Power quality analyzer

QNA 600



INSTRUCTION MANUAL

(M294B01-03-25B)

CE


22
PAP

SAFETY PRECAUTIONS

Follow the warnings described in this manual with the symbols shown below.



DANGER
Warns of a risk, which could result in personal injury or material damage.



ATTENTION
Indicates that special attention should be paid to a specific point.

If you must handle the unit for its installation, start-up or maintenance, the following should be taken into consideration:



Incorrect handling or installation of the device may result in injury to personnel as well as damage to the device. In particular, handling with voltages applied may result in electric shock, which may cause death or serious injury to personnel. Defective installation or maintenance may also lead to the risk of fire.

Read the manual carefully prior to connecting the device. Follow all installation and maintenance instructions throughout the device's working life. Pay special attention to the installation standards of the National Electrical Code.



Refer to the instruction manual before using the device

In this manual, if the instructions marked with this symbol are not respected or carried out correctly, it can result in injury or damage to the device and / or installations.

CIRCUTOR S.A.U. reserves the right to modify features or the product manual without prior notification.

DISCLAIMER

CIRCUTOR S.A.U. reserves the right to make modifications to the device or the unit specifications set out in this instruction manual without prior notice.

CIRCUTOR S.A.U. on its web site, supplies its customers with the latest versions of the device specifications and the most updated manuals.

www.circutor.com





CIRCUTOR S.A.U. recommends using the original cables and accessories that are supplied with the device.

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REVISION LOG

Table 1: Revision log.

Date	Revision	Description
09/23	M294B01-03-23A	First Version
05/25	M294B01-03-25A	Changes in the following sections: 9. - Annex A.
09/25	M294B01-03-25B	Changes in the following sections: 4.1. - 6.1.1. - 7. - 7.2. - 7.3.2. - 7.6.- 8.- Anexo C

SYMBOLS

Table 2: Symbols.

Symbol	Description
CE	In accordance with the relevant European directive.
	Device covered by European Directive 2012/19/EC. At the end of its useful life, do not discard of the device in a household refuse bin. Follow local regulations on electronic equipment recycling.
⎓	Direct current.
~	Alternating current.

Note: *The images of the devices are for illustrative purposes only and may differ from the original device.*

1.- VERIFICATION UPON RECEPTION

Upon reception of the device check the following points:

a) The device meets the specifications described in your order.
b) The device has not suffered any damage during transport.
c) Perform an external visual inspection of the device prior to switching it on.
d) Check that it has been delivered with the following:

- An installation guide.
- One 4G antenna.
- One GPS antenna.
- 4 batteries.
- 2 retainers on the battery holder.

If any problem is noticed upon reception, immediately contact the transport company and/or **CIRCUTOR**'s after-sales service.

2.- PRODUCT DESCRIPTION

The **QNA 600** is a power quality analyzer that measures, calculates, displays and records the main electrical parameters and the quality parameters according to the **IEC 61000-4-30 Edition 3** standard, in singlephase networks, two-phase networks with and without a neutral wire, and balanced or unbalanced three-phase networks.
The measurement is a true RMS that relies on five AC voltage inputs and five current inputs.

The device has a webpage for setting up and displaying all the parameters.



The device features:

- A **display** to show the parameters.
- **7 keys** to browse through the different screens and program the device.
- **6** indication **LEDs.**
- **Ethernet, Wi-Fi and 4G** communications.
- **GPS** to synchronize the internal clock and for global positioning.
- **A battery** to ensure operation, for a limited time, away from the mains.

3.- INSTALLATION OF THE DEVICE

3.1.- PRELIMINARY RECOMMENDATIONS



In order to use the device safely, personnel operating it must follow the safety measures that comply with the standards of the country where it is to be installed; operators must wear the required personal protective equipment (rubber gloves, approved facial protection and flame-resistant clothing) to prevent injuries from electric shock or arcs caused by exposure to current-carrying conductors, and they must heed the various warnings indicated in this instruction manual.

The **QNA 600** device must be installed by authorised and qualified staff.

The power supply plug must be disconnected and measurement systems switched off before handling, altering the connections or replacing the device. It is dangerous to handle the device while it is powered.

Cables must always be kept in perfect condition to avoid accidents or injury to personnel or installations.

Restrict the operation of the device to the specified measurement category, voltage or current values.

The manufacturer of the device is not responsible for any damage resulting from failure by the user or installer to heed the warnings and/or recommendations set out in this manual, nor for damage resulting from the use of non-original products or accessories or those made by other manufacturers.

Do not use the device to take any measurements if an anomaly or malfunction is detected.

Check the surrounding environment before starting to take measurements. Do not take any measurements in hazardous or explosive environments.



Before carrying out maintenance, repair or handling of any of the device's connections, the device must be disconnected from all power sources, both from the device's own power supply and the measurement's.
Contact the after-sales service if you detect that the device is not working properly.

3.2.- MECHANICAL INSTALLATION

The device can be set up on a table thanks to its 4 rubber feet, or inside an electric panel or enclosure, in a 19" rack.

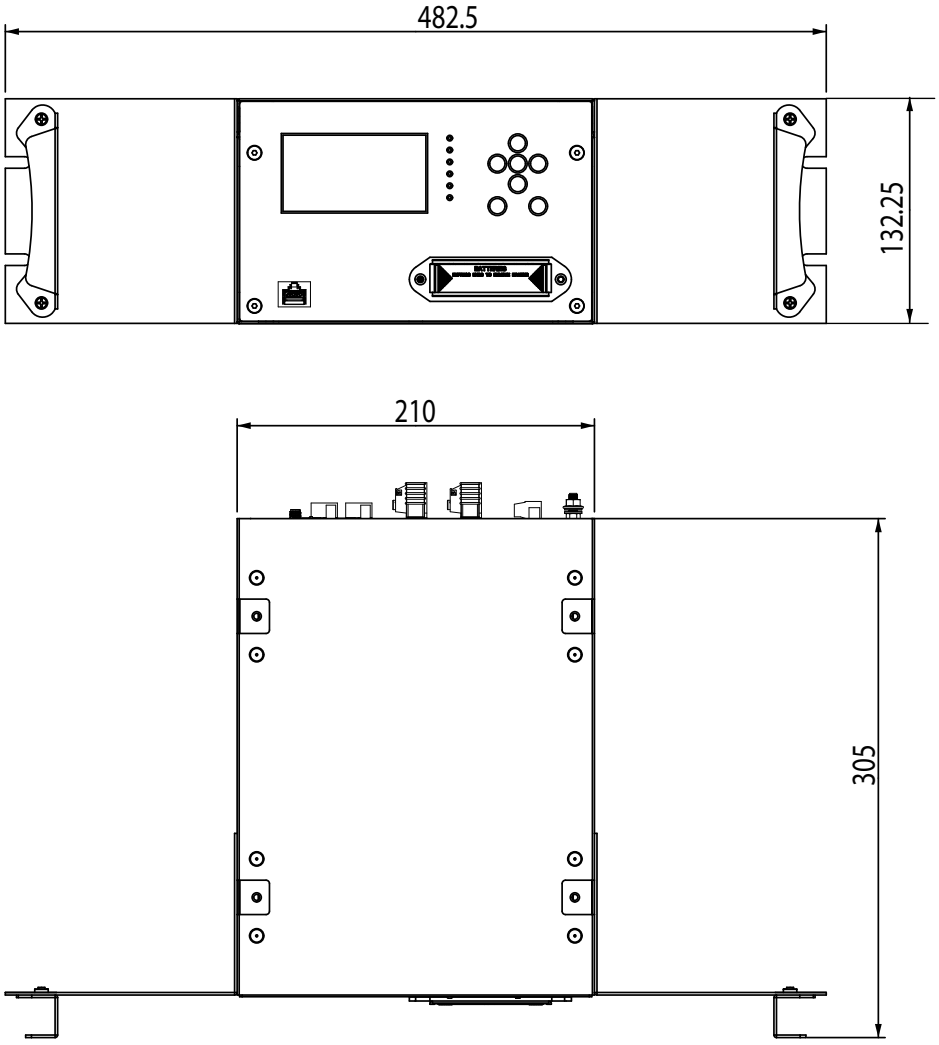


Figure 1: Installation of the QNA 600 in a rack.

The device can be installed in a simple rack (**Figure 2**) or double rack (**Figure 3**). To install in a double rack, it is necessary to use the **Q2200A** accessory, and follow the instructions in the **M339I01-20-xxx** assembly guide.



Figure 2: Installing a QNA 600 in a simple rack.



Figure 3: Installing a QNA 600 in a double rack.

3.3.- ELECTRICAL INSTALLATION

When the device is on, its terminals, opening covers or removing elements may expose the user to parts that are hazardous to touch. Do not use the device until it is fully installed.

The power circuit must be protected with gL (IEC 60269) or type-M fuses rated from 0.5 to 1 A / 600 V (UL listed).
The **QNA 600** must be fitted with a circuit-breaker or equivalent device to disconnect the device from the mains supply.

Check the mechanical characteristics (*"9.- TECHNICAL FEATURES"*) for the cross section and torque of the power and measurement cables.

Note: *A disconnectable terminal block should be installed in order to make the bridges on the secondary side of the current transformers, and to remove the device safely, if necessary.*

3.4.- BATTERY

The **QNA 600** has a battery that can be accessed from the front of the device, see **Figure 4**.

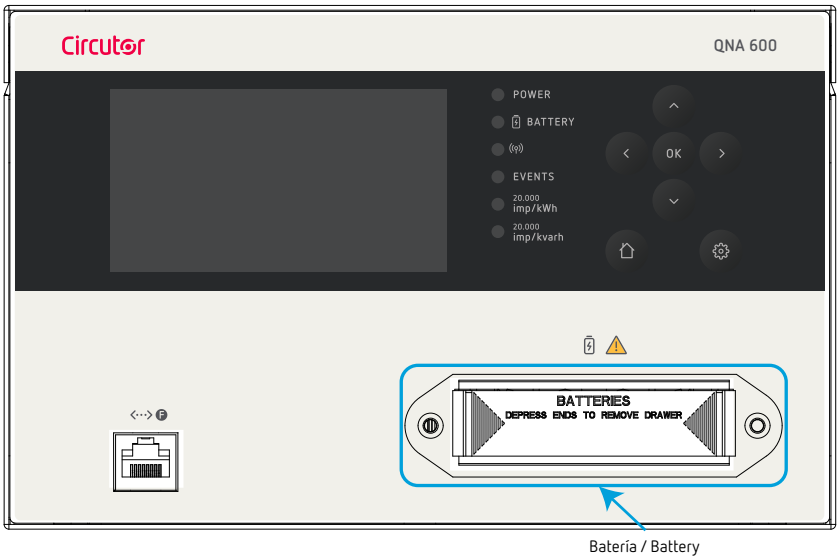


Figure 4: Access to the QNA 600 battery.

Note: *The device is delivered with uninstalled batteries.*

⚠	Do not disassemble or modify the battery. The warranty does not cover any battery not delivered by **Circutor** or batteries that have been disassembled or modified.
⚠	There is a risk of explosion if installed incorrectly. To avoid possible damage: - Only install the batteries supplied or recommended by **Circutor**. - Keep the battery away from fire and high-temperature lights. - Do attempt to disassemble it. - Do not expose it to water. - Do not short-circuit it. - Do not hit the battery.
⚠	When disposing of the battery, comply with local laws and ordinances. Do not dispose of it with household waste. At the end of its useful life, dispose of the product at a specific collection point for electrical or electronic equipment.
⚠	To avoid electric discharges, disconnect the measurement and power supply terminals before accessing the battery.
⚠	Disconnect the battery if the device is going to be idle for more than 3 months.
⚠	Do not charge the battery at temperatures above **40°C** or below **0°C**.

To install the batteries follow the following steps:

1.- Press the tabs on the sides of the battery holder, as shown in **Figure 5,** and pull out the whole battery holder.

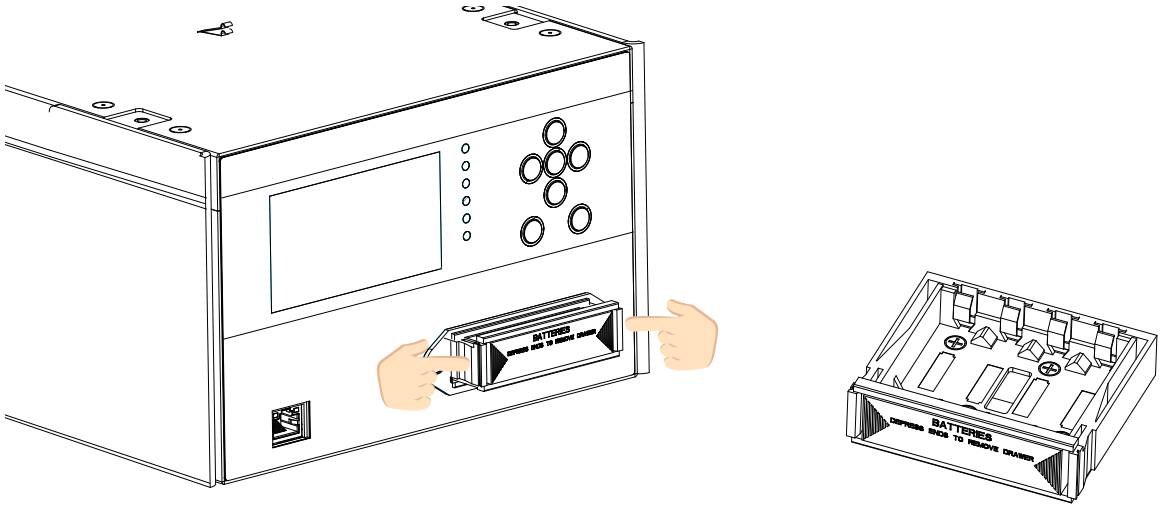


Figure 5: Extract battery holder.

2.- Insert the batteries into the battery holder.
3.- Insert the battery holder into the **QNA 600**.
4.- Place the 2 retainers on the battery holder, **Figure 6**.

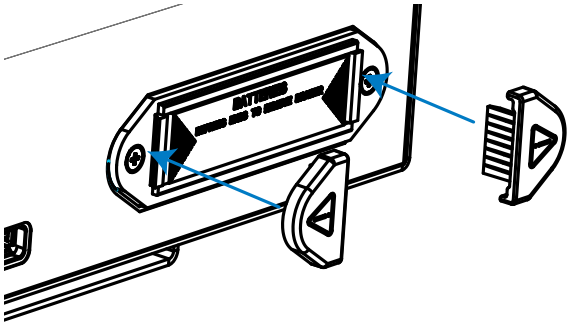


Figure 6: Place retainers on the battery holder.

3.5.- DEVICE TERMINALS

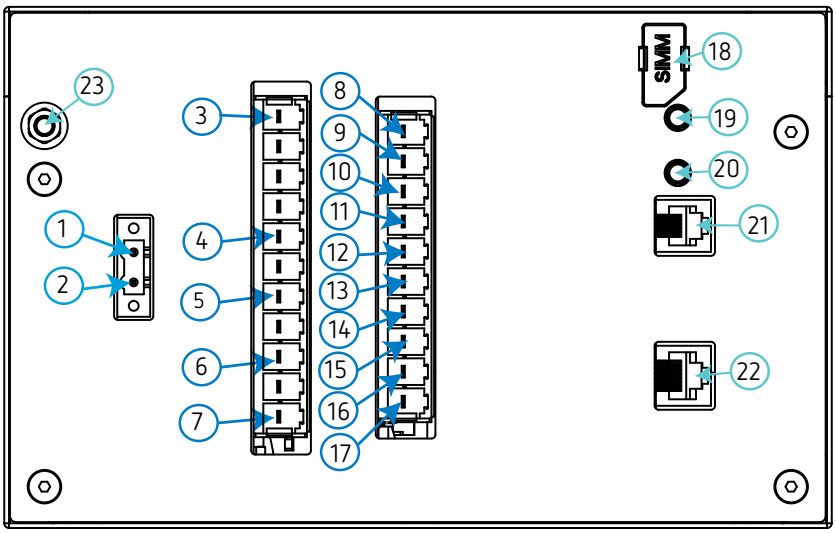


Figure 7: QNA 600 terminals: Posterior face.

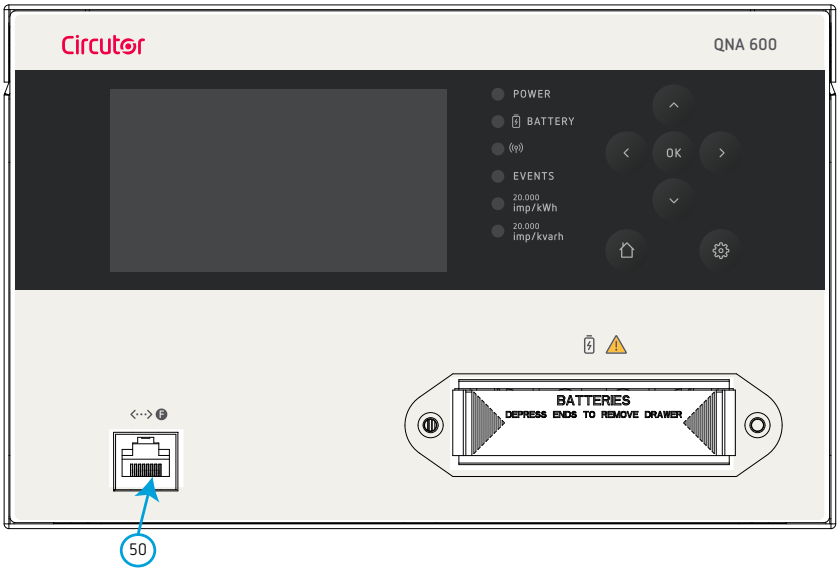


Figure 8: QNA 600 terminals: Front face.

Table 3: List of terminals of the QNA 600 (Table 1).

Device terminals: Power supply	
1: **A2(-)**, Power supply	2: **A1(+)**, Power supply

Table 4: List of terminals of the QNA 600 (Table 2).

Device terminals: Voltage measurement	
3: ***U*⏚**,Voltage input Earth	6: ***U*2**, Voltage input L2
4: ***U*N**,Neutral input	7: ***U*1**, Voltage input L1
5: ***U*3**, Voltage input L3	

Table 5: List of terminals of the QNA 600 (Table 3).

Device terminals: Current measurement	
8: ***I*⏚-s1**, Current input Earth	13: ***I*3-s2**, Current output L3
9: ***I*⏚-s2**, Current output Earth	14: ***I*2-s1**, Current input L2
10: ***I*N-s1**, Current input Neutral	15: ***I*2-s2**, Current output L2
11: ***I*N-s2**, Current output Neutral	16: ***I*1-s1**, Current input L1
12: ***I*3-s1**, Current input L3	17: ***I*1-s2**, Current output L1

Table 6: List of terminals of the QNA 600 (Table 4).

Device terminals: Connectors	
18: **SIM**, SIM card	22: ⟷Ⓡ, Ethernet R Connector (Posterior)
19: Modem Antenna (4G)	23: ⏚, Earth
20: **GPS**, GPS Antenna	24: ⟷Ⓕ, Ethernet F Connector (Frontal)
21: **EXT. GPS**, GPS Connector	

3.6.- CONNECTION DIAGRAMS

3.6.1.- THREE-PHASE NETWORK MEASURING WITH A 4-WIRE CONNECTION

Circuit type: **3PH4W**

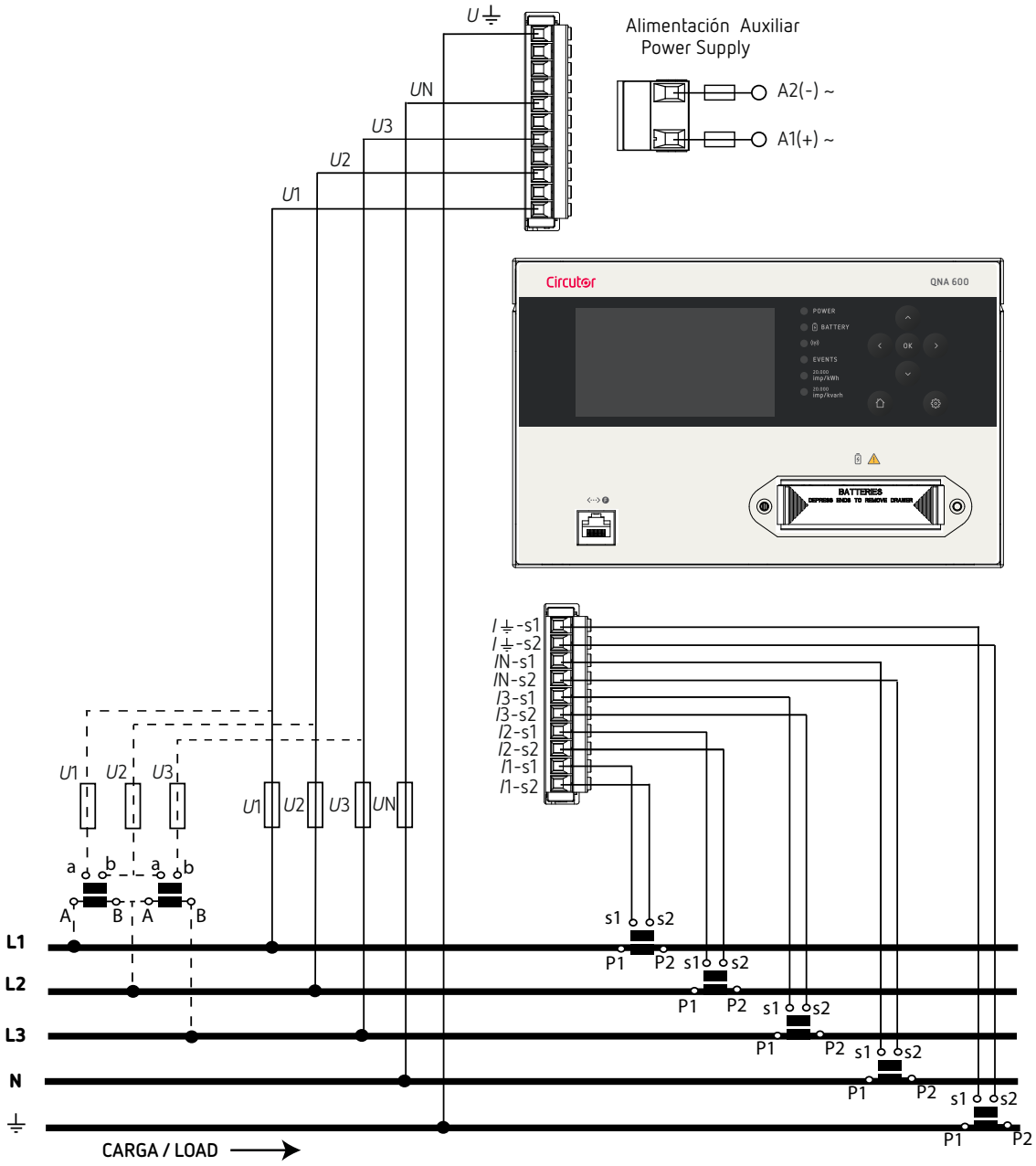


Figure 9: Three-phase network measuring with a 4-wire connection.

