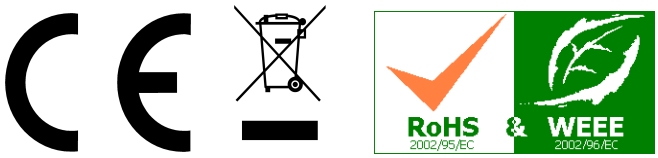
elcontrol® energy net

NanoVIP³

USER MANUAL

Congratulations on having chosen ***NanoVIP³***, a product based on Elcontrol's 50 years of experience in the control of power consumption.
High technological content, careful material selection, and full compliance with the latest regulations, make this product the only one of its kind.
NanoVIP^3 has been designed, built and tested in Italy. It complies with all qualitative requirements for European products regarding the environment, safety and work ethics.



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1 - PRESENTATION

NanoVIP[3] is a leading device equipped with new functions for measuring and monitoring power consumption and for advanced power and power quality analysis. This device can measure, display, process and transmit all the parameters of a system.
With regard to the most common power analysers, its main unique features are as follows:

- new, modern, elegant design which makes this device a *handheld* product – and therefore, light and easy-to-use – with the best performance in its category;
- *Highly efficient 128x128 pixels backlit graphical LCD* for *high ductility display* (multilingual menus, waveforms, histograms, menus, drawings, schemes, images customisation, etc.) and perfect viewing even from a distance;
- *4 voltage measuring channels* (3 with common neutral + 1 auxiliary independent) up to 600V CAT III, able to measure continuous voltage with an accuracy of ±0.25% + SF err.;
- *5 current inputs* (3 independent + 1 for neutral current + 1 auxiliary) able to measure continuous voltage with an accuracy of ±0.25+SF err.;
- Equipped with *flexible current clamps* up to 3000A. Traditional full scale sensors, which can be set by the user, may also be used.
- *High performance battery pack* with more than 24 hours of battery life, so that extended measurement campaigns can also be performed without using main power supply;
- *Powerful but compact external power supply*, compatible with all types of sockets (USA/JP, EU, UK, AU);
- *Membrane keypad* with *10 double-function keys* for easier scrolling of menus and access to different functions;
- Calculation engine based on 16-bit microprocessor, allowing for the measurement of all standard quantities (V I P Q A F PF THD% etc.) in true root mean square (TRMS) value, as well as:
  - Measurement of minimum, average and maximum instant values *on 4 quadrants* (absorbed and generated).
  - *Absorbed and produced* power counters (kWh kVA kVAr), which can be password-protected.
  - *Power quality analysis* by measuring:
    - current and voltage harmonics (all 7 input channels) up to the 50th order;
    - *Network interruptions & micro-interruptions*
    - *Dips* (brownouts)
    - *Swells* (overvoltages)
    - *EN50160 test* (reference standard for power quality)
  - *Event log* (last 5 alarms, 5 dips, 5 swells, 5 interruptions)
  - *Power measurement during 4 time periods* (tariffs), which can be set
  - *For three-phase and each single phase!!!*
  - *6 different electrical systems which can be analysed* (single-phase; two-phase; 3-lead three-phase (unbalanced); 4-lead three-phase (unbalanced); 3-lead three-phase (balanced); 4-lead three-phase (balanced).
  - Medium voltage connection available
- User can *select* the values to be displayed.
- *Multilingual menus* (English, Italian, German, Spanish, French).
- *Automatic connection test* to check if electrical connections are correct.
- *Micro SD memory card* for extended measurement campaigns.
- *Special PC software*, allowing for advanced analysis of data stored on uSD card.

1.1 - Intended Use

NanoVIP[3] is a measuring tool designed for those in need of an accurate and easy-to-use product. It is aimed at both users who want to understand their systems better, and Energy Managers, system installers, electricians, and maintenance workers, for diagnosis and intervention, or for the provision of integral consulting services on electrical power.
NanoVIP[3] allows users to:

- monitor loads, consumption and related costs;
- check if the new systems are dimensioned correctly;
- prevent overheating and lack of insulation due to high harmonics content;
- solve any power factor correction problems;
- identify and eliminate load peaks and excess demand, thereby reducing contractual power consumption;
- monitor power and consumption in the different time bands;
- check and assess the performance of UPSs, with AC/DC measurements;

- measure signals - including asymmetrical signals - for PWM controls on inverters;
- identify the cause of problems resulting from low quality power (presence of harmonics, interruptions, overloads, dips, unbalance in voltage phases, etc.), which may bring about a production standstill, and which may affect or reduce the life cycle of equipment and systems;
- identify fast fluctuations and variations in current and voltage signals;
- measure inrush current of electrical engines and equipment.

2 - SAFETY AND WARRANTY

NanoVIP^3 has been designed and tested in accordance with the latest directives in force, and complies with all technical and safety requirements. To preserve the product and ensure its safe operation, follow the instructions and the CE markings contained herein.

CAUTION! Please read these instructions carefully before using the device!

2.1 - Operators' Safety

- The instrument described herein must only be used by trained personnel.
- Connection and maintenance operations must only be carried out by qualified and authorised personnel, as they may result in electrocution, burns or explosions.
- For the correct and safe use of the instrument, as well as for all installation and maintenance purposes, operators must always comply with standard safety procedures. The manufacturer shall in no way be liable if such procedures are not complied with.
- Before connecting the instrument to the electrical system, as well as before handling, maintaining or repairing the instrument, the instrument and the electrical cabinet to which it is connected must be disconnected from any voltage source.
- Before turning on the instrument, make sure the maximum voltage at the voltmeter inputs is 1000VAC phase/phase or 600VAC phase/neutral.
- If the instrument can no longer be operated safely, it must be discarded and measures must be taken to prevent accidental use. Safe operation is no longer possible in the following cases:
  - ! if damage to instrument is clearly visible;
  - ! if instrument is no longer working;
  - ! after being stored for an extended period under unfavourable conditions;
  - ! if instrument is badly damaged during transportation.

The symbol shown here on the right - when found on the product or elsewhere - means that the user manual must be consulted.

2.2 - EC, RoHS & WEEE Declaration of Conformity

Manufacturer:	**ELCONTROL ENERGY NET S.r.l.** Via Vizzano 44 40044 Sasso Marconi (BO) - Italy
Product:	**NanoVIP^3** / **NanoVIP^2**Power Analyser
Directives complied with: Equipment);	**93/68/EEC** (Low Voltage Electrical
	89/336/EEC and **2004/108/EC** (EMC - Electromagnetic Compatibility); **2006/95/EC** - **72/23/EEC** (LVD - Low Voltage Directive); **2002/95/EC** (RoHS); **2002/96/EC** and **2003/108/EC** (WEEE).
Year of mark affixing:	2012
Certificate:	12CDC27 by Lem S.r.l. Notified Body
Reference standards applied for EC compliance:	EN 61010-1 EN 61326 EN 61326/A1 EN 61326/A2 EN 61326/A3

2.3 - Reference Standards

Standard	Title	Description	Int. Link
EN 61010-1	Safety requirements for electrical equipment for measurement, control, and laboratory use.	General safety requirements for electrical equipment intended for professional, industrial process, and educational use. Electrical test and measurement, control, and laboratory equipment.	Identical to IEC 61010-1:2001-02 EN 61010-1:2001-03
EN 61326	Electrical equipment for measurement, control and laboratory use. EMC requirements.	This Standard specifies the minimum requirements for immunity and emissions regarding electromagnetic compatibility (EMC) for electrical equipment, operating from a supply or battery of less than 1000 VAC or 1500 VDC, intended for professional, industrial-process, industrial-manufacturing and educational use, including equipment and computing devices for measurement and test; control; laboratory use; accessories intended for use with the above equipment.	Identical to IEC 61326-1: 1997-03 EN 61326-1:1997-04 EN 61326-1 Ec:1998-01
EN 61326/A1	Electrical equipment for measurement, control and laboratory use. EMC requirements.	This amendment modifies the requirements for the immunity tests laid down in Standard IEC EN 61326 for the three specific applications specified below: Use in industrial environment; use in laboratories or test and measurement areas with electromagnetically-controlled environments; portable test and measurement equipment operating from a battery or from the circuit being measured.	Identical to IEC 61326-1/A1: 1998-05 EN 1326/A1: 1998-06 EN 61326-1 Ec:1998-09
EN 61326/A2	Electrical equipment for measurement, control and laboratory use. EMC requirements.	This amendment adds an annex to the basic Standard introducing more detailed specifications regarding test configurations, operating conditions, and performance criteria for certain equipment intended for applications where no special EMC requirements are provided. Some examples of such equipment are: oscilloscopes, logic analysers, spectrum analysers, digital multimeters, etc.	Identical to IEC 61326-1/A2: 2000-08 EN 61326/A2: 2001-05
EN 61326/A3	Electrical equipment for measurement, control and laboratory use. EMC requirements	This amendment to IEC EN 61326 (IEC 65-50) adds regulatory Annexes E & F to the basic Standard, regarding test configurations, operating conditions, and performance criteria for portable test, measurement and monitoring equipment which are used in low voltage distribution systems.	Identical to: IEC 61326:2002-02 (Annex E & F); IEC 61326/Ec1:2002-07 EN 61326/A3:2003-12

2.4 - Warranty Conditions

WARRANTIES AND DISCLAIMERS

Elcontrol guarantees that each NanoVIP^{3}is free of defects, complies with technical specifications, and is suitable for the purposes declared by Elcontrol for a period of *twelve (12) months from the documented purchase date* or, in the absence of said date, the date of calibration.
The warranty covers faulty hardware parts, but not software, consumables and labour and transport costs.
Repairs under warranty shall only be performed if Elcontrol actually finds manufacturing defects or poor material quality.
The warranty shall no longer be valid if the defect is due to: incorrect electrical power supply, swells, improper connections, tampering, repairs or modifications carried out without the prior consent of the manufacturer, accidents or use other than that described herein. Damage resulting from disuse or any harm caused to third parties shall not be covered.
Faulty products must be returned to the importer/distributor in your country or to Elcontrol DELIVERED DUTY PAID, subject to prior consent of Elcontrol.
A request for repair under warranty shall be accompanied by proof-of-purchase, stating the date on which the product was purchased. The warranty shall not be valid for products which have not been paid by the purchaser by the agreed deadline, as well as if the faulty product is returned from a country other than that where the product was sold, unless otherwise agreed.

DEFECT REPORT

Any defect reports regarding delivered products - whether apparent or latent - shall be submitted to Elcontrol in writing.
The purchaser can in no way return the products without the prior consent of Elcontrol or following the decision of the judicial authorities.
Products must be returned within ten (10) days of the consent of Elcontrol or the judicial authorities.
In the event of a report - regardless of the object and reason therefore - the purchaser shall pay the full amount indicated on the invoice. If the delivered products have been modified, altered or used by the purchaser, no report shall be accepted or deemed valid.
Discrepancies which are deemed customary in trade, as well as discrepancies which cannot be technically avoided, especially those concerning quality, colours, manufacturing processes, drawings and similar aspects, cannot be the object of a claim.
Elcontrol reserves the right to make any changes to its products without altering their quality or performance. Such changes cannot be the object of a claim.
Whenever Elcontrol receives a claim regarding the condition of a product, quality defects or non-compliance with technical specifications, Elcontrol shall have the right - in its sole discretion - to replace the products without any charge, repair the products or issue a credit note.
Any kind of damage is excluded.
In case of interventions under the warranty period, all shipping costs for repairing and/or replacing the faulty products shall be borne by the purchaser.

LIMITATION OF LIABILITY

Except for the warranty, Elcontrol shall in no way be liable for any direct or indirect damage incurred by the purchaser, such as – but not limited to – material damage, damage for loss in profit and loss, damage to purchaser's documents, archives or data, damage for third party claims, and damage claimed by any party whatsoever, resulting from applications obtained by the purchaser for himself or third parties, with the help – or the use – of products purchased from Elcontrol.

FINAL PROVISIONS

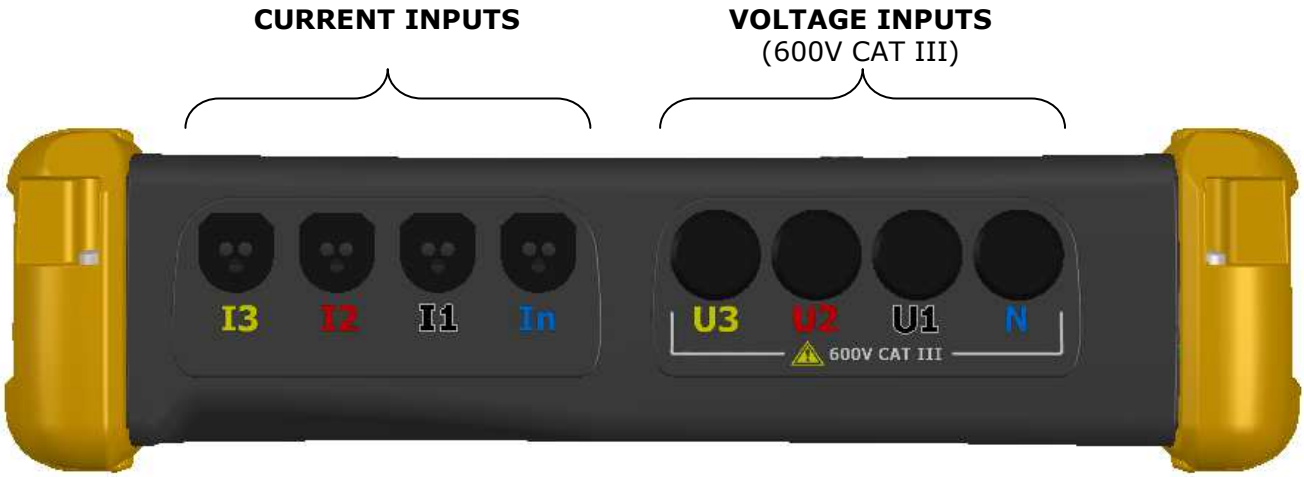
The warranty conditions described herein supersede and void any other obligations and warranties which the parties may have agreed upon – both orally and in writing – before the purchase of NanoVIP^3. Therefore, any such obligations or warranties shall be deemed void and invalid.

3 - DESCRIPTION & CONNECTION TO THE ELECTRICAL SYSTEM

NanoVIP^3 is designed to carry out both real time measurements and extended measurement campaigns.
It is equipped with shockproof, anti-slip rubber details which make it easy to hold with one or both hands, and a support which allows the user to place the instrument on a level surface.

NanoVIP^3 has to be connected to the electrical system by means of special voltage and current inputs.
The figure below shows the 3 voltage channels **U1**, **U2** and **U3**, with common neutral (**N**), and the 4 independent current channels **I1**, **I2**, **I3**, **In**.

The initials below the inputs help the user identify them.



The voltage cables - which come with the instrument - are connected to the voltage inputs. Make sure the cables are connected to the corresponding colours. Alternatively, any cable with a blade plug connector, ∅4mm and certified for at least 600V CAT III, may be connected.
The current inputs can be connected to the flexible current mini-clamps, which come with the instrument and are marked with special coloured rings, which correspond to the different phases. Alternatively, other Elcontrol Energy Net amperometric probes may be used, depending on the specific measurement requirements.
For more details, read Sect. 9 – Accessories & Spare Parts.

An independent, auxiliary voltage input (**U_{AUX}**) and an independent, auxiliary current input (**I_{AUX}**) are also available.
The cables and current sensor for such channels are optional (see Sect. "ACCESSORIES").

3.1 - Power Supply

NanoVIP^3 is equipped with an external power supply which can be connected to any socket (USA/JP, UK, EU, AU) with voltage 100÷240V~ ±10% and frequency 47÷63 Hz.
The output jack of the power supply is to be connected to the special 7.5VDC connector of the device.
The instrument is also equipped with a NiMh rechargeable battery pack, which guarantees more than 24 hours of use, without you having to connect it to the main line. Batteries are recharged by an external power supply, which is supplied with the instrument. Batteries cannot be recharged through the USB connection.
If NanoVIP^3 is not used for a long period of time, then perform a charge cycle every two months (approximately) to prevent the batteries from going almost completely flat, in which case you will no longer be able to recharge them.

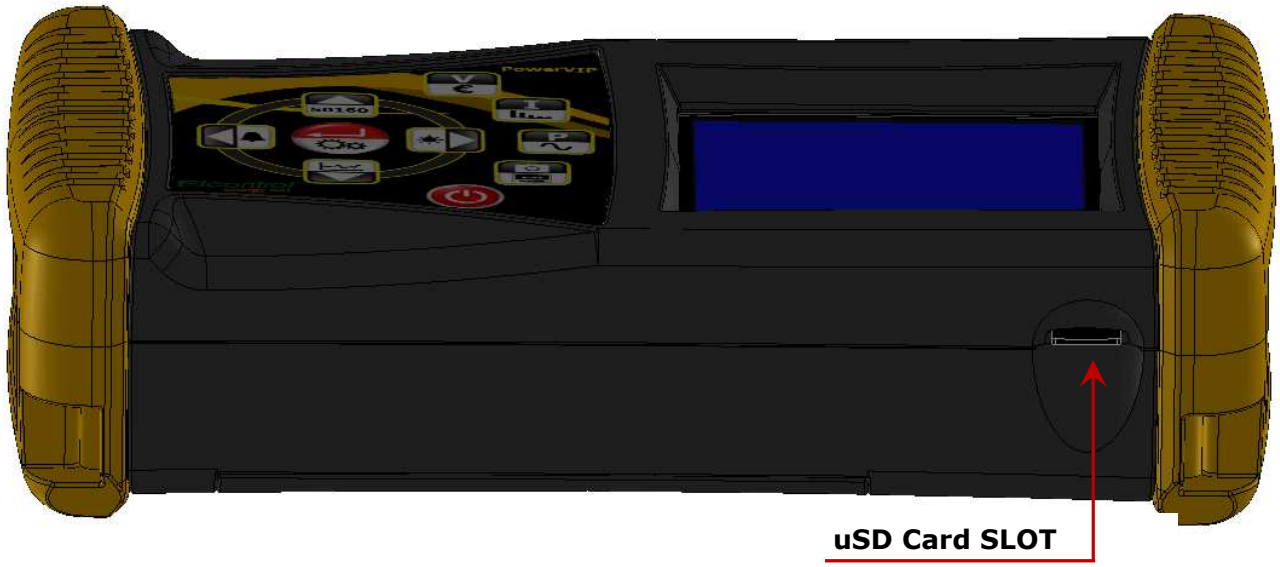
3.2 - USB Port

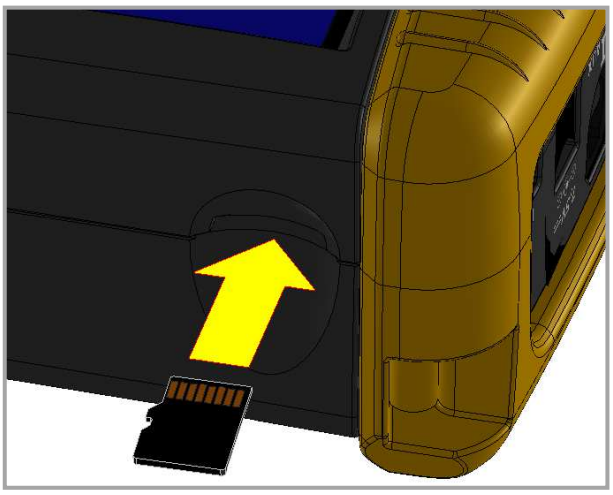
NanoVIP[3] can be connected to a PC through the USB port and the cable supplied. This connection allows the user to download the MODBUS measurement registers using the PC Energy Studio Manager software.
The USB communication may also allow easy upgrade of the firmware (internal software) of the instrument.

NOTE: If the PC does not automatically detects NanoVIP[3] as a device, download or update the appropriate drivers at www.ftdichip.com/Drivers/VCP.htm

3.3 - Memory Card

NanoVIP[3] is equipped with a slot for a 2 GB uSD memory card, which can be used to store measurement campaigns data (Sect. 5.2.11.2), fast transients (Sect. 5.2.10.1) and inrush currents (Sect. 5.2.10.2).





The memory card must be inserted as shown in the figure on the left, with the contacts facing up.

NOTES: The slot is push-push type (the card is both inserted and removed by pressing it). Do not try to remove the card by pulling it, as this will damage the connector.
Do not remove the uSD card whilst a measurement campaign is being performed, as all data will be lost.

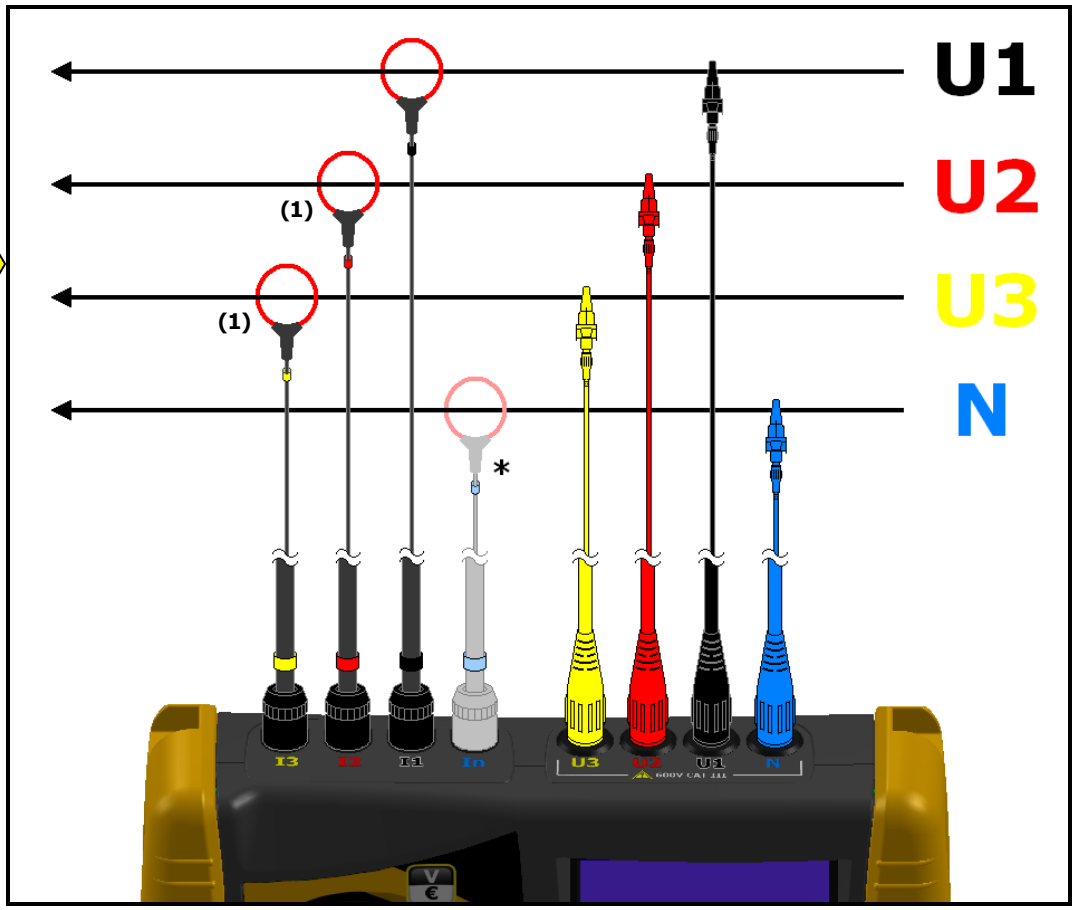
The uSD card is supplied with the instrument, together with the:

- User Manual
- PC software (See software manual for use)

3.4 - Electrical Connection Schemes

Some examples of electrical connections are shown below (See Sect. 4.2.1.1).

