 V category IV or 600 V category III.
- the use of the 5 A adapter unit downgrades the “device + current sensor” system to 150 V category IV or 300 V category III.

16. FUNCTIONAL CHARACTERISTICS

16.1. REFERENCE CONDITIONS

This table indicates the reference conditions of the quantities to be used by default in the characteristics indicated in § 16.2.4.

Parameter	Reference conditions
Ambient temperature	23 ± 3 °C
Humidity (relative humidity)	[45 %; 75 %]
Atmospheric pressure	[860 hPa ; 1060 hPa]
Phase-to-neutral voltage	[50 VRMS ; 1000 VRMS] without DC (< 0.5 %)
Standard current circuit input voltage (Except *FLEX* type current sensors)	[30 mVRMS ; 1 VRMS] without DC (< 0.5 %) ■ A_{nom} ⇔ 1 VRMS ■ 3 × A_{nom} ÷ 100 ⇔ 30 mVRMS
Rogowski current circuit input voltage (*FLEX* type current sensors)	[11,73 mVRMS ; 117.3 mVRMS] without DC (< 0.5 %) ■ 3000 ARMS ⇔ 117.3 mVRMS to 50 Hz ■ 300 ARMS ⇔ 11.73 mVRMS to 50 Hz
Frequency of electrical network	50 Hz ± 0,1 Hz or 60 Hz ± 0,1 Hz
Phase shift	0° (active power and energy) 90° (reactive power and energy)
Harmonics	< 0,1 %
Voltage unbalance	< 10 %
Voltage ratio	1 (unity)
Current ratio	1 (unity)
Power supply	Battery only
Electric field	< 1 V.m-1
Magnetic field	< 40 A.m-1

The values of A_{nom} are given in the table below.

Current sensor (except *FLEX*)	Nominal RMS current (A_{nom}) [A]
C clamp	1000
PAC clamp	1000
MN93 clamp	200
E3N clamp (10 mV/A)	100
MN93A clamp (100 A)	100
E3N clamp (100 mV/A)	10
MN93A clamp (5 A)	5
5 A adapter	5

16.2. ELECTRICAL CHARACTERISTICS

16.2.1. VOLTAGE INPUT CHARACTERISTICS

Range for use: 0 VRMS to 1000 VRMS AC+DC phase-to-neutral and neutral-to-earth.
0 VRMS to 2000 VRMS AC+DC phase-to-phase.
(on condition of compliance with 1000 VRMS with respect to earth in Cat III).

Input impedance: 969 kΩ (between phase and neutral and between neutral and earth).

Admissible overload: 1200 VRMS constant.
2000 VRMS for one second.

16.2.2. CURRENT INPUT CHARACTERISTICS

Operating range: [0 V ; 1 V]

Input impedance: 1 MΩ.

Admissible overload: 1.7 V_{RMS} constant.

FLEX type current sensors (Amp*FLEX*™ and Mini*FLEX*) switch the current input to an integrator assembly ('Rogowski' channel) capable of interpreting the signals from Rogowski sensors. The input impedance is reduced to 12.4 kΩ in this case.

16.2.3. BANDWIDTH

Measurement channels: 256 points per period, i.e.:

- At 50 Hz: 6.4 kHz (256 × 50 ÷ 2).
- At 60 Hz: 7.68 kHz (256 × 60 ÷ 2).

The analogue 3-dB bandwidth exceeds 10 kHz.

16.2.4. CHARACTERISTICS OF THE DEVICE ALONE (EXCLUDING THE CURRENT SENSOR)

Measurement		**Measurement range without ratio (with unity ratio)**		**Display resolution (with unity ratio)**	**Maximum intrinsic error**
		Minimum	**Maximum**		
Frequency		40 Hz	70 Hz	0.01 Hz	±(0.01 Hz)
RMS voltage(5)	simple	1 V	1,200 V (1)	0.1 V V < 1000 V	±(0.5 % + 0.2 V)
				1 V V ≥ 1000 V	±(0.5 % + 1 V)
	compound	1 V	2,400 V (2)	0.1 V U < 1000 V	±(0.5 % + 0.2 V)
				1 V U ≥ 1000 V	±(0.5 % + 1 V)
Direct voltage (DC)(6)	simple	1 V	1,697 V (3)	0.1 V V < 1000 V	±(1 % + 0.5 V)
				1 V V ≥ 1000 V	±(1 % + 1 V)
	compound	1 V	3,394 V (4)	0.1 V U < 1000 V	±(1 % + 0.5 V)
				1 V U ≥ 1000 V	±(1 % + 1 V)
RMS current(5)	C clamp PAC clamp	1 A	1,200 A	0.1 A A < 1000 A	±(0.5 % + 0.2 A)
				1 A A ≥ 1000 A	±(0.5 % + 1 A)
	MN93 clamp	0.2 A	240 A	0.1 A	±(0.5 % + 0.2 A)
	E3N clamp (10 mV/A) MN93A clamp (100 A)	0.1A	120 A	0.01 A A < 100 A	±(0.5 % + 0.02 A)
				0.1 A A ≥ 100 A	±(0.5 % + 0.1 A)
	E3N clamp (100 mV/A)	0.01 A	12 A	0.001 A A < 10 A	±(0.5 % + 0.002 A)
				0.01 A A ≥ 10 A	±(0.5 % + 0.01 A)
	MN93A clamp (5 A) 5 A adapter	0.005 A	6 A	0.001 A	±(0.5 % + 0.002 A)
	Amp*FLEX*™ Mini*FLEX*	10 A	6500 A	0.1 A A < 1000 A	±(0.5 % + 1 A)
				1 A A ≥ 1000 A	
Direct current (DC)(6)	PAC clamp	1 A	1200 A (4)	0.1 A A < 1000 A	±(1 % + 1 A)
				1 A A ≥ 1000 A	
	E3N clamp (10 mV/A)	0.1 A	169.7 A (3)	0.01 A A < 100 A	±(1 % + 0.1 A)
				0.1 A A ≥ 100 A	
	E3N clamp (100 mV/A)	0.01 A	16.97 A (3)	0.001 A A < 10 A	±(1 % + 0.01 A)
				0.01 A A ≥ 10 A	
Peak factor (PF)		1	9.99	0.01	±(1 % + 2 ct) CF < 4
					±(5 % + 2 ct) CF ≥ 4

(1) In 1,000 V_{RMS}, category III, provided that the voltage between each of the terminals and earth does not exceed 1,000 V_{RMS}.
(2) Two-phase (opposite phases) – same note as (1).
((3) $1200 \times \sqrt{2} \approx 1697$; $2400 \times \sqrt{2} \approx 3394$; $120 \times \sqrt{2} \approx 169{,}7$; $12 \times \sqrt{2} \approx 16{,}97$;
(4) Limitation of the PAC clamp.
(5) Total RMS value and RMS value of the fundamental
(6) DC harmonic component (n= 0)