3.6.2.- THREE-PHASE NETWORK MEASURING WITH A 3-WIRE CONNECTION

Circuit type: **3PH3W**

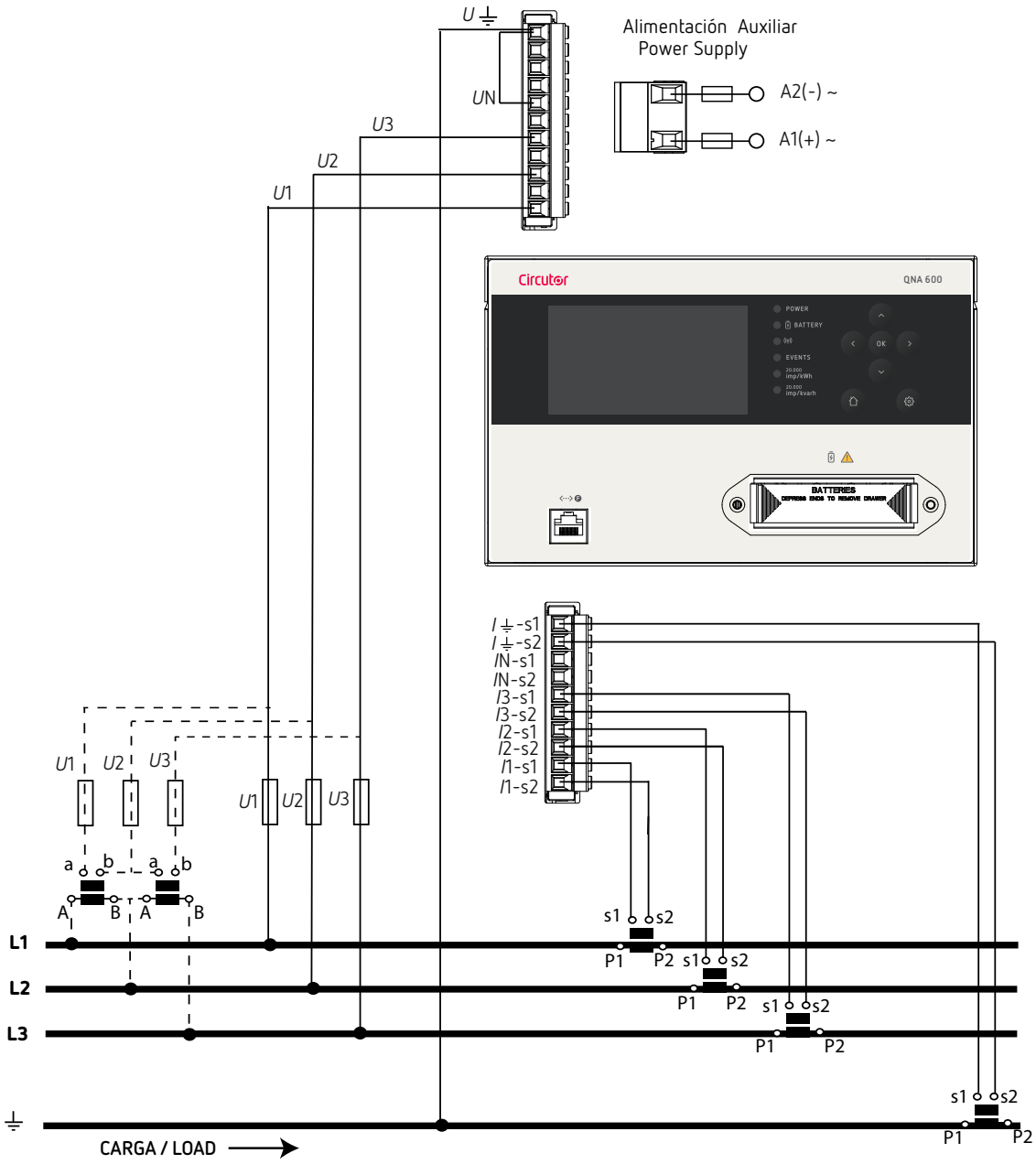


Figure 10: Three-phase network measuring with a 3-wire connection.

Note: *To avoid noise at the Neutral Voltage input, it has to be bridged with the Earth Voltage input.*

3.6.3.- THREE-PHASE NETWORK MEASURING WITH A 3-WIRE CONNECTION AND TRANSFORMERS IN ARON CONNECTION

Circuit type: **ARON**

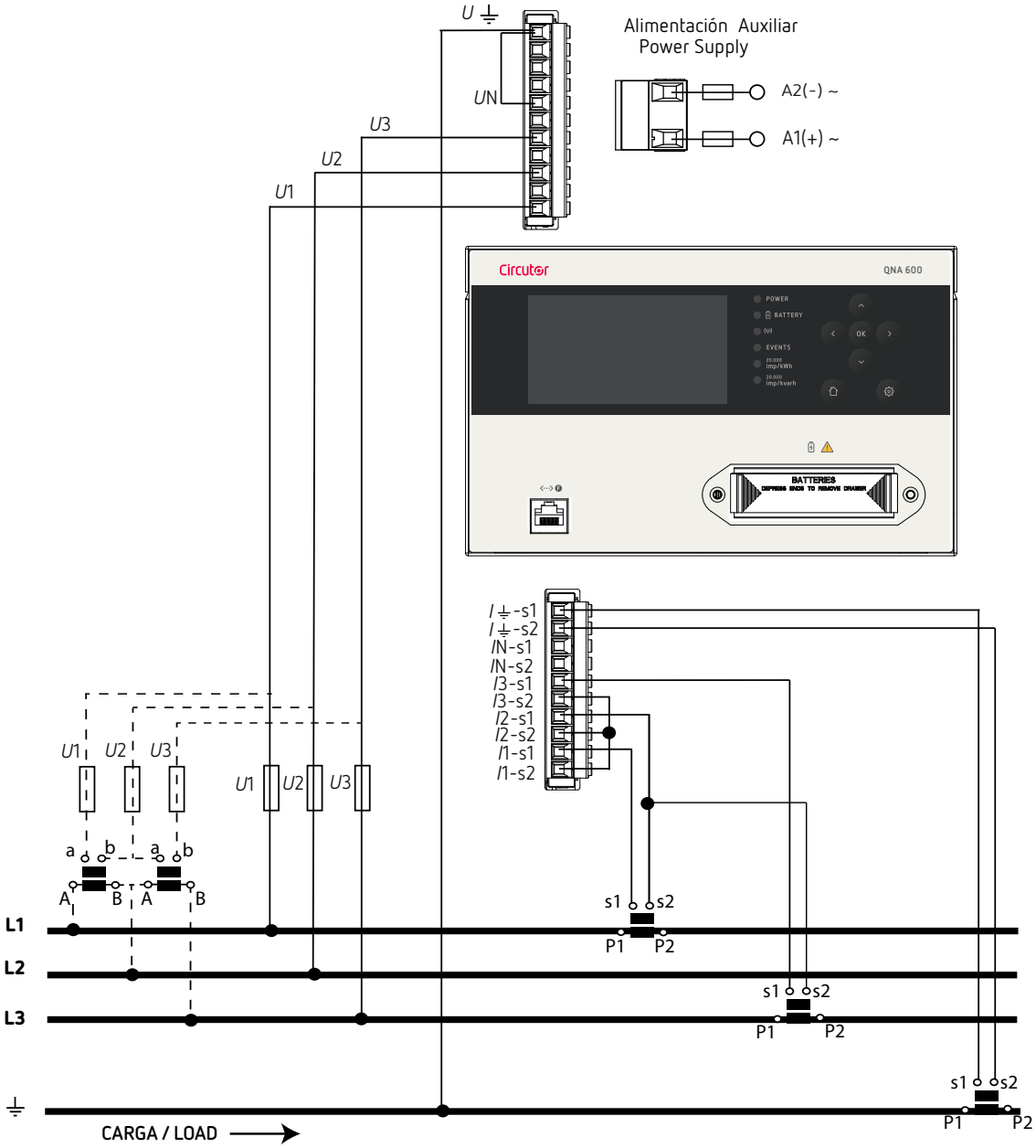


Figure 11: Three-phase network measurement with 3-wire connection and transformers in Aron connection.

Note: *To avoid noise at the Neutral Voltage input, it has to be bridged with the Earth Voltage input.*

3.6.4.- TWO-PHASE NETWORK MEASURING WITH A 3-WIRE CONNECTION

Circuit type: **2PH3W**

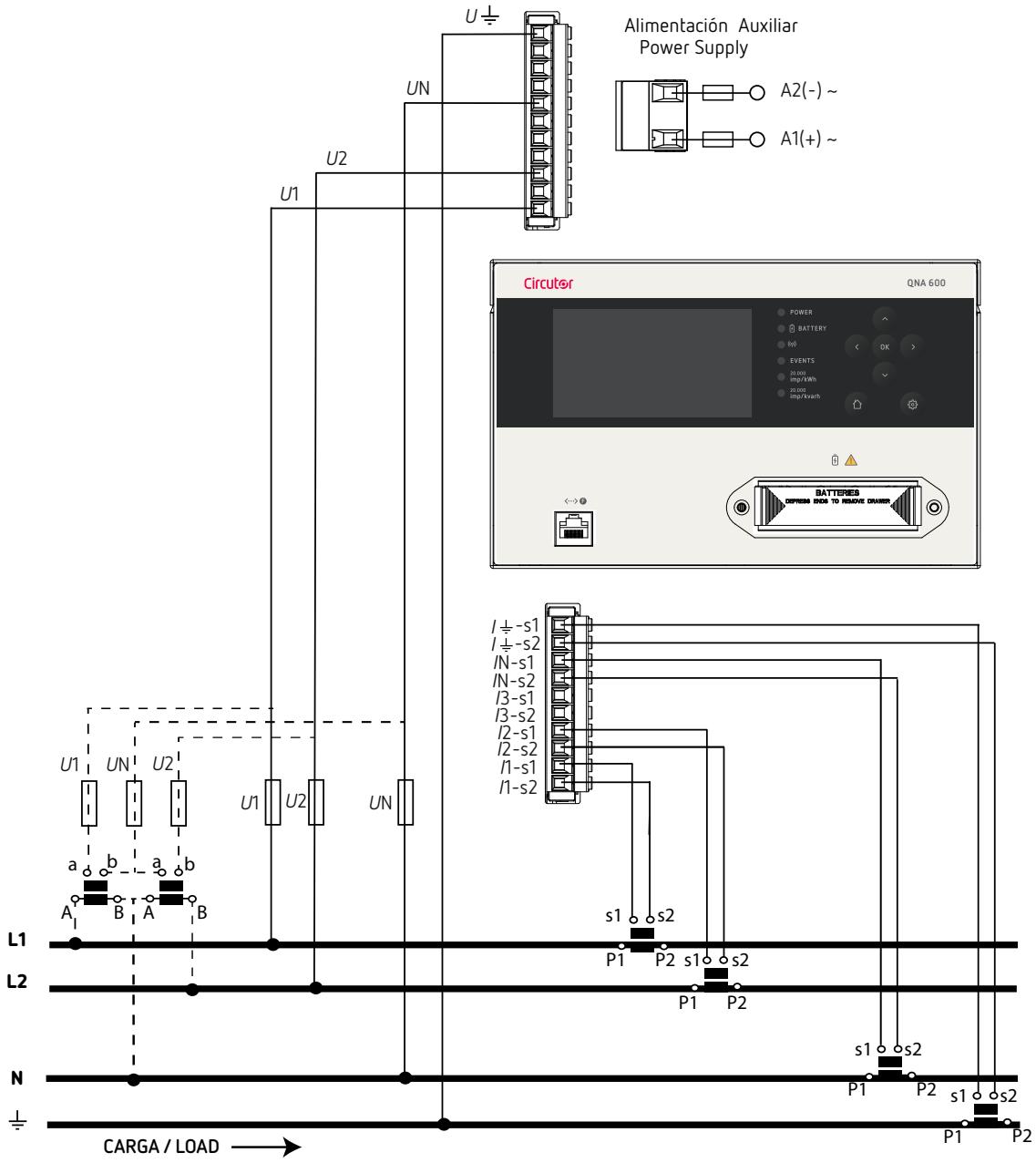


Figure 12: Two-phase network measurement with 3-wire connection.

3.6.5.- SINGLE-PHASE NETWORK MEASUREMENT WITH A 2-WIRE CONNECTION

Circuit type: **1PH2W**

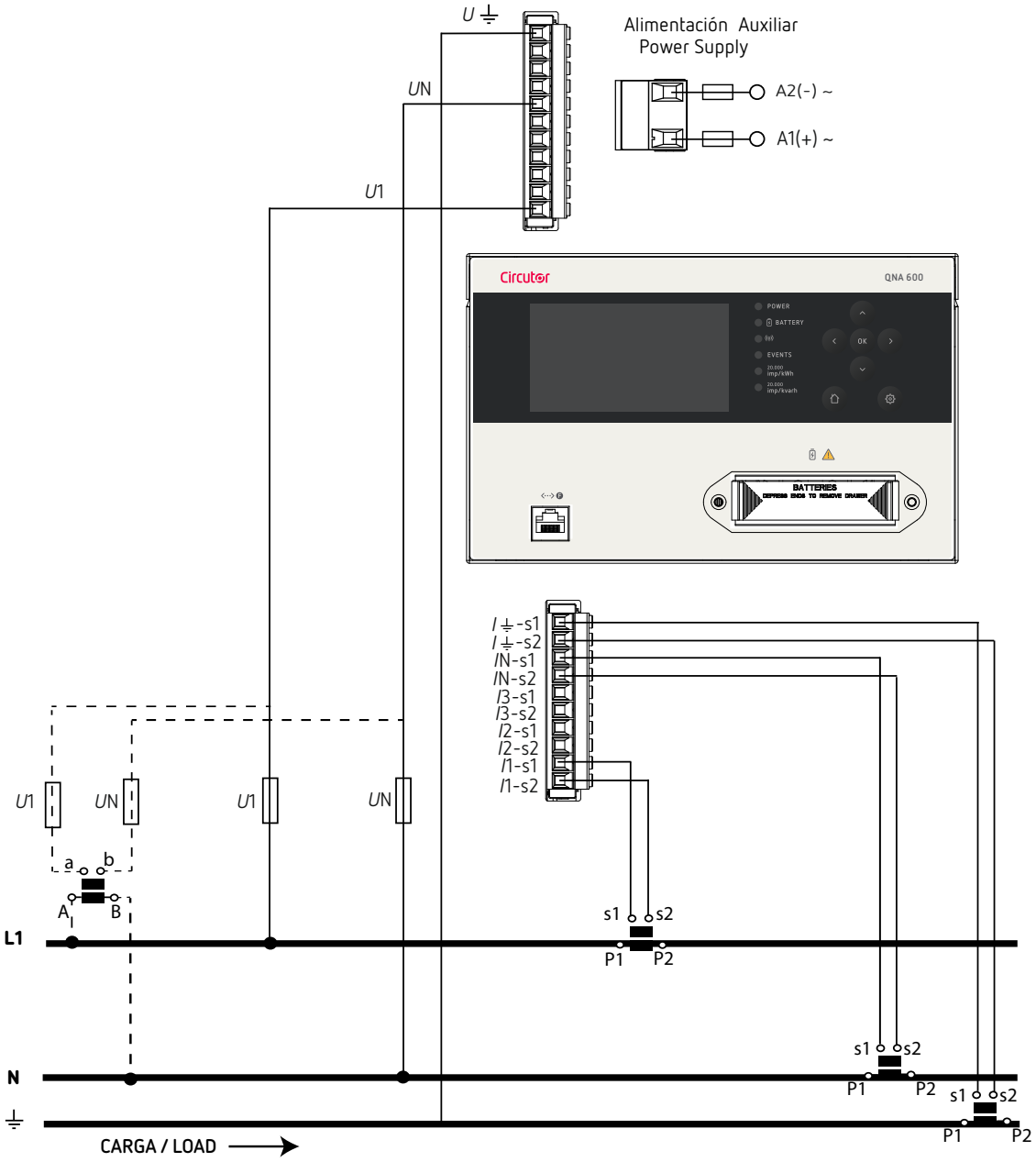
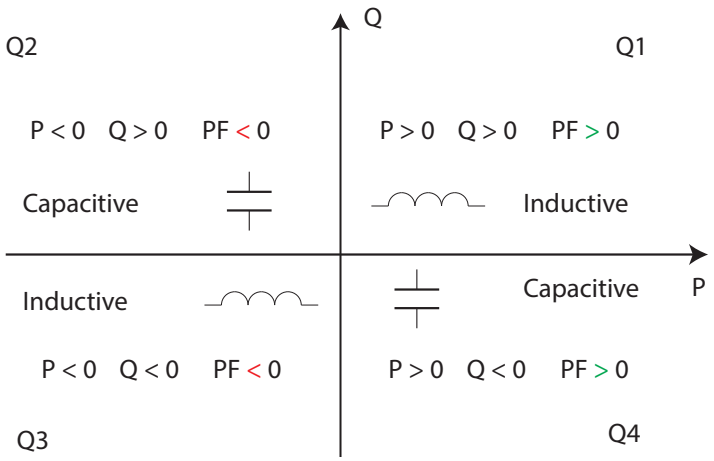


Figure 13: Single-phase network measurement with a 2-wire connection.

4.- OPERATION

The **QNA 600** is a power quality analyzer for all four quadrants (consumption and generation).
The device works as per the **IEC** measurement conventions

Operation in the 4 quadrants (Q1, Q2, Q3, Q4)



cos φ values in the receiver operating mode (Q1,Q4)

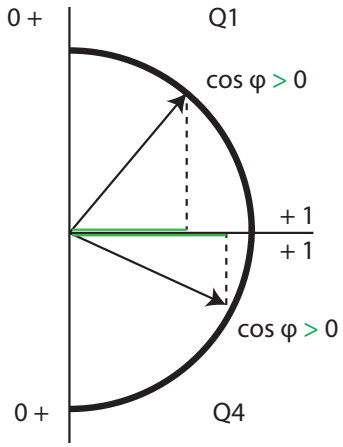


Figure 14: IEC measurement convention.

Apart from the basic functions of any analyzer, the **QNA 600**:

✓ Has a database for recording all the parameters and events made by the device.

✓ The webpage shows the data measured in real time, waveforms and harmonics. The parameters stored in the memory can also be accessed, and a statistical study can be done on demand or on a scheduled basis, as per the **EN50160** standard. The study can be saved in PDF format.
The data in the memory can also be downloaded using a pqdif file (Power Quality Data Interchange Format) and COMTRADE (Common format for Transit Data Exchange for power systems).

4.1.- MEASUREMENT PARAMETERS

The device measures, displays and saves different types of parameters:

✓Electrical parameters,
✓Quality parameters such as overvoltages, gaps and outages, in accordance with EN50160.

Table 7: Measurement parameters of the QNA 600 (Table 1).

Parameter	1PH2W		2PH3W				ARON / 3PH3W			3PH4W						
	L1	N	L1	L2	N	L12	L12	L23	L31	L1	L2	L3	N	L12	L23	L31
Voltage (U) (3)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Voltage THD (THD*U*) (3)	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	-	-	-
Voltage harmonics (4)	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	-	-	-
Voltage interharmonics (4)	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	-	-	-
Voltage phasors (3)	✓	-	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	-	-	-	-
Positive sequence component in voltage (2)	-	-	-	-	-	-	✓	✓	✓	✓	✓	✓	-	-	-	-

Table 7 (Continuation): Measurement parameters of the QNA 600 (Table 1).

Parameter	1PH2W		2PH3W				ARON / 3PH3W			3PH4W						
	L1	N	L1	L2	N	L12	L12	L23	L31	L1	L2	L3	N	L12	L23	L31
Negative sequence component in voltage (2)	-	-	-	-	-	-	✓	✓	✓	✓	✓	✓	-	-	-	-
Zero sequence component in voltage (2)	-	-	-	-	-	-	✓	✓	✓	✓	✓	✓	-	-	-	-
Voltage unbalance (2)	-	-	-	-	-	-	✓	✓	✓	✓	✓	✓	-	-	-	-
Voltage asymmetry (2)	-	-	-	-	-	-	✓	✓	✓	✓	✓	✓	-	-	-	-
Instantaneous Flicker (2)	✓	-	✓	✓	-	-	✓	✓	✓	✓	✓	✓	-	-	-	-
Short duration Flicker (2)	✓	-	✓	✓	-	-	✓	✓	✓	✓	✓	✓	-	-	-	-
Long duration flicker (2)	✓	-	✓	✓	-	-	✓	✓	✓	✓	✓	✓	-	-	-	-
Crest factor Voltage (2)	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	-	-	-
Underdeviation percentage(2)	✓	-	✓	✓	-	-	✓	✓	✓	✓	✓	✓	-	-	-	-
Overdeviation percentage(2)	✓	-	✓	✓	-	-	✓	✓	✓	✓	✓	✓	-	-	-	-
Underdeviation voltage (2)	✓	-	✓	✓	-	-	✓	✓	✓	✓	✓	✓	-	-	-	-
Overdeviation voltage (2)	✓	-	✓	✓	-	-	✓	✓	✓	✓	✓	✓	-	-	-	-
Network signal transmission voltage (2)	✓	-	✓	✓	-	-	✓	✓	✓	✓	✓	✓	-	-	-	-
Counter values of transmission of signals through the network over the threshold (2)	✓	-	✓	✓	-	-	✓	✓	✓	✓	✓	✓	-	-	-	-
Counter values of transmission of signals through the network below the threshold (2)	✓	-	✓	✓	-	-	✓	✓	✓	✓	✓	✓	-	-	-	-

Table 8: Measurement parameters of the QNA 600 (Table 2).