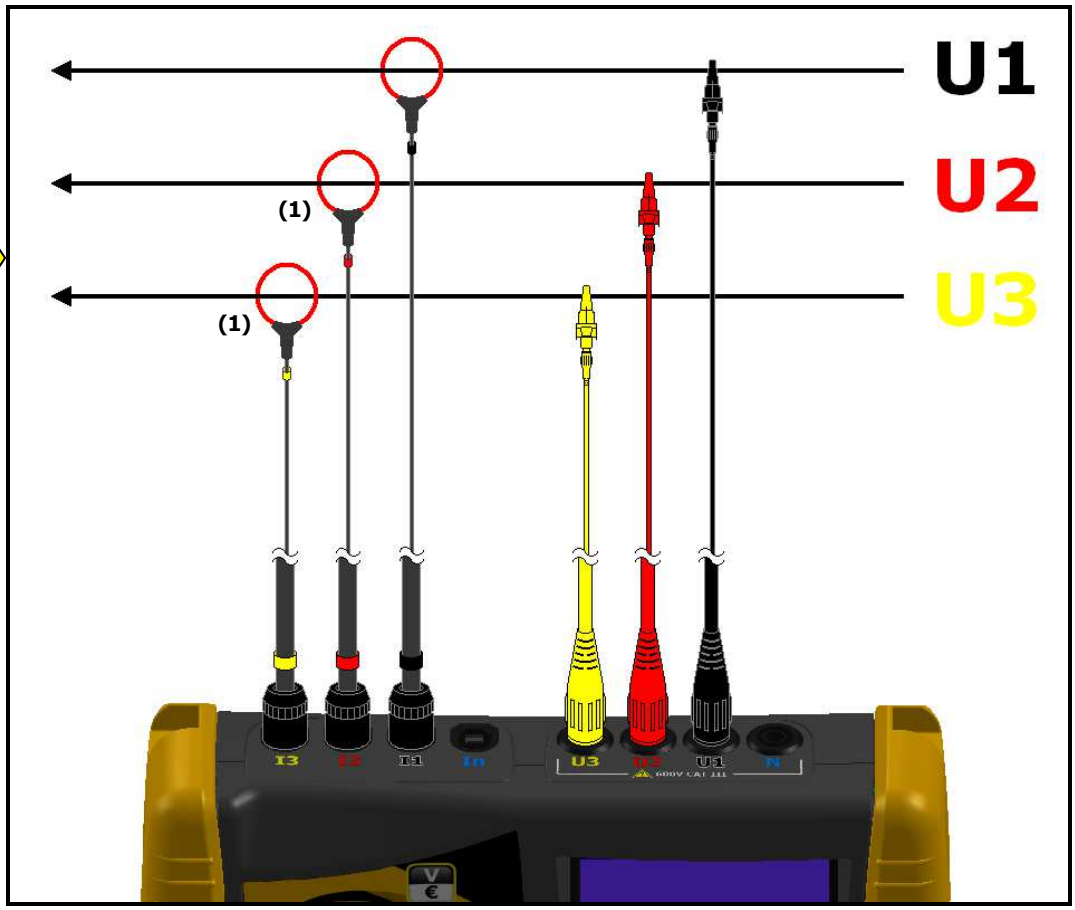
3Φ+N
3Φ+N-BL



* The 4th current probe is optional (See Sect. 9 - Accessories)

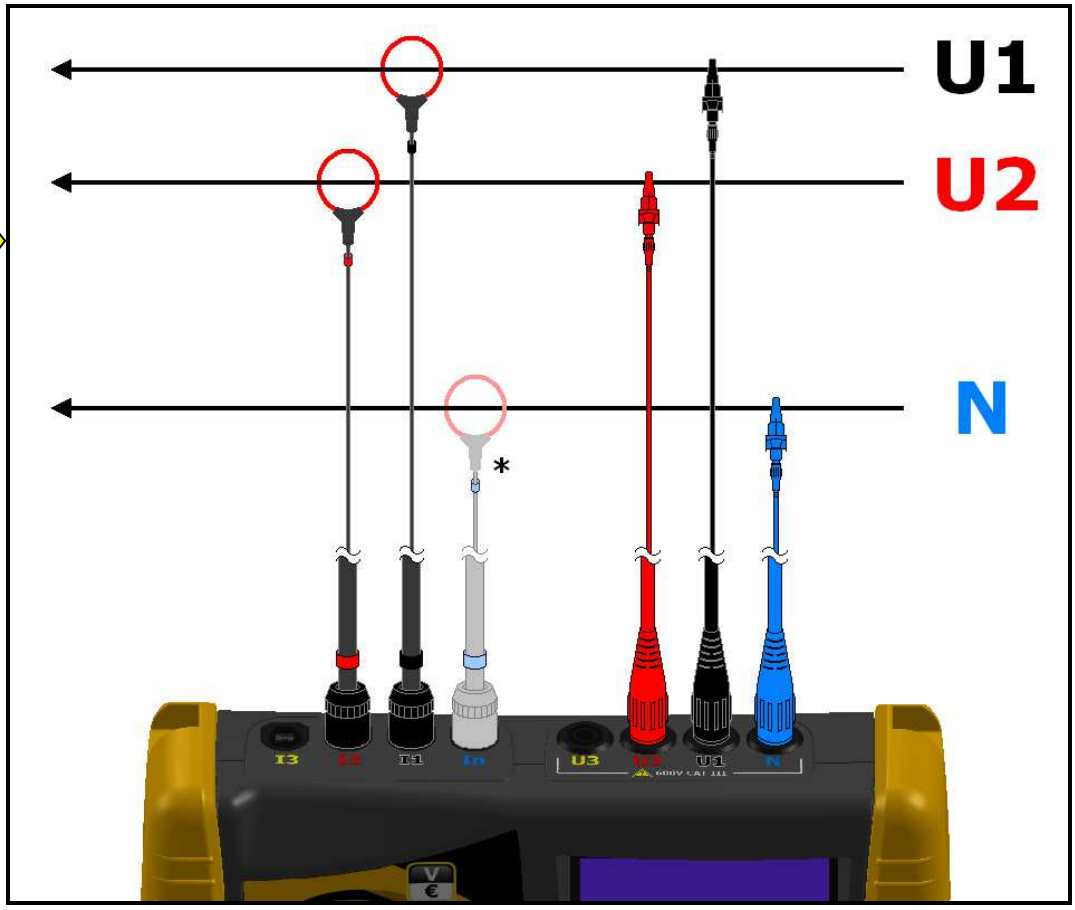
(1) Do not use in the balanced three-phase connection (**3Φ+N-BL**)

3Φ
3Φ-BL



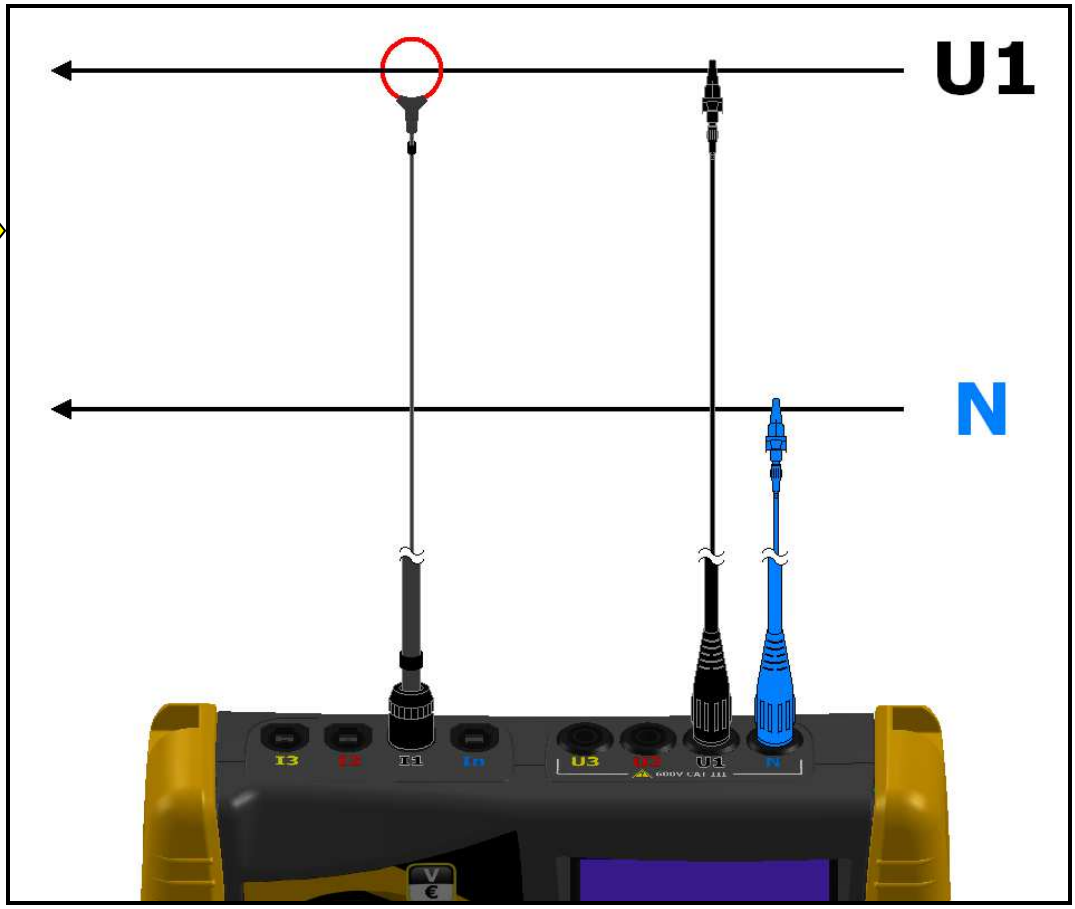
(1) Do not use in the balanced three-phase connection (**3Φ-BL**)

2Φ

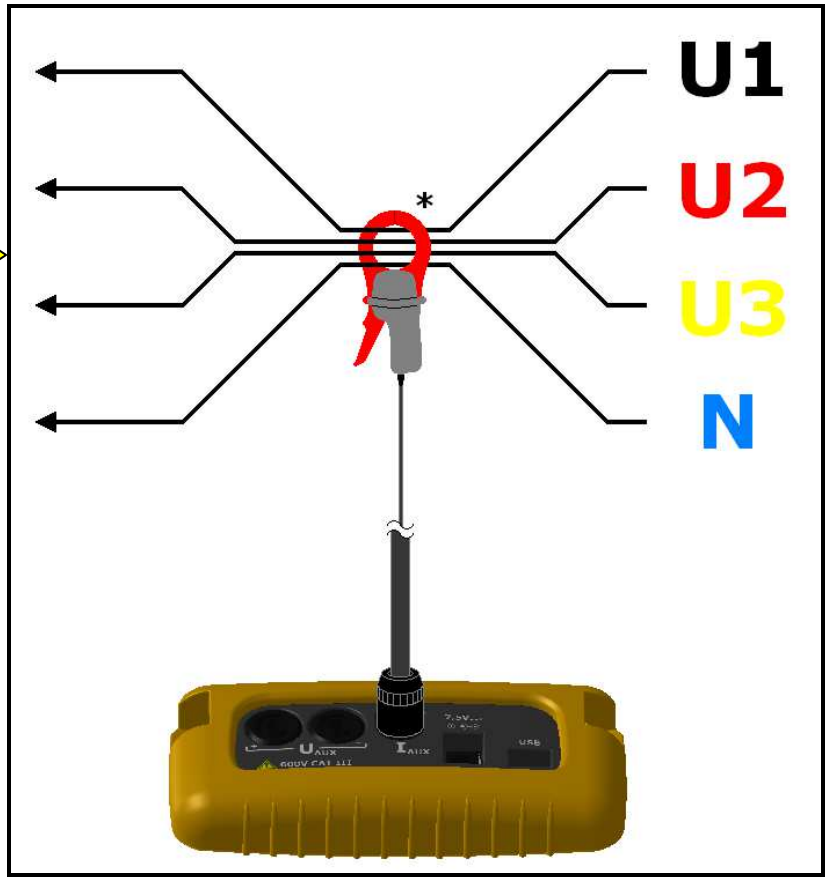


* The probe for measuring the neutral current is optional.

1Φ

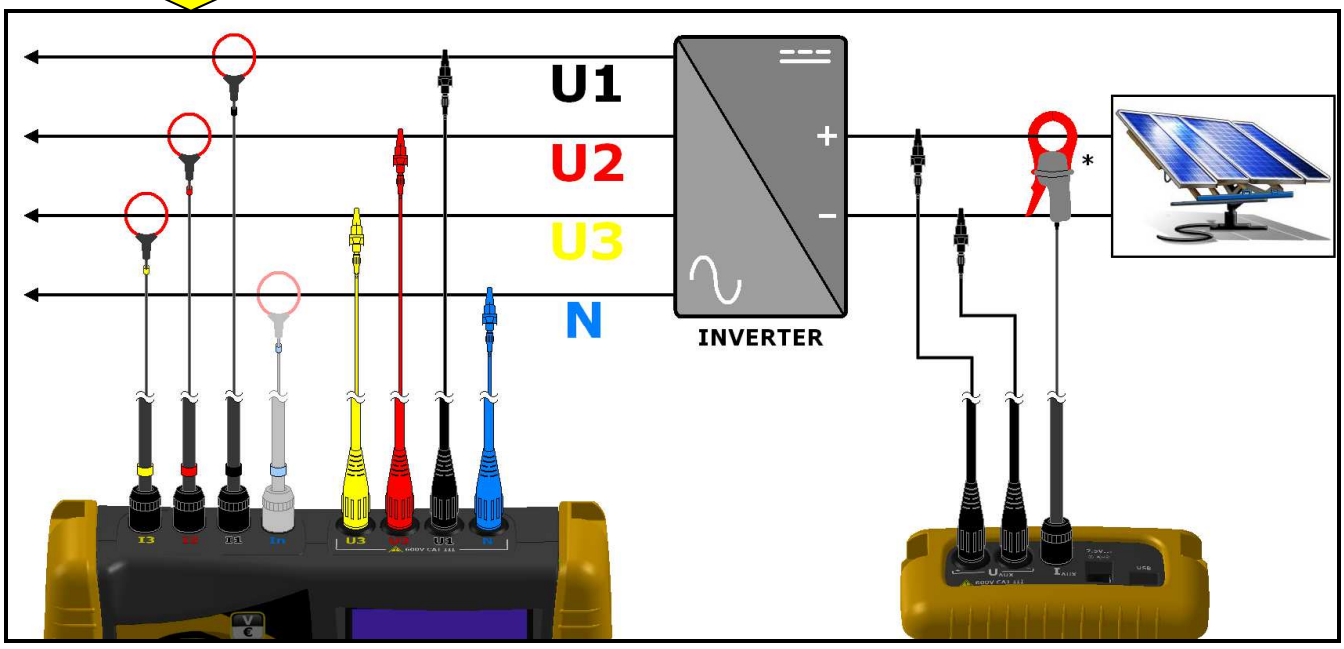


Dispersion Measurement I
(can be combined with the previous schemes)



* **LMA** clamp is optional
(See Sect. 9 – Accessories)

Example of connection on inverter

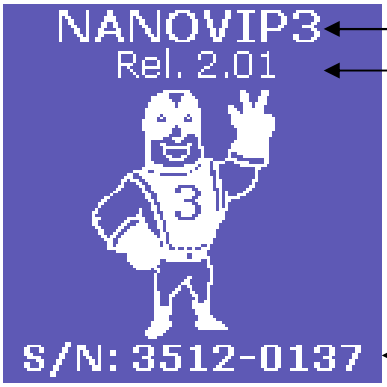


* **DC** clamp and additional voltage cables are optional

4 - START-UP

Before using NanoVIP[3] the correct configuration must be done, depending on the type of installation and system to which it will be connected. Make sure the electrical cabinet is off before connecting the instrument. Once the connection is complete, switch on the electrical cabinet and the instrument by pressing and holding down the **POWER** key for approximately 3 seconds (the same action switches off the instrument).

At start-up, the following screen will be displayed for a few seconds:



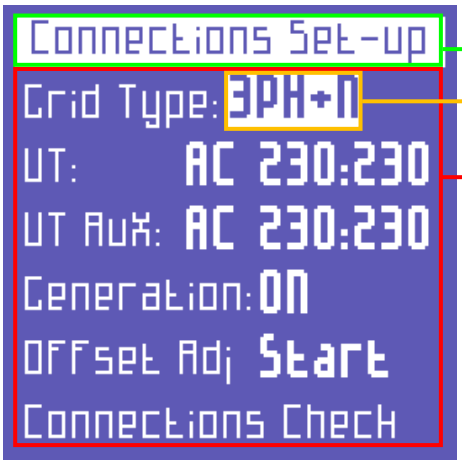
- product model;
- software version;
- serial number.

4.1 - User Interface

For easy use, NanoVIP[3] is equipped with a graphic LCD and a membrane keypad with snap domes for tactile feedback, described in detail in Sect. 4.1.2.
The software architecture of the instrument is divided into MENUS, more specifically SETUP and MEASUREMENT Menus. Each menu consists of a number of pages, which are described in the following section.

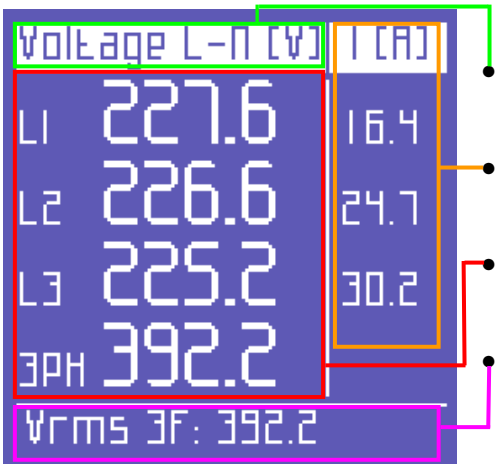
4.1.1 - Description of Setup & Measurement Menus

A typical **SETUP** Menu consists of:



- a heading showing the name/title of the screen;
- an area with the fields to be selected - and possibly modified - by means of the **cursor**.

A typical **MEASUREMENT** Menu consists of:

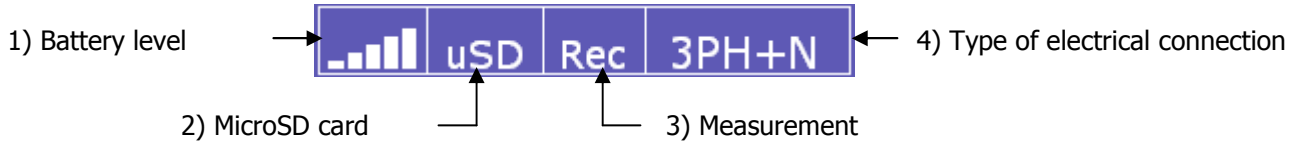


- a heading showing the name/title of the screen;
- an area displaying related parameters (See NOTE);
- an area displaying the main parameters;
- a bottom bar displaying alternating information (See Sect. 4.1.1.1)

NOTE: based on the type of menu, the area of related parameters and/or the bottom bar may not be displayed.

4.1.1.1 - Bottom Bar

This area displays information regarding the status of the instrument, such as:



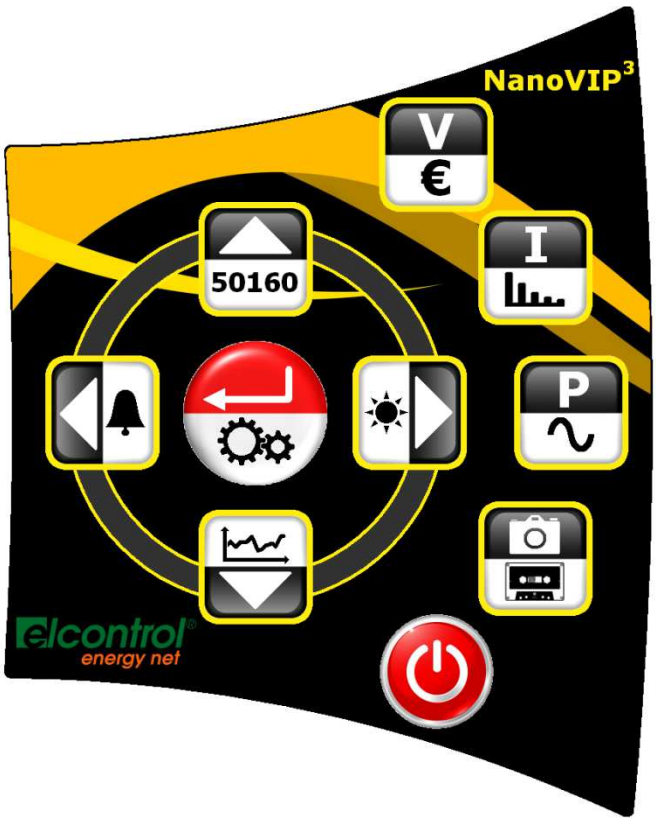
1) Indicates battery life
2) Indicates whether or not a memory card has been inserted
3) Indicates whether or not a measurement campaign is being performed or is scheduled, according to the methods described in Sect. 5.2.10
4) Indicates the type of electrical connection selected (Sect. 4.2.1.1)

In addition to the above information, the bottom bar will alternate between 3 parameters of the user's choice (Sect. 4.2.8).

4.1.2 - Keypad

The NanoVIP[3] keypad is equipped with 9 double-function keys, i.e. the function of each key varies depending on whether it is pressed once or pressed and held for approximately 3 seconds.
Specifically, the functions represented by the icons on the black background (**V**, **I**, **P**, , , , , ,) are activated by pressing the relevant key, whereas the functions represented by the icons on the white background (**€**, , , , **50160**, , , ,) are activated by pressing and holding down the relevant key.
Therefore, the instrument has 12 function keys, a joystick with the Enter function and arrow keys, and a key to access the Setup Menu directly, which allow for a more immediate and effective use of the instrument.
The Power (⏻) key must also be pressed for approximately 3 seconds to be activated.

Moreover, when an alphanumerical value in a field in the Setup Menu must be changed (Sect. 4.2), pressing and holding down the ▲ or ▼ keys will accelerate scrolling, so that the desired value can be reached faster and easier.



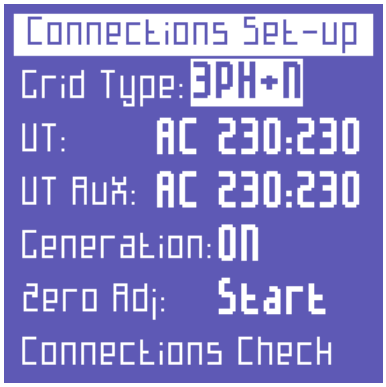
NOTE

Each key is made of a special metal dome. The "click" which can be heard when pressing a key confirms contact.
This technology is more reliable than the classic membrane with embossed keys. However, avoid pressing the keypad too hard, as this may cause damage or the keypad to malfunction.

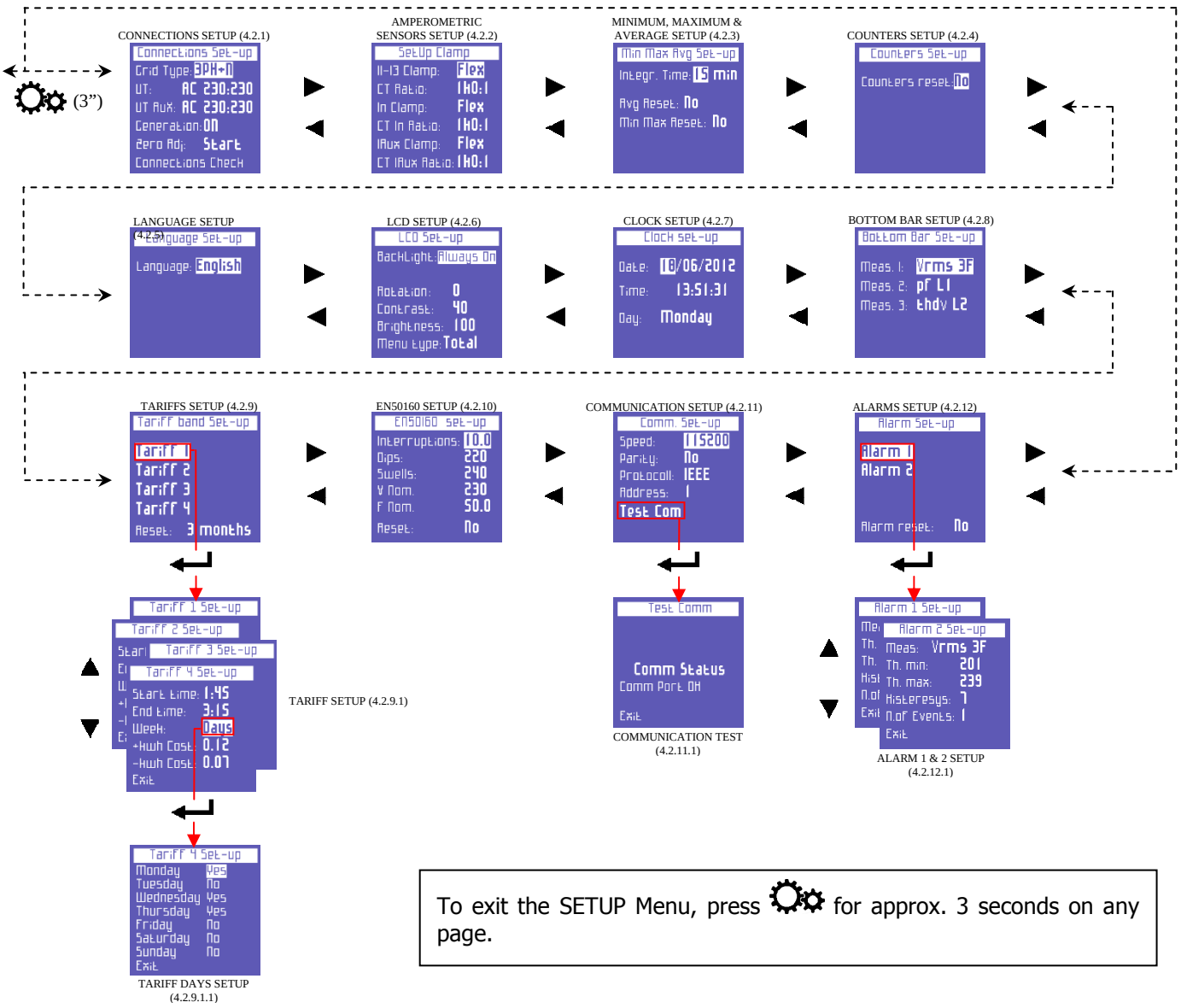
The use of the keypad can easily be learnt through the Setup Diagrams (Sect. 4.2) and Measurement Diagrams (Sect. 5.1). The table below provides a general description of the keys.