Measurement		Measurement range without ratio (with unity ratio)		Display resolution (with unity ratio)	Maximum intrinsic error
		Minimum	Maximum		
RMS ½ voltage	simple	1 V	1,200 V (1)	0.1 V V < 1,000 V 1 V V ≥ 1,000 V	±(0.8 % + 1 V)
	compound	1 V	2,400 V (2)	0.1 V U < 1,000 V 1 V U ≥ 1,000 V	±(0.8 % + 1 V)
Peak voltage	simple	1 V	1,697 V (3)	0.1 V V < 1,000 V 1 V V ≥ 1,000 V	±(1 % + 1 V)
	compound	1 V	3,394 V (3)	0.1 V U < 1,000 V 1 V U ≥ 1,000 V	±(1 % + 1 V)
RMS ½ current	C clamp PAC clamp	1 A	1,200 A	0.1 A A < 1,000 A 1 A A ≥ 1,000 A	±(1 % + 1 A)
	MN93 clamp	0.2 A	240 A	0.1 A	±(1 % + 1 A)
	E3N clamp (10 mV/A) MN93A clamp (100 A)	0.1A	120 A	0.01 A A < 100 A 0.1 A A ≥ 100 A	±(1 % + 0.1 A)
	E3N clamp (100 mV/A)	0.01 A	12 A	0.001 A A < 10 A 0.01 A A ≥ 10 A	±(1 % + 0.01 A)
	MN93A clamp (5 A) 5 A adapter	0.005 A	6 A	0.001 A	±(1 % + 0.01 A)
	Amp*FLEX*™ Mini*FLEX*	10 A	6,500 A	0.1 A A < 1,000 A 1 A A ≥ 1,000 A	±(1.5 % + 5 A)
Peak current)	C clamp PAC clamp	1 A	1,697 A (3)	1 A A < 1,000 A 1 A A ≥ 1,000 A	±(1 % + 1 A)
	MN93 clamp	0.2 A	339.4 A (3)	0.1 A	±(1 % + 1 A)
	E3N clamp (10 mV/A) MN93A clamp (100 A)	0.1 A	169.7 A (3)	0.01 A A < 100 A 0.1 A A ≥ 100 A	±(1 % + 0.1 A)
	E3N clamp (100 mV/A)	0.01 A	16.97 A (3)	0.001 A A < 10 A 0.01 A A ≥ 10 A	±(1 % + 0.01 A)
	MN93A clamp (5 A) 5 A adapter	0.005 A	8.485 A (3)	0.001 A	±(1 % + 0.01 A)
	Amp*FLEX*™ Mini*FLEX*	10 A	9,192 A (3)	0.1 A A < 1,000 A 1 A A ≥ 1,000 A	±(1.5 % + 5 A)
Severity of flicker (Pst)		0	12	0,01	See the corresponding table

(1) In 1,000 V_{RMS}, category III, provided that the voltage between each of the terminals and earth does not exceed 1,000 V_{RMS}.
(2) Two-phase (opposite phases) – same note as (1).
(3) 1200 x $\sqrt{2}$ ≈ 1697; 2400 x $\sqrt{2}$ ≈ 3394; 240 x $\sqrt{2}$ ≈ 339,4; 120 x $\sqrt{2}$ ≈ 169,7; 12 x $\sqrt{2}$ ≈ 16,97; 6 x $\sqrt{2}$ ≈ 8,485; 6500 x $\sqrt{2}$ ≈ 9192;

Measurement		Measurement range without ratio (with unity ratio) Minimum	Measurement range without ratio (with unity ratio) Maximum	Display resolution (with unity ratio)	Maximum intrinsic error
Active power (1)	Excluding *FLEX*	5 mW (3)	7,800 kW (4)	4 digits at most (5)	±(1 %) cos Φ ≥ 0.8
					±(1.5 % + 10 ct) 0.2 ≤ cos Φ < 0.8
	Amp*FLEX*™ Mini*FLEX*				±(1 %) cos Φ ≥ 0.8
					±(1.5 % + 10 ct) 0.5 ≤ cos Φ < 0.8
Reactive power (2)	Excluding *FLEX*	5 mVAR (3)	7,800 kVAR (4)	digits at most (5)	±(1 %) sin Φ ≥ 0.5
					±(1.5 % + 10 ct) 0.2 ≤ sin Φ < 0.5
	Amp*FLEX*™ Mini*FLEX*				±(1.5 %) sin Φ ≥ 0.5
					±(2.5 % + 20 ct) 0.2 ≤ sin Φ < 0.5
Apparent power		5 mVA (3)	7,800 kVA (4)	4 digits at most (5)	±(1 %)
Peak factor (PF)		-1	1	0.001	±(1.5 %) cos Φ ≥ 0.5
					±(1.5 % + 10 ct) 0.2 ≤ cos Φ < 0.8
Active energy (1)	Excluding *FLEX*	1 mWh	9,999,999 MWh (6)	7 digits at most (5)	±(1 %) cos Φ ≥ 0.8
	Amp*FLEX*™ Mini*FLEX*				±(1.5 %) 0.2 ≤ cos Φ < 0.8
					±(1 %) cos Φ ≥ 0.8
					±(1.5 %) 0.5 ≤ cos Φ < 0.8
Reactive energy (2)	Excluding *FLEX*	1 mVARh	9,999,999 MVARh (6)	7 digits at most (5)	±(1 %) sin Φ ≥ 0.5
					±(1.5 %) 0.2 ≤ sin Φ < 0.5
	Amp*FLEX*™ Mini*FLEX*				±(1.5 %) sin Φ ≥ 0.5
					±(2 %) 0.2 ≤ sin Φ < 0.5
Apparent energy		1 mVAh	9,999,999 MVAh (6)	7 digits at most (5)	±(1 %)

(1) The stated uncertainties on the active power and energy measurements are maxima for |cos Φ| = 1 and typical for the other phase differences.
(2) The stated uncertainties on the reactive power and energy measurements are maxima for |sin Φ| = 1 and typical for the other phase shifts.
(3) With MN93A clamp (5 A) or 5 A adapter.
(4) With Amp*FLEX*™ or Mini*FLEX*.
(5) The resolution depends on the current sensor used and on the value to be displayed.
(6) The energy is equivalent to more than 146 years of the associated maximum power (unity ratios).

Measurement	Measurement range		Display resolution	Maximum intrinsic error
	Minimum	Maximum		
Phase differences of fundamentals	-179°	180°	1°	±(2°)
cos Φ (DPF)	-1	1	0.001	±(1°) for Φ ±(5 ct) for DPF
tan Φ	-32.77 (1)	32.77 (1)	0.001 tan Φ < 10	±(1°) for Φ
			0.01 tan Φ ≥ 10	
Unbalance (UNB)	0 %	100 %	0.1 %	±(1 %)

(1) |tan Φ| = 32,767 corresponds to Φ = ±88.25° + k × 180° (k being a natural number)

Measurement	Measurement range		Display resolution	Maximum intrinsic error
	Minimum	Maximum		
Voltage harmonic ratio (τ)	0 %	1,600 %	0.1 % $\tau < 999.9$ %	±(2.5 % + 5 ct)
			1 % $\tau \geq 1,000$ %	
Current harmonic ratio (τ) (non-*FLEX*)	0 %	1,600 %	0.1 % $\tau < 999.9$ %	±(2 % + (n × 0.2 %) + 5 ct) $n \leq 25$
			1 % $\tau \geq 1000$ %	±(2 % + (n × 0.5 %) + 5 ct) $n > 25$
Current harmonic ratio (τ) (Amp*FLEX*™ & Mini*FLEX*)	0 %	1,600 %	0.1 % $\tau < 999.9$ %	±(2 % + (n × 0.3 %) + 5 ct) $n \leq 25$
			1 % $\tau \geq 1,000$ %	±(2 % + (n × 0.6 %) + 5 ct) $n > 25$
Total voltage harmonic distortion THD (THD-F)	0 %	999.9 %	0.1 %	±(2.5 % + 5 ct)
Total current harmonic distortion THD (THD-F) (non-*FLEX*)	0 %	999.9 %	0.1 %	±(2.5 % + 5 ct) si $\forall n \geq 1. \tau_n \leq (100 \div n)$ [%]
				or
				±(2 % + (n_{max} × 0.2 %) + 5 ct) $n_{max} \leq 25$
				±(2 % + (n_{max} × 0.5 %) + 5 ct) $n_{max} > 25$
Total current harmonic distortion THD (THD-F) (Amp*FLEX*™ & Mini*FLEX*)	0 %	999.9 %	0.1 %	±(2.5 % + 5 ct) si $\forall n \geq 1. \tau_n \leq (100 \div n^2)$ [%]
				or
				±(2 % + (n_{max} × 0.3 %) + 5 ct) $n_{max} \leq 25$
				±(2 % + (n_{max} × 0.6 %) + 5 ct) $n_{max} > 25$
Voltage distortion factor DF (THD-R)	0 %	100 %	0.1 %	±(2.5 % + 5 ct)
Current distortion factor DF (THD-R) (hors *FLEX*)	0 %	100 %	0.1 %	±(2.5 % + 5 ct) si $\forall n \geq 1. \tau_n \leq (100 \div n)$ [%]
				or
				±(2 % + (n_{max} × 0.2 %) + 5 ct) $n_{max} \leq 25$
				±(2 % + (n_{max} × 0.5 %) + 5 ct) $n_{max} > 25$
Current distortion factor DF (THD-R) (Amp*FLEX*™ & Mini*FLEX*)	0 %	100 %	0.1 %	±(2.5 % + 5 ct) si $\forall n \geq 1. \tau_n \leq (100 \div n^2)$ [%]
				or
				±(2 % + (n_{max} × 0.3 %) + 5 ct) $n_{max} \leq 25$
				±(2 % + (n_{max} × 0.6 %) + 5 ct) $n_{max} > 25$
K factor (KF)	1	99.99	0.01	±(5 % + (n_{max} × 0.3 %) + 5 ct) $n_{max} \leq 25$
				±(10 % + (n_{max} × 0.6 %) + 5 ct) $n_{max} > 25$
Phase shifts of harmonics(order $n \geq 2$)	-179°	180°	1°	±(1.5° + 1° × (n ÷ 12.5))

N.B. n_{max} is the highest order for which the harmonic ratio is non-zero.