Parameter	1PH2W		2PH3W				ARON / 3PH3W				3PH4W				
	L1	N	L1	L2	N	T(6)	L1	L2	L3	T(6)	L1	L2	L3	N	T(6)
Current (I) (3)	✓	✓	✓	✓	✓	-	✓	✓	✓	-	✓	✓	✓	✓	-
Current THD (THDI) (3)	✓	✓	✓	✓	✓	-	✓	✓	✓	-	✓	✓	✓	✓	-
Current TDD (2)	✓	✓	✓	✓	✓	-	✓	✓	✓	-	✓	✓	✓	✓	-
Current harmonics (4)	✓	✓	✓	✓	✓	-	✓	✓	✓	-	✓	✓	✓	✓	-
Current interharmonics (4)	✓	✓	✓	✓	✓	-	✓	✓	✓	-	✓	✓	✓	✓	-
Current phasors (3)	✓	-	✓	✓	-	-	✓	✓	✓	-	✓	✓	✓	-	-
Positive sequence component in current (2)	-	-	-	-	-	-	✓	✓	✓	-	✓	✓	✓	-	-
Negative sequence component in current (2)	-	-	-	-	-	-	✓	✓	✓	-	✓	✓	✓	-	-
Zero sequence component in current (2)	-	-	-	-	-	-	✓	✓	✓	-	✓	✓	✓	-	-
Current unbalance (2)	-	-	-	-	-	-	✓	✓	✓	-	✓	✓	✓	-	-
Current asymmetry (2)	-	-	-	-	-	-	✓	✓	✓	-	✓	✓	✓	-	-
Crest factor current (2)	✓	✓	✓	✓	✓	-	✓	✓	✓	-	✓	✓	✓	✓	-
K-factor (2)	✓	-	✓	✓	-	-	✓	✓	✓	-	✓	✓	✓	-	-

Table 9: Measurement parameters of the QNA 600 (Table 3).

Parameter	1PH2W		2PH3W				ARON / 3PH3W				3PH4W				
	L1	N	L1	L2	N	T (6)	L1	L2	L3	T (6)	L1	L2	L3	N	T (6)
Frequency (3)	✓	-	✓	-	-	-	✓	-	-	-	✓	-	-	-	-

Table 10: Measurement parameters of the QNA 600 (Table 4).

Parameter	1PH2W	2PH3W	ARON / 3PH3W	3PH4W
Leakage current (2)	✓	✓	✓	✓
Temperature (2)	✓	✓	✓	✓

Table 11:Measurement parameters of the QNA 600 (Table 5).

Parameter	1PH2W		2PH3W				ARON / 3PH3W				3PH4W				
	L1	N	L1	L2	N	T (6)	L1	L2	L3	T (6)	L1	L2	L3	N	T (6)
Active power (P) (3)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Fundamental Active Power (P_1) (3)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Harmonic Active Power (2)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Active Power Consumed (2)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Active power Generated (2)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Fundamental Active Power consumed (2)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Fundamental Active Power generated (2)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Current distortion power (2)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Voltage distortion power (2)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Reactive power (Q) (4)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Fundamental Reactive power (1)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Inductive Reactive Power (2)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Capacitive Reactive Power (2)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Reactive Power Consumed (2)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Reactive Power Generated (2)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Inductive Reactive Power Consumed (2)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Capacitive Reactive Power Consumed (2)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Inductive Reactive Power Generated (2)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Capacitive Reactive Power Generated (2)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Fundamental Reactive power Consumed (2)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Fundamental Reactive power generated (2)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Fundamental Inductive Reactive Power consumed (2)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Fundamental Inductive Reactive Power generated (2)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Fundamental Capacitive Reactive Power Consumed (2)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Fundamental Capacitive Reactive Power generated (2)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Harmonic Distortion Reactive Power (2)	✓	-	✓	✓	-	-	✓	✓	✓	-	✓	✓	✓	-	-
Effective Distortion Reactive Power (2)	-	-	-	-	-	-	-	-	-	✓	-	-	-	-	✓

Table 11 (Continuation): Measurement parameters of the QNA 600 (Table 5).

Parameter	1PH2W		2PH3W				ARON / 3PH3W				3PH4W				
	L1	N	L1	L2	N	T (6)	L1	L2	L3	T (6)	L1	L2	L3	N	T (6)
Nonactive power (N) (3)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Inductive Nonactive power (2)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Capacitive Nonactive power (2)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Apparent power (S) (3)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Fundamental Apparent Power (S_1) (3)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Fundamental Apparent Effective Power(2)	-	-	-	-	-	-	-	-	-	✓	-	-	-	-	✓
Nonfundamental Apparent Power (2)	✓	-	✓	✓	-	-	✓	✓	✓	-	✓	✓	✓	-	-
Nonfundamental Apparent Effective Power (2)	-	-	-	-	-	-	-	-	-	✓	-	-	-	-	✓
Harmonic Apparent Power (2)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Unbalance Apparent Power (2)	-	-	-	-	-	-	-	-	-	✓	-	-	-	-	✓

Table 12: Measurement parameters of the QNA 600 (Table 6).

Parameter	1PH2W		2PH3W				ARON / 3PH3W				3PH4W				
	L1	N	L1	L2	N	T (6)	L1	L2	L3	T (6)	L1	L2	L3	N	T (6)
Power Factor (PF) (3)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Fundamental Power Factor (DPF) (3)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Inductive Power Factor Consumed (2)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Inductive Power Factor Generated (2)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Fundamental Inductive Power Factor Consumed (2)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Fundamental Inductive Power Factor Generated (2)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Capacitive Power Factor Consumed (2)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Capacitive Power Factor Generated (2)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Fundamental Capacitive Power Factor Consumed (2)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Fundamental Capacitive Power Factor Generated (2)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Harmonic Active Power Consumed (2)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
Harmonic Active Power Generated (2)	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓

Table 13: Measurement parameters of the QNA 600 (Table 7).

Parameter	1PH2W		2PH3W				ARON / 3PH3W				3PH4W				
	L1	N	L1	L2	N	T (6)	L1	L2	L3	T (6)	L1	L2	L3	N	T (6)
Three-phase active energy consumed (5)	✓	-	-	-	-	✓	-	-	-	✓	-	-	-	-	✓
Three-phase active energy generated (5)	✓	-	-	-	-	✓	-	-	-	✓	-	-	-	-	✓
Fundamental three-phase reactive energy in Q1 (5)	✓	-	-	-	-	✓	-	-	-	✓	-	-	-	-	✓
Fundamental three-phase reactive energy in Q2 (5)	✓	-	-	-	-	✓	-	-	-	✓	-	-	-	-	✓

Table 13 (Continuation): Measurement parameters of the QNA 600 (Table 7).

Parameter	1PH2W		2PH3W				ARON / 3PH3W				3PH4W				
	L1	N	L1	L2	N	T (6)	L1	L2	L3	T (6)	L1	L2	L3	N	T (6)
Fundamental three-phase reactive energy in Q3 (5)	✓	-	-	-	-	✓	-	-	-	✓	-	-	-	-	✓
Fundamental three-phase reactive energy in Q4 (5)	✓	-	-	-	-	✓	-	-	-	✓	-	-	-	-	✓
Three-phase apparent energy (2)	✓	-	-	-	-	✓	-	-	-	✓	-	-	-	-	✓

(1) Parameter visible on display.

(2) Parameter registered in the database.

(3) Parameter visible on display and Web page and registered in the database.

(4) Parameter visible on the Web page and registered in the database.

(5) Parameter visible on display and registered in the database.

(6) Total.

Note: *The calculation formulas used by the* ***QNA 600*** *can be found in* ***"ANNEX A.- CALCULATION FORMULAS"*** **.**

4.1.1.- QUALITY PARAMETERS

Power quality control requires defining the TRMS of the voltage level, subsequently used by the analyzer to record events. According to Standard **EN-61000-4-30**, the RMS value must be calculated for all the AC magnitudes or each cycle and refresh every ½ cycle. If the RMS value exceeds certain programmed thresholds, this is understood as an **event**.

The device detects quality parameters such as overvoltages, gaps and voltage outages. **Figure 15** shows an example of these events.

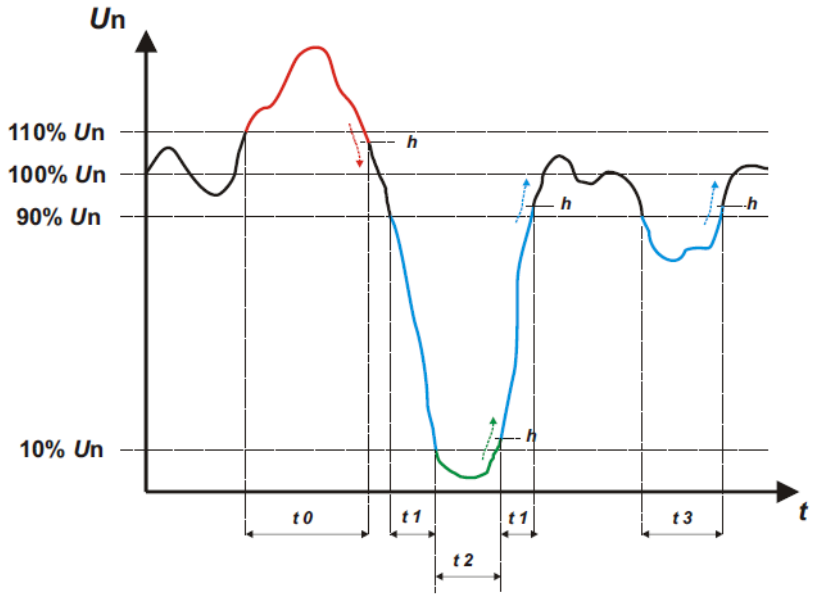


Figure 15: Example of quality events.

✓ **Voltage Swell**

An swell event is shown in the time interval **t0** in **Figure 15.** The duration of the event is the time that the signal stays above the configured threshold value (***"6.3.1.- VOLTAGE DIP AND VOLTAGE SWELL"***). In

this example it is 110% of the rated voltage plus the time the signal takes to fall below the configured value, including a hysteresis of 2%.

✓ **Voltage dip**

The **t1** and **t3** time intervals in **Figure 15** show two voltage gaps. The duration of the event is equal to the time during which the signal is below the configured threshold value (***" 6.3.1.- VOLTAGE DIP AND VOLTAGE SWELL"***), in this example, it is 90% of the rated voltage.

✓ **Voltage outage (Interrupt)**

The **t2** time interval in **Figure 15** shows an outage or interruption event. The duration of the event is equal to the time during which the signal is below the configured threshold value (***"6.3.2.- INTERRUPTIONS"***), in this example, it is 10% of the rated voltage, plus the time the signal takes to increase the value, including a 2% hysteresis

✓ **Rapid voltage changes (RVC)**

A rapid voltage change (RVC) is a sudden change in the voltage between two stable states, where the voltage does not exceed the thresholds of a dip. It may be said to be a dip, but of a smaller size (***"6.3.3.- RAPID VOLTAGE CHANGES"*****).**

✓ **Voltage transients**

The algorithm for calculating voltage transients relies on detecting transients that exceed a threshold in blocks of 5120 samples (when the base frequency is 50 Hz). Specifically, this threshold is calculated automatically (dynamic threshold) as per **Equation 1.**

$$Threshold_n = max\{x_{i+1} - x_i\}_n$$

Equation 1: Threshold.

Where:

i: number of samples [1, 5119] (Frequency: 50 Hz)
i: number of samples [1, 6143] (Frequency: 60 Hz)
n: the number of blocks of 5120 samples. (Frequency: 50 Hz)
n: the number of blocks of 6144 samples. (Frequency: 60 Hz)

The threshold is calculated as the maximum value of the difference between two consecutive samples in block n of size 5120.

This threshold is used as the detection limit of the transient in block **n+1**. If a transient has not occurred in block **n+1**, the threshold is automatically recalculated with the data from block **n+1**. This will be used as the detection threshold for block **n+2** (multiplied by the sensitivity), and so on.

For example, in **Figure 16**, the threshold calculated for block **n** is the maximum of 1.9 V, 2.1 V and 2.3 V, that is, 2.3 V (similar to calculating the maximum slope in the block). If there is a difference between consecutive samples in block **n+1** greater than 2.3 V multiplied by the sensitivity value, a transient is detected.

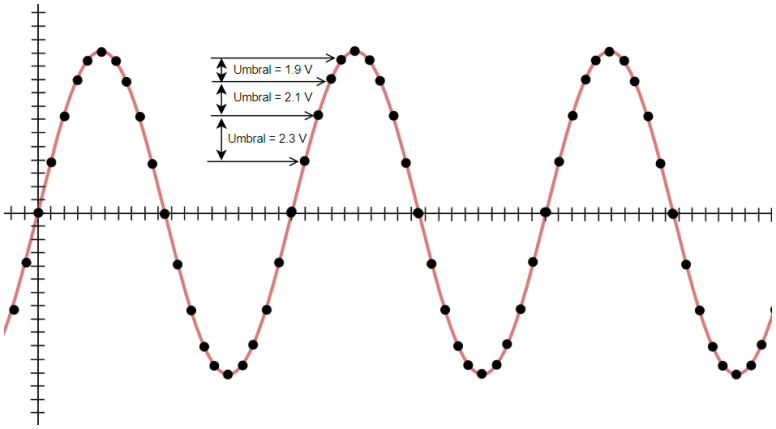


Figure 16: Threshold in block n.

Another parameter involved in the algorithm is the **Sensitivity**. This helps to dampen the algorithm's response to false positives.

Two parameters have to be set to calculate voltage transients:

• **Sensitivity:** The user must enter a value between 0 and 100%. This value is converted into a Sensitivity coefficient (from 1.05 to 10) that is used to modify the threshold value calculated in the previous block, as per **Equation 2** and **Equation 3**.

$$Sensitivity\ coefficient = Sensitivity * \frac{(1.05-10)}{100} + 10$$

Equation 2: Sensitivity coefficient.

$$Threshold_n = Threshold_{n-1} * Sensitivity\ coefficient$$

Equation 3: Threshold as a function of sensitivity.

• **Samples:** In order to be considered a voltage transient, the condition must persist during the number of samples selected by the user, from 1 to 10.
Below are two transient detection examples for the same voltage input signal with minimum sensitivity and maximum sensitivity.

In **Figure 17** it has been configured:
Sensitivity = 0% → **Sensitivity coefficient =** 10

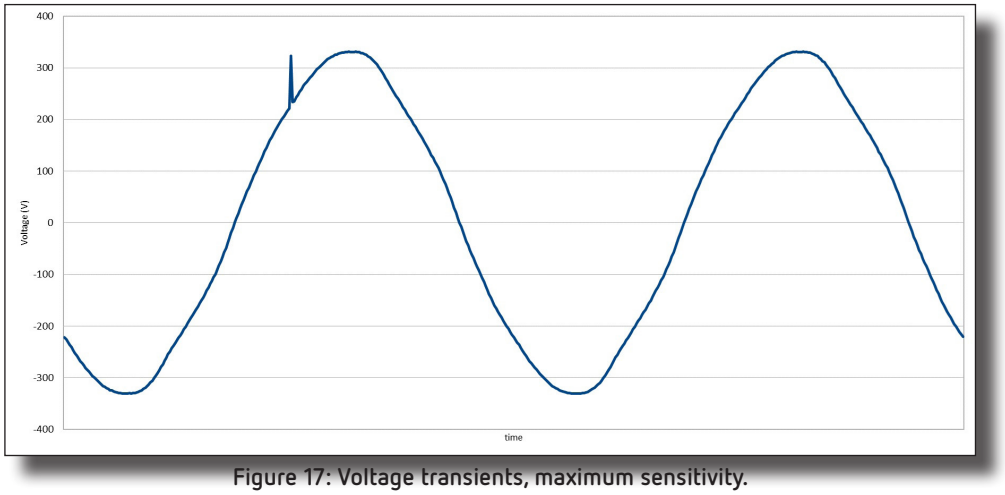


Figure 17: Voltage transients, maximum sensitivity.

In **Figure 18** it has been configured:

Sensitivity = 100% → **Sensitivity coefficient =** 1.05

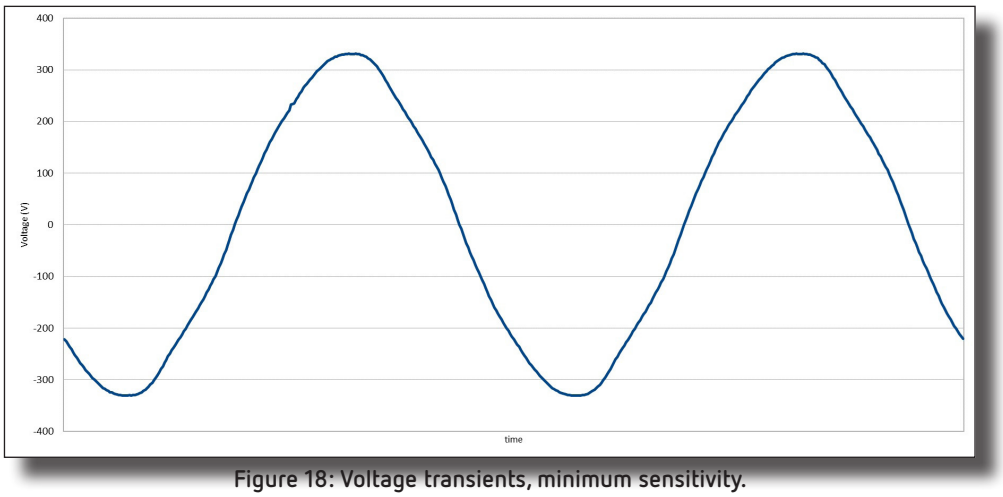


Figure 18: Voltage transients, minimum sensitivity.

Note that with the maximum sensitivity, smaller disturbances can be detected.

The voltage transients can be configured on the webpage, see ***"8.2.3.4.- VOLTAGE TRANSIENTS".***

✓ **Current transients**

Due to the variability of the current waveform, the device implements two calculation algorithms, one to detect slow transients and another to detect fast transients.

Slow transients

The formula, **Equation 4**, for detecting slow current transients is the absolute difference between two consecutive RMS values, normalized with respect to the most recent RMS value. The RMS values selected to carry out this operation are those corresponding to one cycle of the fundamental wave, updated every half-cycle.

$$\frac{\left|U_{rms\left(\frac{1}{2}\right)i} - U_{rms\left(\frac{1}{2}\right)i-1}\right|}{U_{rms\left(\frac{1}{2}\right)i}} * 100 \geq U_{slow} * k_{slow}$$

Equation 4: Slow transients.

This value is updated whenever the number of samples corresponding to one half-cycle of the fundamental wave elapses, since passes through zero do not have to be binding in order to define the signal periods in the current waveform.

Three parameters have to be set to calculate slow transients:

- **Slow threshold (U_{slow}):** percent value from 0 to 100%, relative to the nominal voltage value.
- **Slow sensitivity (K_{slow}):** value used to dampen sensitivity to false positives based on the specific characteristics of each mains. This value is calculated from the value programmed by the user based on **Equation 5**, with a higher sensitivity allowing smaller transients to be calculated.

$$K_{slow} = 5 - \text{Slow detection sensitivity}$$

Equation 5:K_{slow}

• **Slow inhibitory cycles:** Number of cycles until the end of the transient that are inhibited to detect new current transients, to avoid saturating the system during highly non-linear consumption periods.

The current transients can be configured on the webpage, see ***"8.2.4.5.- CURRENT TRANSIENTS".***

Below are two slow transient detection examples for the same current input signal, with minimum and maximum sensitivities.

In **Figure 19** it has been configured:
Slow threshold: 10%
Slow detection sensitivity: 1 → K_{slow} = 4

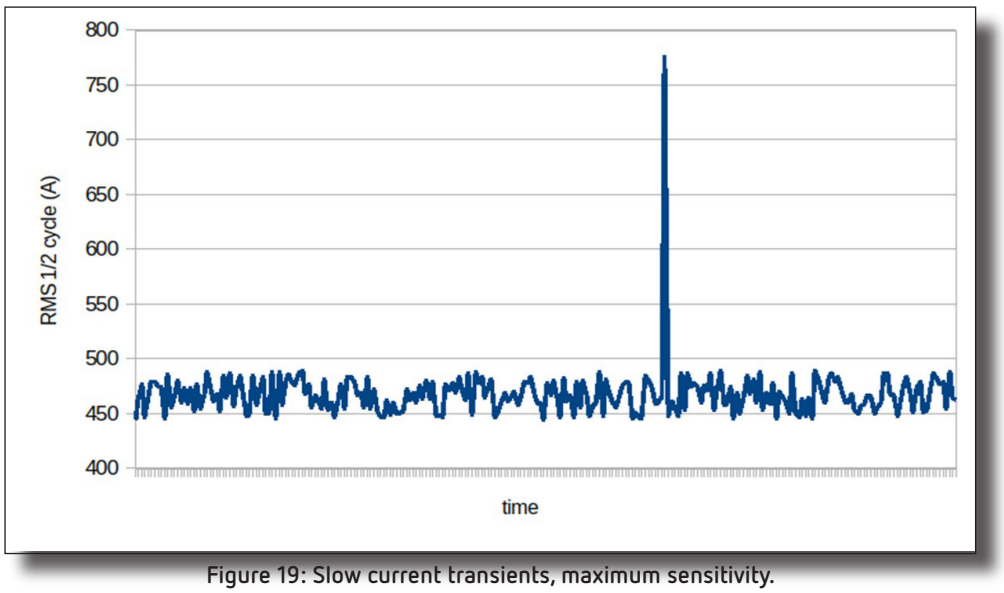


Figure 19: Slow current transients, maximum sensitivity.