KEY	FUNCTION	
	Press Once	**Press and Hold for 3 seconds**
		Switch the instrument **ON** and **OFF**
	Access to **VOLTAGES** Menu	Access to **COUNTERS** Menu
	Access to **CURRENTS** Menu	Access to **HARMONICS - THD - Cosφ** Menu
	Access to **POWER** Menu	Access to **WAVEFORMS** Menu
	Snapshot Function: Takes a snapshot of the parameters and displays them for the desired period of time.	Access to **MEASUREMENT CAMPAIGN** Menu
	• Access to **AUX** channel. • After pressing ↵ , scrolls through the harmonics, trends, dips, interruptions, and alarms menus.	Access to **PHOTOVOLTAIC** (if enabled)
	• Scrolls down the pages of a measurement menu. • Moves cursor down in the setup pages. • Decreases the selected value in the setup pages.	Access to **TRANSIENTS** Menu
	• Exits **AUX** channel. • After pressing ↵ , scrolls through the harmonics, trends, dips, interruptions, and alarms menus.	Access to **ALARMS** Menu
50160	• Scrolls up the pages of a measurement menu. • Moves cursor up in the setup pages. • Increases the selected value in the setup pages.	Access to **EN 50160** Menu
	• Selects a parameter to be modified in the setup pages. • Access to a measurement subpage or submenu. In this case, ENTER will be displayed in the lower right corner of the display.	Access to **SETUP** Menu

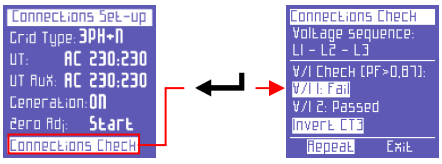
4.2 - Programming & Setup



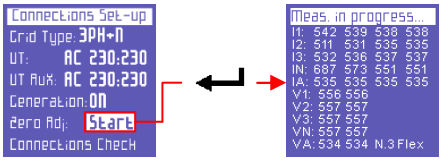
Press ⚙ for approximately 3 seconds to access the configuration menus.
Use ▲ and ▼ keys to select the parameter to be configured.
Press ↵ and the cursor will start to flash. Use ▲ and ▼ keys to modify the selected value.
Press ↵ again to confirm the value. The cursor will stop flashing.
Press ▶ and ◀ to scroll through the setup pages, as illustrated in the flowchart below.
As shown in the flowchart, the menus have a loop-type structure, i.e. when the end of the last page is reached, the menu automatically returns to the first page. You can scroll through the menus in either direction.



To exit the SETUP Menu, press ⚙ for approx. 3 seconds on any page.

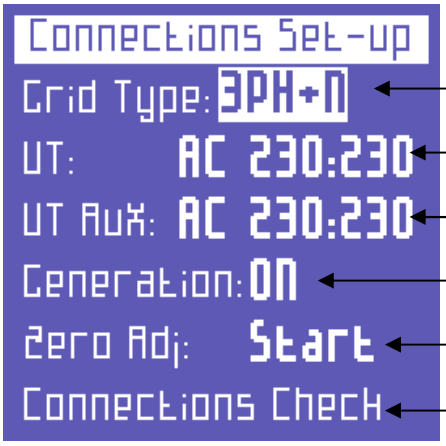


CONNECTION CHECK (4.2.1.6)



ZERO ADJ (4.2.1.5)

4.2.1 - Connections Setup



This menu allows the user to:

- Set the type of electrical network to which the instrument is connected (Sect. 4.2.1.1).
- Set the type of voltage and voltage ratio for phases L1, L2, and L3 (Sect. 4.2.1.2).
- Set the type of voltage and voltage ratio for U AUX (Sect. 4.2.1.3).
- Activate/deactivate measurements in cogeneration mode (Sect. 4.2.1.4).
- Automatically adjust the zero level of measuring channels (Sect. 4.2.1.5).
- Check if the instrument and relevant probes are connected to the electrical system correctly (Sect. 4.2.1.6).

4.2.1.1 - Type of Electrical Connection Setup

To set the type of connection, enter the **CONNECTIONS SETUP** Menu, place the cursor on **GRID TYPE** and select one of the following options (See Sect. 3.2):

- **3PH+N-BL** = balanced three-phase system with neutral (Page 12)
- **3PH-BL** = balanced three-phase system without neutral (Page 12)
- **3PH** = unbalanced three-phase system without neutral (Page 12)
- **3PH+N** = unbalanced three-phase system with neutral (Page 12)
- **2PH** = two-phase system (Page 13)
- **1PH** = single-phase system (Page 13)

4.2.1.2 - Type of Voltage & Voltage Ratio (VT) Setup for L1, L2, L3 phases

NanoVIP^3 can measure both alternate and direct current. The user must set the type of voltage to be analysed, selecting **AC** (alternate current) or **DC** (direct current).
When a voltmeter transformer has to be connected, i.e. when voltages higher than 600VAC must be measured, the corresponding transformation ratio must be set (default value = 1), changing the values as needed (1 to 60000).

4.2.1.3 - Type of Voltage & Voltage Ratio (VT) Setup for U AUX

As described in the previous section, the same settings can be applied to the auxiliary voltage channel U Aux.

4.2.1.4 - Cogeneration Setup

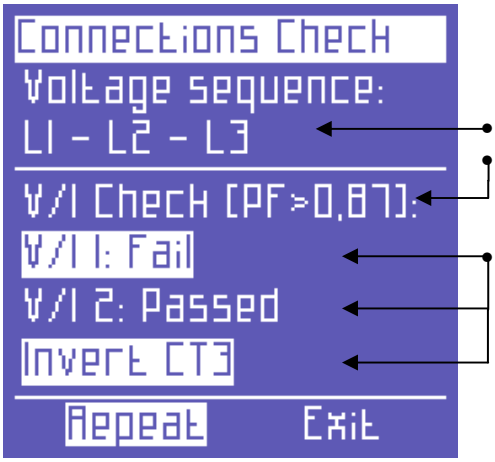
NanoVIP^3 can also be configured to measure the power and energy that might be generated. To do so, place the cursor on **GENERATION** and select **ON**.
By selecting **OFF**, the instrument will stop measuring the power generated, *which will be considered absorbed power.*
NOTE: when changing from Generation ON to Generation OFF, *the counters of generated power are not reset*.

4.2.1.5 - Zero Adjustment

After disconnecting the voltage and current input channels from the measuring grid, place the cursor on **START** and press ↵ to correct the offset, in case the latter has deviated. A page with numerical values will be displayed for the duration of the zero adjustment procedure (10-20"). When the procedure is complete, the system will automatically return to the CONNECTIONS SETUP page.

4.2.1.6 - Connection Check

Once the instrument has been configured and connected to the system, the instrument can check if the connection to the electrical system has been performed correctly (to perform this check, the PF value must comply with the value indicated on the screen).
Place the cursor on **Connection Check** and press ↵ to perform the check. The related outcome will then be displayed.



Voltage phase sequence

Threshold of the measured PF which allows for a correct analysis (if the PF is lower than the value indicated, the check cannot provide valid information)

Check of the correspondence between voltage and current of each phaseand possible error message:

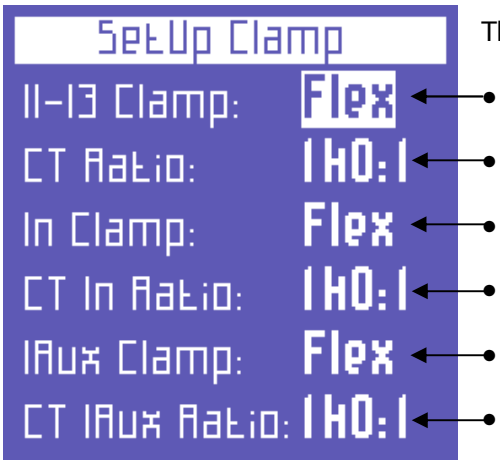
Ok = Connection is correct

Invert CT = Invert the direction of the current clamp indicated

Failed = No correspondence between voltage and current or the PF value is lower than the threshold displayed

Select "Repeat" to perform a new check.
Select "Exit" to return to the CONNECTIONS SETUP page.

4.2.2 - Current Probes Setup



This page allows the user to select:

- the type of probe used for I1, I2, I3, i.e. **Flex** (non-amplified flexible sensors) or **AC/DC** (clamp);
- the sensor transformation ratio on I1, I2, I3 (press and hold down ▲ or ▼ to increase scrolling speed);
- the type of probe used for In, i.e. **Flex** (non-amplified flexible sensor) or **AC/DC** (clamp);
- the sensor transformation ratio on In (press and hold down ▲ or ▼ to increase scrolling speed);
- the type of probe used for Iaux, i.e. **Flex** (non-amplified flexible sensor) or **AC/DC** (clamp);
- the sensor transformation ratio on Iaux (press and hold down ▲ or ▼ to increase scrolling speed).

4.2.3 - Minimum, Maximum & Average Setup

This page allows the user to:

- Set the integration time, i.e. the time at which the average values and maximum demand are calculated.
- Reset the average values and maximum demand.
- Reset the minimum peaks and maximum instant values.

4.2.3.1 - Integration Time Setup

To set the integration time, place the cursor on **INTEGR. TIME** and select the desired time, which is expressed in minutes (default value = 15 min).

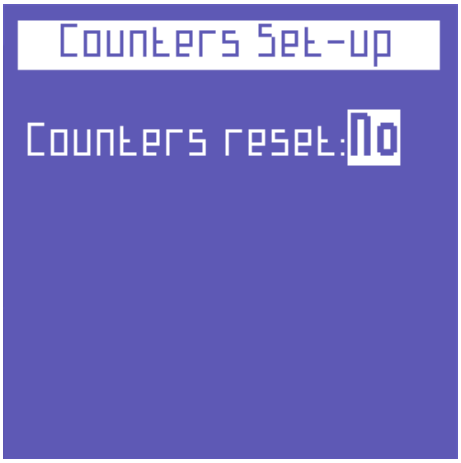
4.2.3.2 - Reset of Average Values & Maximum Demand

To reset the average values and maximum demand, place the cursor on **AVG RESET** and select **YES**.

4.2.3.3 - Reset of Minimum & Maximum Values

To reset the minimum and maximum instant values, place the cursor on **RESET MIN MAX** and select **YES**.

4.2.4 - Counters Reset



To reset the counters of both absorbed and generated power, place the cursor on **COUNTERS RESET** and select **YES**.

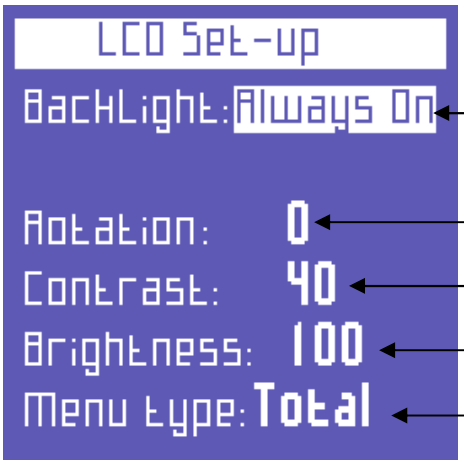
N.B. To reset the tariff counters, see Sect. 4.2.9.1

4.2.5 - Language Setup

Select one of the following languages:

- **ENGLISH**
- **ITALIANO**
- **ESPAÑOL**
- **FRANÇAIS**
- **DEUTSCH**

4.2.6 - LCD Setup



The **LCD SETUP** page allows the user to set:

- The backlight of the display (Sect. 4.2.6.1).
- LCD orientation (Sect. 4.2.6.2).
- LCD contrast level (Sect. 4.2.6.3).
- The display brightness (Sect. 4.2.6.3).
- The menu type (Sect. 4.2.6.4).

4.2.6.1 - Backlight Setup

The **LCD SETUP** page allows the user to set backlight of the display. Place the cursor on **BACKLIGHT** and select:

- **ALWAYS ON**.
- **DELAY OFF 15 SEC** (the backlight dims 15 seconds after the last key was pressed).
- **DELAY OFF 1 MIN** (the backlight dims 1 minute after the last key was pressed).

Obviously, with time, LCD efficiency will depend on the number of hours of operation and the level of brightness selected (Sect. 4.2.6.3). Therefore, unless strictly necessary, we advise against the level of brightness being higher than 70 and keeping the backlight ALWAYS ON.
NOTE: The display turns on automatically if an alarm goes off (See Sect. 4.2.11.1).

4.2.6.2 - Display Orientation Setup

In particular situations, changing the display orientation may be practical, e.g. when the instrument must be placed in a vertical position. This function allows the user to rotate the LCD by 90° with respect to the default setting.

4.2.6.3 - Contrast & Brightness Setup

To adjust the contrast and brightness of the display - so as to increase or decrease display efficiency and better adapt the instrument to different environmental conditions - place the cursor on **CONTRAST** or **BRIGHTNESS** and increase or decrease the parameters by increasing or decreasing the relevant values.

4.2.6.4 - Menu Type Setup

Despite its easy-to-use interface, NanoVIP^3 can perform a great number of measurements, and features many functions. If the user only needs a limited number of functions or measurements, this feature may sometimes be superfluous. Therefore, to make using the instrument even easier, two different types of menus have been provided:

- The **FULL** Menu, which includes all the screens (See Sect. 5).
- The **PARTIAL** Menu, which only displays the Voltage, Currents, Power, Storage, and Setup Menus, making it less exhaustive but quicker to use.

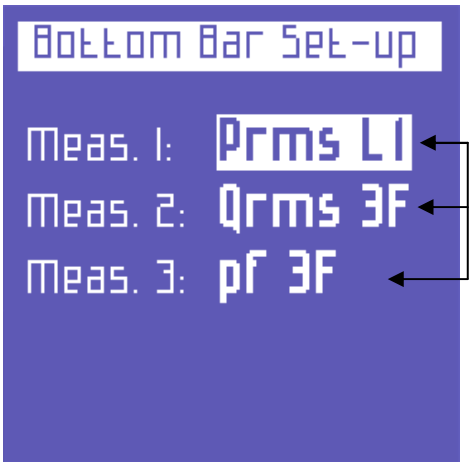
NOTE*:* the Partial Menu only affects the displayed information. All data are always stored. If the user subsequently selects the Full Menu, the analyses performed in the previously disabled menus will also be displayed.

4.2.7 - Clock Setup

This page allows the user to set the date and time.

The format is DD/MM/YYYY

4.2.8 - Bottom Bar Setup



This page allows the user to choose the 3 parameters (out of 63) to be displayed alternately in the bottom part of the measurement screens, in addition to the battery level. The following parameters are available:

Vrms 3F, Vrms L1, Vrms L2, Vrms L3, Irms 3F, Irms L1, Irms L2, Irms L3, Prms 3F, Prms L1, Prms L2, Prms L3, Qrms 3F, Qrms L1, Qrms L2, Qrms L3, Srms 3F, Srms L1, Srms L2, Srms L3, pf 3F", pf L1, pf L2, pf L3, thdv 3F, thdv L1, thdv L2, thdv L3, thdi 3F, thdi L1, thdi L2, thdi L3, KWh+3F, KWh L1, KWh L2, KWh L3, KVArh+3F, KVArhL1, KVArhL2, KVArhL3, KWh-3F, KVArh3F, KWh+F1, KWh+F2, KWh+F3, KWh+F4, Clock, Freq, In, Unbal, n.dip, n.swell, n.int, Vaux, Iaux, Paux, Qaux, Saux, PFaux, FRaux, CosPhi L1, CosPhi L2, CosPhi L3.

NOTE: to display only one parameter, select the same parameter for all 3 options.

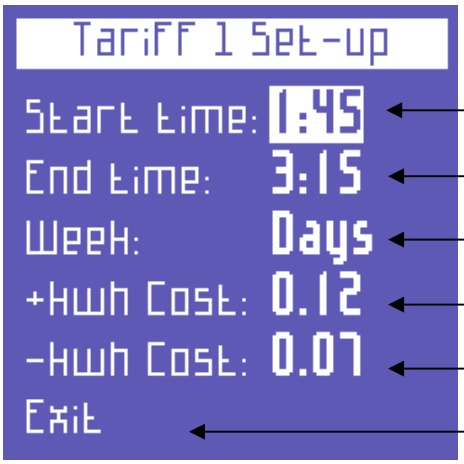
4.2.9 - Tariffs Setup

Choose the tariff band to be set by selecting it with the cursor.

Then press ↵ to access the relevant configuration and reset the submenu (Sect. 4.2.9.1).

- This function resets the measurements previously performed (for all 4 tariffs). The following options are available: **NEVER** - **1 MONTH** - **2 MONTHS** - **3 MONTHS**

4.2.9.1 - Configuration and Resetting of Tariff

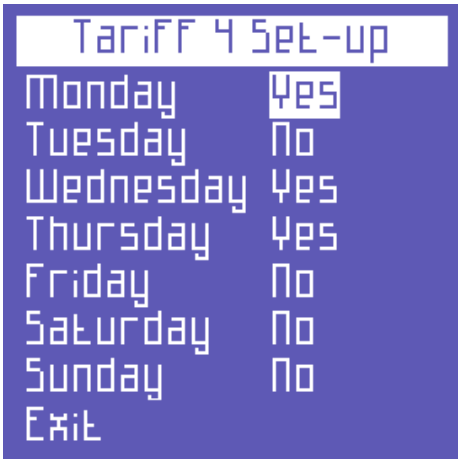


This page allows the user to set the following parameters for each tariff:

- start time (with 15 minute intervals);
- end time (with 15 minute intervals);
- access to the subpage to select the days on which the tariff is to be applied (Sect. 4.2.9.1.1);
- the cost of the kWh consumed (in the relevant currency);
- the yield of the kWh generated (in the relevant currency);
- return to the "Tariffs Setup" page (Sect. 4.2.9).

NOTE: do not cause the time of the different tariff bands to overlap. When the time of a tariff is changed, always make sure that it does not overlap with the time of another tariff. **To set 12:00 am, select 0:00.**

4.2.9.1.1 - Selection of Days

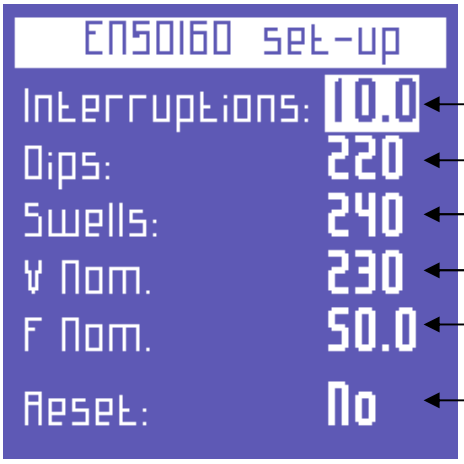


This page allows the user to set the days on which the tariff will be active.
To do so, select the day to be enabled/disabled and press ◀ or ▶ to change its status.

Select "Exit" and press ↵ to return to the "Tariff Setup" page (Sect. 4.2.9.1).

4.2.10 - EN 50160 Setup & Reset

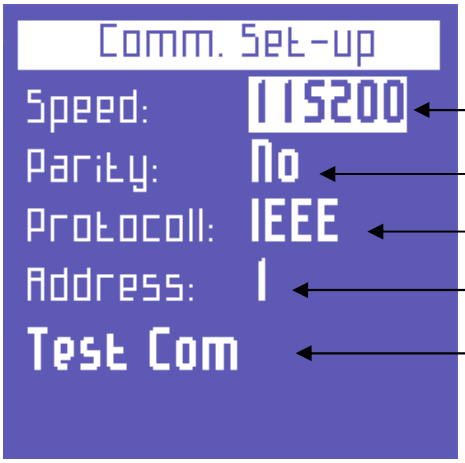
As described in Standard EN 50160, the phenomenon "voltage disturbances" (swells, dips, interruptions, etc.) does not feature standard values by means of which power quality can be evaluated.
Therefore, it is the user's responsibility to evaluate whether the voltage disturbances of the system are actually harmful or if they can be disregarded, based on the type of installation, production, connected instrument, etc.
The **EN 50160 SETUP** page allows the user to set the values necessary for performing the 50160 TEST correctly (Sect. 5.1.7), i.e. for evaluating the power quality of the system.



Specifically, the following parameters can be set:

- Vrms value below which an interruption is defined;
- Vrms value below which a dip is defined;
- Vrms value above which a swell is defined;
- Nominal voltage;
- Nominal frequency;
- Reset the stored data related to all the grid disturbances that have been recorded.

4.2.11 - Serial Communication Setup

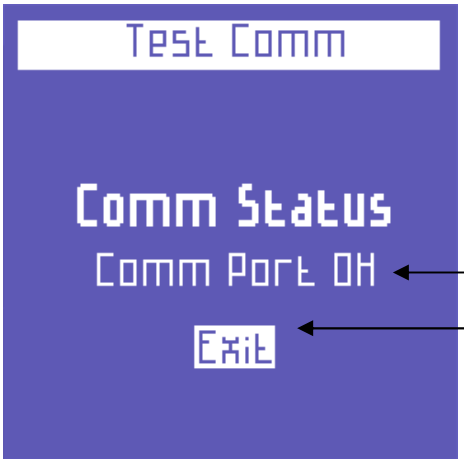


This page allows the user to set the following parameters:

- Data transfer speed (baud rate): 4800, 9600, 19200, 38400, 57600, 115200 bps.
- Type of parity: no parity, even, or odd;
- Protocol type: BCD or IEEE;
- Address of the instrument (which must be unique) if the latter is connected to a PC with Energy Studio Manager monitoring software;
- Press ↵ to access the communication test page (Sect. 4.2.12.1).

NOTE: to consult the Modbus registers, see Appendix 1 attached hereto.

4.2.11.1 - Serial Communication Test

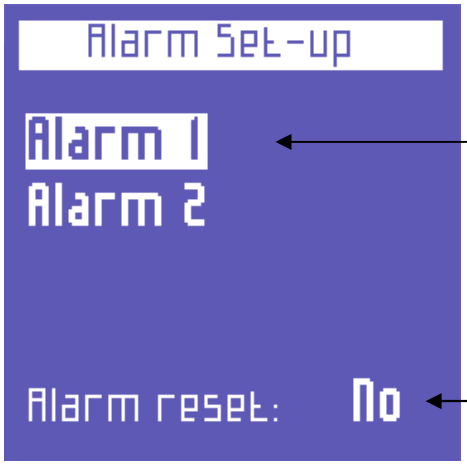


This page is helpful when connecting the instrument to a PC to check if communication is correct, as well as to check if the instrument is working correctly.

- This field shows the current status (No communication, Comm. OK) or the type of error (checksum error, framing error, etc.) occurring during communication.
- Return to the "Communication Setup" page (Sect. 4.2.12).