<table>
<tr><th colspan="2" rowspan="2">Measurement</th><th colspan="2">Measurement range
(with unity ratio)</th><th rowspan="2">Display resolution
(with unity ratio)</th><th rowspan="2">Maximum intrinsic error</th></tr>
<tr><th>Minimum</th><th>Maximum</th></tr>
<tr><td rowspan="4">RMS
harmonic
voltage
(order n ≥ 2)</td><td rowspan="2">simple</td><td rowspan="2">1 V</td><td rowspan="2">1200 V (1)</td><td>0.1 V
V < 1000 V</td><td rowspan="2">±(2.5 % + 1 V)</td></tr>
<tr><td>1 V
V ≥ 1000 V</td></tr>
<tr><td rowspan="2">compound</td><td rowspan="2">1 V</td><td rowspan="2">2400 V (2)</td><td>0.1 V
U < 1000 V</td><td rowspan="2">±(2.5 % + 1 V)</td></tr>
<tr><td>1 V
U ≥ 1000 V</td></tr>
<tr><td rowspan="12">RMS
harmonic
current
(order n ≥ 2)</td><td rowspan="2">C clamp
PAC clamp</td><td rowspan="2">1 A</td><td rowspan="2">1200 A</td><td>0.1 A
A < 1000 A</td><td>±(2 % + (n x 0.2%) + 1 A)
n ≤ 25</td></tr>
<tr><td>1 A
A ≥ 1000 A</td><td>±(2 % + (n x 0.5%) + 1 A)
n > 25</td></tr>
<tr><td>MN93 clamp</td><td rowspan="2">0.2 A</td><td rowspan="2">240 A</td><td rowspan="2">0.1 A</td><td>±(2 % + (n x 0.2%) + 1 A)
n ≤ 25</td></tr>
<tr><td rowspan="2">E3N clamp (10 mV/A)
MN93A clamp (100 A)</td><td>±(2 % + (n x 0.5%) + 1 A)
n > 25</td></tr>
<tr><td rowspan="2">0.1A</td><td rowspan="2">120 A</td><td>0.01 A
A < 100 A</td><td>±(2 % + (n x 0.2%) + 0.1 A)
n ≤ 25</td></tr>
<tr><td rowspan="2">E3N clamp (100 mV/A)</td><td>0.1 A
A ≥ 100 A</td><td>±(2 % + (n x 0.5%) + 0.1 A)
n > 25</td></tr>
<tr><td rowspan="2">0.01 A</td><td rowspan="2">12 A</td><td>0.001 A
A < 10 A</td><td>±(2 % + (n x 0.2%) + 0.01 A)
n ≤ 25</td></tr>
<tr><td>MN93A clamp (5 A)
5 A adapter</td><td>0.01 A
A ≥ 10 A</td><td>±(2 % + (n x 0.5%) + 0.01 A)
n > 25</td></tr>
<tr><td rowspan="2">AmpFLEX™
MiniFLEX</td><td rowspan="2">0.005 A</td><td rowspan="2">6 A</td><td rowspan="2">0.001 A</td><td>±(2 % + (n x 0.2%) + 0.01 A)
n ≤ 25</td></tr>
<tr><td>±(2 % + (n x 0.5%) + 0.01 A)
n > 25</td></tr>
<tr><td rowspan="2">AmpFLEX™
MiniFLEX</td><td rowspan="2">10 A</td><td rowspan="2">6500 A</td><td>0.1 A
A < 1000 A</td><td>±(2 % + (n x 0.3%) + 1 A + (Af_{RMS}(3) x 0.1%))
n ≤ 25</td></tr>
<tr><td>1 A
A ≥ 1000 A</td><td>±(2 % + (n x 0.6%) + 1 A + (Af_{RMS}(3) x 0.1%))
n > 25</td></tr>
</table>

(1) In 1,000 V_{RMS}, category III, provided that the voltage between each of the terminals and earth does not exceed 1,000 V_{RMS}.
(2) Two-phase (opposite phases) – same note as (1).
(3) RMS value of the fundamental.

<table>
<tr><th></th><th colspan="4">Maximum intrinsic error of the flicker severity measurement (Pst)</th></tr>
<tr><th>Rectangular variations
per minute
(50% duty cycle)</th><th colspan="2">120 V lamp
60 Hz network</th><th colspan="2">230 V lamp
50 Hz network</th></tr>
<tr><td>1</td><td>Pst ∈ [0.5 ; 4]</td><td>± 5%</td><td>Pst ∈ [0.5 ; 4]</td><td>± 5%</td></tr>
<tr><td>2</td><td>Pst ∈ [0.5 ; 5]</td><td>± 5%</td><td>Pst ∈ [0.5 ; 5]</td><td>± 5%</td></tr>
<tr><td>7</td><td>Pst ∈ [0.5 ; 7]</td><td>± 5%</td><td>Pst ∈ [0.5 ; 8]</td><td>± 5%</td></tr>
<tr><td>39</td><td>Pst ∈ [0.5 ; 12]</td><td>± 5%</td><td>Pst ∈ [0.5 ; 10]</td><td>± 5%</td></tr>
<tr><td>110</td><td>Pst ∈ [0.5 ; 12]</td><td>± 5%</td><td>Pst ∈ [0.5 ; 10]</td><td>± 5%</td></tr>
<tr><td>1620</td><td>Pst ∈ [0.25 ; 12]</td><td>± 15%</td><td>Pst ∈ [0.25 ; 10]</td><td>± 15%</td></tr>
</table>

Ratio	Minimum	Maximum
Voltage	$\frac{100}{1{,}000 \times \sqrt{3}}$	$\frac{9{,}999{,}900 \times \sqrt{3}}{0{,}1}$
Current [(1)]	1	60,000 / 1

(1) Only for the MN93A clamp (5 A) and the 5 A adapter.

Measurement		Measurement range	
		Minimum with minimum ratio(s)	**Maximum with maximum ratio(s)**
RMS & RMS ½ voltage	simple	58 mV	207.8 GV
	compound	58 mV	415.7 GV
Direct voltage (DC) & peak voltage	simple	58 mV	293.9 GV
	compound	58 mV	587.9 GV
RMS & RMS ½ current		5 mA	360.0 kA
Peak current		5 mA	509.1 kA
Active power		0.289 mW	74.82 PW
Reactive power		0.289 mVAR	74.82 PVAR
Apparent power		0.289 mVA	74.82 PVA
Active energy		1 mWh	9,999,999 EWh [(1)]
Reactive energy		1 mVARh	9,999,999 EVARh [(1)]
Apparent energy		1 mVAh	9,999,999 EVAh [(1)]

(1) The energy corresponds to more than 15,000 years of the associated maximum power (maximum ratios).

16.2.5. CURRENT SENSOR CHARACTERISTICS (AFTER LINEARISATION)

Sensor errors are offset by a typical correction inside the device. This typical correction, applied to the phase and amplitude, depends on the type of sensor connected (detected automatically) and the gain in the current acquisition channel used.

The RMS current measurement error and phase error are additional errors (which must therefore be added to the device errors), indicated as influences on the calculations carried out by the analyser (powers, energies, power factors, tangents, etc.).