In **Figure 20** it has been configured:
Slow threshold: 10%
Slow detection sensitivity: 4 → K_{slow} = 1

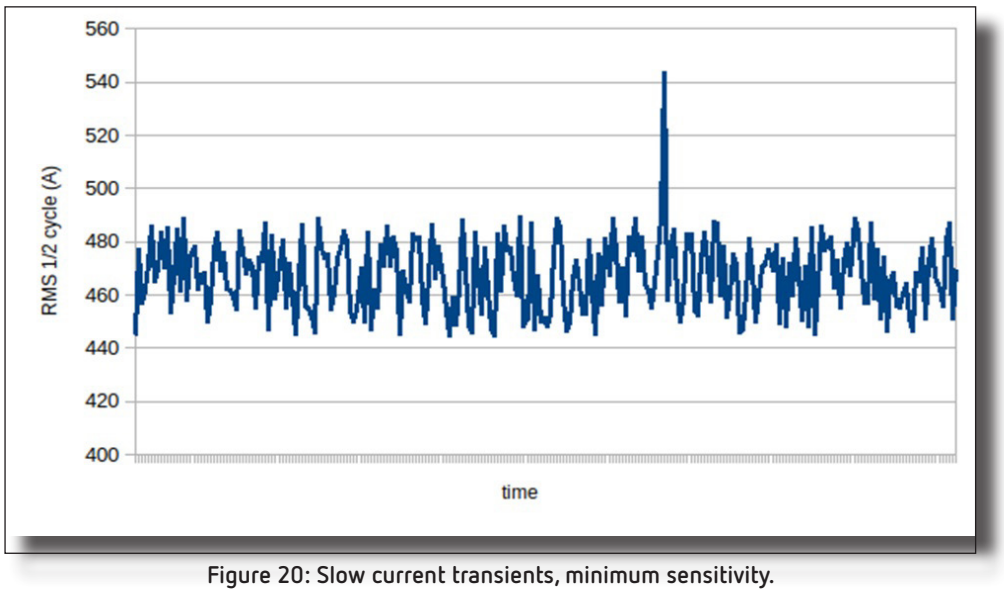


Figure 20: Slow current transients, minimum sensitivity.

Note that with the maximum sensitivity, smaller disturbances can be detected.

Fast transients

The formula selected for detecting fast current transients, **Equation 6**, is the absolute difference between two consecutive samples, normalized with respect to the last RMS cycle value available (updated every half-cycle).
The normalization, considering the latest available RMS value, is only done if the latter value is greater than 1. Otherwise, only the absolute difference between samples is taken (to prevent very small RMS current values from causing fast transients in conventional situations).

$$\begin{cases} \dfrac{|x_n - x_{n-1}|}{U_{rms\left(\frac{1}{2}\right)i}} \times 100 \geq U_{fast} \times k_{fast} & U_{rms\left(\frac{1}{2}\right)i} > 1 \\ |x_n - x_{n-1}| \times 100 \geq U_{fast} \times k_{fast} & U_{rms\left(\frac{1}{2}\right)i} \leq 1 \end{cases}$$

Equation 6:Fast transients.

Three parameters have to be set to calculate fast transients:

- **Fast threshold (U_{fast}):** percent value from 0 to 100%, relative to the nominal voltage value.
- **Fast sensitivity (K_{fast}):** value used to dampen sensitivity to false positives based on the specific characteristics of each mains. This value is calculated from the value programmed by the user based on **Equation 7**, with a higher sensitivity allowing smaller transients to be calculated.

$$K_{fast} = 5 - \text{Fast detection sensitivity}$$

Equation 7:K_{fast}.

- **Fast inhibitory cycles:** Number of cycles until the end of the transient that are inhibited to detect new current transients, to avoid saturating the system during highly non-linear consumption periods. The current transients can be configured on the webpage, see ***"8.2.3.5.- CURRENT TRANSIENTS".***

Below are two fast transient detection examples for the same current input signal, with minimum and maximum sensitivities.
In **Figura 21** it has been configured:
Fast threshold: 40%
Fast detection sensitivity: 1 → K_{fast} = 4

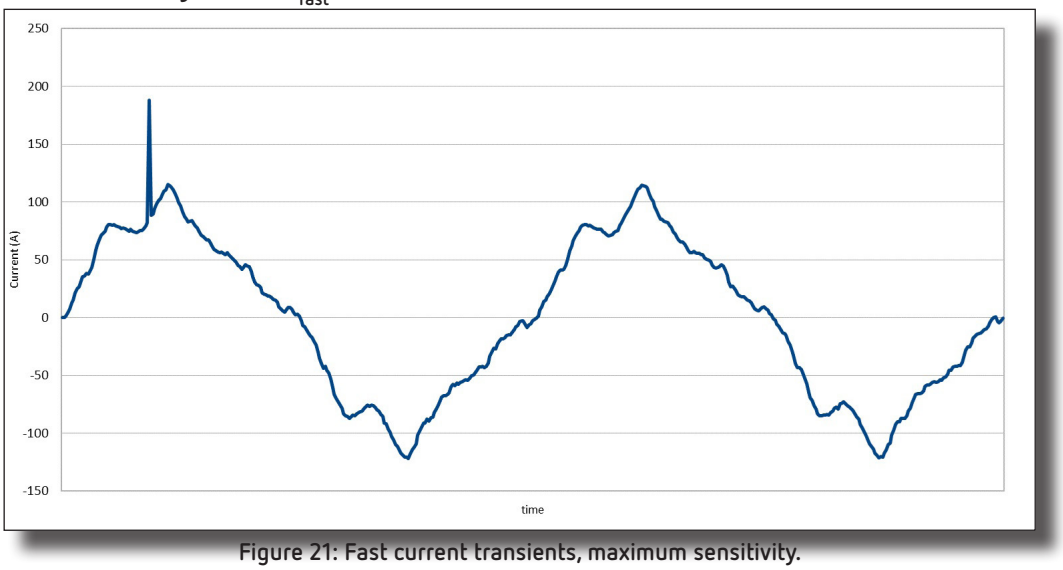


Figure 21: Fast current transients, maximum sensitivity.

In **Figura 22** it has been configured:
Fast threshold: 40%
Fast detection sensitivity: 4 → $K_{fast} = 1$

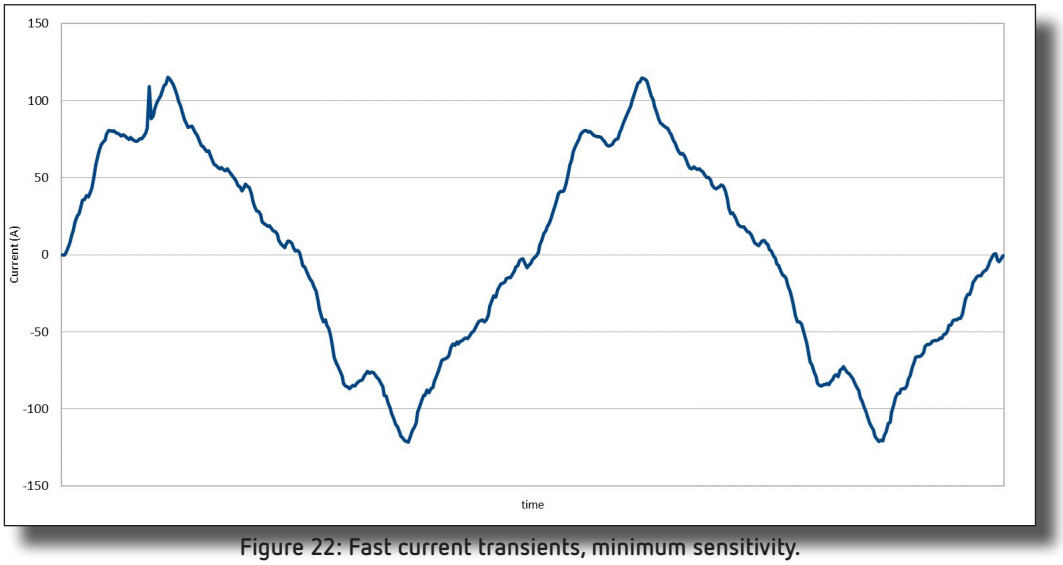


Figure 22: Fast current transients, minimum sensitivity.

Note that with the maximum sensitivity, smaller disturbances can be detected.

4.2.- LED INDICATORS

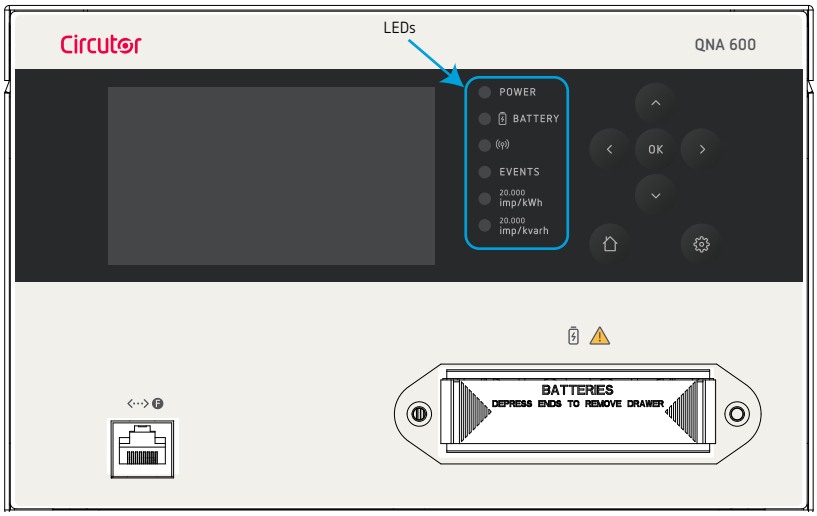


Figure 23: LEDs: QNA 600.

The **QNA 600** devices have 6 indication LEDs:

✓ **POWER**, Indicates the status of the device:

Table 14: LED POWER.

LED	Description
POWER	**On:**
	Green color: Indicates that the device is powered.

✓ **BATTERY**, Indicates battery status:

Table 15: LED BATTERY.

LED	Description
BATTERY	**On:**
	Green color: Battery charged.
	Red color: Battery not detected.
	Flashing (1s):
	Green color: Battery charging.
	Yellow Color: Battery in use.
	Red color: Battery in use, low battery.

✓, Indicates the status of the 4G Modem:

Table 16: LED 4G Modem.

LED	Description
	Flashing (250 ms):
	Green-Red color: Correct SIM and PIN, connected to the network.
	On:
	Red color: Modem disabled, SIM not detected or incorrectly configured. *Green color:* Modem enabled, connected and with IP address.

✓ **EVENTS**, Indicates if the device has detected events:

Table 17: LED EVENTS.

LED	Description
EVENTS	**On:**
	Green color: Indicates that the device has not detected events.
	Color blue: The device has detected an overvoltage.
	Yellow Color: The device has detected a gap.
	Red color: The device has detected an interrupt.

✓ **20000 imp/kWh**, Active energy:

Table 18: LED 20000 imp/kWh.

LED	Description
20000 imp/kWh	**Flashing:**
	Red color: Active energy pulses.

✓ **20000 imp/kvarh**, Reactive energy:

Table 19: LED 20000 imp/kvarh.

LED	Description
20000 imp/kvarh	**Flashing:**
	Red color: Reactive energy pulses.

4.3.- DISPLAY

The device has a 240 x 128 dot display to show the parameters measured and to configure the device.

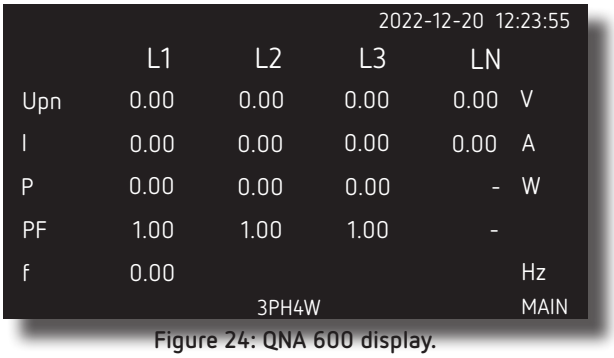


Figure 24: QNA 600 display.

4.4.- KEYBOARD FUNCTIONS

The **QNA 600** has 7 keys, for the display and configuration of the device.

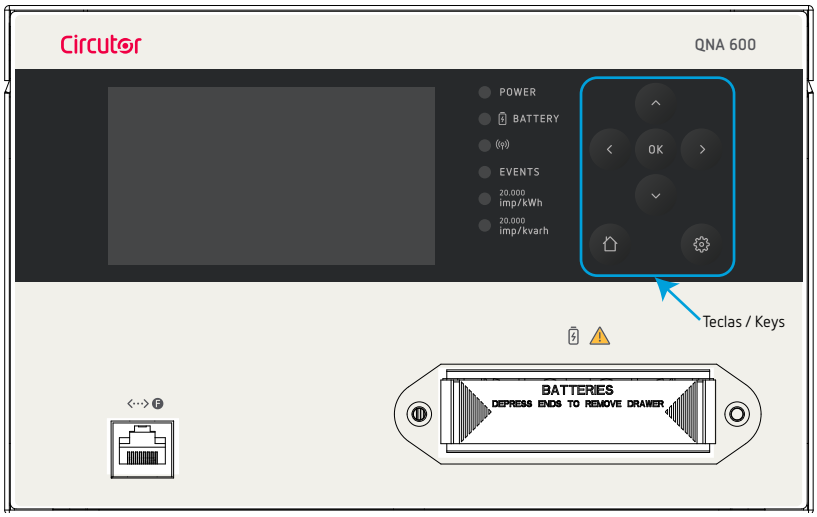


Figure 25: QNA 600 Keys.

✓ Visualization Menu:

Table 20: Keyboard function: Visualization Menu.

Key	Touch
	Previous screen.
	Next screen.
	Jump to the next display menu.
	Jump to the previous display menu.

Table 20 (Continuation): Keyboard function: Visualization Menu.

Key	Touch
	Access to the configuration menu.
	Jumps to the Main screen (**MAIN**).

✓ Configuration menu:

Table 21:Keyboard function: Configuration menu.

Key	Touch
	Previous screen. **Edit Mode:** Previous option / Modifies the value of the digit.
	Next screen. **Edit Mode:** Next option / Modifies the value of the digit.
	Jump to the next configuration menu. **Edit Mode:** Scrolls between digits.
	Jump to previous configuration menu. **Edit Mode:** Scrolls between digits.
	Enter and exit parameter Edit Mode.
	Enter and exit Edit Mode.
	Exit the Setup menu.

5.- DISPLAY

The **QNA 600** arranges all the display screens into 4 menus, **Figure 26.**

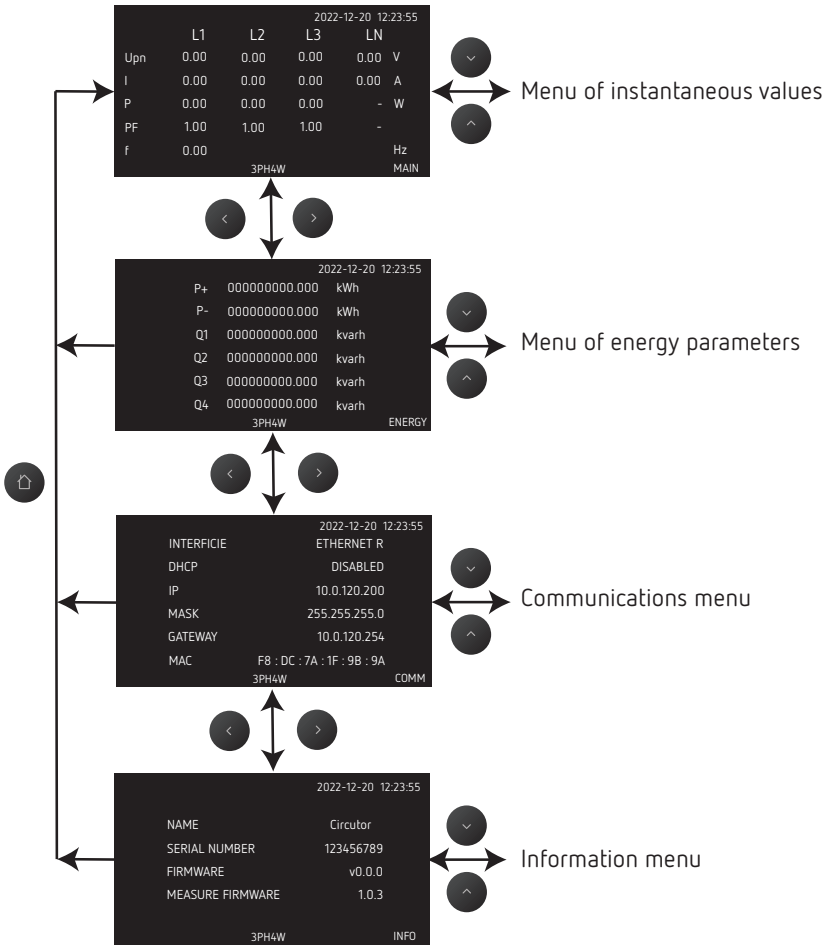


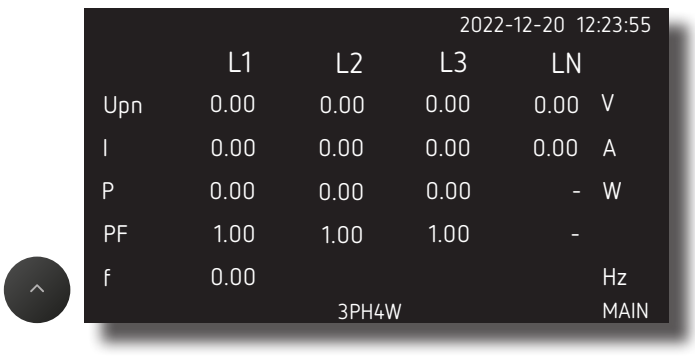
Figure 26: Menú de visualización.

If the key is pressed, the device returns to the **MAIN** screen.

Use the and keys to move between the different display menus.

5.1.- MENU OF INSTANTANEOUS VALUES

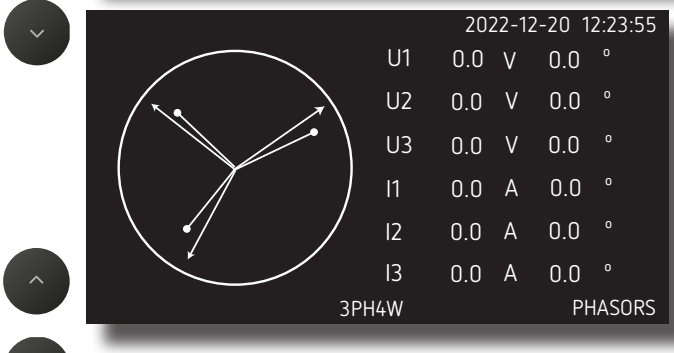
Use the and keys to move between the different screens:



Upn: Phase - Neutral voltage (V).
I: Current (A).
P: Active power (W).
PF: Power factor.
f: Frequency (Hz).



Upn: Phase - Neutral voltage (V).
THDU: Voltage THD (%).
I: Current (A).
THDI: Current THD (%).
f: Frequency (Hz).



U1: Voltage phasor L1: Magnitude (V) and Phase (°).
U2: Voltage phasor L2: Magnitude (V) and Phase (°).
U3: Voltage phasor L3: Magnitude (V) and Phase (°).
I1: Current phasor L1: Magnitude (V) and Phase (°).
I2: Current phasor L2: Magnitude (V) and Phase (°).
I3: Current phasor L3: Magnitude (V) and Phase (°).



Combined values:

P: Active power (W).
N: Nonactive power (var).
S: Apparent power (VA).
PF: Power Factor.



Fundamental values:

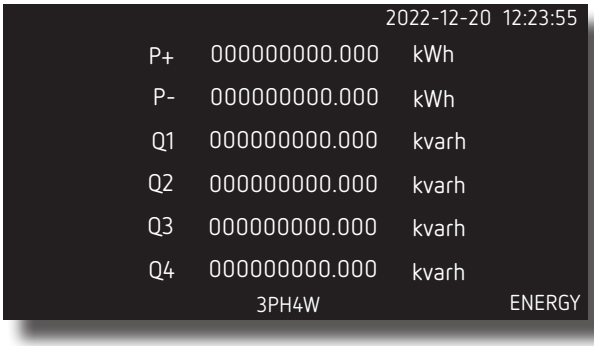
P1: Fundamental Active Power (W).
Q: Fundamental Reactive power (var).
S1: Fundamental Apparent Power (VA).
DPF: Fundamental Power Factor.



U1: Positive sequence component in voltage (V).
U2: Negative sequence component in voltage (V).
U0: Zero sequence component in voltage.
u2: Voltage negative sequence unbalance ratio (%).
u0: Voltage zero sequence unbalance ratio (%).
I1: Positive sequence component in current (A).
I2: Negative sequence component in current (V).
I0: Zero sequence component in current.
i2: Current negative sequence unbalance ratio (%).
i0: Current Zero Sequence Unbalance Ratio (%).

5.2.- MENU OF ENERGY PARAMETERS

The energy parameter menu is identified by the text **ENERGY** at the bottom right of the display.

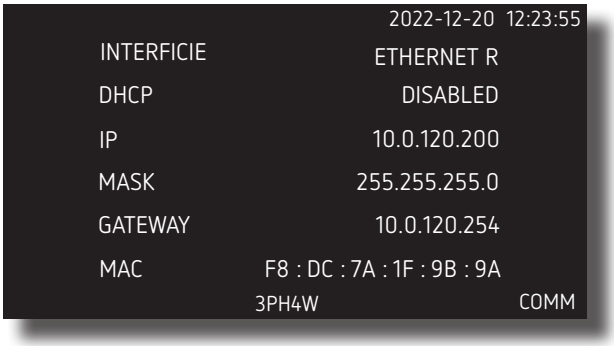


P+: Three-phase active energy consumed (kWh).
P-: Three-phase active energy generated (kWh).
Q1: Fundamental three-phase reactive energy in Q1 (kvarh).
Q2: Fundamental three-phase reactive energy in Q2 (kvarh).
Q3: Fundamental three-phase reactive energy in Q3 (kvarh).
Q4: Fundamental three-phase reactive energy in Q4 (kvarh).

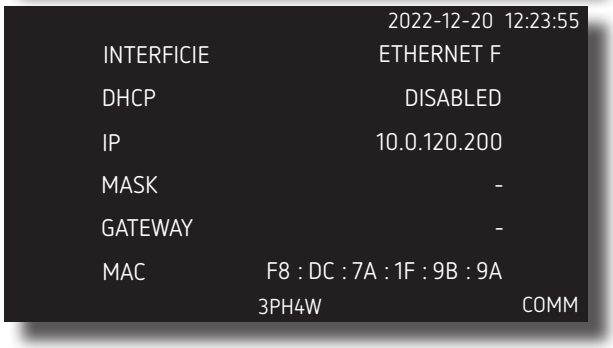
5.3.- COMMUNICATIONS MENU

The menu of the communication parameters is identified by the text **COMM** at the bottom right of the display.