NOTE: in case of a permanent error, check that the parameters have been configured correctly (PC and instrument)

4.2.12 - Alarm Setup & Reset

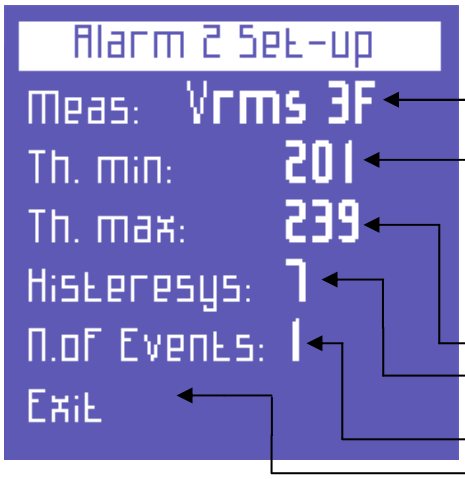


Two alarms can be set and configured with NanoVIP[3].

Place the cursor ↵ on either alarm and press ↵ to access the relevant configuration submenu.

Select ALARM RESET and choose **YES** to reset all the stored alarms that can be viewed in the Alarm Menu (Sect. 5.2.8).

4.2.12.1 - Alarm Configuration



In the Alarm 1 or 2 configuration submenu, select **OFF** to disable the alarm or set the desired parameter to enable the alarm. The following parameters are available:
Vrms 3F, Vrms L1, Vrms L2, Vrms L3, Irms 3F, Irms L1, Irms L2, Irms L3, Prms 3F, Prms L1, Prms L2, Prms L3, Qrms 3F, Qrms L1, Qrms L2, Qrms L3, Srms 3F, Srms L1, Srms L2, Srms L3, pf 3F, pf L1, pf L2, pf L3, thdv 3F, thdv L1, thdv L2, thdv L3, thdi 3F, thdi L1, thdi L2, thdi L3, Freq, In, Unbal, Vaux, Iaux, Paux, Qaux, Saux, PFaux, FRaux, CosPhi L1, CosPhi L2, CosPhi L3.

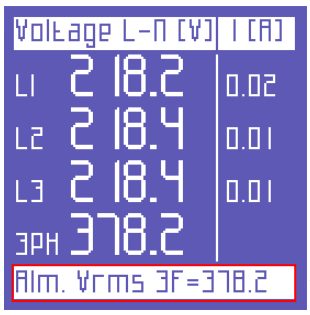
Set the minimum threshold value.

Set the maximum threshold value.

Set the hysteresis percentage (valid for both the minimum and maximum threshold).

Set the number of events after which the alarm should go off.

Return to the "Alarm Setup & Reset" page



NOTE:
if one of the alarms set goes off, it will be indicated in the bottom bar of the measurement pages, where the alarm will be displayed permanently (scrolling through measurements, as described in Sect. 4.2.8, will stop) until it is cleared.

The last 5 alarms which have gone off are stored and can be displayed in the relevant menu (Sect. 5.2.8).

5 - INSTRUMENT USE & CONSULTATION

The NanoVIP[3] keypad allows the user to access all the menus of the instrument directly, thanks to its practical function keys.
Press the desired key to access the relevant menu. Use the arrow keys to scroll through the different pages of a menu. NanoVIP[3] features the following Measurement Menus:

1) **VOLTAGES** Menu (**V**): press key once to access menu	
2) **CURRENTS** Menu (**I**): press key once to access menu	
3) **POWER** Menu (**P**): press key once to access menu	
4) **COUNTERS** Menu (**€**): press and hold key down **for 3"** to access menu	
5) **HARMONICS** Menu (▙▄▄): press and hold key down **for 3"** to access menu	
6) **WAVEFORMS** Menu (∿): press and hold key down **for 3"** to access menu.	
7) **AUX CHANNEL** Menu (▶): press key once to access menu.	
8) **SNAPSHOT** Function (📷): press key once to access menu.	
9) **EN 50160** Menu (**50160**): press and hold key down **for 3"** to access menu.	
10) **ALARMS** Menu (🔔): press and hold key down **for 3"** to access menu.	
11) **TRANSIENTS**Menu (📈): press and hold key down **for 3"** to access menu.	
12) **MEASUREMENT CAMPAIGNS** Menu (📼): press and hold key down **for 3"** to access menu.	

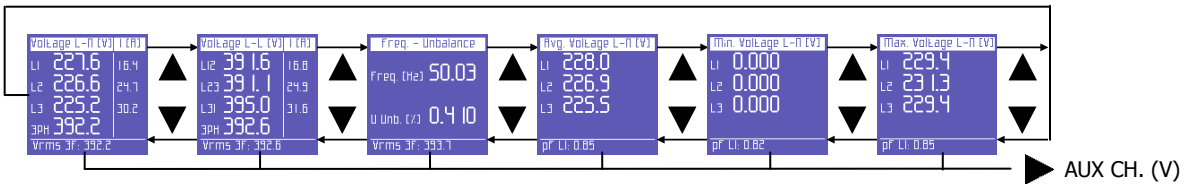
5.1 - Scrolling through Measurement Menus

When accessing a measurement menu, the first page of the selected menu is displayed.
Press ▲ or ▼ to scroll through the pages of the menu up and down, respectively.
In the Voltage, Currents, Power, Counters, Harmonics, and Waveforms Menus, press ▶ to access the relevant Auxiliary Channel Menu. Use ▲ and ▼ arrows to scroll the relevant auxiliary channel menu. Press ◀ to exit the auxiliary channel menu.
Certain pages (e.g. harmonic histograms) allow the user to access internal sub-functions by pressing ↵ . The flowcharts of measurement menus are shown below.

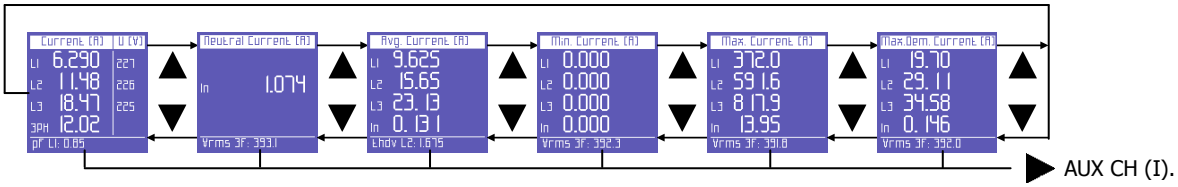
NOTE: entire menus or specific pages/parameters may not be displayed or changed, depending on the menu type which has been set in the LCD configuration (FULL or PARTIAL - See Sect. 4.2.6.4) and/or the type of electrical connection (e.g. if the single-phase connection has been set, the screens regarding three-phase data will not be displayed, and the structure of many other pages will be modified).

Flowchart of **MEASUREMENT MENUS** in **THREE-PHASE WITH NEUTRAL** connection.

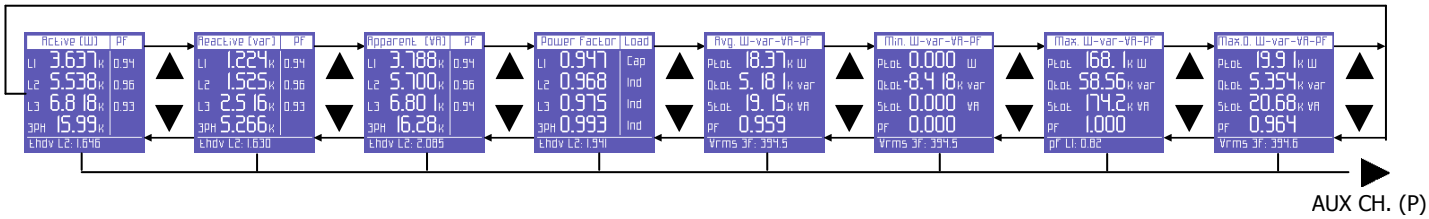
VOLTAGES MENU (Sect. 5.2.1).



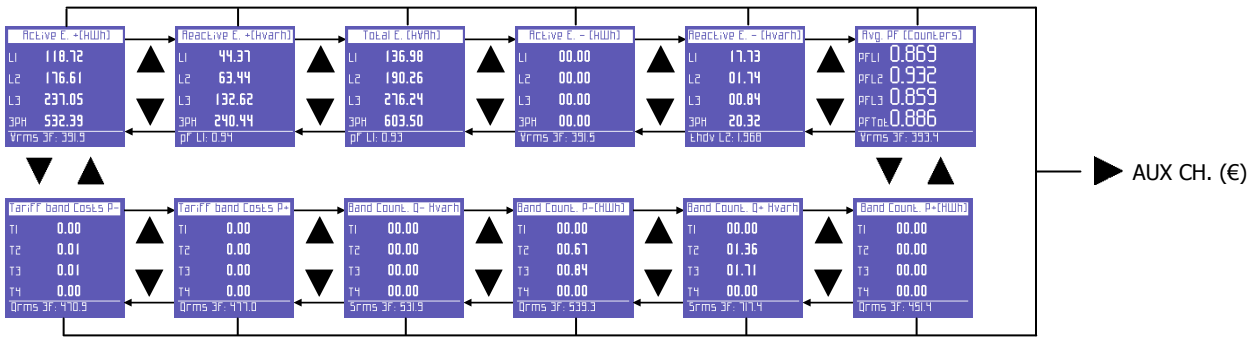
CURRENTS MENU (Sect. 5.2.2).



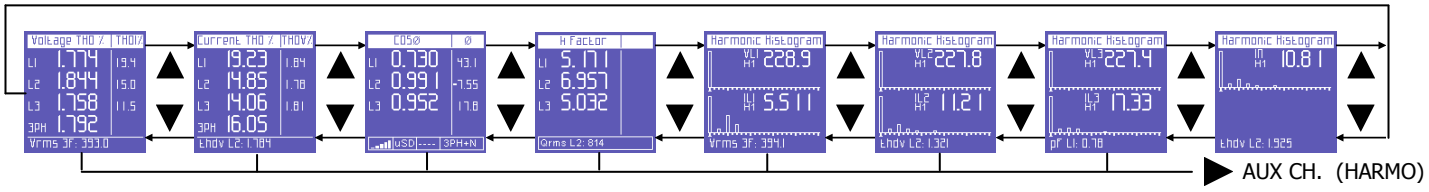
POWER MENU (Sect. 5.2.3).



COUNTERS MENU (Sect. 5.2.4).

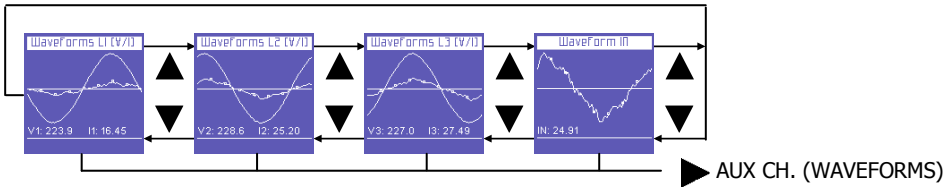


HARMONICS MENU (Sect. 5.2.5).

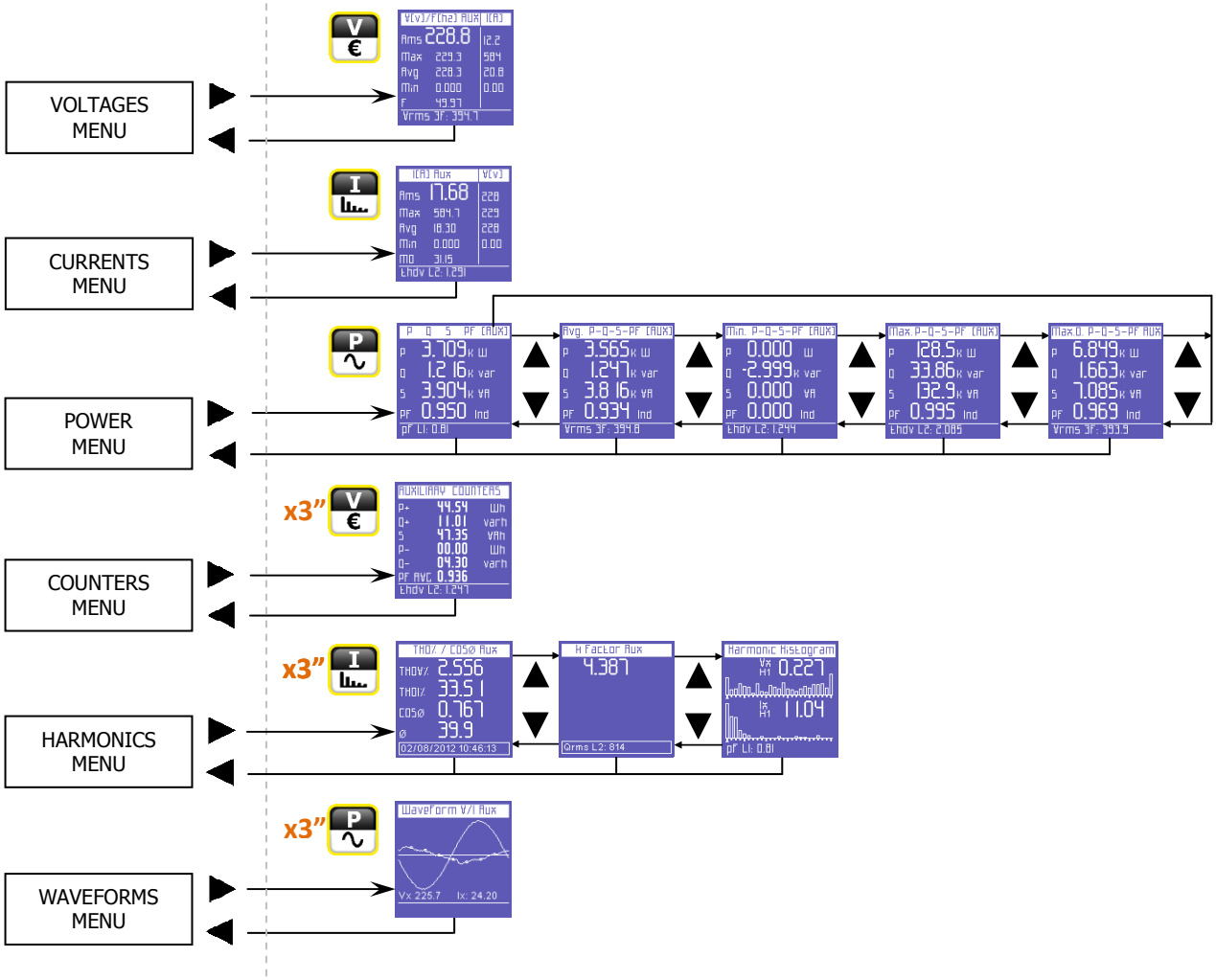


x3”

WAVEFORMS MENU (Sect. 5.2.6).

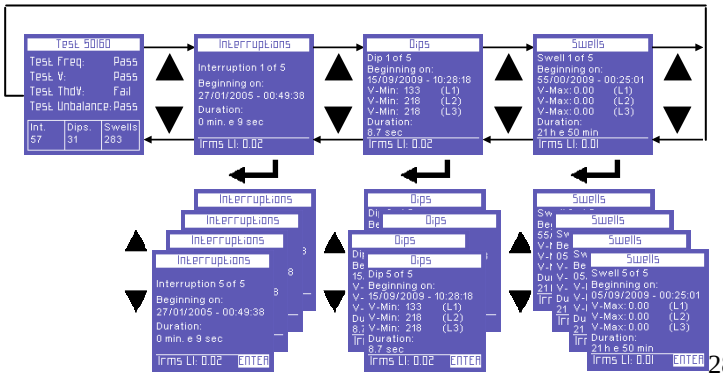


AUX CHANNEL MENU



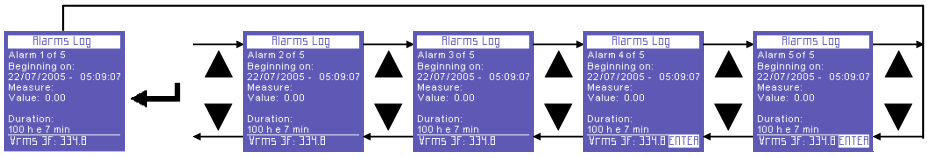
x3”

EN 50160 MENU (Sect. 5.2.8).

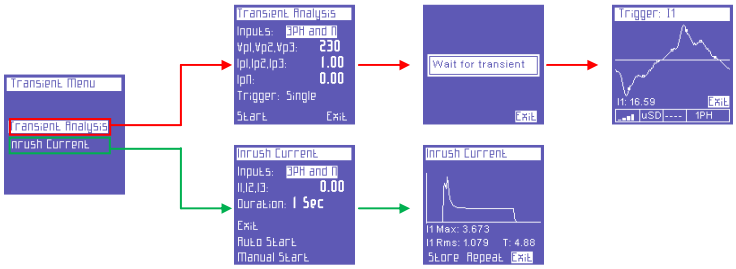


elcontrol energy net

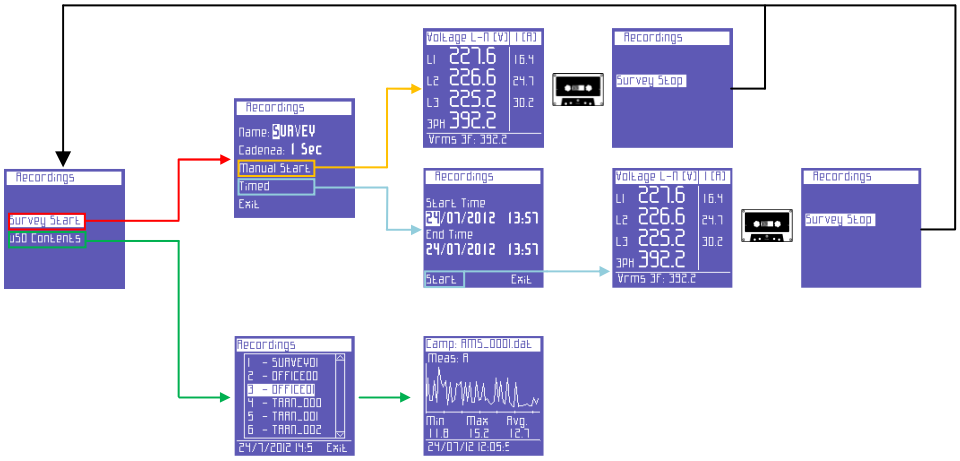
x3”  **ALARMS MENU (Sect. 5.2.9).**



x3”  **TRANSIENTS MENU (Sect. 5.2.10)**

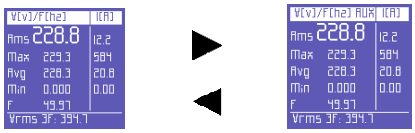


x3”  **MEASUREMENT CAMPAIGNS (Sect. 5.2.11)**

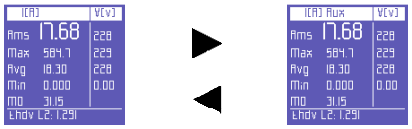


Flowchart of **MEASUREMENT MENUS** in **SINGLE-PHASE** connection.

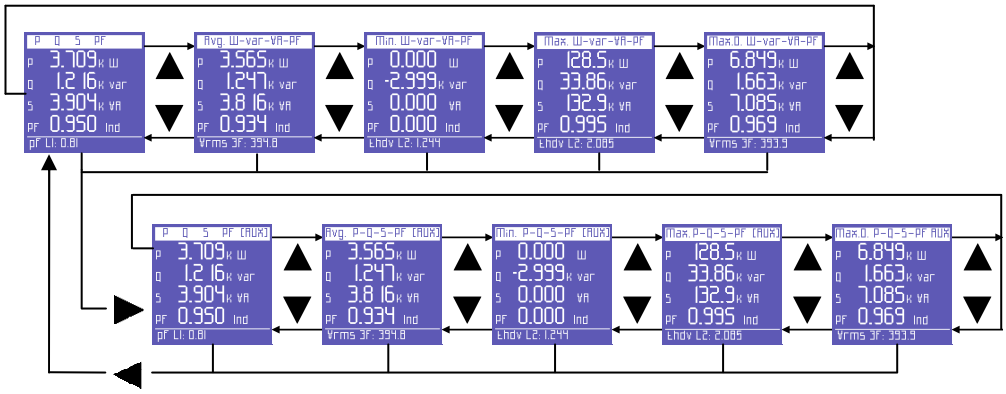
VOLTAGES MENU (Sect. 5.3.1).



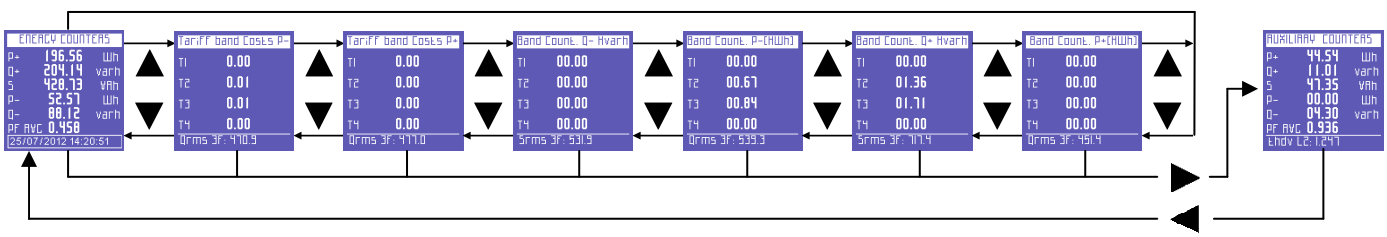
CURRENTS MENU (Sect. 5.3.2).



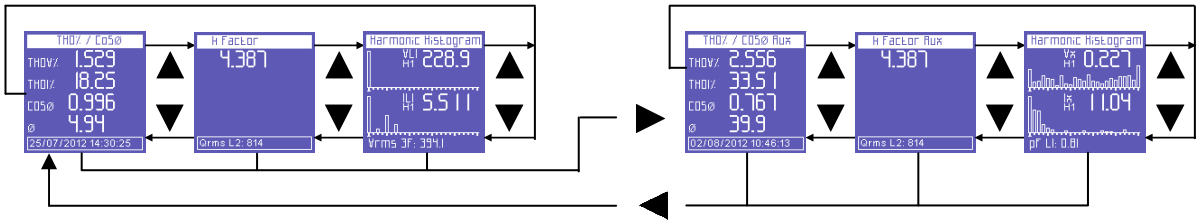
POWER MENU (Sect. 5.3.3).