Type of sensor	TRMS current	Maximum error for I_{RMS}	Maximum error for Φ
PAC93 clamp 1,000 A	[1 A ; 10 A[	±(1.5 % + 1 A)	-
	[10 A ; 100 A[		±(2°)
	[100 A ; 800 A[	±(3 %)	±(1.5°)
	[800 A ; 1,200 A]	±(5 %)	
C193 clamp 1,000 A	[1 A ; 3 A[	±(0.8 %)	-
	[3 A ; 10 A[		±(1°)
	[10 A ; 100 A[	±(0.3 %)	±(0.5°)
	[100 A ; 1,200 A]	±(0.2 %)	±(0.3°)
Amp*FLEX*™ A193 6,500 A	[10 A ; 100 A[	±(3 %)	±(1°)
	[100 A ; 6,500 A]	±(2 %)	±(0.5°)
Mini*FLEX* MA193 6,500 A	[10 A ; 100 A[	±(3 %)	±(1°)
	[100 A ; 6,500 A]	±(2 %)	±(0.5°)
MN93 clamp 200 A	[0.5 A ; 2 A[	±(3 % + 1 A)	-
	[2 A ; 10 A[		±(6°)
	[10 A ; 100 A[	±(2.5 % + 1 A)	±(3°)
	[100 A ; 240 A]	±(1 % + 1 A)	±(2°)
MN93A clamp 100 A	[100 mA ; 300 mA[	±(0.7 % + 2 mA)	-
	[300 mA ; 1 A[		±(1.5°)
	[1 A ; 120 A]	±(0.7 %)	±(0.7°)
MN93A clamp 5 A	[5 mA ; 50 mA[	±(1 % + 0.1 mA)	±(1.7°)
	[50 mA ; 500 mA[	±(1 %)	±(1°)
	[500 mA ; 6 A]	±(0.7 %)	
E3N clamp 100A Sensitivity 10 mV/A	[0 A ; 40 A[	±(2 % + 50 mA)	±(0.5°)
	[40 A ; 100 A]	±(5 %)	
E3N clamp 10A Sensitivity 100 mV/A	[0 A ; 10 A]	±(1.5 % + 50 mA)	±(1°)
5 A adapter	[5 mA ; 50 mA[	±(1 %)	±(1°)
	[50 mA ; 6 A]	±(0.5 %)	±(0°)

17. APPENDICES

This section presents the mathematical formulae used in calculating various parameters for the C.A 8335.

17.1. MATHEMATICAL FORMULAE

17.1.1. NETWORK FREQUENCY AND SAMPLING

Sampling is controlled by (locked to) the network frequency so as to deliver 256 samples per cycle from 40 Hz to 70 Hz. This locking is essential for the calculations of reactive power, unbalance, and harmonic factors and angles.

The instantaneous frequency is measured by analysing eight consecutive positive-going zero crossings in the first voltage channel (V1) or first current channel (I1) after digital low-pass filtering and digital suppression of the DC component.

The time of the zero crossing is determined precisely by linear interpolation between two samples to achieve resolution better than 0.002%. The network frequency over one second is determined (approximately) as the reciprocal of the arithmetic mean of the instantaneous periods.

The signals are acquired using a 16-bit converter and (for current acquisition) dynamic gain switches.

17.1.2. RMS VALUES OF HALF-CYCLE VOLTAGE AND CURRENT (EXCLUDING NEUTRAL)

Half-cycle RMS phase-to-neutral voltage of phase (i+1) with i ∈ [0 ; 2].

$$\text{Vdem}[i] = \sqrt{\frac{1}{NechDemPer} \cdot \sum_{n=Zéro}^{(Zéro\ suivant)-1} V[i][n]^2}$$

Half-cycle RMS phase-to-phase voltage of phase (i+1) with i ∈ [0 ; 2].

$$\text{Udem}[i] = \sqrt{\frac{1}{NechDemPer} \cdot \sum_{n=Zéro}^{(Zéro\ suivant)-1} U[i][n]^2}$$

Half-cycle RMS current of phase (i+1) with i ∈ [0 ; 2].

$$\text{Adem}[i] = \sqrt{\frac{1}{NechDemPer} \cdot \sum_{n=Zéro}^{(Zéro\ suivant)-1} A[i][n]^2}$$

Note: these values are calculated for each half-cycle so as not to miss any fault.
NechDemPer is the number of samples in the half cycle.

17.1.3. MINIMUM AND MAXIMUM HALF-CYCLE RMS VALUES (EXCLUDING NEUTRAL)

Minimum and maximum RMS phase-to-neutral voltages of phase (i+1) with i ∈ [0 ; 2].
Vmax [i] = max(Vdem[i]), Vmin[i] = min(Vdem[i])

Minimum and maximum RMS phase-to-phase voltages of phase (i+1) with i ∈ [0 ; 2].
Umax [i] = max(Udem[i]), Umin[i] = min(Udem[i])

Minimum and maximum RMS currents of phase (i+1) with i ∈ [0 ; 2].
Amax [i] = max(Adem[i]), Amin[i] = min(Adem[i])

Note: The duration of the evaluation is left to the user's discretion (reset by pressing the ↵ key).

17.1.4. SHORT-TERM FLICKER – 10 MINUTES (EXCLUDING NEUTRAL)

Method based on the IEC 61000-4-15 standard.

The input values are half-cycle phase-to-neutral voltages. Blocks 3 and 4 are created digitally. The classifier of block 5 has 128 levels.

The value Vflk[i] is updated every 10 minutes (phase (i+1) with i ∈ [0 ; 2]).

17.1.5. PEAK VALUES (NEUTRAL EXCEPT Upp AND Upm – REASSESSMENT EVERY SECOND

Positive and negative phase-to-neutral peak voltages of phase (i+1) with i ∈ [0 ; 3].
Vpp[i] = max(V[i][n]), Vpm[i] = min(V[i][n]) n ∈ [0 ; N]

Positive and negative phase-to-phase peak voltages of phase (i+1) with i ∈ [0 ; 2].
Upp[i] = max(U[i][n]), Upm[i] = min(U[i][n]) n ∈ [0 ; N]

Positive and negative peak currents of phase (i+1) with i ∈ [0 ; 3].
App[i] = max(A[i][n]), Apm[i] = min(A[i][n]) n ∈ [0 ; N]

Note: The duration of the evaluation is left to the user's discretion (reset by pressing the ↵ key).

17.1.6. PEAK FACTORS (EXCLUDING NEUTRAL – OVER ONE SECOND)

Peak factor of phase-to-neutral voltage of phase (i+1) with i ∈ [0 ; 2].

$$\mathrm{Vcf}[i]=\frac{\max(|\mathrm{Vpp}[i]|,|\mathrm{Vpm}[i]|)}{\sqrt{\frac{1}{NechSec}\cdot\sum_{n=0}^{NechSec-1}V[i][n]^2}}$$

Peak factor of phase-to-phase voltage of phase (i+1) with i ∈ [0 ; 2].

$$\mathrm{Ucf}[i]=\frac{\max(|\mathrm{Upp}[i]|,|\mathrm{Upm}[i]|)}{\sqrt{\frac{1}{NechSec}\cdot\sum_{n=0}^{NechSec-1}U[i][n]^2}}$$

Peak factor of current of phase (i+1) with i ∈ [0 ; 2].

$$\mathrm{Acf}[i]=\frac{\max(|\mathrm{App}[i]|,|\mathrm{Apm}[i]|)}{\sqrt{\frac{1}{NechSec}\cdot\sum_{n=0}^{NechSec-1}A[i][n]^2}}$$

Note: NechSec is the number of samples in the second. Here, the peak values are evaluated over a period of one second.

17.1.7. RMS VALUES (NEUTRAL EXCEPT URMS – OVER ONE SECOND)

RMS phase-to-neutral voltage of phase (i+1) with i ∈ [0 ; 3] (i = 3 ⇔ neutral-to-earth voltage).

$$\mathrm{Vrms}[i]=\sqrt{\frac{1}{NechSec}\cdot\sum_{n=0}^{NechSec-1}V[i][n]^2}$$

RMS phase-to-phase voltage of phase (i+1) with i ∈ [0 ; 2].

$$\mathrm{Urms}[i]=\sqrt{\frac{1}{NechSec}\cdot\sum_{n=0}^{NechSec-1}U[i][n]^2}$$

RMS current of phase (i+1) with i ∈ [0 ; 3] (i = 3 ⇔ neutral current).