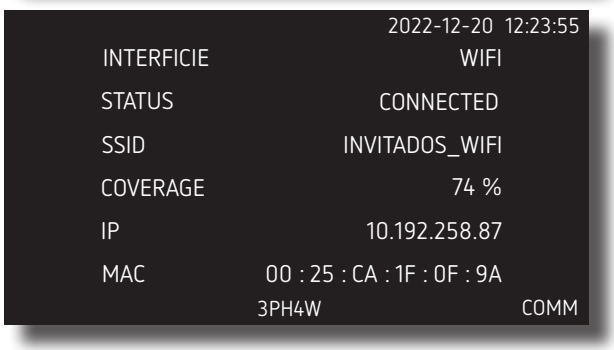
Use the ^ and v keys to move between the different screens:



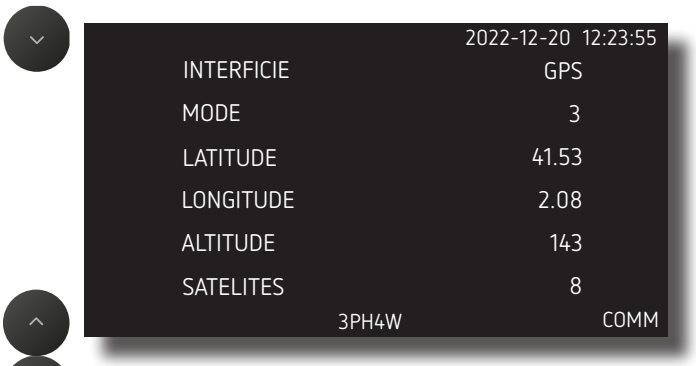
INTERFICIE: Ethernet connection R.
DHCP: Enable / Disable DHCP.
IP: IP address.
MASK: IP Mask.
GATEWAY: Gateway.
MAC: MAC address.



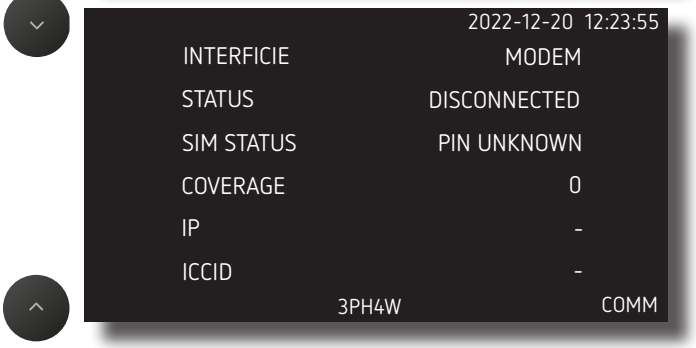
INTERFICIE: Ethernet connection F.
DHCP: Enable / Disable DHCP.
IP: IP address.
MASK: IP Mask.
GATEWAY: Gateway.
MAC: MAC address.



INTERFICIE: WIFI, Wi-Fi connection.
STATUS: Connection status.
SSID: Wi-Fi network name.
COVERAGE: Wi-Fi signal level.
IP: IP address.
MAC: MAC address.



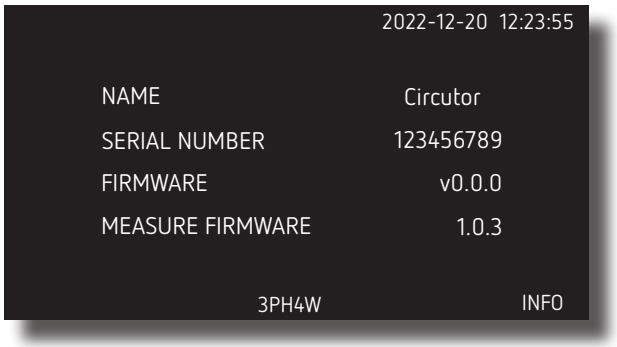
INTERFICIE: GPS, GPS connection.
MODE: GPS mode.
LATITUDE: Latitude.
LONGITUDE: Longitude.
ALTITUDE: Altitude.
SATELITES: Satellites.



INTERFICIE: MODEM, Modem connection (4G).
STATUS: Connection status.
SIM STATUS: SIM Status.
COVERAGE: Signal level.
IP: IP address.
ICCID: SIM ICCID number.

5.4.- INFORMATION MENU

The information menu is identified by the text **INFO** at the bottom right of the display.



NAME: Manufacturer's name.
SERIAL NUMBER: Serial no.
FIRMWARE: Firmware version.
MEASURE FIRMWARE: Measurement firmware version.

6.- CONFIGURATION

The **QNA 600** arranges all the device setting into 7 menus, **Figure 27.**

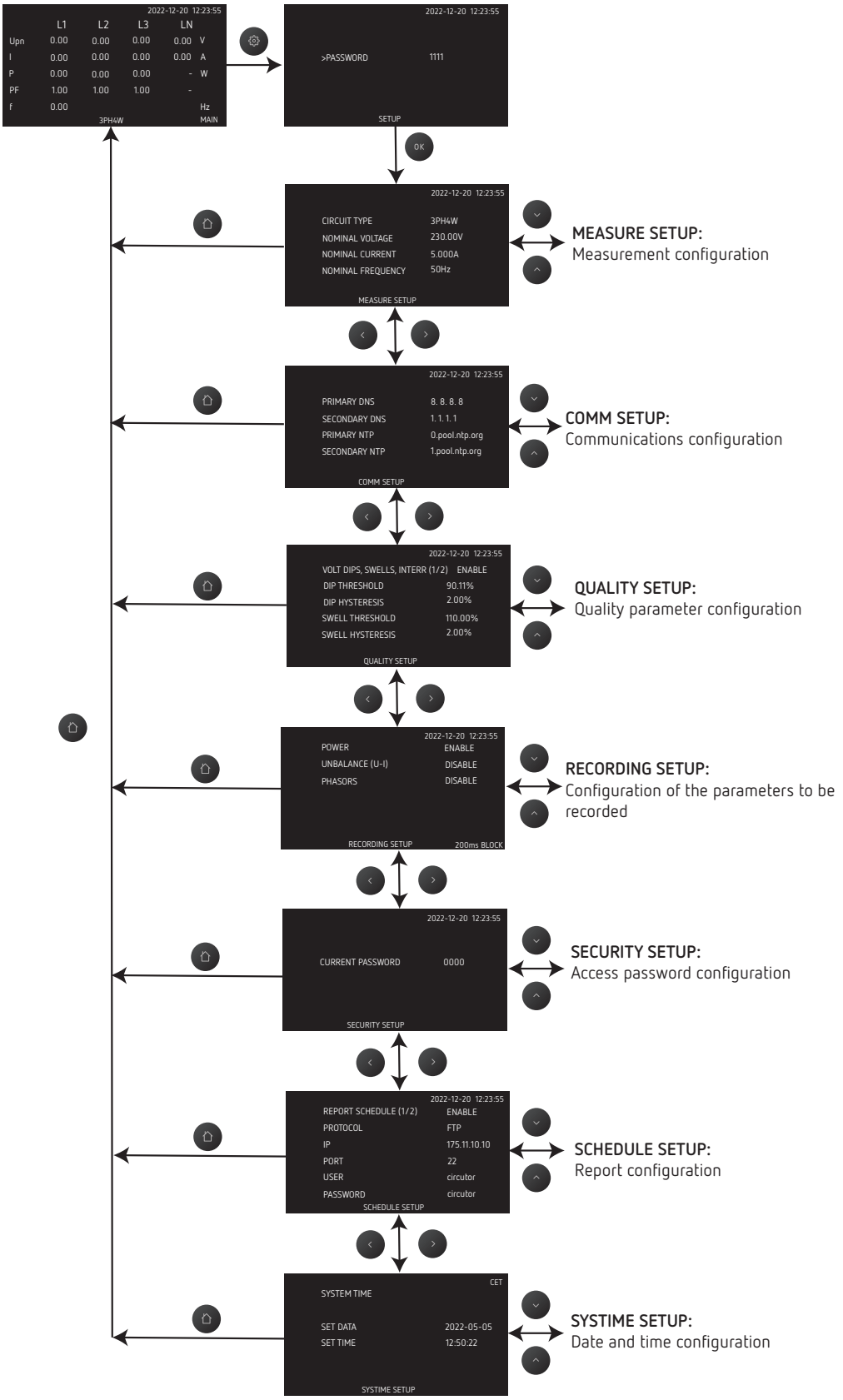


Figure 27: Configuration menu.

To access the configuration menu, press the key, the password screen appears, **Figure 28.**

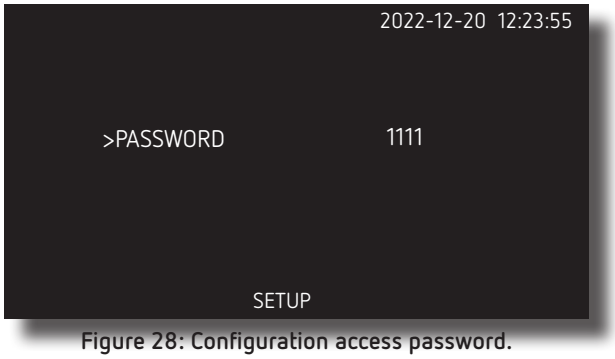


Figure 28: Configuration access password.

Use keys and to modify the value of the digit.

Press keys and to jump to digit.

To validate the value, press the OK key, if the password is correct, the device enters the configuration menu. If it is incorrect, the device returns to the **MAIN** screen.

Default password: 9182.

Note: *The login password can be edited in section* ***"6.5 - ACCESS PASSWORD CONFIGURATION".***
Note: *The full configuration tree is shown in* ***"ANNEX B- CONFIGURATION MENU".***

Use the and keys to move between the different configuration menus.

6.1.- MEASUREMENT CONFIGURATION

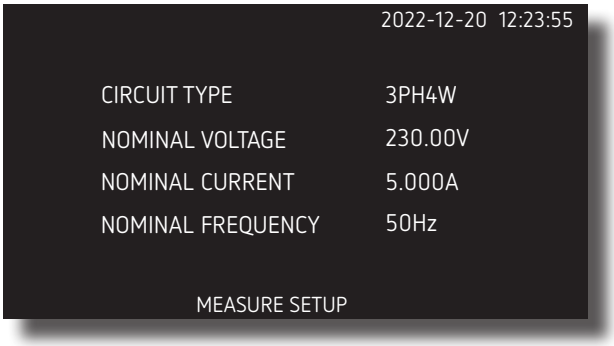
6.1.1.- TYPE OF INSTALLATION AND NOMINAL PRIMARY VALUES

On this screen you configure:

- ✓**CIRCUIT TYPE:** type of installation.
- ✓**NOMINAL VOLTAGE:** nominal voltage measured by the **QNA 600**. The value set must be Phase-Phase or Phase-Neutral, depending on the type of installation, but always referenced to the primary. This value is essential to the proper operation of the event log.
- ✓**NOMINAL CURRENT:** Nominal current being measured by the device, which will be used to set the maximum and minimum % to record disturbances. By default, this value is 5 A. It should be set to the same value as the measurement transformers.
- ✓**NOMINAL FREQUENCY:** Nominal frequency of the mains being analyzed. This parameter is required to calculate the RMS value of the signal in extreme quality mains.

Example 1: *In a three-phase, 4-wire (**3PH4W**) installation with a medium-voltage line supply of 20000 V (phase-to-phase). If a 22000/110 voltage transformer is connected, the settings must be:*
PRIMARY U *(Primary voltage) = 22000 V*
SECONDARY U *(Secondary voltage) = 110 V*
NOMINAL VOLTAGE *(Nominal voltage) = 22000 / √3 = 11547 V*

Example 2: *In a three-phase, 3-wire (**3PH3W**) installation with a medium-voltage line supply of 20000 V (phase-to-phase). If a 22000/110 voltage transformer is connected, the settings must be:*
***PRIMARY U** (Primary voltage) = 22000 V*
***SECONDARY U** (Secondary voltage) = 110 V*
NOMINAL VOLTAGE *(Nominal voltage) = 22000 V*



Press key to enter editing mode, the **>** symbol is displayed to the right of the first parameter.

Use the and keys to jump between the different parameters.

Press the OK key to edit the parameter.

Use keys and to modify the value of the digit or change the option.

Press keys and to jump to digit.

Press the OK key to finish editing the parameter.

✓ **Configuration values**

Table 22: Configuration values: CIRCUIT TYPE.

	CIRCUIT TYPE	
Possible values	3PH4W	Three-phase network measuring with a 4-wire connection.
	3PH3W	Three-phase network measuring with a 3-wire connection.
	ARON	Three-phase network measuring with a 3-wire connection and transformers in Aron connection.
	1PH2W	Single-phase network measuring with a 2-wire connection.
	2PH3W	Two-phase network measuring with a 3-wire connection.

Table 23: Configuration values: NOMINAL VOLTAGE, NOMINAL CURRENT.

	NOMINAL VOLTAGE	NOMINAL CURRENT
Minimum value	1.00 V	0.050 A
Maximum value	2000000.00 V	20000.000 A

Table 24: Configuration values: NOMINAL FREQUENCY.

	NOMINAL FREQUENCY	
Possible values	50 Hz	60 Hz

Note: *When the **CIRCUIT TYPE** is changed, the database is automatically deleted.*

Press the key to exit edit mode.

Use the key to jump to the next programming point.

Press key to save the changes and exit the configuration menu, the screen in **Figure 29** is displayed.

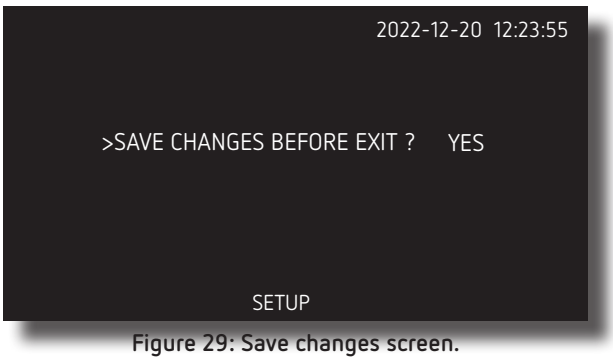


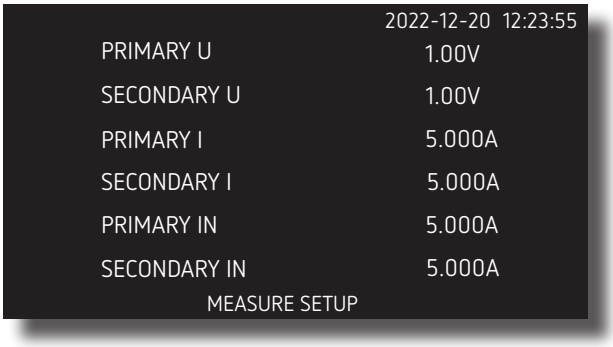
Figure 29: Save changes screen.

Use keys and to select the option: **YES** or **NO**.

Press OK to validate and exit the menu.

6.1.2.- RATIOS OF THE VOLTAGE, CURRENT AND NEUTRAL CURRENT TRANSFORMER

This screen is used to configure the values of the primary and secondary voltage, current and neutral current.



Press key to enter editing mode, the **>** symbol is displayed to the right of the first parameter.

Use the and keys to jump between the different parameters.

Press the OK key to edit the parameter.

Use keys and to modify the value of the digit or change the option.

Press keys and to jump to digit.

Press the OK key to finish editing the parameter.

✓ **Configuration values**

Table 25:Configuration values: PRIMARY U, I, IN, SECONDARY U, I, IN.

	PRIMARY U	SECONDARY U	PRIMARY I	SECONDARY I	PRIMARY IN	SECONDARY IN
Minimum value	1.00 V		1.000 A	1.000 A	1.000 A	1.000 A
Maximum value	2000000.00 V		2000000.000 A	5.000 A	2000000.000 A	5.000 A

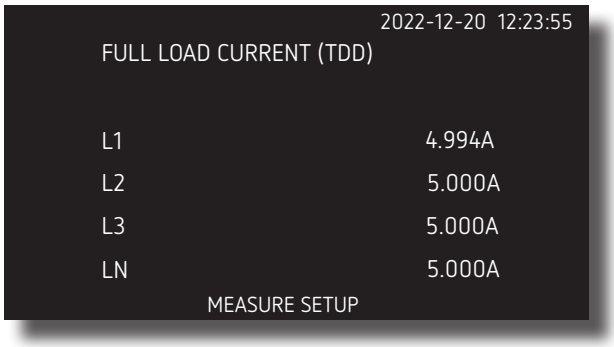
Press the key to exit edit mode.

Use the key to jump to the next programming point.

Press key to save the changes and exit the configuration menu, the screen in **Figure 29** is displayed.

6.1.3.- FULL LOAD CURRENT

This screen is used to configure the full load current of each phase of the installation, which is used to calculate the TDD (Total Distortion Demand).



Press key to enter editing mode, the **>** symbol is displayed to the right of the first parameter.

Use the and keys to jump between the different parameters.

Press the key to edit the parameter.

Use keys and to modify the value of the digit or change the option.

Press keys and to jump to digit.

Press the key to finish editing the parameter.

✓ **Configuration values**

Table 26:Configuration values: L1, L2, L3, LN (TDD).

	L1	L2	L3	LN
Minimum value	0.050 A			
Maximum value	20000.000 A			

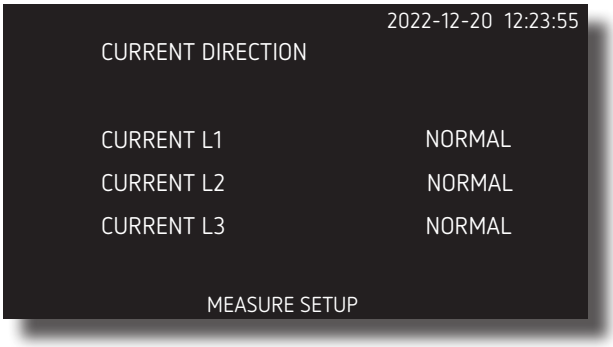
Press the key to exit edit mode.

Use the key to jump to the next programming point.

Press key to save the changes and exit the configuration menu, the screen in **Figure 29** is displayed.

6.1.4.- CURRENT DIRECTION

The direction of the current in each line is selected on this screen.



Press key to enter editing mode, the **>** symbol is displayed to the right of the first parameter.

Use the and keys to jump between the different parameters.

Press the key to edit the parameter.

Use keys and to modify the value of the digit or change the option.

Press keys and to jump to digit.

Press the key to finish editing the parameter.

✓ **Configuration values**

Table 27:Configuration values: Current direction.

		CURRENT L1	CURRENT L2	CURRENT L3
Possible values	**NORMAL**	Normal current direction.		
	REVERSE	Reverse current direction.		

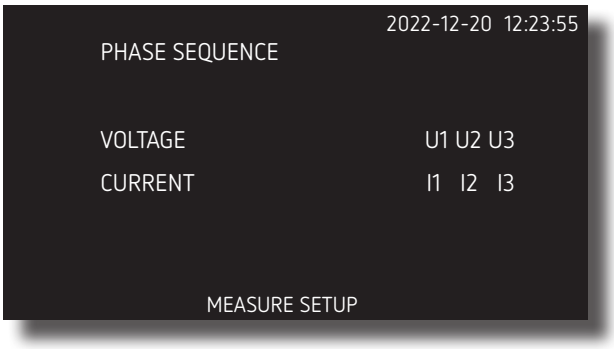
Press the key to exit edit mode.

Use the key to jump to the next programming point.

Press key to save the changes and exit the configuration menu, the screen in **Figure 29** is displayed.

6.1.5.- PHASE SEQUENCE

The sequence of the voltage and current phases is selected on this screen.



Press key to enter editing mode, the **>** symbol is displayed to the right of the first parameter.

Use the and keys to jump between the different parameters.

Press the key to edit the parameter.

Use keys and to modify the value of the digit or change the option.

Press keys and to jump to digit.

Press the key to finish editing the parameter.

✓ **Configuration values**

Table 28:Configuration values: Phase sequence, voltage.

	VOLTAGE		
Possible values	U1 U2 U3	U1 U3 U2	U2 U1 U3
	U2 U3 U1	U3 U1 U2	U3 U2 U1

Table 29:Configuration values: Phase sequence, current.

	CURRENT		
Possible values	I1 I2 I3	I1 I3 I2	I2 I1 I3
	I2 I3 I1	I3 I1 I2	I3 I2 I1

Press the key to exit edit mode.

Use the key to jump to the next programming point.

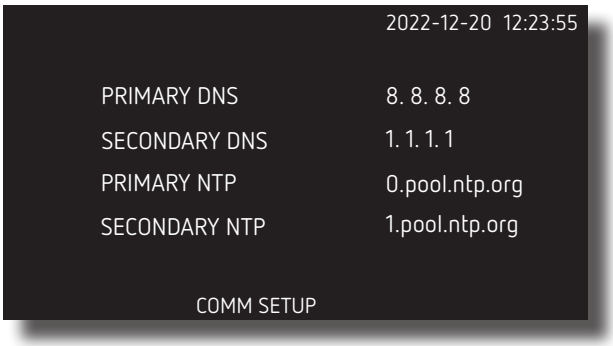
Press key to save the changes and exit the configuration menu, the screen in **Figure 29** is displayed.

6.2.- COMMUNICATIONS CONFIGURATION

6.2.1.- DNS / NTP SETTINGS

On this screen you configure:

✓**PRIMARY DNS:** address of the primary DNS server.
✓**SECONDARY DNS:** address of the secondary DNS server.
✓**PRIMARY NTP:** address of the clock synchronization protocol, Network Time Provider.
✓**SECONDARY NTP:** secondary address of the Network Time Provider, in case the primary NTP fails.



Press key to enter editing mode, the **>** symbol is displayed to the right of the first parameter.

Use the and keys to jump between the different parameters.

Press the OK key to edit the parameter.

Use keys and to modify the value of the digit or change the option.

Press keys and to jump to digit.

Press the OK key to finish editing the parameter.

Press the key to exit edit mode.

Use the key to jump to the next programming point.