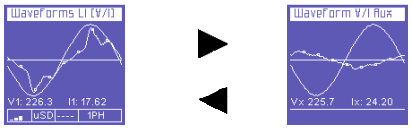
x3” **COUNTERS MENU (Sect. 5.3.4).**



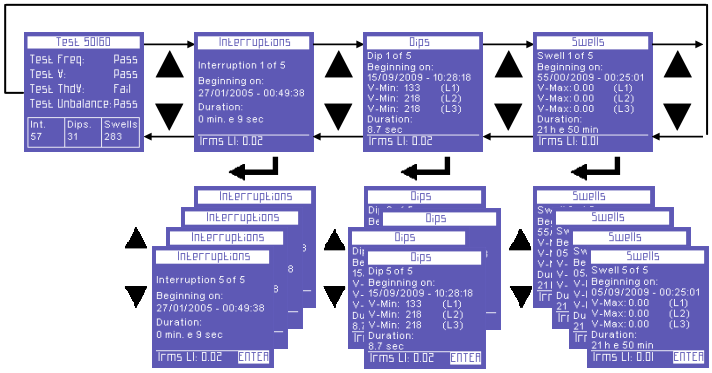
x3” **HARMONICS MENU (Sect. 5.3.5).**



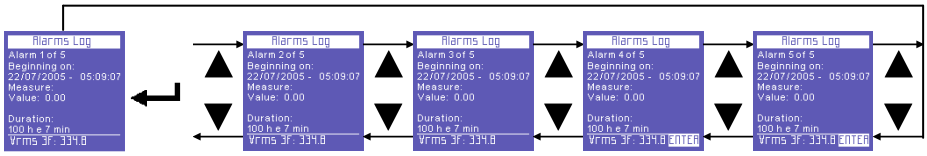
x3" **WAVEFORMS MENU (Sect. 5.3.6).**



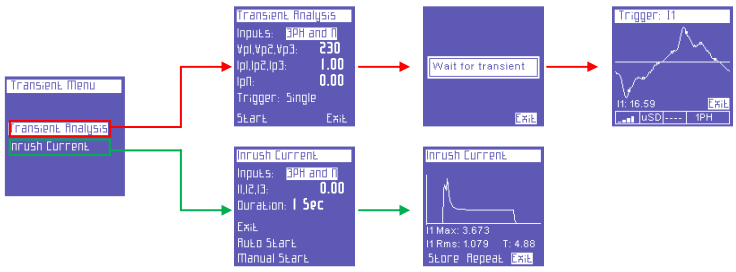
x3" **EN 50160 MENU (Sect. 5.2.8).**



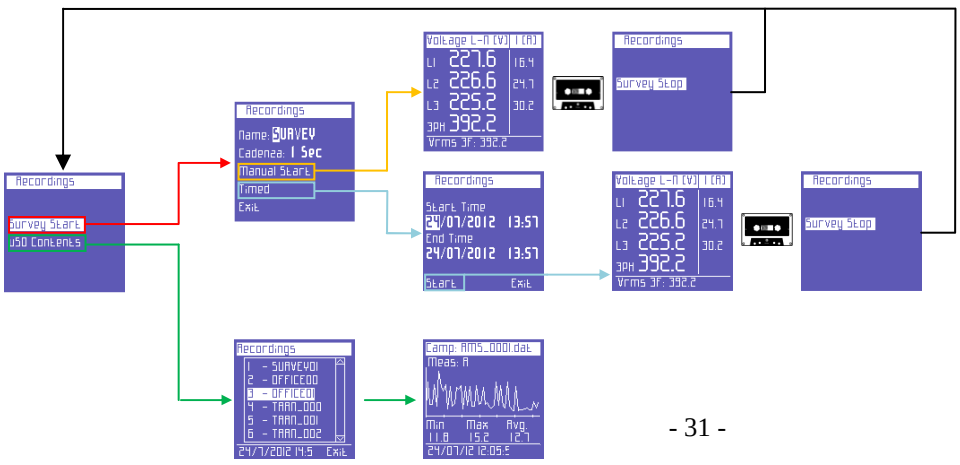
x3" **ALARMS MENU (Sect. 5.2.9).**



x3" **TRANSIENTS MENU (Sect. 5.2.10)**



x3" **MEASUREMENT CAMPAIGNS (Sect. 5.2.11)**



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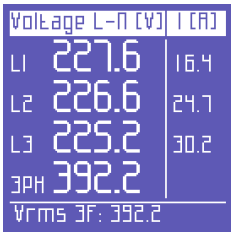
5.2 - Three-phase or Two-phase Connection Menu

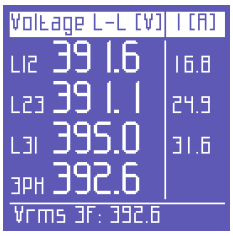
When switching on the instrument or exiting the Setup Menu, NanoVIP[3] displays the first page of the Voltages Menu. As shown in the flowcharts, the menus have a loop-type structure, i.e. when the end of the last page is reached, the menu automatically returns to the first page. You can scroll through the menus in either direction. The information displayed will then vary, depending on the type of connection that has been set in the Setup Menu.

5.2.1 - Voltages Menu

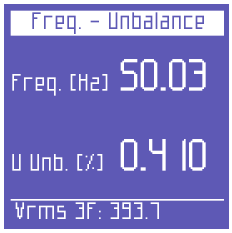


If the 3PH+N, 3PH+N-BL or 2PH connection is set (unbalanced/balanced three-phase with neutral connection or two-phase connection - See Sect. 4.2.1.1), the first page will display the phase-neutral voltages, the relevant phase currents, and the three-phase (or two-phase) voltage.
NOTE: if another type of electrical connections without neutral is set, this page will not be displayed.

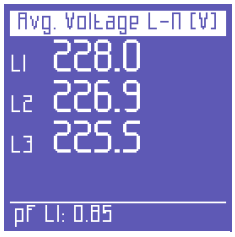
When scrolling through the pages of this menu, as described in Sect. 5.1, the following pages will be displayed.



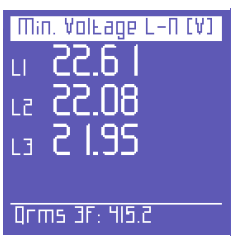
Line voltages and relevant phase currents.



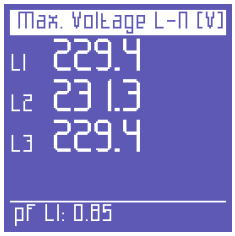
Frequency (measured on L1) and unbalance.
NOTE: in a three-phase system, the unbalance value is a parameter indicating a condition in which the effective values of phase voltages or the phase angles between consecutive phases differ. This parameter is one of the values which serve as an indication of power quality. The lower the percentage value, the better the power quality.



Average voltage levels (calculated on the basis of the integration time which has been set. Values can be reset as described in Sect. 4.2.3).

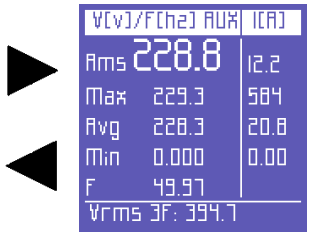


Minimum instant voltage values (Values can be reset as described in Sect. 4.2.3.3)

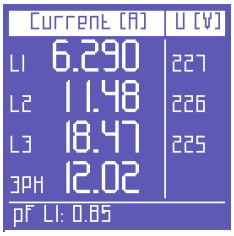


Maximum instant voltage values (Values can be reset as described in Sect. 4.2.3.3)

On any of the Voltages Menu pages, press ▶ to access the page containing all the information regarding auxiliary channel voltage. In the AUX Menu, the user can also access the other Auxiliary Channel Menus (Currents, Power, Counters, Harmonics, Waveforms) by selecting them with the relevant function keys.
Press ◀ to exit the Auxiliary Menu and return to the first page of the relevant menu.

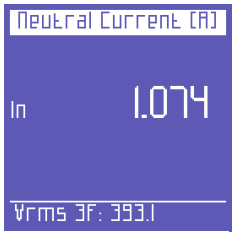


5.2.2 - Currents Menu

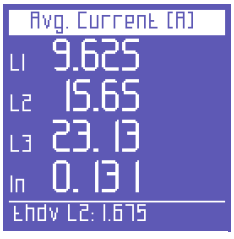


The first page of this menu displays the currents in each phase, as well as in the three-phase current (or two-phase current, depending on the electrical connection) and corresponding voltages.

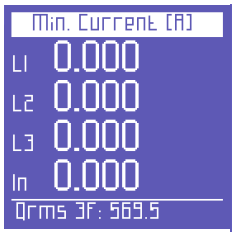
When scrolling through the pages as described in Sect. 5.1, the following pages will be displayed.



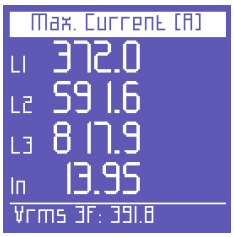
Neutral current or, in general, 4th current channel.
NOTE: if a connection other than 3PH+N or 3PH+N-BL (unbalanced or balanced three-phase with neutral - see Sect. 4.2.1.1) is used, the value will always be 0.000



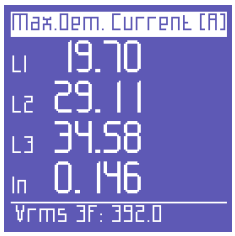
Average current values in each phase (calculated on the basis of the integration time set. Values can be reset as described in Sect. 4.2.3).



Minimum instant current values in each phase (values can be reset as described in Sect. 4.2.3.3).

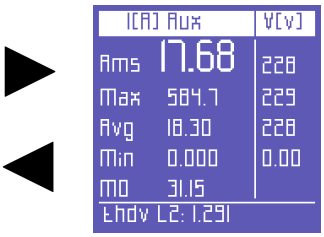


Maximum instant current values in each phase (values can be reset as described in Sect. 4.2.3.3)

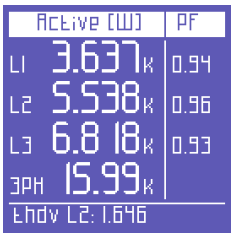


Load peaks, i.e. the highest average current (calculated on the basis of the integration time set. Values can be reset as described in Sect. 4.2.3.2)

On any of the Currents Menu pages, press ▶ to access the page containing all the information regarding the auxiliary channel current. In the AUX Menu, the user can also access the other Auxiliary Channel Menus (Voltages, Power, Counters, Harmonics, Waveforms) by selecting them with the relevant function keys.
Press ◀ to exit the Auxiliary Menu and return to the first page of the relevant menu.

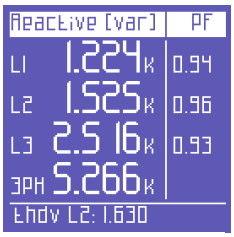


5.2.3 - Power Menu

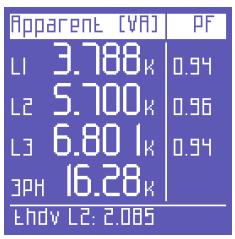


The first page of this menu displays the active power (W) in each phase and in the three-phase (or two-phase) connection and the corresponding PF values.
NOTE: as a norm, active power is shown as a negative when generated and a positive when absorbed.

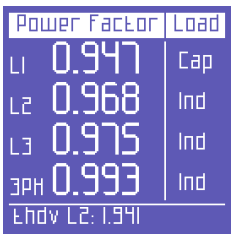
When scrolling through the pages of this menu, as described in Sect. 5.1, the following pages will be displayed.



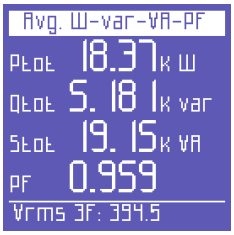
Reactive power (Var) in each phase and in the three-phase (or two-phase) connection and the corresponding PF values.
NOTE: as a norm, reactive power is shown as a negative when capacitive and a positive when inductive.



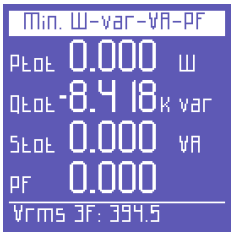
Apparent power (VA) in each phase and in the three-phase (or two-phase) connection and the corresponding PF values.



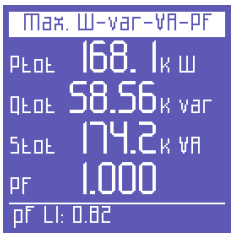
PF values in each phase and in the three-phase (or two-phase) connection and the relevant type (Ind = Inductive load; Cap = Capacitive load)
NOTE: the PF is always positive. As a norm, it is shown as a negative when active power is generated and a positive when absorbed.



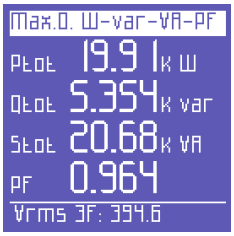
Average total power and PF (calculated on the basis of the integration time set. Values can be reset as described in Sect. 4.2.3).



Minimum instant values of total power and PF (values can be reset as described in Sect. 4.2.3.3)

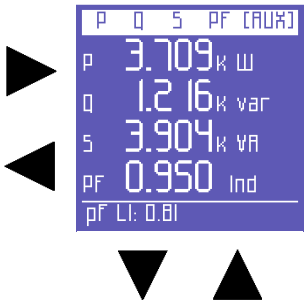


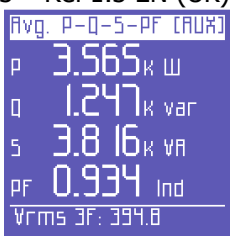
Maximum instant values of total power and PF (values can be reset as described in Sect. 4.2.3.3)



Load peaks and relevant PF, i.e. the highest average power (calculated on the basis of the integration time set. Values can be reset as described in Sect. 4.2.3.2)

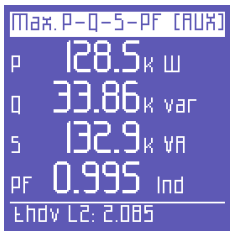
On any of the Power Menu pages, press ▶ to access a series of pages containing all the information regarding auxiliary channel power. The first page displays active, reactive and apparent power, as well as the PF. Use ▲ and ▼ arrows to scroll through the pages (See below). In the AUX Menu, the user can also access the other Auxiliary Channel Menus (Voltages, Currents, Counters, Harmonics, Waveforms), by selecting them with the relevant function keys.
Press ◀ to exit the Auxiliary Menu and return to the first page of the relevant menu.



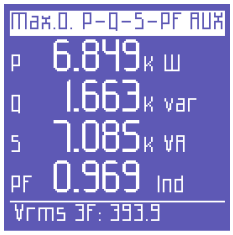


Average power and PF (calculated on the basis of the integration time set. Values can be reset as described in Sect. 4.2.3) related to the auxiliary channel.

Minimum instant values of power and PF (values can be reset as described in Sect. 4.2.3.3) related to the auxiliary channel.



Maximum instant values of power and PF (values can be reset as described in Sect. 4.2.3.3) related to the auxiliary channel.



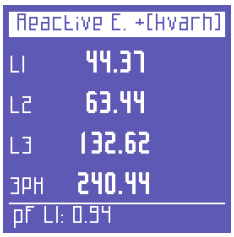
Load peaks and relevant PF, i.e. the highest average power (calculated on the basis of the integration time set. Values can be reset as described in Sect. 4.2.3.2) related to the auxiliary channel.

x3” 

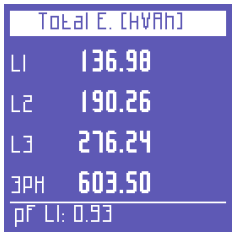
5.2.4 - Counters Menu

The first page of this menu shows the counters of the active power **absorbed** (+kWh) in each phase and three- or two-phase connections.

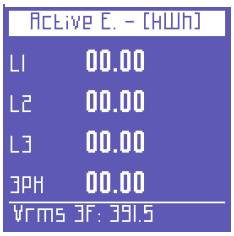
When scrolling through the pages as described in Sect. 5.1, the following pages will be displayed.



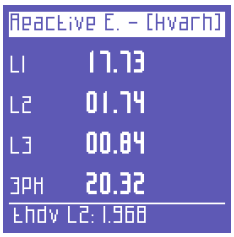
The counters of the reactive power **absorbed** (+kVarh) in each phase and in three- or two-phase connections.



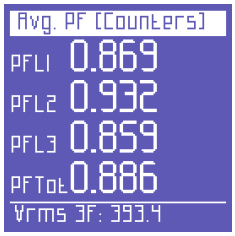
The counters of the apparent power (kVAh) in each phase and in the three- or two-phase connections.



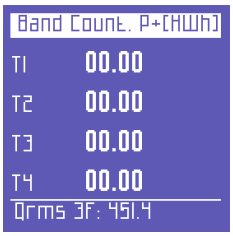
The counters of the active power **generated** (-kWh) in each phase and in three- or two-phase connections.



The counters of the reactive power **generated** (-kVarh) in each phase and in the three- or two-phase connections.

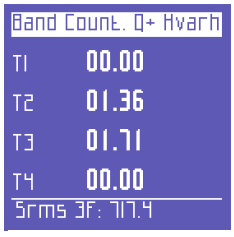


The average PFs calculated as kWh/kVAh ratio (only the real part of the counters is taken into account; the decimal part is not considered).

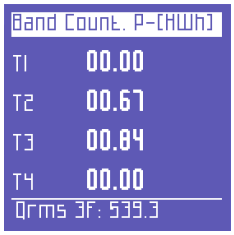


This page displays the absorbed and/or generated power, and the related costs for the time bands selected in the Setup Menu (Sect. 4.2.9).

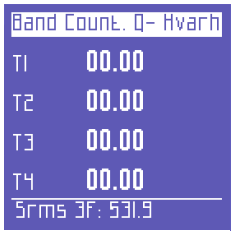
The first page displays the kWh absorbed during the various time bands.



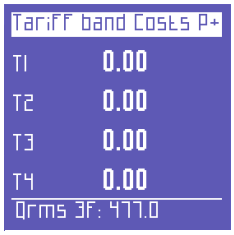
The kVArh absorbed during the various time bands.



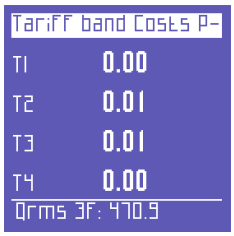
The kWh generated during the various time bands.



The kVArh generated during the various time bands.

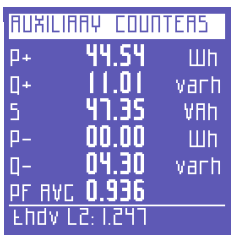


The cost of the kWh absorbed during the various tariff bands, expressed in the currency selected in the Setup Menu (Sect. 4.2.9.1).



The income expressed in the set currency unit (sect. 4.2.9.1) of the kWh generated during the different tariff bands.

On any of the Counters Menu pages, press ▶ to access the page containing all the information regarding auxiliary channel counters. In the AUX Menu, the user can also access the other Auxiliary Channel Menus (Voltages, Currents, Power, Harmonics, Waveforms) by selecting them with the relevant function keys.
Press ◀ to exit the Auxiliary Menu and return to the first page of the relevant menu.



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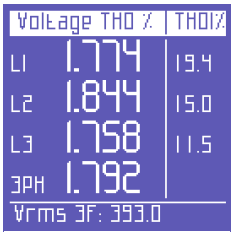
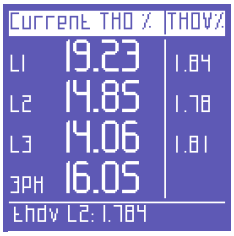
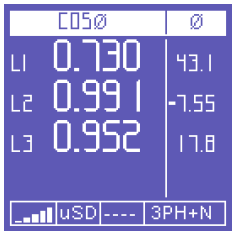
5.2.5 - Harmonics Menu



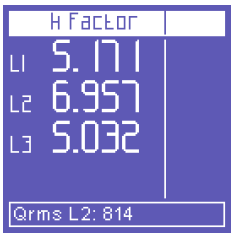
The first page of this menu displays the THD% (Total Harmonic Distortion) of the voltage of each phase and the three-phase (or two-phase) connection, as well as the THD% of the relevant phase currents.



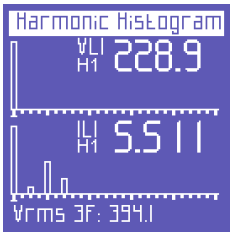
The next page displays the THD% of the current of each phase and the three-phase (or two-phase) connection, as well as the THD% of the relevant phase voltages.



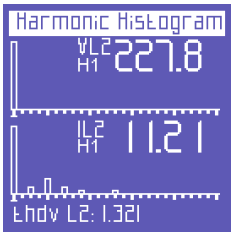
This page displays the cosφ of the 3 phases with the relevant angles expressed in degrees (the negative sign indicates that current comes before voltage; thus, the load is capacitive)



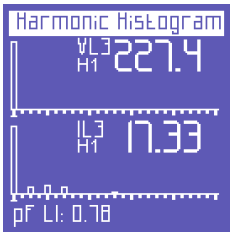
This page display the K factors of the phases



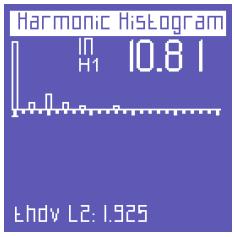
This page displays the harmonic histogram of the voltage and current of phase L1. To select and scroll through single harmonics, see Sect. 5.2.5.1



Harmonic histogram of the voltage and current of phase L2. To select and scroll through single harmonics, see Sect. 5.2.5.1



Harmonic histogram of the voltage and current of phase L3. To select and scroll through single harmonics, see Sect. 5.2.5.1



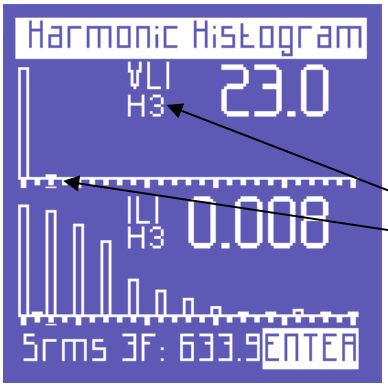
Harmonic histogram of neutral current. To select and scroll through single harmonics, see Sect. 5.2.5.1

On any of the Harmonics Menu pages, press ▶ to access two pages containing all the information regarding auxiliary channel harmonics. The first page displays the THD% of V and I. Use ▲ or ▼ to view the other page (see below). In the AUX Menu, the user can also access the other Auxiliary Channel Menus (Voltages, Currents, Counters, Harmonics, Waveforms), by selecting them with the relevant function keys.
Press ◀ to exit the Auxiliary Menu and return to the first page of the relevant menu.

K factor of the AUX channel

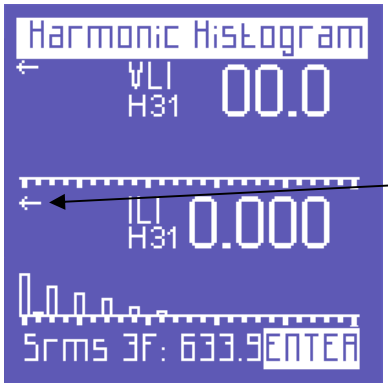
Harmonic histogram of auxiliary voltage and current.

5.2.5.1 - Consulting Harmonic Histograms



On any of the Harmonic Histograms pages, press ↵ to access the function for selecting and scrolling through the single harmonics.
Press ▶ and ◀ to select each single harmonic of the histogram (up to the 50th) and check the relevant RMS values.
The selected harmonic is indicated by:

- A number identifying the series;
- The cursor below the histogram.



Over and above the 25th harmonic - which is the last one that can be displayed on one page - the screen will change, i.e. the first 25 harmonics of the spectrum will disappear to the left, and the harmonics between the 26th and the 50th will appear.

- An arrow pointing towards the left indicates that the screen continues (to the left).

Press ↵ again to return to the function that allows you to scroll through the pages of the Harmonics Menu.

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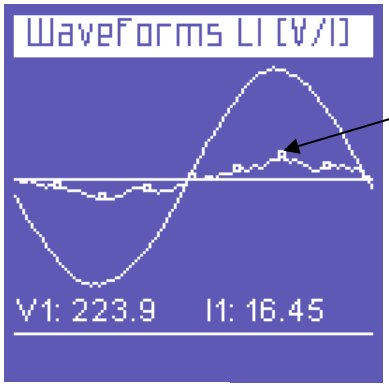
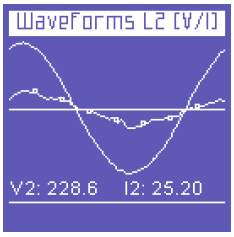
5.2.6 - Waveforms Menu



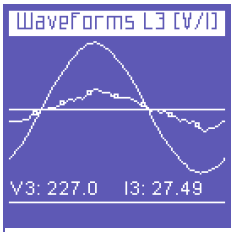
This menu shows the real-time waveforms and the relevant system voltage and current values.

- **NOTE**: current tracing can be distinguished from voltage tracing by little square markers. Waveform amplitude is purely indicative and is automatically adjusted to screen size.

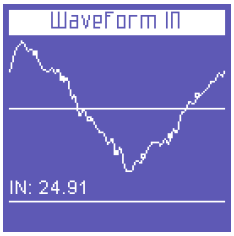
The first page of the menu displays the L1 voltage and current waveforms and relevant RMS values.



L2 voltage and current waveforms and relevant RMS values.

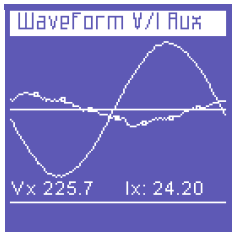


L3 voltage and current waveforms and relevant RMS values.

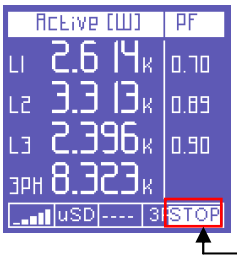


Neutral current waveform and relevant RMS value.

On any of the Waveforms Menu pages, press ▶ to access the auxiliary channel tracing page. In the AUX Menu, the user can also access the other Auxiliary Channel Menus (Voltages, Currents, Power, Counters, Harmonics) by selecting them with the relevant function keys.
Press ◀ to exit the Auxiliary Menu and return to the first page of the relevant menu.



5.2.7 - Snapshot Function

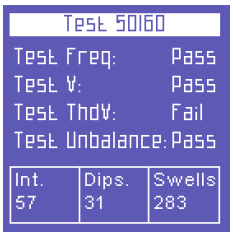


During measurements, press the 📷 key to block all measurements immediately – not only those currently displayed. By doing so, the measurements will remain "frozen" on screen until the same key is pressed again.
After blocking the measurements, all other menus can be scrolled through to check the status of the other parameters captured at the same time.
The word STOP appears on the bottom bar to indicate that measurements have been blocked.

NOTE: blocking not only interrupts what appears on the display, but also the entire measurement process. This means that the data during the block will not be recorded.

x3" 50160 5.2.8 - EN50160 Menu

This menu allows the user to monitor certain main power quality parameters.