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

Note: NechSec is the number of samples in the second.

17.1.8. UNBALANCES (THREE-PHASE CONNECTION – OVER ONE SECOND)

These are calculated from the filtered RMS vector values (over one second) VFrms[i] and Afrms[i] (ideally the fundamental vectors of the signals).

Note: The operations are vector operations in complex notation with $\mathrm{a}=\mathrm{e}^{\mathrm{j}\frac{2\pi}{3}}$

Forward phase-to-neutral voltage (vector)

$$\mathrm{Vrms}_{+} = \frac{1}{3}(\mathrm{VFrms}[0] + \mathrm{a} \cdot \mathrm{VFrms}[1] + \mathrm{a}^{2} \cdot \mathrm{VFrms}[2])$$

Reverse phase-to-neutral voltage (vector)

$$\mathrm{Vrms}_{-} = \frac{1}{3}(\mathrm{VFrms}[0] + \mathrm{a}^{2} \cdot \mathrm{VFrms}[1] + \mathrm{a} \cdot \mathrm{VFrms}[2])$$

Phase-to-neutral voltage unbalance (vector)

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

Forward current (vector)

$$\mathrm{Arms}_{+} = \frac{1}{3}(\mathrm{AFrms}[0] + \mathrm{a} \cdot \mathrm{AFrms}[1] + \mathrm{a}^{2} \cdot \mathrm{AFrms}[2])$$

Reverse current (vector)

$$\mathrm{Arms}_{-} = \frac{1}{3}(\mathrm{AFrms}[0] + \mathrm{a}^{2} \cdot \mathrm{AFrms}[1] + \mathrm{a} \cdot \mathrm{AFrms}[2])$$

Current unbalance (vector)

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

17.1.9. HARMONIC CALCULATIONS (EXCLUDING NEUTRAL – OVER 4 CONSECUTIVE PERIODS EVERY SECOND)

These calculations are carried out by FFT (16 bits), 1024 points over four cycles, with a rectangular window (see IEC 1000-4-7). From the real parts b_k and the imaginary parts a_k, the harmonic factor is calculated for each order (j) and for each phase (i) (Vharm[i][j], Uharm[i][j], and Aharm[i][j]) with respect to the fundamental and the angles Vph[i][j], Uph[i][j], and Aph[i][j] with respect to the fundamental.

Note: The calculations are performed sequentially: {V1; A1} then {V2; A2} then {V3; A3} then {U1; U2} and finally {U3}.

This calculation is carried out according to the following principle:

The factor in percent [%] ⇔ $\tau_k = \frac{c_k}{c_4} 100$

The angle in degrees [°] ⇔ $\varphi_k = \arctan\left(\frac{a_k}{b_k}\right) - \varphi_4$

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

c_k is the amplitude of the component of order $j = \frac{k}{4}$ with a frequency $f_k = \frac{k}{4} f_4$.

F_s is the sampled signal at the fundamental frequency.

c_o is the DC component.

k is the index of the spectral spike (the order of the harmonic component is $j = \frac{k}{4}$).

Note: The power harmonic factors are calculated by multiplying the phase-to-neutral voltage harmonic factors by the current harmonic factors. The power harmonic angles (VAharm[i][j] and VAph[i][j]) are calculated by differentiating the phase-to-neutral voltage harmonic angles with the current harmonic angles.

17.1.10. HARMONIC DISTORTIONS (EXCLUDING NEUTRAL – OVER 4 CONSECUTIVE CYCLES EVERY SECOND)

Two global values giving the relative quantity of harmonics are calculated: the THD as a proportion of the fundamental ("THD-F") and the DF as a proportion of the RMS value ("THD-R").

Total harmonic distortion of phase (i+1) with i ∈ [0 ; 2] (THD or THD-F).

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

Distortion factors of phase (i+1) with i ∈ [0 ; 2] (DF or THD-R).

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

17.1.11. K FACTOR (EXCLUDING NEUTRAL – OVER 4 CONSECUTIVE CYCLES EVERY SECOND)

K factor for phase (i+1) with i ∈ [0 ; 2].

$$\mathrm{Akf}[i] = \frac{\sum_{n=1}^{n=50} n^2 \cdot Aharm[i][n]^2}{\sum_{n=1}^{n=50} Aharm[i][n]^2}$$

17.1.12. SEQUENCE HARMONICS (OVER 3 × (4 CONSECUTIVE CYCLES) EVERY SECOND)

Negative-sequence harmonics

$$\mathrm{Vharm}_- = \frac{1}{3}\sum_{i=0}^{2} \frac{\sum_{j=0}^{7} Vharm[i][3j+2]}{Vharm[i][1]}, \mathrm{Aharm}_- = \frac{1}{3}\sum_{i=0}^{2} \frac{\sum_{j=0}^{7} Aharm[i][3j+2]}{Aharm[i][1]}$$

Zero-sequence harmonics

$$\mathrm{Vharm}_0 = \frac{1}{3}\sum_{i=0}^{2} \frac{\sum_{j=0}^{7} Vharm[i][3j+3]}{Vharm[i][1]}, \mathrm{Aharm}_0 = \frac{1}{3}\sum_{i=0}^{2} \frac{\sum_{j=0}^{7} Aharm[i][3j+3]}{Aharm[i][1]}$$

Positive -sequence harmonics

$$\mathrm{Vharm}_+ = \frac{1}{3}\sum_{i=0}^{2} \frac{\sum_{j=0}^{7} Vharm[i][3j+4]}{Vharm[i][1]}, \mathrm{Aharm}_+ = \frac{1}{3}\sum_{i=0}^{2} \frac{\sum_{j=0}^{7} Aharm[i][3j+4]}{Aharm[i][1]}$$

17.1.13. POWERS (EXCLUDING NEUTRAL – OVER ONE SECOND)

Active power of phase (i+1) with i ∈ [0 ; 2].

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

Apparent power of phase (i+1) with i ∈ [0 ; 2].

$$VA[i] = Vrms[i] \cdot Arms[i]$$

Reactive power (without harmonics) of phase (i+1) with i ∈ [0 ; 2].

$$VAR[i] = \frac{1}{NechSec} \cdot \sum_{n=0}^{NechSec-1} VF[i][n - \frac{NechPer}{4}] \cdot AF[i][n]$$

Reactive power (with harmonics) of phase (i+1) with i ∈ [0 ; 2].

$$VAR[i] = \sqrt{VA[i]^2 - W[i]^2}$$

Reactive powers are calculated using the filtered signals (without harmonics) – VF[i][j] and AF[i][j] - in accordance with EDF (French national electricity company) rules or from the apparent and active powers (with harmonics). The choice of calculation is left up to the user.

Total active power
W[3] = W[0] + W[1] + W[2]

Total apparent power
VA[3] = VA[0] + VA[1] + VA[2]

Total reactive power
VAR[3] = VAR[0] + VAR[1] + VAR[2]

17.1.14. POWER RATIOS (EXCLUDING NEUTRAL – OVER ONE SECOND)

Power Factor of phase (i+1) with i ∈ [0 ; 2].

$$PF[i] = \frac{W[i]}{VA[i]}$$

Displacement Power factor of phase (i +1) or cosine of the angle of the phase-to-neutral voltage fundamental of phase (i+1) with respect to the current fundamental of phase (i+1) with i ∈ [0 ; 2].

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

Tangent of phase (i +1) or tangent of the angle of the phase-to-neutral voltage fundamental of phase (i+1) with respect to the current fundamental of phase (i+1) with i ∈ [0 ; 2].

$$Tan[i] = \tan(\phi[i]) = \frac{\sum_{n=0}^{NechSec-1} VF[i][n - \frac{NechPer}{4}] \cdot AF[i][n]}{\sum_{n=0}^{NechSec-1} VF[i][n] \cdot AF[i][n]}$$

Total power factor

$$PF[3] = \frac{|PF[0]| + |PF[1]| + |PF[2]|}{3}$$

Total displacement power factor

$$\mathrm{DPF}[3]=\frac{|\mathrm{DPF}[0]|+|\mathrm{DPF}[1]|+|\mathrm{DPF}[2]|}{3}$$

Total tangent

$$\mathrm{Tan}[3]=\frac{|\mathrm{Tan}[0]|+|\mathrm{Tan}[1]|+|\mathrm{Tan}[2]|}{3}$$

17.1.15. ENERGIES (EXCLUDING NEUTRAL – OVER TINT WITH REFRESH EVERY SECOND)

Tint is the power integration time in energy calculations; the beginning and end of this period are user-controlled.