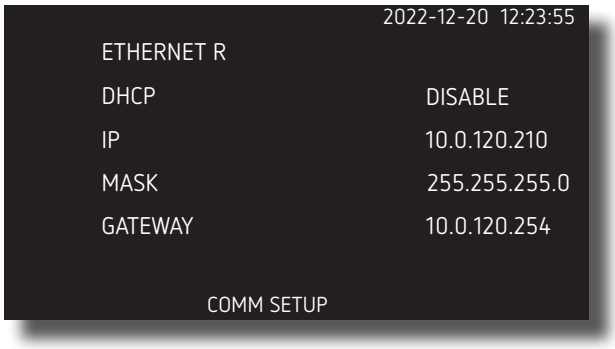
Press key to save the changes and exit the configuration menu, the screen in **Figure 29** is displayed.

6.2.2.- ETHERNET R (Rear Port)

This screen is used to configure the Ethernet communications for the **Ethernet R** port, which is on the back of the device:

✓**DHCP:** If DHCP is enabled (ENABLE), the IP address is dynamically assigned by a central server and no further parameters need to be configured.
If this option is disabled (DISABLE), the IP address is fixed and the following parameters need to be configured:

✓ **IP:** IP address.
✓**MASK:** IP mask.
✓**GATEWAY:** Gateway.



Press key to enter editing mode, the **>** symbol is displayed to the right of the first parameter.

Use the and keys to jump between the different parameters.

Press the key to edit the parameter.

Use keys and to modify the value of the digit or change the option.

Press keys and to jump to digit.

Press the key to finish editing the parameter.

Press the key to exit edit mode.

Use the key to jump to the next programming point.

Press key to save the changes and exit the configuration menu, the screen in **Figure 29** is displayed.

6.2.3.- ETHERNET F (Frontal Port)

This screen is used to configure the Ethernet communications for the **Ethernet F** port, which is on the front of the device.

The configuration is identical to that of section ***"6.2.2.- ETHERNET R (Rear Port)".***

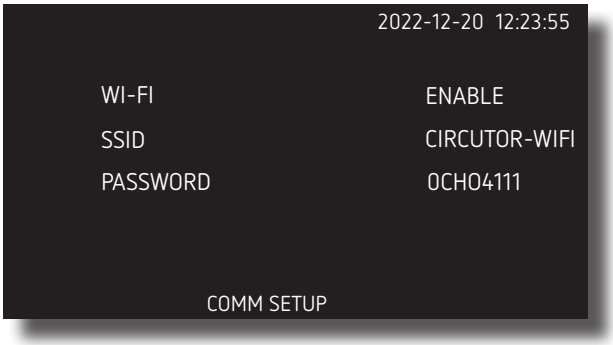
6.2.4.- WI-FI CONFIGURATION

On this screen you configure:

✓**WI-FI:** Select to enable Wi-Fi communications or not. If enabled, the following parameters need to be configured:

✓**SSID:** Wi-Fi network name.

✓**PASSWORD:** Network access password.



Press key to enter editing mode, the **>** symbol is displayed to the right of the first parameter.

Use the and keys to jump between the different parameters.

Press the key to edit the parameter.

Use keys and to modify the value of the digit or change the option.

Press keys and to jump to digit.

Press the key to finish editing the parameter.

Press the key to exit edit mode.

Use the key to jump to the next programming point.

Press key to save the changes and exit the configuration menu, the screen in **Figure 29** is displayed.

6.2.5.- CONFIGURATION OF THE 4G MODEM

This screen is used to configure the parameters of the 4G modem.

✓**APN:** Name of the access point.
✓**USER:** Username.
✓**PASSWORD:** Modem login password.
✓**PIN:** Modem PIN code.



Press key to enter editing mode, the **>** symbol is displayed to the right of the first parameter.

Use the and keys to jump between the different parameters.

Press the key to edit the parameter.

Use keys and to modify the value of the digit or change the option.

Press keys and to jump to digit.

Press the key to finish editing the parameter.

Press the key to exit edit mode.

Use the key to jump to the next programming point.

Press key to save the changes and exit the configuration menu, the screen in **Figure 29** is displayed.

6.3.- CONFIGURATION OF QUALITY PARAMETERS

6.3.1.- VOLTAGE DIP AND VOLTAGE SWELL

On this screen you configure:

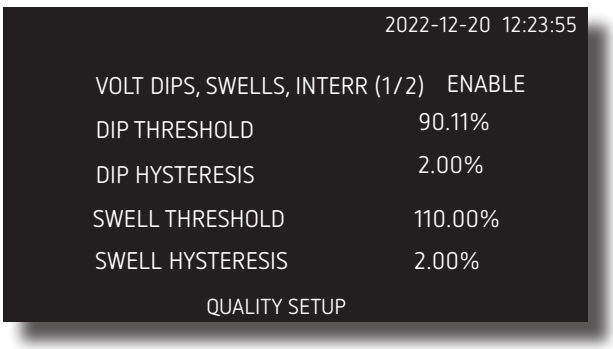
✓**VOLT DIPS, SWELLS, INTERR (1/2):** Select to enable the detection of the following quality events or not. If enabled, the following parameters need to be configured:

✓**DIP THRESHOLD:** a dip is defined as a drop in the RMS voltage value below the threshold set in this parameter. The value is set as a % of the nominal voltage value.

✓**DIP HYSTERESIS:** value of the dip hysteresis, so as to make the trip and reset values of the event different. The value is set as a % of the **DIP THRESHOLD** value.

✓**SWELL THRESHOLD:** a swell is defined as a rise in the RMS voltage value above the threshold set in this parameter. The value is set as a % of the nominal voltage value.

✓**SWELL HYSTERESIS:** swell hysteresis value, so as to make the trip and reset values of the event different. The value is set as a % of the **SWELL THRESHOLD** value.



Press key to enter editing mode, the **>** symbol is displayed to the right of the first parameter.

Use the and keys to jump between the different parameters.

Press the OK key to edit the parameter.

Use keys ^ and v to modify the value of the digit or change the option.

Press keys < and > to jump to digit.

Press the OK key to finish editing the parameter.

✓ **Configuration values**

Table 30:Configuration values: Voltage dip and voltage swell.

	DIP THRESHOLD	DIP HISTERESIS	SWELL THRESHOLD	SWELL HISTERESIS
Minimum value	50.00 %	0.00 %	100.00 %	0.00 %
Maximum value	97.00 %	100.00 %	150.00 %	100.00 %

Press the ⚙ key to exit edit mode.

Use the v key to jump to the next programming point.

Press key ⌂ to save the changes and exit the configuration menu, the screen in **Figure 29** is displayed.

6.3.2.- INTERRUPTIONS

On this screen you configure:

✓**VOLT DIPS, SWELLS, INTERR (2/2):** Select to enable the detection of the following quality events or not. If enabled, the following parameters need to be configured:

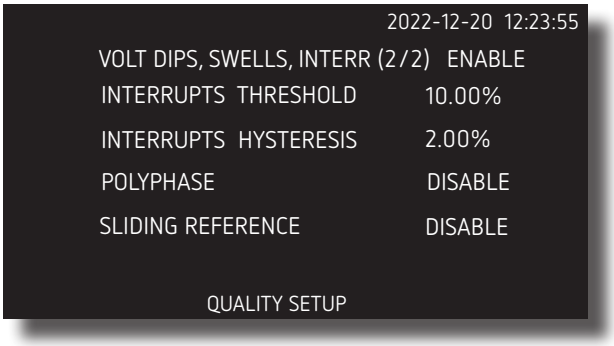
✓**INTERRUPTS THRESHOLD:** an interruption is defined as a drop in the RMS voltage value below the threshold set in this parameter. The value is set as a % of the nominal voltage value.

✓**INTERRUPTS HYSTERESIS:** interruption hysteresis value, so as to make the trip and reset values of the event different. The value is set as a % of the **INTERRUPTS THRESHOLD** value.

✓**POLYPHASE:** select to enable polyphase or not. Polyphase is the polyphase detection of dips, swells, interruptions and RVC. This means that an event in any of the 3 phases, or in more than one simultaneously, will lead to a polyphase event as per the characteristics specified for each event in **IEC 61000-4-30**.

✓**SLIDING REFERENCE:** select to enable the sliding reference or not.

The slider reference is the weighted average voltage value in the 1 minute that precedes a dip or a swell. If the sliding reference voltage is enabled, the voltage levels for detecting a dip or a swell will be calculated based on the threshold percentages with reference to this voltage.



Press key to enter editing mode, the **>** symbol is displayed to the right of the first parameter.

Use the and keys to jump between the different parameters.

Press the OK key to edit the parameter.

Use keys and to modify the value of the digit or change the option.

Press keys and to jump to digit.

Press the OK key to finish editing the parameter.

✓ **Configuration values**

Table 31:Configuration values: Interrupts.

	INTERRUPTS THRESHOLD	INTERRUPTS HISTERESIS
Minimum value	1.00 %	0.00 %
Maximum value	20.00 %	100.00 %

Press the key to exit edit mode.

Use the key to jump to the next programming point.

Press key to save the changes and exit the configuration menu, the screen in **Figure 29** is displayed.

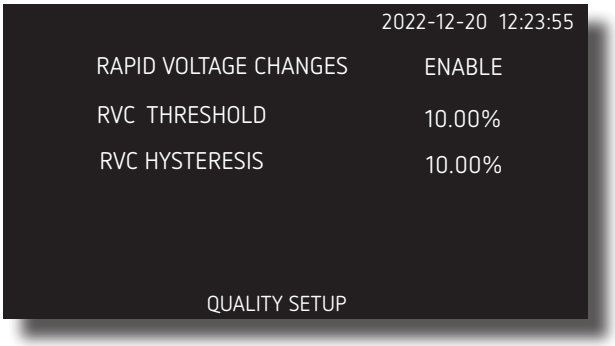
6.3.3.- RAPID VOLTAGE CHANGES

On this screen you configure:

✓**RAPID VOLTAGE CHANGES:** Select to enable rapid voltage change detection or not. If enabled, the following parameters need to be configured:

✓**RVC THRESHOLD:** a rapid voltage change (RVC) is defined as a drop in the RMS voltage value below the threshold set in this parameter. The value is set as a % of the arithmetic mean of the 100 previous 1/2 Urms values.

✓**RVC HYSTERESIS:** value of the RVC hysteresis, so as to make the trip and reset values of the event different. The value is set as a % of the **RVC THRESHOLD** value.



Press key to enter editing mode, the **>** symbol is displayed to the right of the first parameter.

Use the and keys to jump between the different parameters.

Press the key to edit the parameter.

Use keys and to modify the value of the digit or change the option.

Press keys and to jump to digit.

Press the key to finish editing the parameter.

✓ **Configuration values**

Table 32:Configuration values: RVC.

	RVC THRESHOLD	RVC HISTERESIS
Minimum value	0.00 %	0.00 %
Maximum value	100.00 %	100.00 %

Note: *To achieve a stable measurement voltage close to the nominal voltage, the configuration values must be greater than those programmed for the dip detection. If not, when the device detects a dip, it no longer considers RVC detection.*

Press the key to exit edit mode.

Use the key to jump to the next programming point.

Press key to save the changes and exit the configuration menu, the screen in **Figure 29** is displayed.

6.3.4.- SIGNALING VOLTAGE

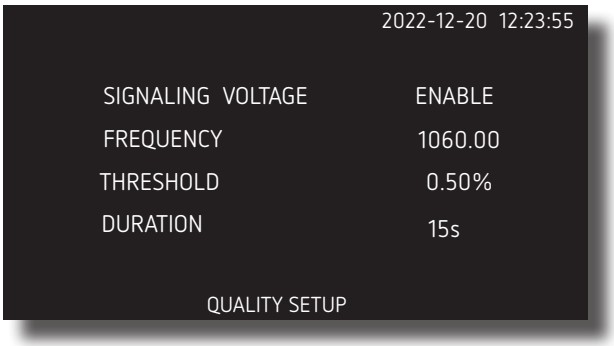
The transmission of signaling voltages that can travel through the supply mains are usually sent in bursts, applied at non-harmonic frequencies and used to control industrial devices or other devices remotely. The method applied by the **QNA 600** to detect signaling voltages measures the level of a signal voltage for a specified carrier.

✓**SIGNALING VOLTAGE:** Select to enable signaling voltages through the mains or not. If enabled, the following parameters need to be configured:

✓**FREQUENCY:** Frequency to be observed.

✓**THRESHOLD:** Detection threshold as a % of the Nominal Voltage.

✓**DURATION:** Length of time during which the specified values are recorded.



Press key to enter editing mode, the > symbol is displayed to the right of the first parameter.

Use the and keys to jump between the different parameters.

Press the key to edit the parameter.

Use keys and to modify the value of the digit or change the option.

Press keys and to jump to digit.

Press the key to finish editing the parameter.

✓ **Configuration values**

Table 33:Configuration values: Signaling voltage.

	FREQUENCY	THRESHOLD	DURATION
Minimum value	0.00 Hz	0.30 %	1 s
Maximum value	3000.00 Hz	100 %	120 s

Press the key to exit edit mode.

Use the key to jump to the next programming point.

Press key to save the changes and exit the configuration menu, the screen in **Figure 29** is displayed.

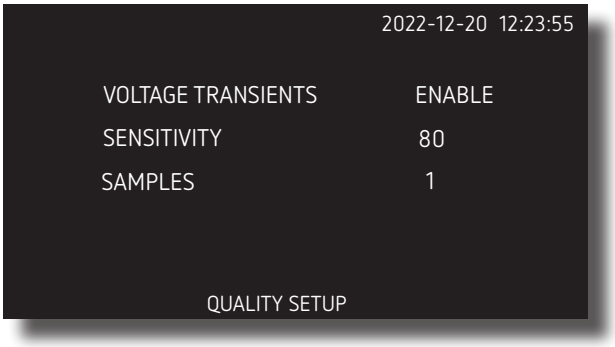
6.3.5.- VOLTAGE TRANSIENTS

On this screen you configure:

✓**VOLTAGE TRANSIENTS:** Select to enable the detection of voltage transients or not. If enabled, the following parameters need to be configured:

✓**SENSITIVITY:** This variable is used to weight the detection level of transients in order to avoid false positives. The higher this value, the more the device will detect smaller transients.

✓**SAMPLES:** Number of samples to be used to detect voltage transients.



Press key to enter editing mode, the **>** symbol is displayed to the right of the first parameter.

Use the and keys to jump between the different parameters.

Press the key to edit the parameter.

Use keys and to modify the value of the digit or change the option.

Press keys and to jump to digit.

Press the key to finish editing the parameter.

✓ **Configuration values**

Table 34:Configuration values: Voltage transients.

	SENSITIVITY	SAMPLES
Minimum value	0 %	1
Maximum value	100 %	10

Press the key to exit edit mode.

Use the key to jump to the next programming point.

Press key to save the changes and exit the configuration menu, the screen in **Figure 29** is displayed.

6.3.6.- SLOW CURRENT TRANSIENTS

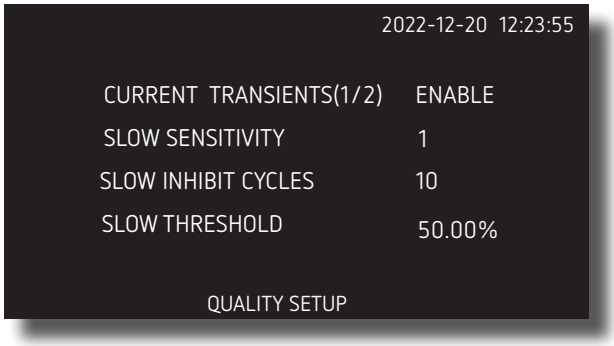
On this screen you configure:

✓**CURRENT TRANSIENTS(1/2):** Select to enable the detection of current transients or not. If enabled, the following parameters need to be configured to calculate a slow transient:

✓**SLOW SENSITIVITY:** value used to dampen sensitivity to false positives.

✓**SLOW INHIBIT CYCLES:** Number of cycles until the end of the transient that are inhibited to detect new current transients.

✓**SLOW THRESHOLD:** Threshold value for detecting slow transients as a %. The value is set as a % of the nominal voltage value.



Press key to enter editing mode, the **>** symbol is displayed to the right of the first parameter.

Use the and keys to jump between the different parameters.

Press the key to edit the parameter.

Use keys and to modify the value of the digit or change the option.

Press keys and to jump to digit.

Press the key to finish editing the parameter.

✓ **Configuration values**

Table 35:Configuration values: Slow current transients.

	SLOW SENSITIVITY	SLOW INHIBIT CYCLES	SLOW THRESHOLD
Minimum value	1	1	1.00 %
Maximum value	4	10	100 %

Press the key to exit edit mode.

Use the key to jump to the next programming point.

Press key to save the changes and exit the configuration menu, the screen in **Figure 29** is displayed.

6.3.7.- FAST CURRENT TRANSIENTS

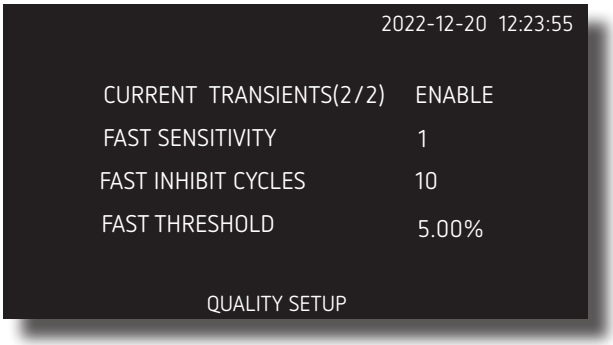
On this screen you configure:

✓**CURRENT TRANSIENTS(2/2):** Select to enable the detection of current transients or not. If enabled, the following parameters need to be configured to calculate a fast transient:

✓**FAST SENSITIVITY:** value used to dampen sensitivity to false positives.

✓**FAST INHIBIT CYCLES:** Number of cycles until the end of the transient that are inhibited to detect new current transients.

✓**FAST THRESHOLD:** Threshold value for detecting fast transients as a %. The value is set as a % of the nominal voltage value.



Press key to enter editing mode, the **>** symbol is displayed to the right of the first parameter.

Use the and keys to jump between the different parameters.

Press the OK key to edit the parameter.

Use keys and to modify the value of the digit or change the option.

Press keys and to jump to digit.

Press the OK key to finish editing the parameter.

✓ **Configuration values**

Table 36:Configuration values: Fast current transients.

	FAST SENSITIVITY	FAST INHIBIT CYCLES	FAST THRESHOLD
Minimum value	1	1	1.00 %
Maximum value	4	10	100 %

Press the key to exit edit mode.

Use the key to jump to the next programming point.

Press key to save the changes and exit the configuration menu, the screen in **Figure 29** is displayed.

6.3.8.- WAVEFORM

On this screen you configure:

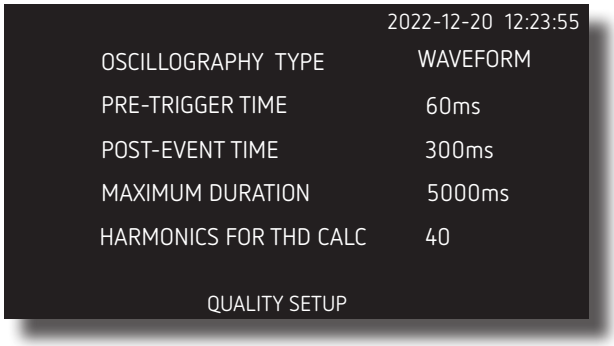
✓**OSCILLOGRAPHY TYPE:** Select the waveform that the device will record and that can be viewed in real time on the webpage. The possible options are: DISABLED, WAVEFORM or RMS.

✓**PRE-TRIGGER TIME:** recording time before the trigger condition.

✓**POST-EVENT TIME:** recording time after the trigger condition.

✓**MAXIMUM DURATION:** Maximum waveform recording time (pre-trigger time + post-trigger time).

✓**HARMONICS FOR THD CALC:** No. of harmonics used to calculate the THD.



Press key to enter editing mode, the **>** symbol is displayed to the right of the first parameter.

Use the and keys to jump between the different parameters.

Press the OK key to edit the parameter.

Use keys and to modify the value of the digit or change the option.

Press keys and to jump to digit.

Press the OK key to finish editing the parameter.

✓ **Configuration values**

Table 37: Configuration values: OSCILLOGRAPHY TYPE.

	OSCILLOGRAPHY TYPE	
Possible values	**DISABLED**	The device does not record any waveform
	WAVEFORM	In **Waveform** mode, the device records the waveform of the input signal.
	RMS	In **RMS** Mode, the device records the 1-cycle RMS values, updated every 1/2 cycle.

Table 38:Configuration values: PRE-TRIGGER TIME, POST-EVENT TIME, MAXIMUM DURATION, HARMONICS FOR THE THD CALC.

	PRE-TRIGGER TIME	POST-EVENT TIME	MAXIMUM DURATION	HARMONICS FOR THD CALC
Minimum value	20 ms	20 ms	1000 ms	2
Maximum value	1000 ms	1000 ms	60000 ms	64

Press the key to exit edit mode.

Use the key to jump to the next programming point.

Press key to save the changes and exit the configuration menu, the screen in **Figure 29** is displayed.

6.4.- CONFIGURATION OF THE PARAMETERS TO RECORD

The parameters to record in the database are selected in this menu. Application note **M294E0101-03-xxx** details the APIs (*Application Programming Interface*) that can be used to access the database. The API can also be downloaded from the link:

https://docs.circutor.com/docs/QNA_REST_API.yaml

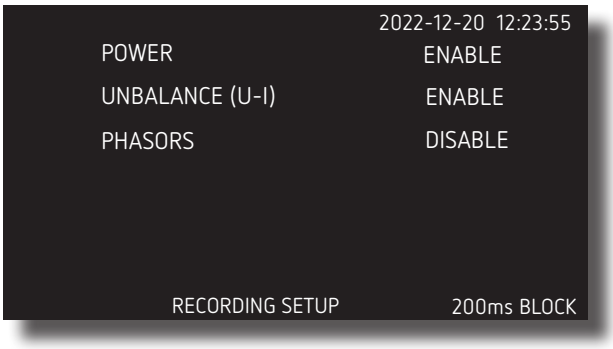
6.4.1.- MEASUREMENT BLOCK: 200 ms

The parameters to be recorded in the database every 200 ms are selected on this screen:

✓**POWER:** Power.
✓**UNBALANCE (U-I):** Unbalance.
✓**PHASORS:** Phasors.

Depending on the selected parameter, the device records certain parameters, see **Table 45.**

Note: *Through the web configuration page it is possible to select more parameters (See* ***"8.2.4.- RECORDING"****).*



Press key to enter editing mode, the **>** symbol is displayed to the right of the first parameter.