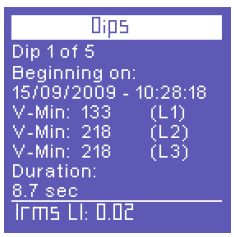


The first page displays the outcome of the EN50160 compliance test (Reference Standard for power quality), according to the parameters selected in the Setup Menu (Sect. 4.2.10).
A test is performed to check whether frequency, voltage, harmonic voltage distortion, and unbalance comply with the above-mentioned reference Standard and the nominal values which have been set.
A table also shows the number of interruptions, dips and swells which have occurred during the period monitored.

▼ ▲

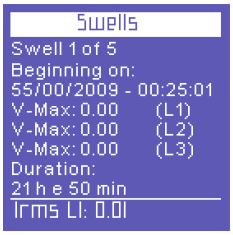
These pages display the last 5 interruptions recorded (if any occurred).
NOTE: according to Standard EN50160, an "interruption" is defined as the simultaneous drop of all phase voltages below 5% of nominal V (See Setup, Sect. 4.2.10). However, a different threshold may be set by the user.
The Start Date and Time and Duration of each interruption are displayed.
When scrolling through the EN50160 Menu, the page of the most recent interruption is displayed automatically.
To view any previous interruptions, scroll through the relevant pages using the ◀ and ▶ keys.

▼ ▲



These pages display the last 5 dips recorded (if any occurred).
NOTE: according to Standard EN50160, a "dip" is defined as a drop of one or more phase voltages below 90% of nominal V (See Setup, Sect. 4.2.10). However, a different threshold may be set by the user.
The Start Date and Time, Affected Phase(s), and Duration of each dip are displayed.
When scrolling through the EN50160 Menu, the page of the most recent dip is displayed automatically.
To view any previous dips, scroll through the relevant pages using the ◀ and ▶ keys.

▼ ▲



These pages display the last 5 swells recorded (if any occurred).
NOTE: according to Standard EN50160, a "swell" is defined as an increase of one or more phase voltages above 110% of nominal V (See Setup, Sect. 4.2.10). However, a different threshold may be set by the user.
The Start Date and Time, Affected Phase(s), and Duration of each swell are displayed.
When scrolling through the EN50160 Menu, the page of the most recent swell is displayed automatically.
To view any previous swells, scroll through the relevant pages using the ◀ and ▶ keys.

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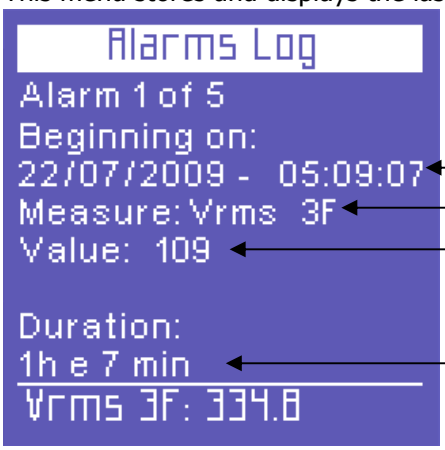
5.2.9 - Alarms Menu

This menu stores and displays the last 5 alarms to go off (if any did go off) (For Alarm Setup, see Sect. 4.2.11).



The menu automatically displays the page of the most recent alarm.

Each alarm is identified by:

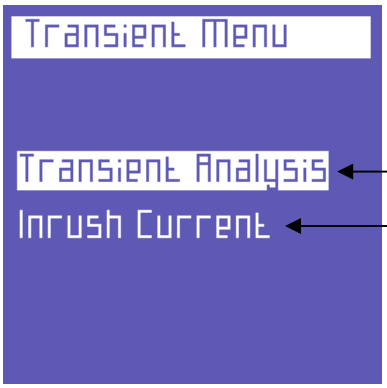
- Start Date and Time;
- type of parameter that exceeded the thresholds set;
- value of the parameter which caused the alarm to go off;
- duration of the event.

To view any previous alarms, scroll through the relevant pages using the ◀ and ▶ keys.

NOTE: Alarms are stored - hence displayed - only at the end of the event, i.e. when the parameter in question falls within the set values again.

x3" 

5.2.10 - Transients Menu

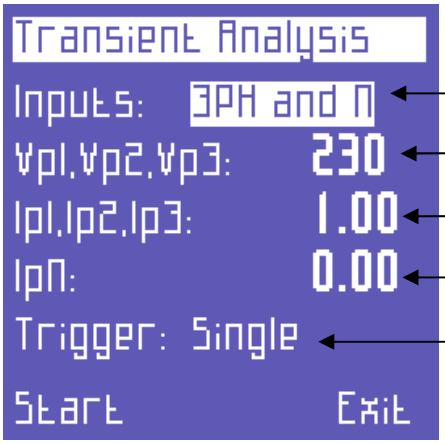


This menu can be used to capture and analyse temporary signal-specific phenomena and variations, such as:

- Fast transient events (Sect. 5.2.10.1).
- Inrush currents (Sect. 5.2.10.2).

5.2.10.1 - Transients Setup

This page allows the user to set the thresholds that the instrument will use to identify the transient event (i.e. the instant swell or overcurrent of peak). The following parameters must be set:



- Channels to be measured (Sect. 5.2.10.1.1).
- The voltage peak threshold (Sect. 5.2.10.1.2).
- The phase current peak threshold (Sect. 5.2.10.1.3).
- The neutral current threshold - which obviously is not present if the "Inputs" field is set to "Auxiliary" (Sect. 5.2.10.1.4).
- The capturing mode (Sect. 5.2.10.1.5).

5.2.10.1.1 - Input Selection

The two options available are "Three-phase and neutral inputs" (3PH and N) or "Auxiliary input".
NOTE: This field does not indicate the electrical connection; therefore, the channels will always be identified as 3PH and N, even if a single phase, two-phase or three-phase without neutral connection is being used.

5.2.10.1.2 - Voltage Threshold

This value indicates the **peak** voltage threshold over which the instrument will identify the presence of a transient. Set "0" to disable this transient search function.

5.2.10.1.3 - Current Threshold

This value indicates the **peak** phase current threshold over which the instrument will identify the presence of a transient. Set "0" to disable this transient search function.

5.2.10.1.4 - In Threshold

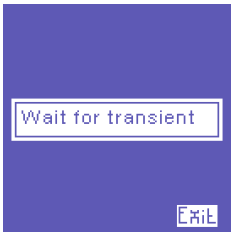
This value indicates the **peak** In current threshold over which the instrument will identify the presence of a transient. Set "0" to disable this transient search function.

5.2.10.1.5 - Transient Detecting Mode

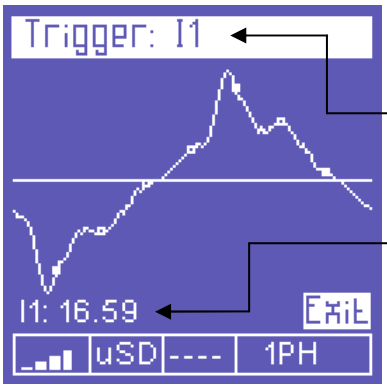
Transients can be detected in 4 different modes:

- **SINGLE TRIGGER**: only one transient (the first to occur) will be detected and displayed, but not stored.
- **SINGLE TRIGGER + MEM**: same as single trigger, but the transient will also be stored on the uSD card (Sect. 5.2.11)
- **AUTO TRIGGER**: the instrument will detect all transients and display the last one.
- **AUTO TRIGGER + MEM**: same as auto trigger, but all transients will also be stored on the uSD card (Sect. 5.2.11)

NOTE: do not set thresholds lower than the nominal peak value of the signal, as this will result in the continuous recording of events.
After setting all the parameters, select START to start the transient search. Select "Exit" to return to the Transient Menu (Sect. 5.2.10).



A waiting page will then appear. The instrument will stay in this state until a transient actually occurs or the user presses ↵ (Exit) to exit and return to the Transient Setup page (Sect. 5.2.10).



If NanoVIP[3] detects a transient, the following information will be displayed:

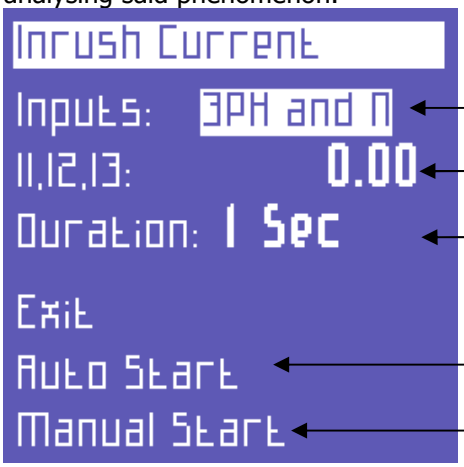
- Channel(s) in which the transient has occurred.
- Transient waveform.
- Relevant peak value.

To scroll through the transients that occurred at the same time as the one being displayed (all the channels on which a transient has occurred are listed in the heading of the page), use the ▲ and ▼ keys.

To exit and return to the Transients Menu (Sect. 5.2.10), press ↵ (Exit).

5.2.10.2 - Inrush Current Setup

On any of the Transients Menu pages (Sect. 5.2.10), select "Inrush Current" to access the configuration page for analysing said phenomenon.



The following parameters can be set:

- Channels to be measured (Sect. 5.2.10.2.1).
- The current RMS threshold (Sect. 5.2.10.2.2).
- The duration of the analysis (Sect. 5.2.10.2.3).
- Automatic start (Sect. 5.2.10.2.4).
- Manual start (Sect. 5.2.10.2.5).

5.2.10.2.1 - Input Selection

The two options available are "Three-phase and neutral inputs" (3PH and N) or "Auxiliary input".
NOTE: this field does not indicate the electrical connection; therefore, the channels will always be identified as 3PH and N, even if a single phase, two-phase or three-phase without neutral connection is being used.

5.2.10.2.2 - Current Threshold

This value indicates the current threshold expressed in RMS amperes over which the instrument will identify current as "inrush current". A threshold slightly higher than the nominal I of the connected instrument should be set.
As NanoVIP[3] cannot know the value of the inrush current to be measured, it will try to use the most appropriate amplification scale based on the threshold set by the user to perform as accurate a measurement as possible. However, the estimate may be incorrect and the instrument may suggest performing a new measurement (Sect. 5.2.10.3).

5.2.10.2.3 - Analysis Duration

This field allows the user to set the maximum duration (in seconds) of the inrush current analysis.

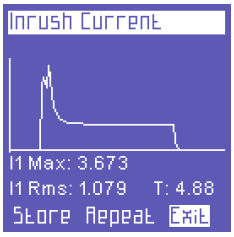
5.2.10.2.4 - Automatic Start

If automatic start is selected, the instrument will wait for the inrush current to occur, and then detect it automatically (Sect. 5.2.10.3).
NOTE: If an unsuitable threshold is set, the instrument may not detect any event; it will remain in standby mode. To exit this condition, press ↵.

5.2.10.2.5 - Manual Start

If manual start is selected, the instrument will detect any current (without the threshold set acting as a trigger) occurring during the time period selected. At the end of the selected time period, the waveform detected will be displayed (Sect. 5.2.10.3).

5.2.10.3 - Inrush Current Display



When an inrush current is detected, the following information will be displayed:

- Waveform;
- Maximum value;
- RMS value;
- Duration.

This screen will be displayed until the user:

- Exits (Exit = Return to the Setup page, Sect. 5.2.9.2).
- Repeats the measurement using the same settings (Repeat).
- Stores the measurement on the uSD card (Store, Sect. 5.2.10).

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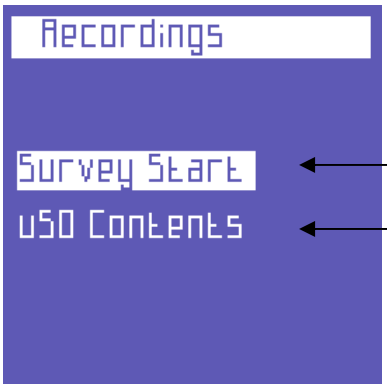
5.2.11 - Measurement Campaigns Menu

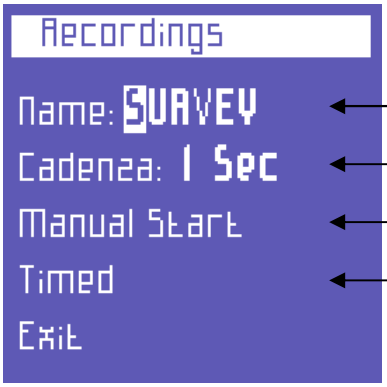


This menu allows the user to:

- Survey Start → Set a Measurement Campaign (Sect. 5.2.11.1).
- uSD Contents → View the data stored on the uSD card (Sect. 5.2.11.2).

5.2.11.1 - Measurement Campaigns

Select "Start Campaign" to view the Measurement Campaign configuration page.



The following parameters can be set:

- Name: SURVEY → Campaign Name (Sect. 5.2.11.1.1).
- Cadenza: 1 Sec → Storing Rate (Sect. 5.2.11.1.2).
- Manual Start → Manual Start (Sect. 5.2.11.1.3).
- Timed → Scheduled Start (Sect. 5.2.11.1.4).
- Exit

5.2.11.1.1 - Campaign Name

To assign a name to the campaign, place the cursor on the first character, press ↵ and change the character using the ▲ and ▼ keys.
The selection of the other characters has been made easier: move the flashing cursor using the ▶ and ◀ keys, and change the character as described above. The campaign name must have 6 alphanumeric characters (if the same name is assigned to more than one campaign, progressive numbers will automatically be added to subsequent campaign names, e.g. Survey01).

5.2.11.1.2 - Storing Rate

This parameter indicates the rate at which NanoVIP[3] stores the data.
The following options are available: 1" - 5" - 30" - 1' - 5' - 15'. Obviously, from the choice of memorization frequency and duration of the campaign, will depend the MB employed by the campaign on uSD. It 'is clear that a storage every second for a long period of time, would produce a campaign very heavy and therefore not practical to analyze. To adjust with these parameters we recommend that you follow the mirror below.

Duration of the campaign	Recommended rate of storage	Maximum use of memory
Up to 12h	1 second	217 Mbyte
From 12 to 48h	5 seconds	174 Mbyte
From 48h a 2 weeks	30 seconds	204 Mbyte
From 2 weeks to 1 month	60 seconds	217 Mbyte
From 1 to 6 months	5 minutes	264 Mbyte
From 6 months to 1 year	15 minutes	176 Mbyte

5.2.11.1.3 - Manual Start

Select "Manual Start" to start a campaign immediately. NanoVIP[3] will automatically display the first page of the Voltages Menu.
To make sure the campaign has started correctly, check that "Rec" features on the bottom bar (Sect. 4.1.1.1).
To stop the campaign, return to the Menu, where the "Stop" function appears, and press ↵ to stop the campaign and return to the Measurement Campaigns Menu (Sect. 5.2.11).

5.2.11.1.4 - Scheduled Start

Select "Scheduled" to access the page for scheduling a campaign. The following parameters can be set:

- Start Date and Time;
- End Date and Time.

By selecting "Start", NanoVIP[3] will automatically display the first page of the Voltages Menu.
To make sure the campaign has been scheduled correctly, check that "Prg" features on the bottom bar (Sect. 4.1.1.1).
To stop a campaign (if already underway) or cancel a scheduled one, return to the Menu, where the "Stop" function appears, and press ↵ to stop the campaign and return to the Measurement Campaigns Menu (Sect. 5.2.11).

5.2.11.2 - uSD Content

Select "uSD Content" to review all stored data.

There are three types of recordings:

- Manual or scheduled measurement campaigns (Sect. 5.2.11.1).
- Fast transients (Sect. 5.2.10.1).
- Inrush currents (Sect. 5.2.10.2).

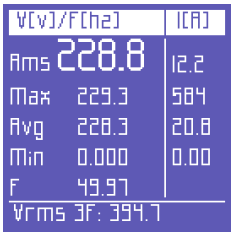
Measurement campaigns are identified by the name assigned to them, whereas transients and inrush currents are identified by the abbreviations TRANS (transients) and INRU (inrush), respectively, which are numbered progressively.

To scroll through the various recordings, use the ▲ and ▼ keys.

5.3 - Single-phase Connection Menu

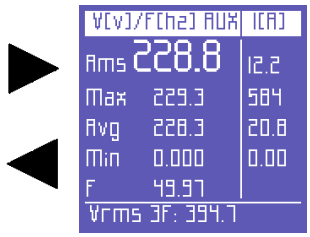
As already mentioned, if the single-phase connection is set, the instrument will automatically change the structure of the menus, eliminating the non-applicable items for this type of electrical connection, and grouping information in fewer pages.

5.3.1 - Voltages Menu (1ph)

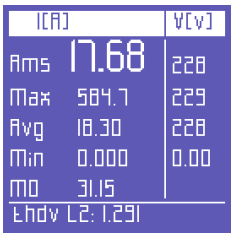


This page displays the RMS voltage, maximum, average and minimum value, and frequency, and the relevant currents.
Minimum and maximum voltage values can be reset as described in Sect. 4.2.3.3, whereas the average value can be reset as described in Sect. 4.3.3.

Press ▶ to access the page containing the information regarding auxiliary channel voltage. In the AUX Menu, the user can also access the other Auxiliary Channel Menus (Currents, Power, Counters, Harmonics, Waveforms) by selecting them with the relevant function keys.
Press ◀ to exit the Auxiliary Menu and return to the first page of the relevant menu.

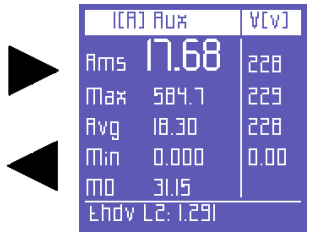


5.3.2 - Currents Menu (1ph)

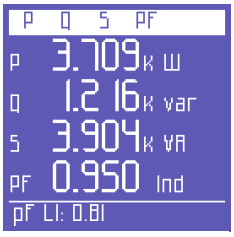


This page displays the RMS current, maximum, average and minimum value, and maximum demand (load peaks are calculated on the basis of the integration time set), and the relevant voltages.
Minimum and maximum current values can be reset as described in Sect. 4.2.3.3, whereas the average value can be reset as described in Sect. 4.3.3, and maximum demand can be reset as described in Sect. 4.2.3.2.

Press ▶ to access the page containing all the information regarding auxiliary channel current. In the AUX Menu, the user can also access the other Auxiliary Channel Menus (Voltages, Power, Counters, Harmonics, Waveforms) by selecting them with the relevant function keys.
Press ◀ to exit the Auxiliary Menu and return to the first page of the relevant menu.

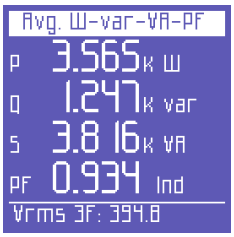


5.3.3 - Power Menu (1ph)



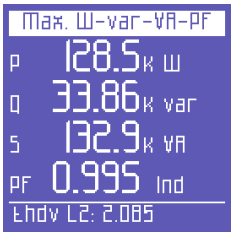
This page displays active, reactive and apparent power, and the PF (including a note whether the latter is inductive or capacitive).
NOTE: as a norm:

- Active power is shown as a negative when generated and a positive when absorbed.
- Reactive power is shown as a negative when capacitive and a positive when inductive.
- The PF is shown as a negative when active power is generated and a positive when it is absorbed.

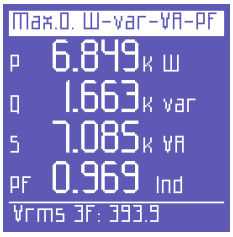


Average power and PF (calculated on the basis of the integration time set. Values can be reset as described in Sect. 4.3.3).

Minimum instant values of power and PF (values can be reset as described in Sect. 4.2.3.3).

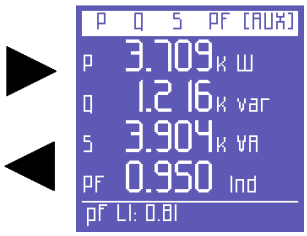


Maximum instant values of power and PF (values can be reset as described in Sect. 4.2.3.3).

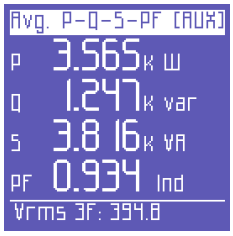


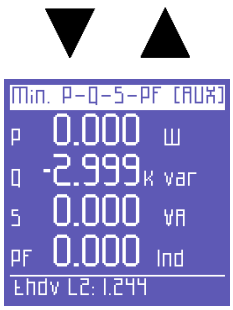
Load peaks of power and PF, i.e. the highest average values (calculated on the basis of the integration time set. Values can be reset as described in Sect. 4.2.3.2).

On any of the Power Menu pages, press ▶ to access a series of pages containing all the information regarding auxiliary channel power. The first page displays active, reactive and apparent power, as well as the PF. Use ▲ and ▼ arrows to scroll through the pages (See below). In the AUX Menu, the user can also access the other Auxiliary Channel Menus (Voltages, Currents, Counters, Harmonics, Waveforms), by selecting them with the relevant function keys.
Press ◀ to exit the Auxiliary Menu and return to the first page of the relevant menu.

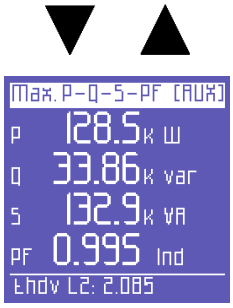


Average power and PF (calculated on the basis of the integration time set. Values can be reset as described in Sect. 4.2.3) related to the auxiliary channel.

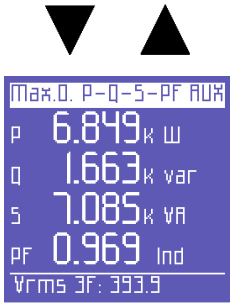




Minimum instant values of power and PF (values can be reset as described in Sect. 4.2.3.3) related to the auxiliary channel.



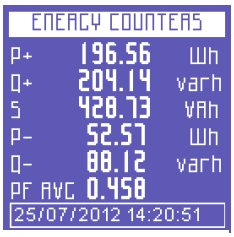
Maximum instant values of power and PF (values can be reset as described in Sect. 4.2.3.3) related to the auxiliary channel.



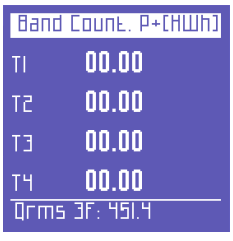
Load peaks and relevant PF, i.e. the highest average power (calculated on the basis of the integration time set. Values can be reset as described in Sect. 4.2.3.2) related to the auxiliary channel.

x3" 

5.3.4 - Counters Menu (1ph)

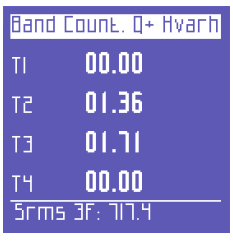


Counters of absorbed (P+ Q+) and generated (P- Q-) power, and average value of the PF calculated as kWh/kVAh ratio.

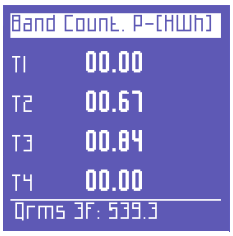


This page displays the absorbed and/or generated power, and the related costs for the time bands selected in the Setup Menu (Sect. 4.2.9).

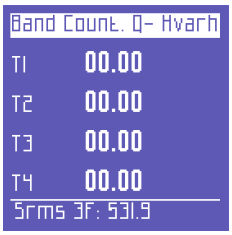
The first page displays the kWh absorbed during the various time bands.



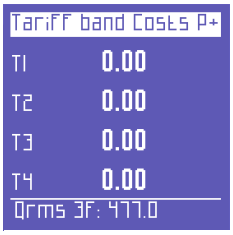
The kVArh absorbed during the various time bands.



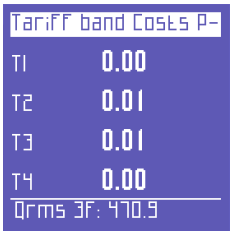
The kWh generated during the various time bands.



The kVArh generated during the various time bands.

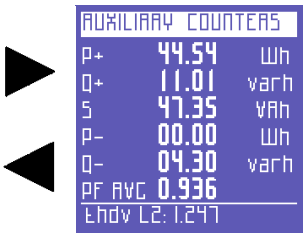


The cost of the kWh absorbed during the various tariff bands, expressed in the currency selected in the Setup Menu (Sect. 4.2.9.1).