- **Case 1: consumed energies (W[i] ≥ 0)**
  Consumed active energy of phase (i+1) with i ∈ [0 ; 2].

$$\mathrm{Wh}[0][i]=\sum_{\mathrm{Tint}}\frac{W[i]}{3600}$$

  Consumed apparent energy of phase (i+1) with i ∈ [0 ; 2].

$$\mathrm{VAh}[0][i]=\sum_{\mathrm{Tint}}\frac{VA[i]}{3600}$$

  Consumed inductive reactive energy of phase (i+1) with i ∈ [0 ; 2].

$$\mathrm{VARhL}[0][i]=\sum_{\mathrm{Tint}}\frac{VAR[i]}{3600}\ \text{avec}\ \mathrm{VAR}[i]\geq 0$$

  Consumed capacitive reactive energy of phase (i+1) with i ∈ [0 ; 2].

$$\mathrm{VARhC}[0][i]=\sum_{\mathrm{Tint}}\frac{-VAR[i]}{3600}\ \text{avec}\ \mathrm{VAR}[i]<0$$

  Total consumed active energy
  Wh[0][3] = Wh[0][0] + Wh[0][1] + Wh[0][2]

  Total consumed apparent energy
  VAh[0][3] = VAh[0][0] + VAh[0][1] + VAh[0][2]

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

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

- **Case 2: generated energies (W[i] < 0)**
  Generated active energy of phase i + 1.

$$\mathrm{Wh}[1][i]=\sum_{\mathrm{Tint}}\frac{W[i]}{3600}$$

  Generated apparent energy of phase (i+1) with i ∈ [0 ; 2].

$$\mathrm{VAh}[1][i]=\sum_{\mathrm{Tint}}\frac{VA[i]}{3600}$$

  Generated inductive reactive energy of phase (i+1) with i ∈ [0 ; 2].

$$\mathrm{VARhL}[1][i]=\sum_{\mathrm{Tint}}\frac{-VAR[i]}{3600}\ \text{avec}\ \mathrm{VAR}[i]<0$$

Generated capacitive reactive energy of phase (i+1) with i $\in$ [0 ; 2].

$$\mathrm{VARhC}[1][i] = \sum_{\mathrm{Tint}} \frac{VAR[i]}{3600} \text{ avec } \mathrm{VAR}[i] \geq 0$$

Total generated active energy
Wh[1][3] = Wh[1][0] + Wh[1][1] + Wh[1][2]

Total generated apparent energy
VAh[1][3] = VAh[1][0] + VAh[1][1] + VAh[1][2]

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

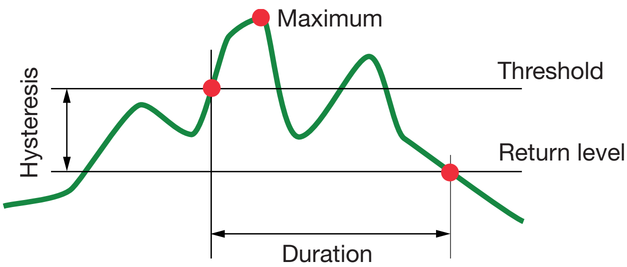
Total generated inductive reactive energy
VARhL[1][3] = VARhL[1][0] + VARhL[1][1] + VARhL[1][2]

17.2. HYSTERESIS

Hysteresis is a screening principle that is often used after detection of a threshold stage in Alarm mode (See § 5.10) and in Inrush current mode (see § 6.3). A correct hysteresis setting avoids repeated changes of state when the measurement oscillates about the threshold.

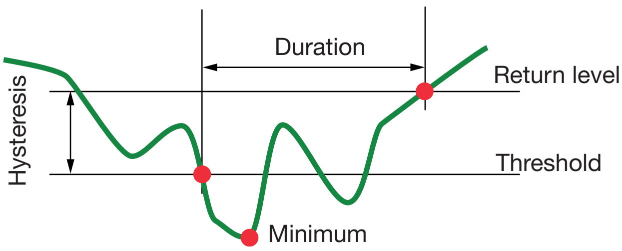
17.2.1. SURGE DETECTION

With a hysteresis of 2%, for example, the return level for surge detection is equal to (100% - 2%) or 98% of the reference voltage threshold.



17.2.2. UNDERVOLTAGE OR BLACKOUT DETECTION

With a hysteresis of 2%, for example, the return level for undervoltage detection is equal to (100% + 2%) or 102% of the Uref voltage threshold.



17.3. MINIMUM SCALE VALUES FOR WAVEFORMS AND MINIMUM RMS VALUES

	Minimum scale value (waveform mode)
Phase-to-neutral and phase-to-phase voltages	8 V (1)
Amp*FLEX*™	90 A
Mini*FLEX*	90 A
C clamp	8 A
PAC clamp	8 A
MN93 clamp	2 A
E3N clamp (10 mV/A)	0.8 A
MN93A clamp (100 A)	0.8 A
E3N clamp (100 mV/A)	0.08 A
MN93A clamp (5 A)	0.04 A (1)
5 A adapter	0.04 A (1)

(1) Value to be multiplied by the ratio in effect (if not unity).

17.4. FOUR-QUADRANT DIAGRAM

This diagram is used for power and energy measurements W (see § 10).

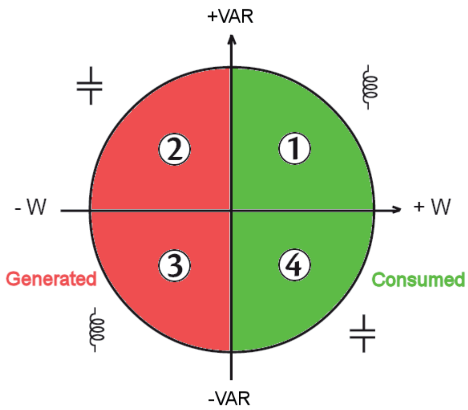
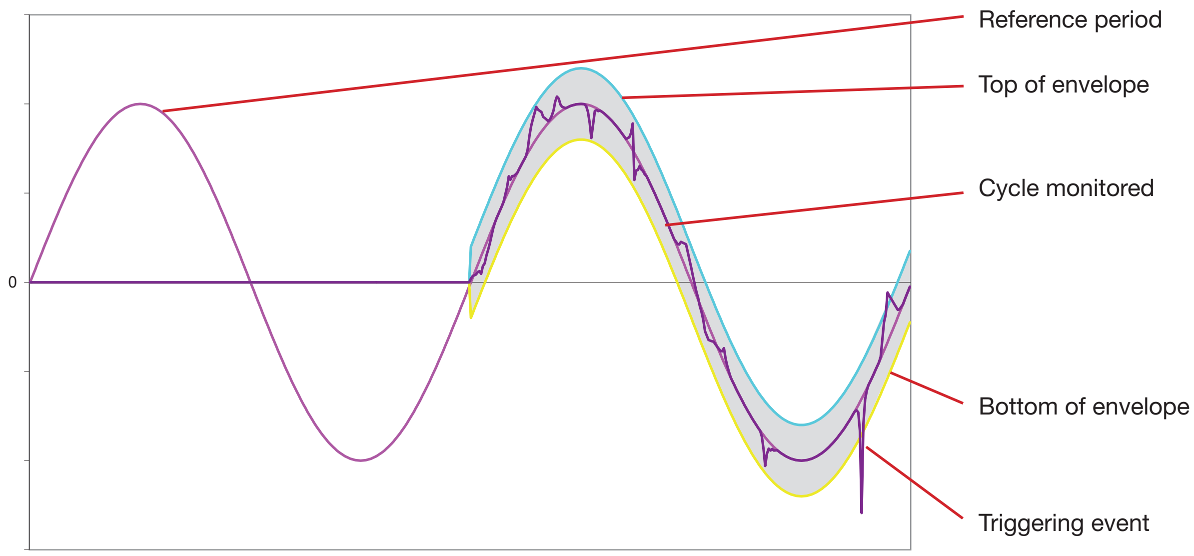


Figure 98: Four-quadrant diagram

17.5. MECHANISM FOR TRIGGERING TRANSIENT CAPTURES

The sampling rate is a constant 256 samples per cycle. When a transient capture is started, each sample is compared to the sample from the preceding cycle. The preceding cycle defines the mid-point of the trigger envelope and is used as reference. As soon as a sample is outside the envelope, the triggering event occurs; the representation of the transient is then captured by the C.A 8335. The cycle preceding the event and the three following cycles are saved to memory.