Use the and keys to jump between the different parameters.

Press the key to edit the parameter.

Use the and keys to change the option.

Press the key to finish editing the parameter.

Press the key to exit edit mode.

Use the key to jump to the next programming point.

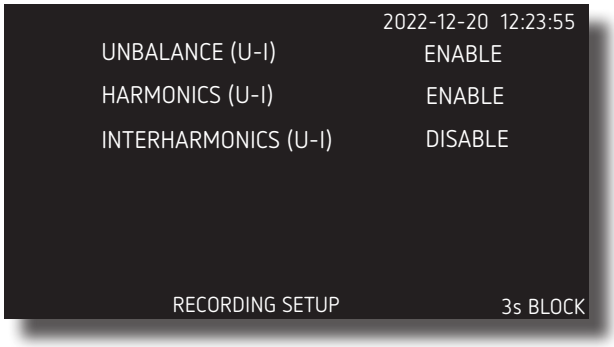
Press key to save the changes and exit the configuration menu, the screen in **Figure 29** is displayed.

6.4.2.- MEASUREMENT BLOCK: 3 s

The parameters to be recorded in the database every 3 s are selected on this screen:

✓**UNBALANCE (U-I):** Unbalance.
✓**HARMONICS (U-I):** Harmonics of voltage and current.
✓**INTERHARMONICS (U-I):** Voltage and current interharmonics.

Depending on the selected parameter, the device records certain parameters, see **Table 45.**
Note: *Through the web configuration page it is possible to select more parameters (See "8.2.4.- RECORDING").*



Press key to enter editing mode, the **>** symbol is displayed to the right of the first parameter.
Use the and keys to jump between the different parameters.
Press the key to edit the parameter.
Use the and keys to change the option.
Press the key to finish editing the parameter.
Press the key to exit edit mode.
Use the key to jump to the next programming point.
Press key to save the changes and exit the configuration menu, the screen in **Figure 29** is displayed.

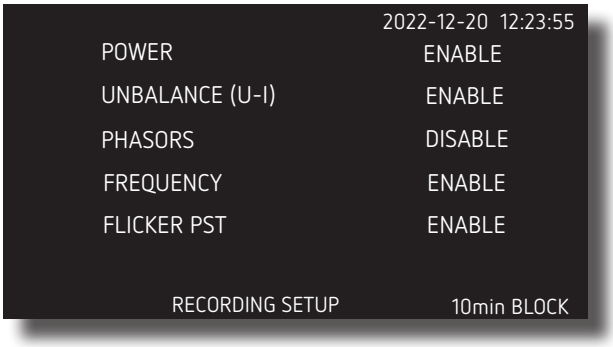
6.4.3.- MEASUREMENT BLOCK: 10 min.

The parameters to be recorded in the database every 10 minutes are selected on this screen:

✓**POWER:** Power
✓**UNBALANCE (U-I):** Unbalance.
✓**PHASORS:** Phasors.
✓**FREQUENCY:** Frequency.
✓**FLICKER PST:** Flicker PST

Depending on the selected parameter, the device records certain parameters, see **Table 45.**
Note: *The log time can be modified and more parameters can be selected on the configuration web-*

*page (see **"8.2.4 - RECORDING"**).*



Press key to enter editing mode, the **>** symbol is displayed to the right of the first parameter.

Use the and keys to jump between the different parameters.

Press the key to edit the parameter.

Use the and keys to change the option.

Press the key to finish editing the parameter.

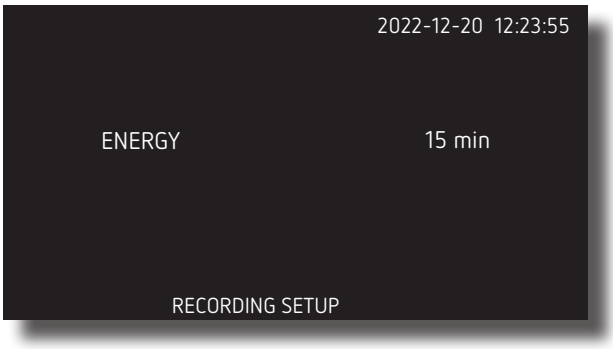
Press the key to exit edit mode.

Use the key to jump to the next programming point.

Press key to save the changes and exit the configuration menu, the screen in **Figure 29** is displayed.

6.4.4.- ENERGY METER

This screen is used to select how long the energy parameters are recorded in the database.
Table 45, shows the energy values that are saved in the database.



Press key to enter editing mode, the **>** symbol is displayed to the right of the parameter.

Use the and keys to jump between the different parameters.

Press the key to edit the parameter.

Use the and keys to change the option.

Press the key to finish editing the parameter.

✓ **Configuration values**

Table 39:Configuration values: ENERGY

	ENERGY					
Possible values	1 min	2 min	3 min	4 min	5 min	6 min
	10 min	12 min	15 min	20 min	30 min	60 min

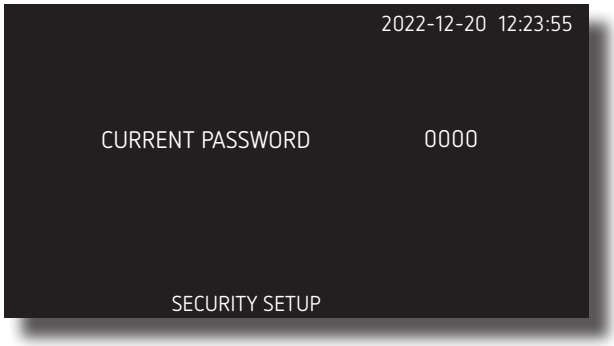
Press the key to exit edit mode.

Use the key to jump to the next programming point.

Press key to save the changes and exit the configuration menu, the screen in **Figure 29** is displayed.

6.5.- ACCESS PASSWORD CONFIGURATION

On this screen you can modify the password for access to the configuration menu.



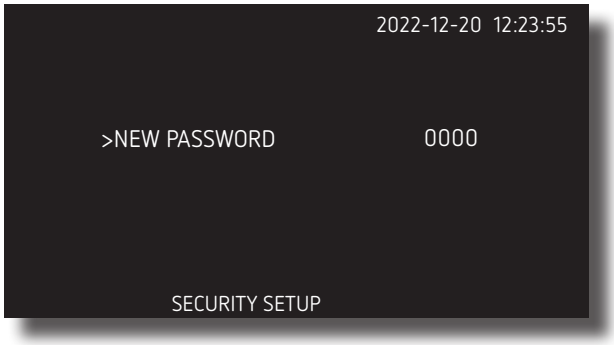
Press key to enter editing mode, the **>** symbol is displayed to the right of the parameter.
In this first screen it is necessary to enter the current password of the device.

Press the OK key to edit the parameter.

Use the and keys to modify the value of the digit.

Press keys and to jump to digit.

Press key OK, if the current password is correct, the screen to enter the new password is displayed.



Pressing key OK, displays the screen to confirm the new password.

Once the new password has been confirmed, press the key to save the changes and exit the configuration menu, the screen in **Figure 29** is displayed.

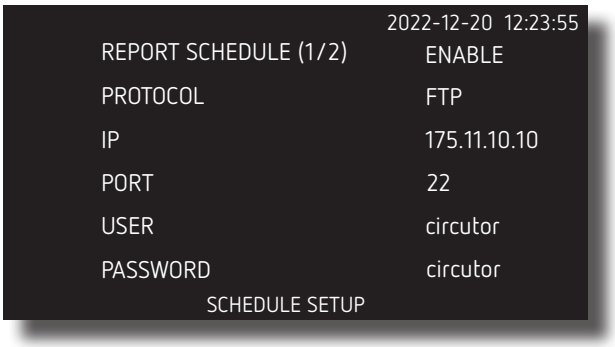
6.6.- REPORT CONFIGURATION

6.6.1.- SCHEDULING OF REPORTS

On this screen you configure:

✓**REPORT SCHEDULE (1/2):** Select to enable report scheduling or not. If enabled, the following parameters need to be configured:

- ✓**PROTOCOL:** protocol to use to generate the report.
- ✓**IP:** IP address of the server to which the reports are sent.
- ✓**PORT:** Server port.
- ✓**USER:** Server user.
- ✓**PASSWORD:** Server user password.



Press key to enter editing mode, the **>** symbol is displayed to the right of the first parameter.

Use the and keys to jump between the different parameters.

Press the OK key to edit the parameter.

Use keys and to modify the value of the digit or change the option.

Press keys and to jump to digit.

Press the OK key to finish editing the parameter.

✓ **Configuration values**

Table 40: Configuration values: PROTOCOL.

	PROTOCOL	
Possible values	**FTP**	FTP protocol (File Transfer Protocol)
	SFTP	SFTP Protocol (Secure File Transfer Protocol)

Press the key to exit edit mode.

Use the key to jump to the next programming point.

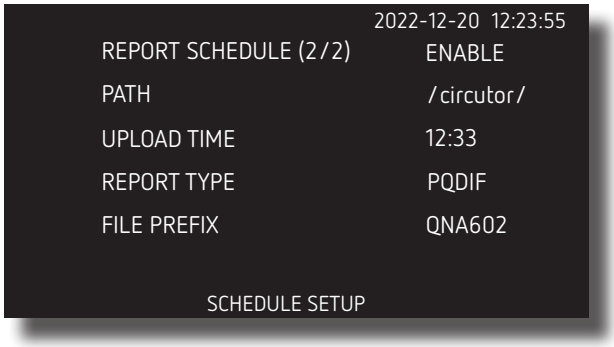
Press key to save the changes and exit the configuration menu, the screen in **Figure 29** is displayed.

6.6.2.- SCHEDULING OF REPORTS (PART 2)

This screen is used to configure more report schedule parameters:

✓**REPORT SCHEDULE (2/2):** Select to enable report scheduling or not. If enabled, the following parameters need to be configured:

- ✓**PATH:** FTP or SFTP server path.
- ✓**UPLOAD TIME:** Time of sending the reports.
- ✓**REPORT TYPE:** Report type.
- ✓**FILE PREFIX:** Prefix attached to the name of the report that is sent.



Press key to enter editing mode, the **>** symbol is displayed to the right of the first parameter.

Use the and keys to jump between the different parameters.

Press the key to edit the parameter.

Use keys and to modify the value of the digit or change the option.

Press keys and to jump to digit.

Press the key to finish editing the parameter.

✓ **Configuration values**

Table 41: Configuration values: REPORT TYPE.

	REPORT TYPE	
Possible values	**EN50160**	The output file is a PDF, as per the EN50160 standard.
	PQDIF	**pqdif** (Power Quality Data Interchange Format) file.

Press the key to exit edit mode.

Use the key to jump to the next programming point.

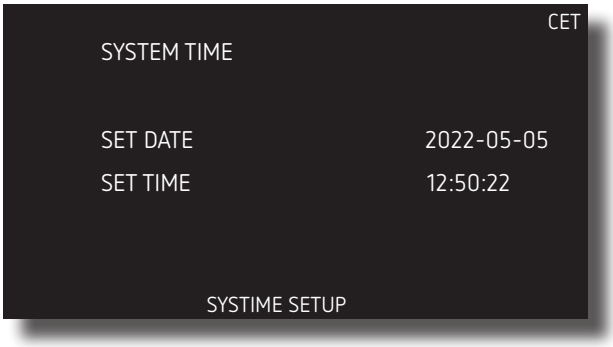
Press key to save the changes and exit the configuration menu, the screen in **Figure 29** is displayed.

6.7.- DATE AND TIME CONFIGURATION

6.7.1.- DATE AND TIME OF THE DEVICE

In this screen the date and time of the device are configured:

✓**SET DATA:** Current date.
✓**TIME:** Current time.



Press key to enter editing mode, the **>** symbol is displayed to the right of the first parameter.

Use the and keys to jump between the different parameters.

Press the key to edit the parameter.

Use keys and to modify the value of the digit or change the option.

Press keys and to jump to digit.

Press the key to finish editing the parameter.

Press the key to exit edit mode.

Use the key to jump to the next programming point.

Press key to save the changes and exit the configuration menu, the screen in **Figure 29** is displayed.

7.- COMMUNICATIONS

The **QNA 600** devices are equipped with Ethernet, Wi-Fi and 4G communications.

The Modbus map described in section ***"7.6.- MODBUS COMMANDS"*** uses the Modbus TCP protocol.

7.1.- USAGE ENVIRONMENT AND HEALTH

Wireless communications emit radio frequency electromagnetic energy, like other radio devices.

Because wireless communications operate under the guidelines found in radio frequency standards and recommendations, they are safe for users to use.

In some settings and situations the use of wireless communications may be restricted by the building's owner of representatives of the organisation.
These may include:

✓Use of wireless connections on board aircraft, in hospitals or near service stations, blasting areas, medical implants or electronic medical devices implanted in the human body (pacemakers, etc.).

✓ In any other setting where the risk of interference with other devices or services is a hazard.

If you are not sure of the applicable usage policy for wireless devices in a specific organisation (airport, hospital, etc.) we recommend requesting permission to use wireless communications.

7.2.- CYBERSECURITY BEST PRACTICES FOR INDUSTRIAL ENVIRONMENTS

This device features Ethernet and Wi-Fi communication interfaces and has been designed and manufactured in accordance with the following regulations:

✓ **Directive 2014/53/UE (RED)**:

- Electrical safety.
- Electromagnetic compatibility.
- Efficient use of the radio spectrum.

✓**Delegated Regulation (EU) 2022/30 (RED-DA) in accordance with requirement 3.3(d), as per standard EN 18031-1:**

- Protection against unauthorised access.
- Preservation of network integrity.
- Protection of the user's personal data.

To ensure secure operation, the following cybersecurity best practices must be applied during configuration and deployment:

✓**Minimum secure network requirements:**

• Install the device on private industrial networks (not on public or open networks).
• Segment the network using **VLANs** (Virtual Local Area Networks) or dedicated subnets.
• Use firewalls or perimeter devices to filter traffic.
• Enable only the ports and protocols required for the operation of the device.
• If not strictly necessary, block or restrict the device's access to the Internet.
• Restrict physical network access to authorised personnel only.

✓**Wi-Fi network security:**

• Connect the device only to Wi-Fi networks using **WPA2** or **WPA3** authentication.
• Avoid open networks, **WEP** (Wired Equivalent Privacy), or other obsolete and insecure protocols.
• If the Wi-Fi interface is not required for the installation, disable it from the device's communication menu to reduce risk.

✓**Password and authentication management:**

• All default passwords **must be** changed upon initial commissioning.
• Use passwords with the following characteristics (according to **NIST SP 800-63B**):
  - Minimum length of 15 characters.
  - Combination of uppercase, lowercase, numbers, and symbols.

These measures help prevent unauthorised access through brute force or dictionary attacks.

✓**Cryptography:**

• All interfaces of the device (Ethernet, Wi-Fi, REST API, Web interface) use secure cryptographic protocols:

  - **WPA2** or **WPA3** for Wi-Fi.
  - **TLS 1.2** or higher for encrypted communications.
  - Algorithms validated by **NIST** (National Institute of Standards and Technology).

• Obsolete technologies are not used, including: **WEP**, **SSL**, **Telnet**, and unencrypted **HTTP**.

✓**Updates and maintenance:**

• Firmware updates must be carried out exclusively from verified and trusted sources, thereby ensuring the integrity and authenticity of the software loaded onto the device.
• Prior to applying a new version, the system shall verify the validity of the digital signature associated with the firmware, ensuring it has not been tampered with.

• It is recommended to:

  - Establish preventive maintenance procedures.
  - Implement a periodic update plan as part of the cybersecurity policy.
  - Document updates as part of the device lifecycle management.

7.3.- 4G COMMUNICATIONS

The **QNA 600** model has 4G communications, so the device can be connected and exchange data with other mobile devices without a Wi-Fi connection. The only thing required is a SIM card.

The configuration of the 4G communications must be done through the web page of the device, see *"8.2.5.- COMMUNICATION"*.

A 4G antenna is provided with the device that needs to be installed for the communications to work correctly, see **Figure 30.**

7.3.1.- INSERTING THE SIM CARD

> To avoid electric discharges, disconnect the measurement and power supply terminals before handling the SIM card.

The SIM card is located on the back of the device, see **Figure 30.**

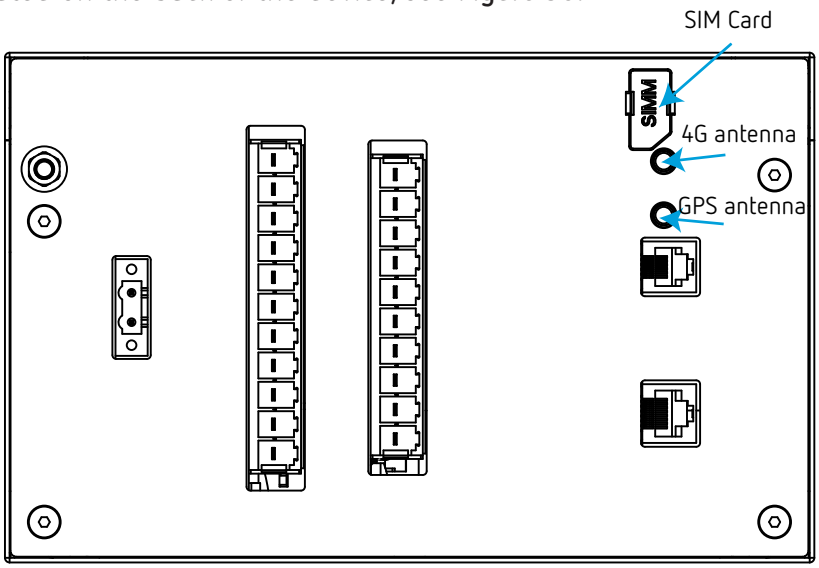


Figure 30: SIM card.

7.3.2.- IEC 61850 PROTOCOL

The **QNA 600** device is equipped with 4G communications with support for the **IEC 61850** protocol, an international standard used in the automation of electrical substations.
This protocol defines an object-oriented data model and communication services, enabling interoperability between devices from different manufacturers and ensuring reliable and structured real-time data transmission.

The **IEC 61850** server of the device implements a set of measurement and status variables, accessible both individually and grouped into datasets. These datasets allow information to be organised according to the nature and update frequency of the data, optimising communication with supervisory systems.

Implemented variables

The main variables available on the **IEC 61850** server are listed below, **Table 42**:

Table 42: Variables implemented on the IEC 61850 server.

	Variables	
Voltage	Phase - Neutral voltage L1, L2, L3	Phase-phase voltage L1-L2, L2-L3, L3-L1
Current	Current L1, L2, L3	
Power	Active power (P) L1, L2, L3, Total	Reactive power (Q) L1, L2, L3, Total
	Apparent power (S) L1, L2, L3, Total	
	Power factor (PF) L1, L2, L3, Total	Fundamental power factor (DPF) L1, L2, L3, Total
Unbalance	Positive sequence component in voltage	Negative sequence component in voltage
	Zero sequence component in voltage	Voltage unbalance
Phase displacement	Average phase displacement between voltage and current L1, L2, L3	Average voltage phase angle L1, L2, L3
THD	Voltage THD L1, L2, L3	Current THD L1, L2, L3
Voltage harmonics	Voltage harmonics L1, L2, L2 (orders 1 to 50)	
Current harmonics	Current harmonics L1, L2, L2 (orders 1 to 50)	
Frequency	Frequency	
Flicker PST	Short-term flicker L1, L2, L3	

Configured datasets

The data are grouped into the following datasets:

- **Dataset3s:** main electrical values (voltage, current, power, power factor and phase displacement) updated every 3 seconds.

- **Dataset10min:** power quality parameters (unbalance, frequency, THD, Flicker) updated every 10 minutes.

- Harmonic datasets: **Dataset10mHV1**, **Dataset10mHV2**, **Dataset10mHV3**, **Dataset10mHA1**, **Dataset10mHA2**, **Dataset10mHA3**, corresponding to each phase and harmonic quantity..

Dataset3s is configured both as a Report (subscription-based reading) and as a **GOOSE Report**, a method widely used for fast and secure transmission of grouped data between devices in substation environments.

Implementation and configuration file

The **IEC 61850** server is based on the **libIEC61850** library by **MZ Automation**, which is certified and tested in accordance with **IEC 61850** standards.

This is an open-source library licensed under **GPLv3**, ensuring transparency and accessibility in its implementation.

All server configuration, including defined datasets, data objects and reports, is described in the **.icd** file (see *"ANNEX C.- .icd FILE"*).

7.4.- Wi-Fi COMMUNICATIONS

Wi-Fi is one of the most widely-used wireless technologies today, used to connect electronic devices and exchange information between them without a physical connection.

The **QNA 600** has Wi-Fi communications over the 2.4 GHz band, in accordance with the IEEE 802.11b, IEEE 802.11g and IEEE 802.11n standards.

7.5.- GPS

The **QNA 600** has GPS for clock synchronization according to the IEC 6100-4-30 standard, achieving an uncertainty < 50 ns.

A GPS antenna is provided with the device that needs to be installed for the communications to work correctly, see **Figure 30.**

7.6.- MODBUS COMMANDS

The device supports Modbus TCP on port 502.

All addresses in the **MODBUS** map are expressed in hexadecimal format, **Table 43**

For all variables, **Function 0x04** is implemented.

Table 43: Modbus Map.

Variable	Type	Address	Units
Measurement block: 3s			
Phase-Neutral voltage L1	Float32	00-01	V
Current L1	Float32	02-03	A
Active power L1 (P)	Float32	04-05	W
Apparent power L1 (S)	Float32	0A-0B	VA
Power factor L1 (PF)	Float32	0C-0D	-
Fundamental power factor L1 (DPF)	Float32	0E-0F	-
Phase-Neutral voltage L2	Float32	10-11	V
Current L2	Float32	12-13	A
Active power L2 (P)	Float32	14-15	W
Apparent power L2 (S)	Float32	1A-1B	VA
Power factor L2 (PF)	Float32	1C-1D	-
Fundamental power factor L2 (DPF)	Float32	1E-1F	-
Phase-Neutral voltage L3	Float32	20-21	V
Current L3	Float32	22-23	A
Active power L3 (P)	Float32	24-25	W
Apparent power L3 (S)	Float32	2A-2B	VA
Power factor L3 (PF)	Float32	2C-2D	-
Fundamental power factor L3 (DPF)	Float32	2E-2F	-

Table 43 (Continuation): Modbus Map.