The income expressed in the set currency unit (sect. 4.2.9.1) of the kWh generated during the different tariff bands.

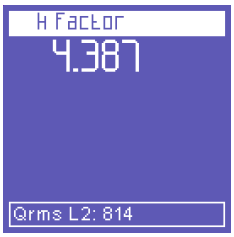
On any of the Counters Menu pages, press ▶ to access the page containing all the information regarding auxiliary channel counters. In the AUX Menu, the user can also access the other Auxiliary Channel Menus (Voltages, Currents, Power, Harmonics, Waveforms) by selecting them with the relevant function keys.
Press ◀ to exit the Auxiliary Menu and return to the first page of the relevant menu.



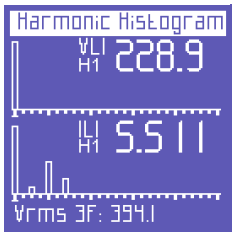
x3" 

5.3.5 - Harmonics Menu (1ph)

THD% (Total Harmonic Distortion) for voltage and current, Cosφ value and relevant angle expressed in degrees (the negative sign indicates that current comes before voltage and that the load is capacitive).

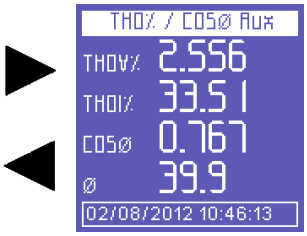


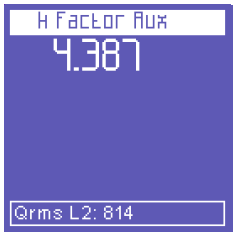
K factor



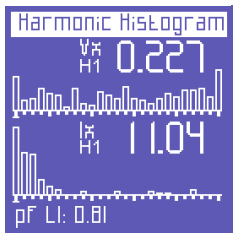
Harmonic histogram of current and voltage.

On any of the Harmonics Menu pages, press ▶ to access two pages containing all the information regarding auxiliary channel harmonics. The first page displays the THD% of V and I. Use ▲ or ▼ to view the other page (see below). In the AUX Menu, the user can also access the other Auxiliary Channel Menus (Voltages, Currents, Counters, Harmonics, Waveforms), by selecting them with the relevant function keys.
Press ◀ to exit the Auxiliary Menu and return to the first page of the relevant menu.





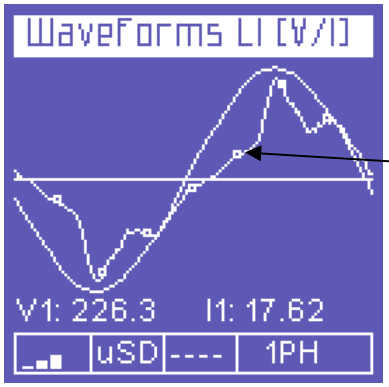
K factor of the AUX channel



Harmonic histogram of auxiliary voltage and current.

NOTE: For instructions on the complete consultation of harmonic histograms (up to the 50th harmonic), see Sect. 5.2.5.1.

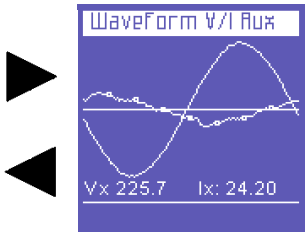
x3"  **5.3.6 - Waveforms Menu (1ph)**



This page displays the real-time waveforms and the relevant voltage and current RMS values.

- **NOTE**: current tracing can be distinguished from voltage tracing by little square markers. Waveform amplitude is purely indicative and is automatically adjusted to screen size.

On the Waveforms Menu page, press ▶ to access the page of auxiliary channel tracing. In the AUX Menu, the user can also access the other Auxiliary Channel Menus (Voltages, Currents, Power, Counters, Harmonics) by selecting them with the relevant function keys.
Press ◀ to exit the Auxiliary Menu and return to the first page of the relevant menu.



NOTE: the "**EN 50160**", "**Transients**", "**Alarms**", and "**Measurement Campaigns**" Menus, as well as the "**Snapshot**" function for the single phase connection, are identical to the corresponding menus of the three-phase connection. See Sect. 5.1.7/8/9/10/11.

6 - MAINTENANCE

NanoVIP^3 does not require any special maintenance. Simply comply with the common rules that apply to any electronic device:

- Clean the instrument with a soft and clean cloth (the edges must not be frayed).
- Do not use detergents or corrosive or abrasive substances.
- Do not store the instrument in areas where the humidity and temperature levels exceed the ranges prescribed below.

6.1 - Accuracy Check

The manufacturer cannot determine in advance the frequency at which an accuracy check should be performed, as instrument performance will depend on the conditions of use (heavy- or light-duty, environmental conditions, etc.).
Therefore, the user should perform periodical performance checks, using a sample instrument (of a higher category). At first, accuracy checks should be performed yearly, and thereafter increased or decreased based on the outcome of the checks.
If new calibration is required, the instrument can be sent to the manufacturer's in-house laboratory.
If deemed appropriate, the user can also request that the manufacturer perform the accuracy check.
NOTE: the in-house calibration laboratory of Elcontrol Energy Net is currently the only authorised calibration centre used.

6.2 - Repair

NanoVIP^3 is a sophisticated electronic product designed by Elcontrol Energy Net.
Any attempt to repair the instrument without the necessary know-how may pose a safety risk.
Therefore, no unauthorised personnel or laboratories should carry out repair, maintenance or calibration operations. The warranty shall no longer be valid if the instrument is tampered with by third parties.

6.3 - Troubleshooting

- Instrument will not switch on.

The battery has run out. Connect instrument to power supply.

- Instrument does not perform correct measurements.

Make sure the current and voltage ratios match the current clamps and VTs connected to the system (Sect. 4.2.1 and 4.2.2).
Make sure the current clamps are not connected inversely (Sect. 4.2.1.6).
Make sure the phase sequence is correct (Sect. 4.2.1.6).

- The display is blurry.

Check the brightness and contrast levels of the LCD (Sect. 4.2.6.3).

- The display dims after a few seconds.

Check the screensaving settings (Sect. 4.2.6.1).

- The display stays on permanently, even though it has been set-up differently.

Check if a video alarm is present (Sect. 4.2.12).

- Certain pages or entire menus are not displayed.

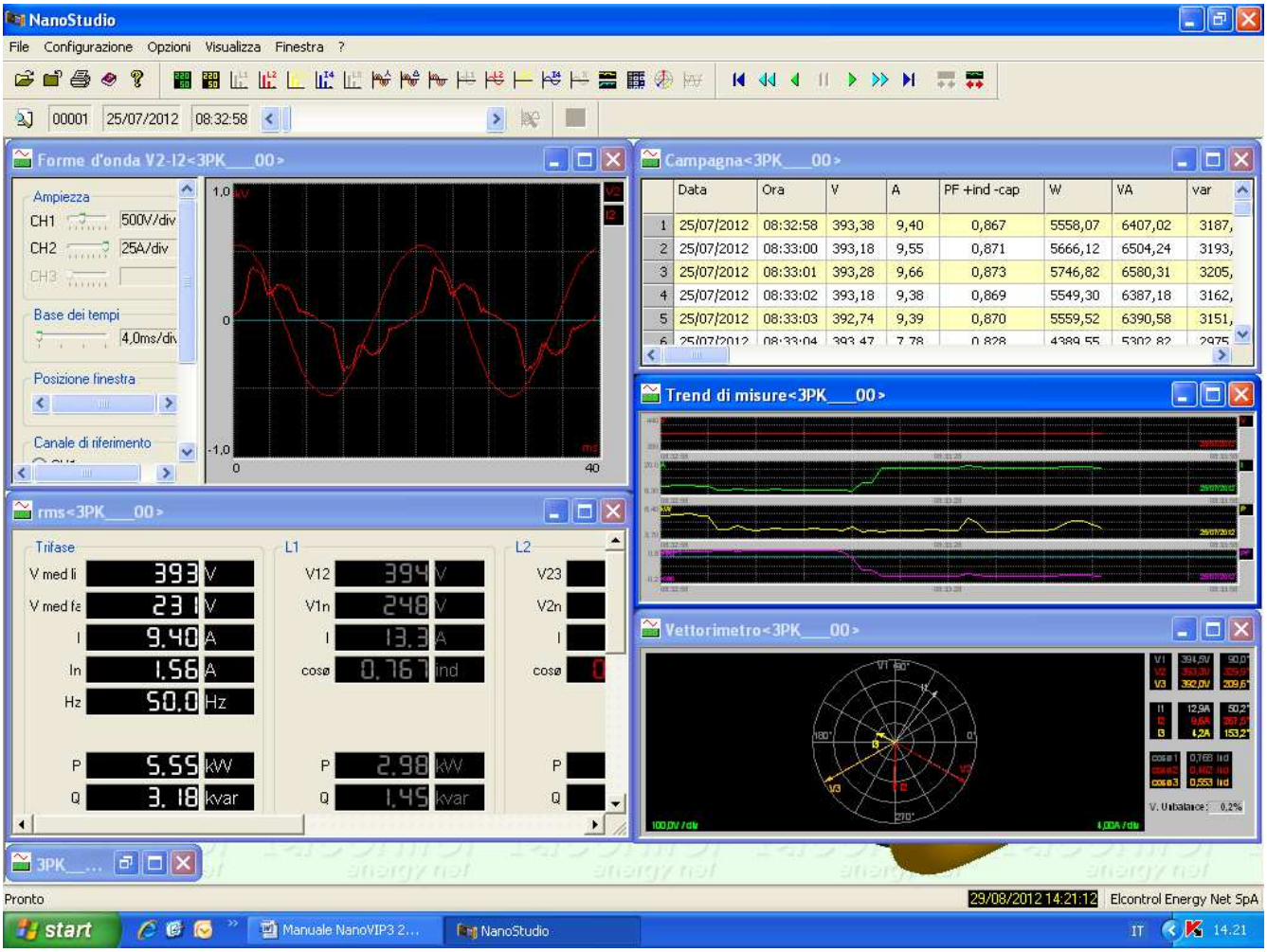
Make sure the menu type is set on Full and not Partial (Sect. 4.2.6.4).
Make sure the connection type set is correct (Sect. 4.2.1.1).

- A significant number of alarms have gone off.

Make sure a suitable alarm hysteresis has been set (Sect. 4.2.12.1).

7 - NANOSTUDIO SOFTWARE

NANOSTUDIO Software is a simple and practical tool for analysing the measurement campaigns performed with NANOVIP^3.
NANOSTUDIO is compatible with WINDOWS XP, WINDOWS VISTA, and WINDOWS7. To install it, launch the file SETUP.EXE contained on the uSD card and follow the instructions provided.
Thanks to this software, the user will be able to analyse all the events recorded in the campaign, export the measurements performed to an EXCEL file, create reports, etc.
To use NANOSTUDIO, see the manual included in the installation pack.



8 - TECHNICAL SPECIFICATIONS

CASE:	
Dimensions	203x116x53mm
Material	ABS with self-extinguishing V0 grade
Protection class	IP30
Weight	580 g
DISPLAY:	
Dimensions	68x68mm
Type	128x128 FSTN Negative dot matrix graphic LCD
Backlight	White LED
Languages	English - Spanish - Italian - German - French
KEYPAD:	
Type	Membrane keypad with 10 double-function keys
POWER SUPPLY:	
External power supply	wall-plug switching; input 100-240VAC ±10% 47-63Hz with interchangeable plug; output 7.5VDC - 12W
Battery pack	4 x AA NiMh 2100mAh
Duration of the battery charge	>24h
CONNECTIONS:	
Voltages	Flexible cables L = 1.5m; 2.5mm^2 - 36A; 1000V CAT III - 600V CAT IV with a 4mm, 90° protected blade plug connector, and a crocodile clip with a 45mm opening (for sections up to 32mm)
Currents	Elcontrol Energy Net interchangeable amperometric sensors
FUNCTIONS:	
Traditional electrical analisys	V, I, P, Q, S, F, PF, THD(V)%, THD(I)%, cosφ, φ, peaks, minimums, maximums, averages, max. demands, etc.
Neutral current	Measured
Three phase counters	kWh, kVArh, kVAh, both absorbed that generated
Counters for each single phase	kWh, kVArh, kVAh, both absorbed that generated
Cogeneration	✓
Waveforms	V & I
Harmonics	Values and histograms up to the 50th order
Sags	Dips, swells & interruptions
Transients	Overvoltages & overcurrents
Unbalance	✓
Test EN 50160	✓
Inrush current	✓
DC measures	✓
K factor	Up to the 25th order
Alarms	Displayed
Alarms log	5 at display
Tariff bands	4
Energy costs	✓
Measurament campaigns	unlimited, up to fill the memory card
CONNECTING SYSTEMS:	
Single phase	✓
Two phase	✓
Three-phase, 3-wires, balanced	✓
Three-phase, 3-wires, unbalanced	✓
4-phase, 4-wires, balanced	✓
4-phase, 4-wires, unbalanced	✓
MEASUREMENTS:	
Display refresh rate	1 sec.
Type of connections available	Three-phase (3 or 4 leads), two-phase (2 leads), and single phase grid
Type of grid which can be connected	Low and medium voltage (LV and MV)
VOLTAGE (TRMS)	
Channels	3 channels with common neutral + 1 independent, auxiliary channel
Input impedance	4 Mohm

Scales	2
Direct measurement	Phase-phase: 7-1000VAC 40-70Hz Phase-neutral: 5-600VAC 40-70Hz Aux: 5-1000VAC 40-70Hz 10-1400VDC
Measurement with VT	Ratio: 1-60000 Maximum value which can be displayed: 20MV
Permanent overload	Phase-phase: 1200VAC Phase-neutral: 700VAC Aux: 1200VAC 1700VDC
Sensitivity	5VAC Phase-neutral, 7VAC Phase-phase 10VDC
CURRENT (TRMS)	
Channels	5 independent channels
Input impedance	10KOhm
Scales	4
Measurement with current clamps	Ratio: 1-60000 Maximum value which can be displayed: 500KA
Sensitivity	2% of F.S.
POWERS	
Single phase power	Values < 999 GW, Gvar, GVA
Total power	Values < 999 GW, Gvar, GVA
POWER COUNTERS	
Maximum value before reset	99999999 kWh, kvarh, kVAh
ACCURACY	
RMS voltages:	
Scale 1	±0.25% + 0.1%FS @ RMS V < 350VAC (1)
Scale 2	±0.25% + 0.05%FS @ RMS V > 350VAC (1)
RMS currents:	
Scale 1	±0.25% + 0.1%FS @ RMS I < 5% IN clamp (1)
Scale 2	±0.25% + 0.05%FS @ 5% < RMS I < 20% IN clamp (1)
Scale 3	±0.25% + 0.05%FS @ 20% < RMS I < 50% IN clamp (1)
Scale 4	±0.25% + 0.05%FS @ > 50% IN clamp (1)
Power	±0.5% + 0.05%FS
Power Factor (PF)	±0.5°
Frequency	±0.01 Hz (40-70Hz)
Active power count (kW)	Class 0.5
Reactive power count (kVar)	Class 1
HARMONIC ANALISYS	Up yo 50^{th} order
ANALYSIS of EN50160 parameters	
Interruptions	>500mS
Dips	>500mS
Swells	>500mS
Transient ANALYSIS	
Swells and overcurrents	>150uS
Inrush current analysis	RMS continuous sampling every 2 periods – Duration 1, 2, 5, 10 sec.
COMMUNICATION:	
USB	to PC
DATA STORAGE:	
Internal memory	64kB
External memory	Micro SD (2GB included)
OPERATING CONDITIONS:	
Operating temperature	-10 to +55 °C
Storage temperature	-20 to +85 °C
Relative humidity	Max 95%
Maximum altitude a.s.l. (600V CAT III)	2000 m
EC COMPLIANCE:	
Directives	93/68/EEC (Low Voltage Electrical Equipment); 89/336/EEC and 2004/108/EC (EMC - Electromagnetic Compatibility); 2006/95/EC - 72/23/EEC (LVD - Low Voltage Directive); 2002/95/EC (RoHS - Restriction of Hazardous Substances); 2002/96/EC and 2003/108/EC (WEEE - Waste Electrical and Electronic

	Equipment);
REFERENCE STANDARDS:	
Safety	EN 61010-1
Electromagnetic Compatibility (EMC)	EN 61326 EN 61326/A1 EN 61326/A2 EN 61326/A3
Temperature	IEC 60068-2-1 (Operating temperature) IEC 60068-2-2 (Storing temperature)
Vibrations	IEC 60068-2-6
Humidity	IEC 60068-2-30 (Humidity)
Overload	IEC 60947-1

(1) The instrument changes the voltage and current scale automatically when the values of the signals detected by the analogue-to-digital converter exceed a pre-set threshold. Therefore, the thresholds provided are purely indicative.

9 - ACCESSORIES & SPARE PARTS

NanoVIP^3 KIT is composed by:

n. 1 NanoVIP^3 handheld energy analyser
n. 1 battery pack
n. 4 voltage cables (yellow, black, red, blue) with integrated alligator clips
n. 3 current probes (type chosen by the user)
n. 1 USB-A/miniUSB-B connection cable
n. 1 memory card MicroSD 2GB (containing the PC software NanoStudio and the user manual)
n. 1 wall-plug power supply
n. 1 hard carrying case

NanoVIP^3 may come with a range of accessories, which are listed in the table below. These accessories allow for the instrument to be used for special purposes or measurement conditions which are less common than standard measurement operations.

ACCESSORIES	
Code	**Description**
4AAWS	1000A Clamp
4AR10	200A Clamp
4AAYW	5A Clamp
4AAZA	Nanoflex (21cm 3000A flexible mini-clamp)
4AAXS	1000A 40cm flexible current sensor
4AADM	LMA clamp (dispersion measurement)
4AQ02	Set of voltage cables for the aux channel (2 cables + 2 alligator clips + rigid toe)
4AAER	5A/1V SEPA (for medium voltage measurements)
SPARE PARTS	
Code	**Description**
6MAON	NanoVIP$^{2-3}$ battery pack
4AQ03	NanoVIP$^{2-3}$ power supply
4AQ05	Little carrying case
4AQ06	Big carrying case
4AQ01	Set of 4 voltage cables (yellow, black, red, blue) with integrated alligator clips
4AQ04	USB-A/miniUSB-B cable
4AUSD	memory card MicroSD 2GB (containing the PC software NanoStudio and the user manual)

Appendix 1 - MODBUS Measurement Registers

Elcontrol standard MODBUS registers:

0001	V (3ph)	Three-phase voltage (BCD mantissa)
0002	V (3 ph)	Three-phase voltage (exponent in binary format)
0003	A (3 ph)	Three-phase current
0004	A (3 ph)	Three-phase current
0005	kW (3 ph)	Three-phase active power
0006	kW (3 ph)	Three-phase active power
0007	kVAr (3 ph)	Three-phase reactive power
0008	kVAr (3 ph)	Three-phase reactive power
0009	kVA (3 ph)	Three-phase apparent power
0010	kVA (3 ph)	Three-phase apparent power
0011	PF (3 ph)	Three-phase power factor
0012	PF (3 ph)	Three-phase power factor
0013	kW avg (3 ph)	Average active power (average calculated according to integration time set - see 4.2.2)
0014	kW avg (3 ph)	Average active power
0015	kVA avg (3 ph)	Average apparent power
0016	kVA avg (3 ph)	Average apparent power
0017	kW max (3 ph)	Load peak of active power (maximum value of average active power)
0018	kW max (3 ph)	Load peak of active power
0019	kVA max (3 ph)	Load peak of apparent power (maximum value of average apparent power)
0020	kVA max (3 ph)	Load peak of apparent power
0021	kWh (3 ph)	Three-phase active power counter (BCD integers)
0022	kWh (3 ph)	Three-phase active power counter (BCD integers)
0023	kWh (3 ph)	Three-phase active power counter (Binary-coded decimals)
0024	kVArh (3 ph)	Three-phase reactive power counter
0025	kVArh (3 ph)	Three-phase reactive power counter
0026	kVArh (3 ph)	Three-phase reactive power counter
0027	S/N	Serial number
0028	S/N	Serial number
0029	V (L1)	Voltage L1
0030	V (L1)	Voltage L1
0031	V (L2)	Voltage L2
0032	V (L2)	Voltage L2
0033	V (L3)	Voltage L3
0034	V (L3)	Voltage L3
0035	A (L1)	Current L1
0036	A (L1)	Current L1
0037	A (L2)	Current L2
0038	A (L2)	Current L2
0039	A (L3)	Current L3
0040	A (L3)	Current L3
0041	kW (L1)	Active power L1
0042	kW (L1)	Active power L1
0043	kW (L2)	Active power L2
0044	kW (L2)	Active power L2
0045	kW (L3)	Active power L3
0046	kW (L3)	Active power L3
0047	Hz	Frequency (measured on L1)
0048	Hz	Frequency (measured on L1)
0049	kVAr (L1)	Reactive power measured on L1 (used by instrument for internal calculations)
0050	kVAr (L1)	Reactive power measured on L1
0051	kVAr (L2)	Reactive power measured on L2
0052	kVAr (L2)	Reactive power measured on L2
0053	kVAr (L3)	Reactive power measured on L3
0054	kVAr (L3)	Reactive power measured on L3
0055	kVA (L1)	Apparent power L1
0056	kVA (L1)	Apparent power L1
0057	kVA (L2)	Apparent power L2
0058	kVA (L2)	Apparent power L2
0059	kVA (L3)	Apparent power L3
0060	kVA (L3)	Apparent power L3
0061	kVAr (L1)	Reactive power calculated on L1 (value displayed on instrument)
0062	kVAr (L1)	Reactive power calculated on L1
0063	kVAr (L2)	Reactive power calculated on L2
0064	kVAr (L2)	Reactive power calculated on L2
0065	kVAr (L3)	Reactive power calculated on L3
0066	kVAr (L3)	Reactive power calculated on L3
0067	PF (L1)	Power factor L1
0068	PF (L1)	Power factor L1
0069	PF (L2)	Power factor L2
0070	PF (L2)	Power factor L2
0071	PF (L3)	Power factor L3
0072	PF (L3)	Power factor L3

0073	A n	Neutral current
0074	A n	Neutral current
0075	A avg (L1)	Average current L1 (average calculated according to integration time set - see 4.2.2)
0076	A avg (L1)	Average current L1
0077	A avg (L2)	Average current L2
0078	A avg (L2)	Average current L2
0079	A avg (L3)	Average current L3
0080	A avg (L3)	Average current L3
0081	Amax (L1)	Load peak of current L1 (maximum value of average currents)
0082	Amax (L1)	Load peak of current L1
0083	Amax (L2)	Load peak of current L2
0084	Amax (L2)	Load peak of current L2
0085	Amax (L3)	Load peak of current L3
0086	Amax (L3)	Load peak of current L3
0087	kVAr avg	Average reactive power
0088	kVAr avg	Average reactive power
0089	kVAr max	Load peak of reactive power (maximum value of average reactive power)
0090	kVAr max	Load peak of reactive power
0091	kWh cog	Three-phase counter of generated active power
0092	kWh cog	Three-phase counter of generated active power
0093	kWh cog	Three-phase counter of generated active power
0094	kVArh cog	Three-phase counter of generated reactive power (lagging)
0095	kVArh cog	Three-phase counter of generated reactive power
0096	kVArh cog	Three-phase counter of generated reactive power
0097	kVAh	Three-phase apparent power counter
0098	kVAh	Three-phase apparent power counter
0099	kVAh	Three-phase apparent power counter
0100	kWh T1	Three-phase active power counter (tariff T1)
0101	kWh T1	Three-phase active power counter (tariff T1)
0102	kWh T1	Three-phase active power counter (tariff T1)
0103	kWh T2	Three-phase active power counter (tariff T2)
0104	kWh T2	Three-phase active power counter (tariff T2)
0105	kWh T2	Three-phase active power counter (tariff T2)
0106	kWh T3	Three-phase active power counter (tariff T3)
0107	kWh T3	Three-phase active power counter (tariff T3)
0108	kWh T3	Three-phase active power counter (tariff T3)
0109	kWh T4	Three-phase active power counter (tariff T4)
0110	kWh T4	Three-phase active power counter (tariff T4)
0111	kWh T4	Three-phase active power counter (tariff T4)
0112	Inp1	Digital input counter 1
0113	Inp1	Digital input counter 1
0114	Inp1	Digital input counter 1
0115	Inp2	Digital input counter 2
0116	Inp2	Digital input counter 2
0117	Inp2	Digital input counter 2
0197	THD Vtot%	Total Harmonic Distortion Vtot
0198	THD Vtot%	Total Harmonic Distortion Vtot
0199	THD Itot%	Total Harmonic Distortion Itot
0200	THD Itot%	Total Harmonic Distortion Itot
0201	THD V1%	Total Harmonic Distortion V1
0202	THD V1%	Total Harmonic Distortion V1
0203	THD V2%	Total Harmonic Distortion V2
0204	THD V2%	Total Harmonic Distortion V2
0205	THD V3%	Total Harmonic Distortion V3
0206	THD V3%	Total Harmonic Distortion V3
0207	THD A1%	Total Harmonic Distortion A1
0208	THD A1%	Total Harmonic Distortion A1
0209	THD A2%	Total Harmonic Distortion A2
0210	THD A2%	Total Harmonic Distortion A2
0211	THD A3%	Total Harmonic Distortion A3
0212	THD A3%	Total Harmonic Distortion A3