Here is a graphic representation of the transient capture triggering mechanism:



The half-width of the envelope for the voltage and current is equal to the threshold programmed in the Transient mode of the configuration (see § 5.8).

17.6. CAPTURE CONDITIONS IN INRUSH CURRENT MODE

The capture depends on a triggering (start) event and a stop event. If a capture ends with a stop event or if the recording memory of the C.A 8335 is full, the capture stops automatically.

The capture stop threshold is calculated as follows:

[Stop threshold [A]] = [Start threshold [A]] × (100 – [stop hysteresis [%]]) ÷ 100

Here are the conditions for triggering and stopping captures:

Triggering filter	Triggering and stop conditions
A1	Triggering condition ⇔ [A1 half-cycle RMS value] > [Triggering threshold] Condition d'arrêt ⇔ [A1 half-cycle RMS value] < [Stop threshold]
A2	Triggering condition ⇔ [A2 half-cycle RMS value] > [Triggering threshold] Condition d'arrêt ⇔ [A2 half-cycle RMS value] < [Stop threshold]
A3	Triggering condition ⇔ [A3 half-cycle RMS value] > [Triggering threshold] Condition d'arrêt ⇔ [A3 half-cycle RMS value] < [Stop threshold]
3A	Triggering condition ⇔ [[the half-cycle RMS value of **one** current channel]> [Triggering threshold] Condition d'arrêt ⇔ [the half-cycle RMS values of **all** current channels] < [Stop threshold]

17.7. GLOSSARY

Blackout: fall of voltage, at some point in the power network, to below a specified threshold.

Channel and phase: a measurement channel corresponds to a difference in potential between two conductors. A phase is a single conductor. In polyphased systems, a measurement channel may be between two phases, or between a phase and neutral, or between a phase and earth, or between neutral and earth.

Dip threshold: specific voltage used to define the beginning and end of a voltage dip.

Distortion factor (DF - Distortion Factor): ratio of the harmonics of a signal to the whole signal without the DC or bias component (THD-R).

Flicker: a visual effect of voltage variations.

Frequency: number of full voltage or current cycles in one second.

Fundamental component: component at the fundamental frequency.

Harmonics: in electrical systems, voltages and currents at frequencies that are multiples of the fundamental frequency.

Hysteresis: difference between thresholds for reciprocal changes of state.

K factor: used to quantify the effect of a load on a transformer.

Nominal voltage: Reference voltage of a network.

Order of a harmonic: ratio of the frequency of the harmonic to the fundamental frequency; a whole number.

Passband: range of frequencies in which the response of a device exceeds some specified minimum.

Peak (PK): maximum (+) or minimum (-) instantaneous value of a signal.

Peak factor (CF - Crest Factor): ratio of the peak value of a signal to the RMS value.

Phase: temporal relationship between current and voltage in alternating current circuits.

Power factor (PF): ratio of active power to apparent power.

Root Mean Square (RMS) value: square root of the mean of the squares of the instantaneous values of a quantity during a specified interval.

Severity of short-term flicker (PST): the C.A 8335 calculates its PST over 10 minutes.

Temporary surge at industrial frequency: temporary increase in voltage at some point in the power network, to above a specified threshold.

Total Harmonic Distortion (THD): ratio of all harmonics of a signal to the fundamental (THD-F).

Voltage dip: temporary fall of voltage, at some point in the power network, to below a specified threshold.

Voltage unbalance in a polyphased electric power network (UNB - unbalance): state in which the RMS voltages between conductors and/or the phase differences between successive conductors are not all equal.

18. MAINTENANCE

18.1. IMPORTANT RECOMMENDATION

⚠ For maintenance, use only the spare parts specified. The manufacturer cannot be held liable for any accident that occurs following a repair not performed by its customer service department or by an approved repairer.

18.2. RECHARGING THE BATTERY

The battery charge is managed by the device when connected to the AC network via the mains power unit supplied.

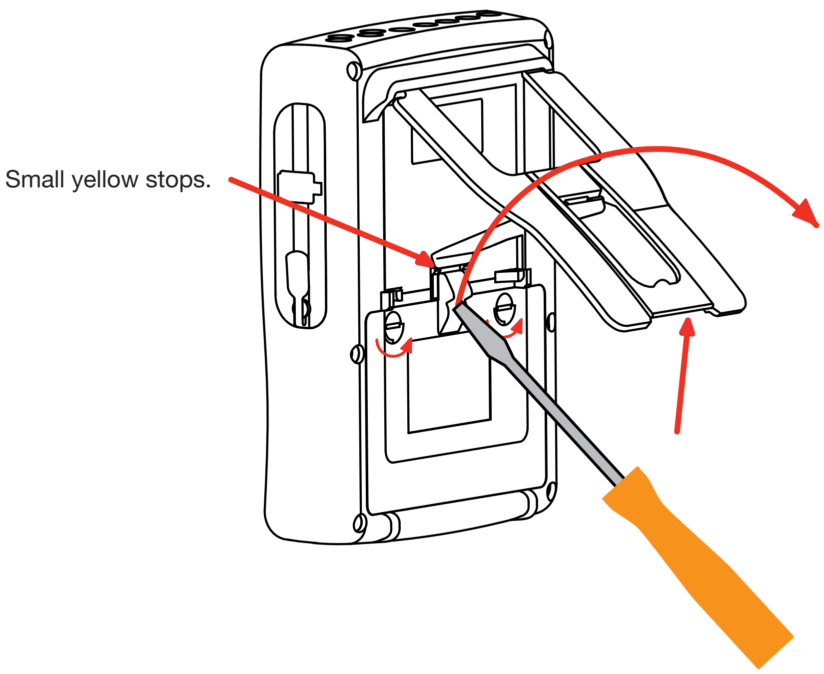
⚠
- **For safety reasons and to ensure the correct operation of the charger, the storage battery must be replaced with the power off.**
- **Do not throw the battery into a fire.**
- **Do not expose the battery to a temperature in excess of 100°C.**
- **Do not short-circuit the terminals of the battery.**

18.3. REPLACING THE BATTERY

⚠ For safety reasons, replace the battery only with the original model (see § 20.3).

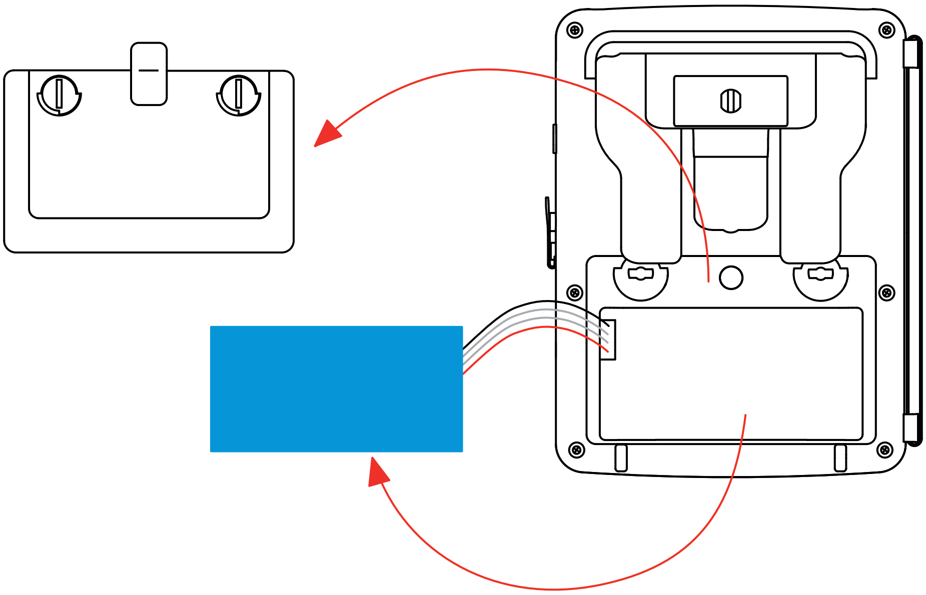
To replace the battery, proceed as follows:

Step 1: remove the old battery.
- To eliminate all risk of electric shock, disconnect the power supply cord and measurement leads.
- Turn the device over, raise the stand, and prop it up against the small yellow stops.
- Use a coin to unscrew the two quarter-turn screws on the back of the housing.