Voltage Harmonics

H01 (Fundamental)

0213	V1 h01	Harmonic No.1 voltage L1
0214	V1 h01	Harmonic No.1 voltage L1
0215	V2 h01	Harmonic No.1 voltage L2
0216	V2 h01	Harmonic No.1 voltage L2
0217	V3 h01	Harmonic No.1 voltage L3
0218	V3 h01	Harmonic No.1 voltage L3

H02 Harmonic 2

0219	V1 h02	Harmonic No.2 voltage L1
0220	V1 h02	Harmonic No.2 voltage L1

0221 V2 h02 Harmonic No.2 voltage L2
0222 V2 h02 Harmonic No.2 voltage L2
0223 V3 h02 Harmonic No.2 voltage L3
0224 V3 h02 Harmonic No.2 voltage L3
…….
Consecutive addresses up to the 25th harmonic:

H25 Harmonic 25
0357 V1 h25 Harmonic No.25 voltage L1
0358 V1 h25 Harmonic No.25 voltage L1
0359 V2 h25 Harmonic No.25 voltage L2
0360 V2 h25 Harmonic No.25 voltage L2
0361 V3 h25 Harmonic No.25 voltage L3
0362 V3 h25 Harmonic No.25 voltage L3

Current Harmonics

H01 (Fundamental)
0375 A1 h01 Harmonic No.1 current L1
0376 A1 h01 Harmonic No.1 current L1
0377 A2 h01 Harmonic No.1 current L2
0378 A2 h01 Harmonic No.1 current L2
0379 A3 h01 Harmonic No.1 current L3
0380 A3 h01 Harmonic No.1 current L3

H02 Harmonic 2
0381 A1 h02 Harmonic No.2 current L1
0382 A1 h02 Harmonic No.2 current L1
0383 A2 h02 Harmonic No.2 current L2
0384 A2 h02 Harmonic No.2 current L2
0385 A3 h02 Harmonic No.2 current L3
0386 A3 h02 Harmonic No.2 current L3
…….
…….
Consecutive addresses up to the 25th harmonic:

H25 Harmonic 25
0519 A1 h025 Harmonic No.25 current L1
0520 A1 h025 Harmonic No.25 current L1
0521 A2 h025 Harmonic No.25 current L2
0522 A2 h025 Harmonic No.25 current L2
0523 A3 h025 Harmonic No.25 current L3
0524 A3 h025 Harmonic No.25 current L3

Harmonic Phase Displacement (cosphi)
H01 (Fundamental)
537 PF1 h01 Phase displacement of harmonic No.1 L1
538 PF1 h01 Phase displacement of harmonic No.1 L1
539 PF2 h01 Phase displacement of harmonic No.1 L2
540 PF2 h01 Phase displacement of harmonic No.1 L2
541 PF3 h01 Phase displacement of harmonic No.1 L3
542 PF3 h01 Phase displacement of harmonic No.1 L3

H02 Harmonic 2
543 PF1 h02 Phase displacement of harmonic No.2 L1
544 PF1 h02 Phase displacement of harmonic No.2 L1
545 PF2 h02 Phase displacement of harmonic No.2 L2
546 PF2 h02 Phase displacement of harmonic No.2 L2
547 PF3 h02 Phase displacement of harmonic No.2 L3
548 PF3 h02 Phase displacement of harmonic No.2 L3
…….
…….
Consecutive addresses up to the 25th harmonic:

H31 Harmonic 25
681 PF1 h31 Phase displacement of harmonic No.31 L1
682 PF1 h31 Phase displacement of harmonic No.31 L1
683 PF2 h31 Phase displacement of harmonic No.31 L2
684 PF2 h31 Phase displacement of harmonic No.31 L2
685 PF3 h31 Phase displacement of harmonic No.31 L3
686 PF3 h31 Phase displacement of harmonic No.31 L3

NEW NANOVIP[3] REGISTERS

1001	V (3ph)	Three-phase voltage (BCD mantissa)
1002	V (3 ph)	Three-phase voltage (exponent in binary format)
1003	A (3 ph)	Three-phase current
1004	A (3 ph)	Three-phase current
1005	kW (3 ph)	Three-phase active power
1006	kW (3 ph)	Three-phase active power
1007	kVAr (3 ph)	Three-phase reactive power
1008	kVAr (3 ph)	Three-phase reactive power
1009	kVA (3 ph)	Three-phase apparent power
1010	kVA (3 ph)	Three-phase apparent power
1011	PF (3 ph)	Three-phase power factor
1012	PF (3 ph)	Three-phase power factor
1013	V (L1)	Voltage L1
1014	V (L1)	Voltage L1
1015	V (L2)	Voltage L2
1016	V (L2)	Voltage L2
1017	V (L3)	Voltage L3
1018	V (L3)	Voltage L3
1019	V (L1)	Voltage L1-L2
1020	V (L1)	Voltage L1-L2
1021	V (L2)	Voltage L2-L3
1022	V (L2)	Voltage L2-L3
1023	V (L3)	Voltage L3-L1
1024	V (L3)	Voltage L3-L1
1025	A (L1)	Current L1
1026	A (L1)	Current L1
1027	A (L2)	Current L2
1028	A (L2)	Current L2
1029	A (L3)	Current L3
1030	A (L3)	Current L3
1031	A n	Neutral current
1032	A n	Neutral current
1033	kW (L1)	Active power L1
1034	kW (L1)	Active power L1
1035	kW (L2)	Active power L2
1036	kW (L2)	Active power L2
1037	kW (L3)	Active power L3
1038	kW (L3)	Active power L3
1039	kVAr (L1)	Reactive power calculated on L1
1040	kVAr (L1)	Reactive power calculated on L1
1041	kVAr (L2)	Reactive power calculated on L2
1042	kVAr (L2)	Reactive power calculated on L2
1043	kVAr (L3)	Reactive power calculated on L3
1044	kVAr (L3)	Reactive power calculated on L3
1045	kVA (L1)	Apparent power L1
1046	kVA (L1)	Apparent power L1
1047	kVA (L2)	Apparent power L2
1048	kVA (L2)	Apparent power L2
1049	kVA (L3)	Apparent power L3
1050	kVA (L3)	Apparent power L3
1051	PF (L1)	Power factor L1
1052	PF (L1)	Power factor L1
1053	pf (L2)	Power factor L2
1054	pf (L2)	Power factor L2
1055	PF (L3)	Power factor L3
1056	PF (L3)	Power factor L3
1057	Hz	Frequency (measured on L1)
1058	Hz	Frequency (measured on L1)
1059	Unbalance	Unbalance of three-phase voltages
1060	Unbalance	Unbalance of three-phase voltages
1061	V avg (L1)	Average voltage L1
1062	V avg (L1)	Average voltage L1
1063	V avg (L2)	Average voltage L2
1064	V avg (L2)	Average voltage L2
1065	V avg (L3)	Average voltage L3
1066	V avg (L3)	Average voltage L3
1067	V min (L1)	Minimum voltage L1
1068	V min (L1)	Minimum voltage L1
1069	V min (L2)	Minimum voltage L2
1070	V min (L2)	Minimum voltage L2
1071	V min (L3)	Minimum voltage L3
1072	V min (L3)	Minimum voltage L3
1073	V max (L1)	Maximum voltage L1

1074	V max (L1)	Maximum voltage L1
1075	V max (L2)	Maximum voltage L2
1076	V max (L2)	Maximum voltage L2
1077	V max (L3)	Maximum voltage L3
1078	V max (L3)	Maximum voltage L3
1079	A avg (L1)	Average current L1
1080	A avg (L1)	Average current L1
1081	A avg (L2)	Average current L2
1082	A avg (L2)	Average current L2
1083	A avg (L3)	Average current L3
1084	A avg (L3)	Average current L3
1085	A min (L1)	Minimum current L1
1086	A min (L1)	Minimum current L1
1087	A min (L2)	Minimum current L2
1088	A min (L2)	Minimum current L2
1089	A min (L3)	Minimum current L3
1090	A min (L3)	Minimum current L3
1091	A max (L1)	Maximum current L1
1092	A max (L1)	Maximum current L1
1093	A max (L2)	Maximum current L2
1094	A max (L2)	Maximum current L2
1095	A max (L3)	Maximum current L3
1096	A max (L3)	Maximum current L3 L3
1097	Amax (L1)	Load peak of current L1
1098	Amax (L1)	Load peak of current L1
1099	Amax (L2)	Load peak of current L2
1100	Amax (L2)	Load peak of current L2
1101	Amax (L3)	Load peak of current L3
1102	Amax (L3)	Load peak of current L3
1103	kW avg (3 ph)	Average active power
1104	kW avg (3 ph)	Average active power
1105	kW min (3 ph)	Minimum active power
1106	kW min (3 ph)	Minimum active power
1107	kW max (3 ph)	Maximum active power
1108	kW max (3 ph)	Maximum active power
1109	kW max (3 ph)	Load peak of active power
1110	kW max (3 ph)	Load peak of active power
1111	kVAr avg (3 ph)	Average reactive power
1112	kVAr avg (3 ph)	Average reactive power
1113	kVAr min (3 ph)	Minimum reactive power
1114	kVar min (3 ph)	Minimum reactive power
1115	kVar max (3 ph)	Maximum reactive power
1116	kVar max (3 ph)	Maximum reactive power
1117	kVAr max (3 ph)	Load peak of reactive power
1118	kVAr max (3 ph)	Load peak of reactive power
1119	kVA avg (3 ph)	Average apparent power
1120	kVA avg (3 ph)	Average apparent power
1121	kVA min (3 ph)	Minimum apparent power
1122	kVA min (3 ph)	Minimum apparent power
1123	kVA max (3 ph)	Maximum apparent power
1124	kVA max (3 ph)	Maximum apparent power
1125	kVA max (3 ph)	Load peak of apparent power
1126	kVA max (3 ph)	Load peak of apparent power
1127	PF avg (3 ph)	Average power factor
1128	PF avg (3 ph)	Average power factor
1129	PF min (3 ph)	Minimum power factor
1130	PF min (3 ph)	Minimum power factor
1131	PF max (3 ph)	Maximum power factor
1132	PF max (3 ph)	Maximum power factor
1133	PF max (3 ph)	Maximum average power factor
1134	PF max (3 ph)	Maximum average power factor
1135	kWh (3 ph)	Three-phase active power counter (BCD integers)
1136	kWh (3 ph)	Three-phase active power counter (BCD integers)
1137	kWh (3 ph)	Three-phase active power counter (binary-coded decimals)
1138	kVArh (3 ph)	Three-phase reactive power counter
1139	kVArh (3 ph)	Three-phase reactive power counter
1140	kVArh (3 ph)	Three-phase reactive power counter
1141	kVAh (3 ph)	Three-phase apparent power counter
1142	kVAh (3 ph)	Three-phase apparent power counter
1143	kVAh (3 ph)	Three-phase apparent power counter
1144	kWh cog (3 ph)	Three-phase counter of generated active power
1145	kWh cog (3 ph)	Three-phase counter of generated active power
1146	kWh cog (3 ph)	Three-phase counter of generated active power
1147	kVArh cog	Three-phase counter of generated reactive power (lagging)
1148	kVArh cog	Three-phase counter of generated reactive power

1149	kVArh cog	Three-phase counter of generated reactive power
1150	kVAh (3 ph)	Three-phase apparent power counter
1151	kVAh (3 ph)	Three-phase apparent power counter
1152	kVAh (3 ph)	Three-phase apparent power counter
1153	kWh (L1)	Three-phase active power counter L1
1154	kWh (L1)	Three-phase active power counter L1
1155	kWh (L1)	Three-phase active power counter L1
1156	kWh (L2)	Three-phase active power counter L2
1157	kWh (L2)	Three-phase active power counter L2
1158	kWh (L2)	Three-phase active power counter L2
1159	kWh (L3)	Three-phase active power counter L3
1160	kWh (L3)	Three-phase active power counter L3
1161	kWh (L3)	Three-phase active power counter L3
1162	kVArh (L1)	Three-phase reactive power counter L1
1163	kVArh (L1)	Three-phase reactive power counter L1
1164	kVArh (L1)	Three-phase reactive power counter L1
1165	kVArh (L2)	Three-phase reactive power counter L2
1166	kVArh (L2)	Three-phase reactive power counter L2
1167	kVArh (L2)	Three-phase reactive power counter L2
1168	kVArh (L3)	Three-phase reactive power counter L3
1169	kVArh (L3)	Three-phase reactive power counter L3
1170	kVArh (L3)	Three-phase reactive power counter L3
1171	kWh cog Exported (L1)	Counter of generated active power L1
1172	kWh cog Exported (L1)	Counter of generated active power L1
1173	kWh cog Exported (L1)	Counter of generated active power L1
1174	kWh cog Exported (L2)	Counter of generated active power L2
1175	kWh cog Exported (L2)	Counter of generated active power L2
1176	kWh cog Exported (L2)	Counter of generated active power L2
1177	kWh cog Exported (L3)	Counter of generated active power L3
1178	kWh cog Exported (L3)	Counter of generated active power L3
1179	kWh cog Exported (L3)	Counter of generated active power L3
1180	kVArh cog lagging (L1)	Counter of generated reactive power L1 (lagging)
1181	kVArh cog lagging (L1)	Counter of generated reactive power L1
1182	kVArh cog lagging (L1)	Counter of generated reactive power L1
1183	kVArh cog lagging (L2)	Counter of generated reactive power L2
1184	kVArh cog lagging (L2)	Counter of generated reactive power L2
1185	kVArh cog lagging (L2)	Counter of generated reactive power L2
1186	kVArh cog lagging (L3)	Counter of generated reactive power L3
1187	kVArh cog lagging (L3)	Counter of generated reactive power L3
1188	kVArh cog lagging (L3)	Counter of generated reactive power L3
1189	kVAh Apparent (L1)	Apparent power counter L1
1190	kVAh Apparent (L1)	Apparent power counter L1
1191	kVAh Apparent (L1)	Apparent power counter L1
1192	kVAh Apparent (L2)	Apparent power counter L2
1193	kVAh Apparent (L2)	Apparent power counter L2
1194	kVAh Apparent (L2)	Apparent power counter L2
1195	kVAh Apparent (L3)	Apparent power counter L3
1196	kVAh Apparent (L3)	Apparent power counter L3
1197	kVAh Apparent (L3)	Apparent power counter L3
1198	kWh T1	Three-phase active power counter (tariff T1)
1199	kWh T1	Three-phase active power counter (tariff T1
1200	kWh T1	Three-phase active power counter (tariff T1
1201	kWh T2	Three-phase active power counter (tariff T2
1202	kWh T2	Three-phase active power counter (tariff T2
1203	kWh T2	Three-phase active power counter (tariff T2)
1204	kWh T3	Three-phase active power counter (tariff T3)
1205	kWh T3	Three-phase active power counter (tariff T3)
1206	kWh T3	Three-phase active power counter (tariff T3)
1207	kWh T4	Three-phase active power counter (tariff T4)
1208	kWh T4	Three-phase active power counter (tariff T4)
1209	kWh T4	Three-phase active power counter (tariff T4)
1210	kVarh T1	Three-phase reactive power counter (tariff T1
1211	kVarh T1	Three-phase reactive power counter (tariff T1
1212	kVarh T1	Three-phase reactive power counter (tariff T1
1213	kVarh T2	Three-phase reactive power counter (tariff T2
1214	kVarh T2	Three-phase reactive power counter (tariff T2
1215	kVarh T2	Three-phase reactive power counter (tariff T2
1216	kVarh T3	Three-phase reactive power counter (tariff T3
1217	kVarh T3	Three-phase reactive power counter (tariff T3
1218	kVarh T3	Three-phase reactive power counter (tariff T3
1219	kVarh T4	Three-phase reactive power counter (tariff T4
1220	kVarh T4	Three-phase reactive power counter (tariff T4
1221	kVarh T4	Three-phase reactive power counter (tariff T4
1222	kWh T1	Three-phase counter of generated active power (tariff T1
1223	kWh T1	Three-phase counter of generated active power (tariff T1

1224	kWh T1	Three-phase counter of generated active power (tariff T1
1225	kWh T2	Three-phase counter of generated active power (tariff T2
1226	kWh T2	Three-phase counter of generated active power (tariff T2
1227	kWh T2	Three-phase counter of generated active power (tariff T2
1228	kWh T3	Three-phase counter of generated active power (tariff T3
1229	kWh T3	Three-phase counter of generated active power (tariff T3
1230	kWh T3	Three-phase counter of generated active power (tariff T3
1231	kWh T4	Three-phase counter of generated active power (tariff T4
1232	kWh T4	Three-phase counter of generated active power (tariff T4
1233	kWh T4	Three-phase counter of generated active power (tariff T4
1234	kVarh T1	Three-phase counter of generated reactive power (tariff T1)
1235	kVarh T1	Three-phase counter of generated reactive power (tariff T1)
1236	kVarh T1	Three-phase counter of generated reactive power (tariff T1)
1237	kVarh T2	Three-phase counter of generated reactive power (tariff T2)
1238	kVarh T2	Three-phase counter of generated reactive power (tariff T2)
1239	kVarh T2	Three-phase counter of generated reactive power (tariff T2)
1240	kVarh T3	Three-phase counter of generated reactive power (tariff T3)
1241	kVarh T3	Three-phase counter of generated reactive power (tariff T3)
1242	kVarh T3	Three-phase counter of generated reactive power (tariff T3)
1243	kVarh T4	Three-phase counter of generated reactive power (tariff T4)
1244	kVarh T4	Three-phase counter of generated reactive power (tariff T4)
1245	kVarh T4	Three-phase counter of generated reactive power (tariff T4)
1246	Inp1	Digital input counter 1
1247	Inp1	Digital input counter 1
1248	Inp1	Digital input counter 1
1249	Inp2	Digital input counter 2
1250	Inp2	Digital input counter 2
1251	Inp2	Digital input counter 2
1252	THD Vtot%	Total Harmonic Distortion Vtot
1253	THD Vtot%	Total Harmonic Distortion Vtot
1254	THD Itot%	Total Harmonic Distortion Itot
1255	THD Itot%	Total Harmonic Distortion Itot
1256	THD V1%	Harmonic distortion V1
1257	THD V1%	Harmonic distortion V1
1258	THD V2%	Harmonic distortion V2
1259	THD V2%	Harmonic distortion V2
1260	THD V3%	Harmonic distortion V3
1261	THD V3%	Harmonic distortion V3
1262	THD A1%	Harmonic distortion I1
1263	THD A1%	Harmonic distortion I1
1264	THD A2%	Harmonic distortion I2
1265	THD A2%	Harmonic distortion I2
1266	THD A3%	Harmonic distortion I3
1267	THD A3%	Harmonic distortion I3

Voltage Harmonics

H01 (Fundamental)

1268	V1 h01	Harmonic No.1 voltage L1
1269	V1 h01	Harmonic No.1 voltage L1
1270	V2 h01	Harmonic No.1 voltage L2
1271	V2 h01	Harmonic No.1 voltage L2
1272	V3 h01	Harmonic No.1 voltage L3
1273	V3 h01	Harmonic No.1 voltage L3

H02 Harmonic 2

1274	V1 h02	Harmonic No.2 voltage L1
1275	V1 h02	Harmonic No.2 voltage L1
1276	V2 h02	Harmonic No.2 voltage L2
1277	V2 h02	Harmonic No.2 voltage L2
1278	V3 h02	Harmonic No.2 voltage L3
1279	V3 h02	Harmonic No.2 voltage L3

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Consecutive addresses up to the 31st harmonic:

H31 Harmonic 31

1448	V1 h31	Harmonic No.31 voltage L1
1449	V1 h31	Harmonic No.31 voltage L1
1450	V2 h31	Harmonic No.31 voltage L2
1451	V2 h31	Harmonic No.31 voltage L2
1452	V3 h31	Harmonic No.31 voltage L3
h1453	V3 h31	Harmonic No.31 voltage L3

Current Harmonics

H01 (Fundamental)

1460	A1 h01	Harmonic No.1 current L1
1461	A1 h01	Harmonic No.1 current L1
1462	A2 h01	Harmonic No.1 current L2
1463	A2 h01	Harmonic No.1 current L2
1464	A3 h01	Harmonic No.1 current L3
1465	A3 h01	Harmonic No.1 current L3

H02 Harmonic 2

1466	A1 h02	Harmonic No.1 current L1
1467	A1 h02	Harmonic No.1 current L1
1468	A2 h02	Harmonic No.1 current L2
1469	A2 h02	Harmonic No.1 current L2
1470	A3 h02	Harmonic No.1 current L3
1471	A3 h02	Harmonic No.1 current L3

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Consecutive addresses up to the 31st harmonic:

H31 Harmonic 31

1640	A1 h31	Harmonic No.31 current L1
1641	A1 h31	Harmonic No.31 current L1
1642	A2 h31	Harmonic No.31 current L2
1643	A2 h31	Harmonic No.31 current L2
1644	A3 h31	Harmonic No.31 current L3
1645	A3 h31	Harmonic No.31 current L3

Harmonic Phase Displacement (cosphi)
H01 (Fundamental)

1652	Pf1 h01	Phase displacement of harmonic No.1 L1
1653	Pf1 h01	Phase displacement of harmonic No.1 L1
1654	Pf2 h01	Phase displacement of harmonic No.1 L2
1655	Pf2 h01	Phase displacement of harmonic No.1 L2
1656	Pf3 h01	Phase displacement of harmonic No.1 L3
1657	Pf3 h01	Phase displacement of harmonic No.1 L3

H02 Harmonic 2

1658	Pf1 h02	Phase displacement of harmonic No.2 L1
1659	Pf1 h02	Phase displacement of harmonic No.2 L1
1660	Pf2 h02	Phase displacement of harmonic No.2 L2
1661	Pf2 h02	Phase displacement of harmonic No.2 L2
1662	Pf3 h02	Phase displacement of harmonic No.2 L3
1663	Pf3 h02	Phase displacement of harmonic No.2 L3

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Consecutive addresses up to the 31st harmonic:

H31 Harmonic 31

1832	Pf1 h31	Phase displacement of harmonic No.31 L1
1833	Pf1 h31	Phase displacement of harmonic No.31 L1
1834	Pf2 h31	Phase displacement of harmonic No.31 L2
1835	Pf2 h31	Phase displacement of harmonic No.31 L2
1836	Pf3 h31	Phase displacement of harmonic No.31 L3
1837	Pf3 h31	Phase displacement of harmonic No.31 L3

1844	Test Pass/Fail (1.0)	Freq 50160
1845	Test Pass/Fail (1.0)	Freq 50160
1846	Test Pass/Fail (1.0)	V1 50160
1847	Test Pass/Fail (1.0)	V1 50160
1848	Test Pass/Fail (1.0)	V2 50160
1849	Test Pass/Fail (1.0)	V2 50160
1850	Test Pass/Fail (1.0)	V3 50160
1851	Test Pass/Fail (1.0)	V3 50160
1852	Test Pass/Fail (1.0)	Unbal 50160
1853	Test Pass/Fail (1.0)	Unbal 50160
1854	Test Pass/Fail (1.0)	ThdV1 50160
1855	Test Pass/Fail (1.0)	ThdV1 50160
1856	Test Pass/Fail (1.0)	ThdV2 50160
1857	Test Pass/Fail (1.0)	ThdV2 50160
1858	Test Pass/Fail (1.0)	ThdV3 50160
1859	Test Pass/Fail (1.0)	ThdV3 50160
1860	Number of Interruptions	

1861 Number of Interruptions
1862 Number of Dips
1863 Number of Dips
1864 Number of Swells
1865 Number of Swells

See documentation on Elcontrol website in case of use and development of own software.