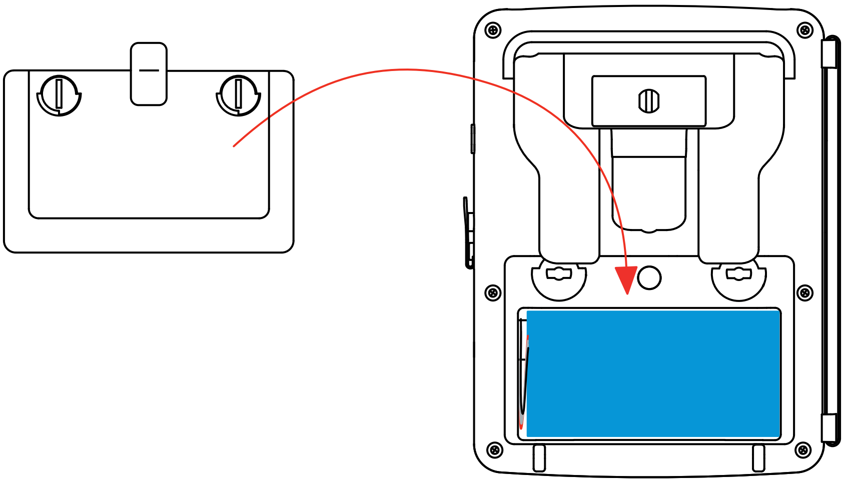
- Using a flat screwdriver, remove the cover from the compartment.

- Turn the device over and hold the battery as it slides out of its compartment.
- Disconnect the battery connector without pulling on the wires.



Remark: The Qualistar+ preserves the date-time function for approximately 24 hours without the battery.

Step 2: insert the new battery.
- Connect the new battery. The connector is error-proofed to prevent reversals of polarity.
- Place the battery in its compartment and arrange the wires so that they do not protrude.
- Put the battery compartment cover back in place and screw the 2 quarter-turn screws back in.



Note: If the battery is disconnected, it must then be fully recharged, even if it is not replaced, so that the device will know the battery charge condition (this information is lost when the battery is disconnected).

18.4. CLEANING THE CASING

Disconnect the unit completely and switch it OFF.

Use a soft cloth, dampened with soapy water. Rinse with a damp cloth and dry rapidly with a dry cloth or forced air. Do not use alcohol, solvents, or hydrocarbons.

18.5. REPLACING THE SCREEN FILM

Proceed as follows to replace the screen film of the C.A 8335:

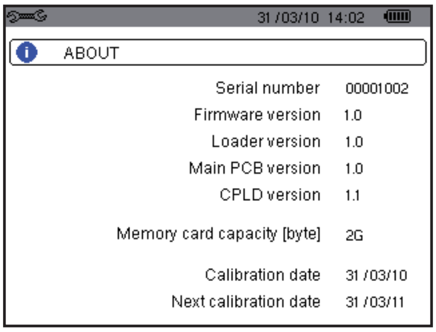
- Remove the old screen film.
- Remove the plastic film from the new screen film using the white tab.
- Place the adhesive side of the film against the screen of the C.A 8335. Smooth the film with a clean cloth to remove any air bubbles.

18.6. METROLOGICAL CHECK

⚠ **Like all measuring or testing devices, the instrument must be checked regularly.**

This instrument should be checked at least once a year. For checks and calibrations, contact one of our accredited metrology laboratories (information and contact details available on request), at our Chauvin Arnoux subsidiary or the branch in your country.

Note: After your C.A 8335 is checked, the About sub-menu of the Configuration menu displays the date of calibration and the date of the next calibration, as shown below:



18.7. REPAIR

For all repairs before or after expiry of warranty, please return the device to your distributor.

18.8. UPDATING OF THE INTERNAL SOFTWARE

With a view to providing, at all times, the best possible service in terms of performance and technical upgrades, Chauvin Arnoux invites you to update the embedded software of the device by downloading the new version, available free of charge on our web site.

Our site:
http://www.chauvin-arnoux.com
Sign in and open your account.
Then go to “Software support space”, then “Freely available software”, then “C.A 8335”.

Connect the C.A 8335 to your PC using the type A-B USB cord provided.

The embedded software update requires compatibility with the hardware version of the device, indicated in the *About* sub-menu of the *Configuration* menu (see § 5.12).

Warning: the update of the embedded software erases all data (configuration, alarms log, snapshots, inrush current capture, transient captures, trend recordings). Save any data you want to keep to a PC using the PAT software (see § 14) before updating the embedded software.

18.9. SENSORS

Current sensors must be maintained and calibrated as follows:

- Clean with a sponge and soapy water, rinse with a sponge and clean water, and dry rapidly.
- Keep the air gaps of the clamps (MN93, MN93A, C193, PAC93 and E3N) perfectly clean using a cloth. Lightly oil visible metal parts to avoid rust.

19. WARRANTY

Except as otherwise stated, our warranty is valid for **three years** starting from the date on which the equipment was sold. Extract from our General Conditions of Sale provided on request.

The warranty does not apply in the following cases:

- Inappropriate use of the equipment or use with incompatible equipment;
- Modifications made to the equipment without the explicit permission of the manufacturer's technical staff;
- Work done on the device by a person not approved by the manufacturer;
- Adaptation to a particular application not anticipated in the definition of the equipment or not indicated in the user's manual;
- Damage caused by shocks, falls, or floods.

20. TO ORDER

20.1. C.A 8335 POWER ANALYSER

C.A 8335 without clamp P01160577
C.A 8335 MN P01160571
C.A 8335 MN93A P01160572
C.A 8335 AMP450 .... P01160573
C.A 8335 AMP800 .... P01160574
C.A 8335 PAC P01160575
C.A 8335 C193 .... P01160576
C.A 8335 Mini*FLEX* P01160581

The device is delivered with:
- 1 no. 22 shoulder bag
- 5 black straight-straight safety cables 3 m long.
- 5 black crocodile clips.
- 1 specific PA 30 W mains power unit with mains cord.
- 1 set of 12 inserts and rings to identify voltage phases and leads and current phases and leads.
- 1 USB A/B cord, 1.80m long, with ferrite.
- 1 Power Analyser Transfer (PAT) software.
- 1 calibration certificate
- 5 user's manuals on CD (one per language)
- 5 safety sheets (one per language)

and, when clamps are included:
- 4 current sensors (one type from among the 7 possible).

20.2. ACCESSORIES

5 A adapter unit (three-phase) P01101959
MN93 clamp P01120425B
MN93A clamp P01120434B
PAC93 clamp P01120079B
C193 clamp P01120323B
Amp*FLEX*™ A193 450 mm P01120526B
Amp*FLEX*™ A193 800 mm P01120531B
Mini*FLEX* MA193 200 mm P01120580
E3N clamp P01120043A
E3N clamp adapter P01102081
Mains power unit + E3N clamp P01120047
Dataview software P01102095

20.3. SPARE PARTS

9.6 V 4 Ah NiMH battery pack P01296024
USB-A USB-B cord P01295293
PA30W mains power unit P01102057
Screen protection film P01102059
No. 22 carrying bag........ P01298056
No. 21 carrying bag........ P01298055
Black banana-banana straight-straight safety cables .... Please consult us
Black crocodile clips .... Please consult us
Set of 12 inserts and rings to identify voltage phases and leads and current phases and leads P01102080

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