Variable	Type	Address	Units
Phase-Phase voltage L1-L2	Float32	36-37	V
Phase-Phase voltage L2-L3	Float32	38-39	V
Phase-Phase voltage L3-L1	Float32	3A-3B	V
Total active power	Float32	42-43	W
Total apparent power	Float32	4A-4B	VA
Total fundamental power factor	Float32	4C-4D	-
Voltage THD L1	Float32	4E-4F	%
Voltage THD L2	Float32	50-51	%
Voltage THD L3	Float32	52-53	%
Current THD L1	Float32	56-57	%
Current THD L2	Float32	58-59	%
Current THD L3	Float32	5A-5B	%
Reactive power L1 (Q)	Float32	5E-5F	var
Reactive power L2 (Q)	Float32	60-61	var
Reactive power L3 (Q)	Float32	62-63	var
Total reactive power(Q)	Float32	64-65	var
Three-phase active energy consumed	Float32	520-521	kWh
Three-phase fundamental reactive energy in Q1	Float32	530-531	kvarh
Three-phase fundamental reactive energy in Q2	Float32	540-541	kvarh
Three-phase active energy generated	Float32	570-571	kWh
Three-phase fundamental reactive energy in Q3	Float32	580-581	kvarh
Three-phase fundamental reactive energy in Q4	Float32	590-591	kvarh

8.- WEB PAGE

The configuration and display webpage for the device is accessed via its IP address.
To access the webpage, open the screen shown in **Figure 31**, and enter the Username and Password. The default values are shown in **Table 44**.

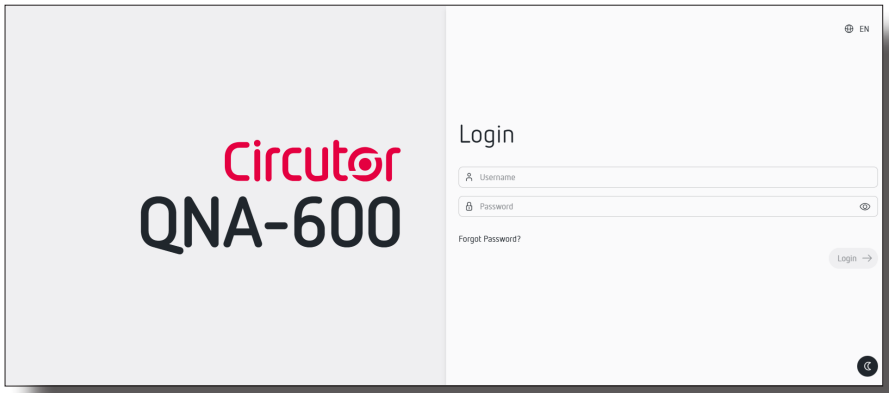


Figure 31: Access to the configuration Web Page.

Table 44: Access to the configuration Web Page.

Access to the configuration Web Page	
Username	admin
Password	circutor

If the access password has been forgotten, select the option **Forgot Password?** in order to change the password using the device serial number.

Note: *In the upper right-hand corner, ⊕, it is possible to change the language of the web page.*

Once validated, the main screen is accessed, **Figure 32**.

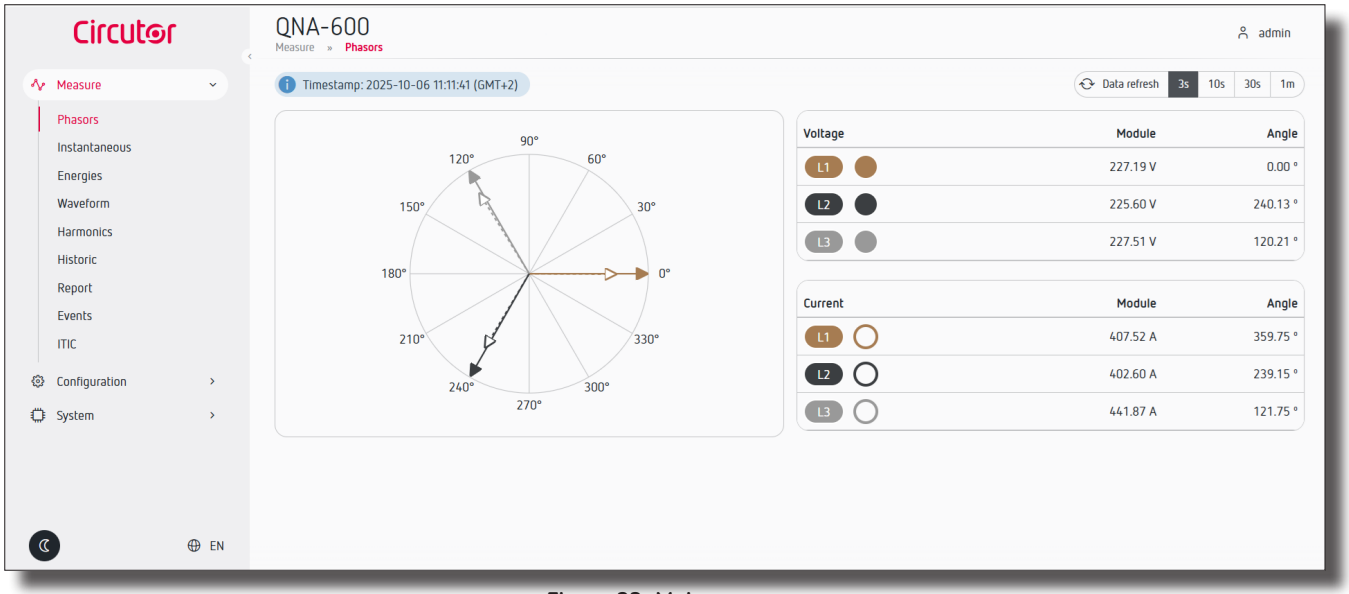


Figure 32: Main screen.

From this screen, it is possible to access the configuration web page menu:

- **Measure** → display of the values measured by the device.
- **Configuration** → configuration of the device parameters.
- **System** → display of system information.

On the web page it is also possible to:

Select to log out.
Change the language of the web page.
Switch the web page to night mode.

8.1.- MEASURE

In the **Measure** section, the most important values measured by the device are displayed.

8.1.1.- PHASORS

This section displays the graphical representation and the numerical value of the voltage and current phasors, **Figure 33**.

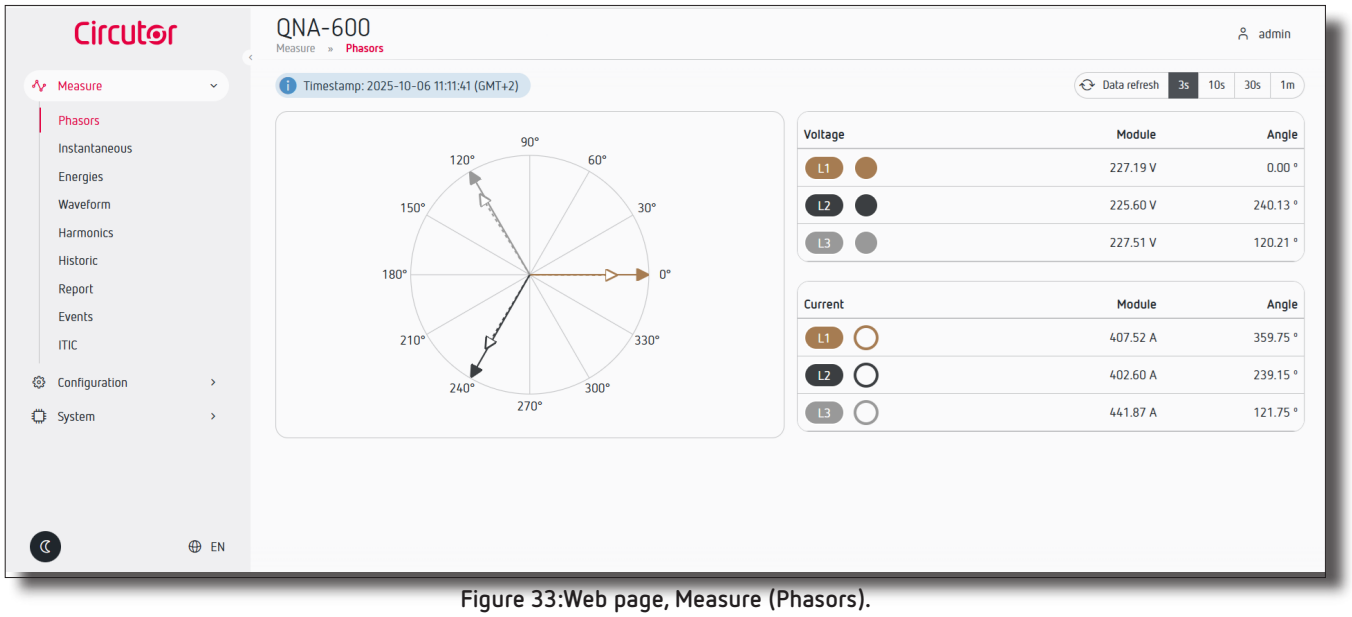


Figure 33:Web page, Measure (Phasors).

Note: *Angles are calculated relative to Phase 1 voltage angle.*

8.1.2.- INSTANTANEOUS

This section displays the instantaneous values of the parameters measured by the **QNA 600, Figure 34**.



Figure 34:Web page, Measure (Instantaneous).

8.1.3.- ENERGIES

This section shows the energies measured by the **QNA 600, Figure 35.**

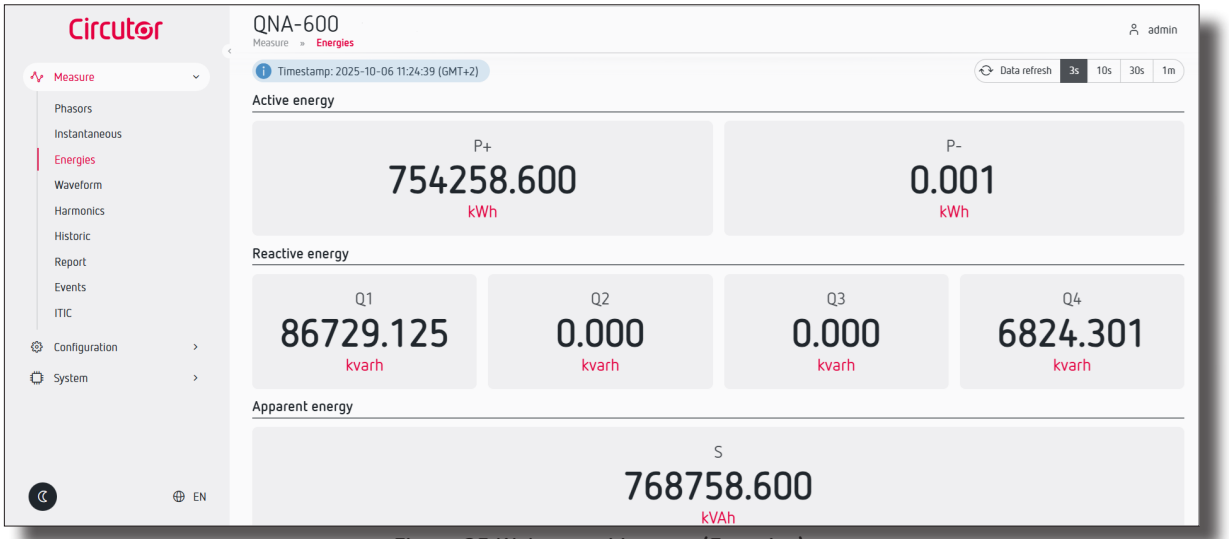


Figure 35:Web page, Measure (Energies).

8.1.4.- WAVEFORM

This section shows the waveforms or RMS values of 1 voltage and current cycle of the **QNA 600, Figure 36**. Depending on the option programmed in sections ***"6.3.8 - WAVEFORM"*** or ***"8.2.3.6 - WAVEFORM"***.

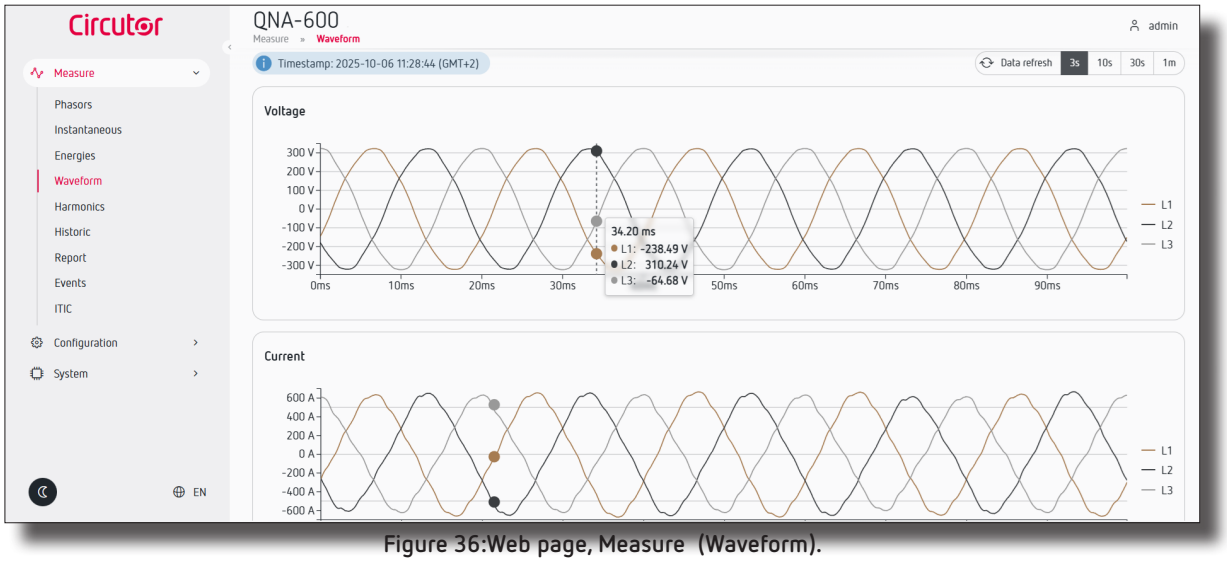


Figure 36:Web page, Measure (Waveform).

8.1.5.- HARMONICS

In this section the harmonics and interharmonics of voltage and current are displayed, **Figure 37**.

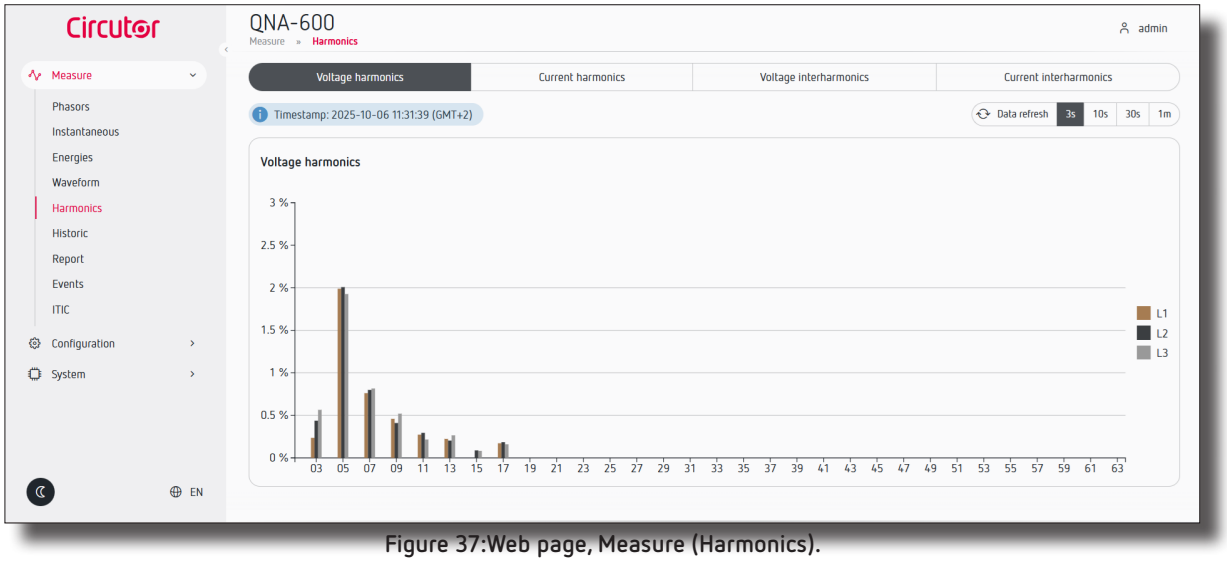


Figure 37:Web page, Measure (Harmonics).

The **QNA 600** represents the harmonic from the source with a positive sign and the % calculated. The harmonic from the load is represented with a negative sign and the % calculated.

If the power harmonic is not large enough or its angle is too close to 90° or 270°, the sign of the % harmonic is positive. (See ***"A.2.12 - VOLTAGE AND CURRENT HARMONICS"***).

8.1.6.- HISTORIC

In this section, it is possible to view the historical records of the values measured by the device, **Figure 38**, by selecting the periodicity and the start and end dates.

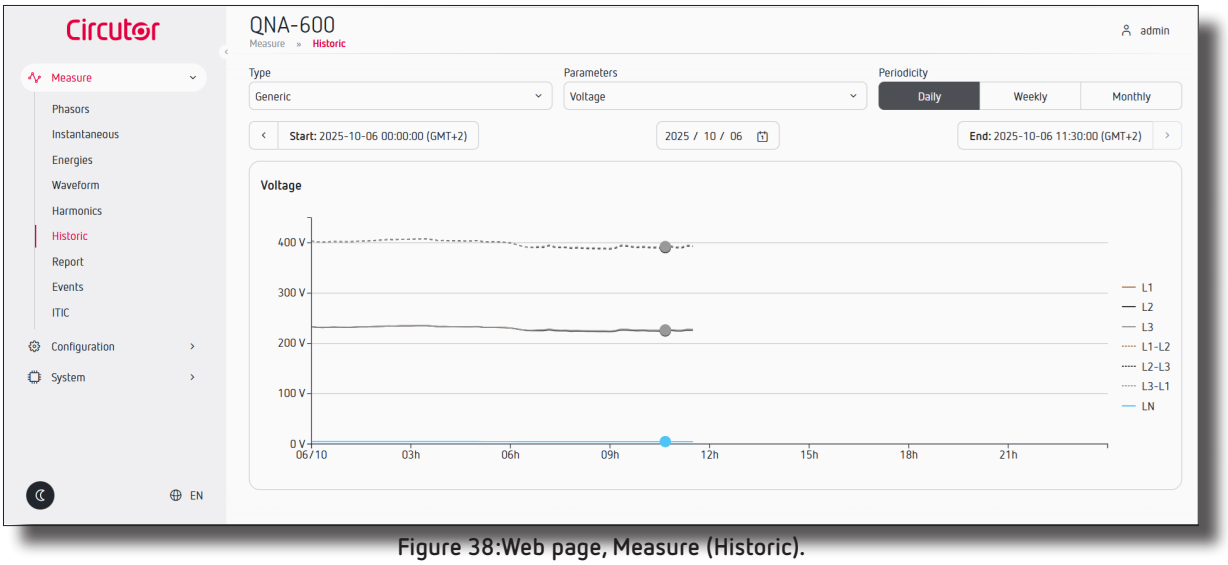


Figure 38:Web page, Measure (Historic).

8.1.7.- REPORT

In this section, it is possible to generate a statistical study in accordance with the **EN 50160** standard, **PQDIF** (Power Quality Data Interchange Format), or the **Código Red de México** over a scheduled time period, **Figure 39.**
The report scheduling can be configured in section ***"8.2.6.- SCHEDULE"***.

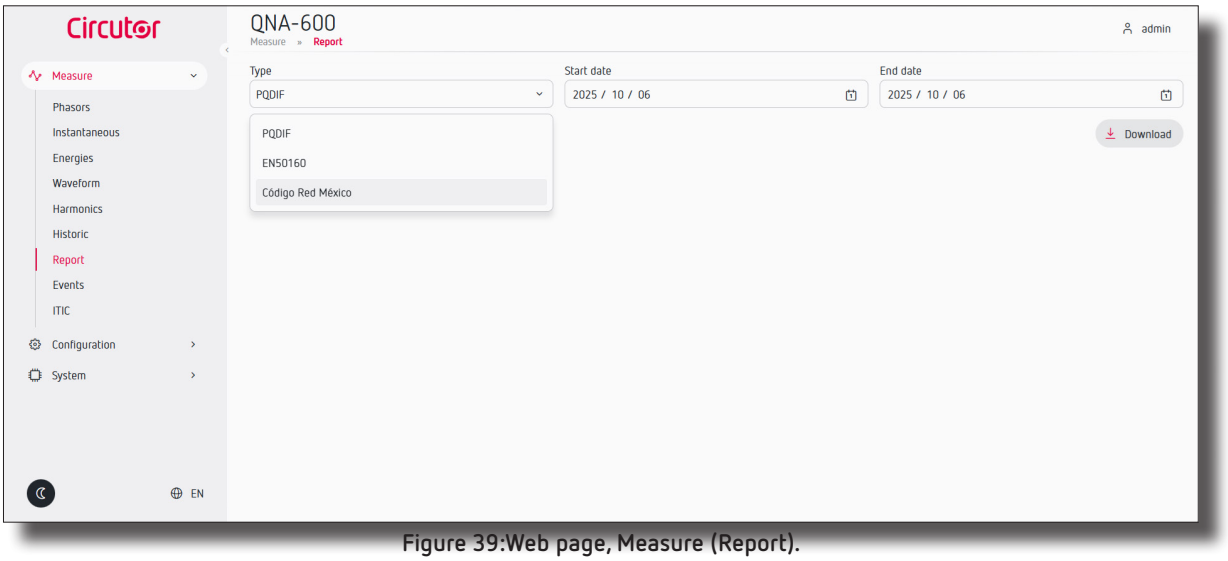


Figure 39:Web page, Measure (Report).

The output file can be a **pdf** in accordance with the EN 50160 standard when the **EN50160** type is selected, a **pqdif** (Power Quality Data Interchange Format) file when the **PQDIF** type is selected, or a pdf when the **Código Red de México** is selected.

8.1.8.- EVENTS

In this section, the measurement events generated in the **QNA 600** are displayed by selecting the event type and the start and end dates, **Figure 40**.

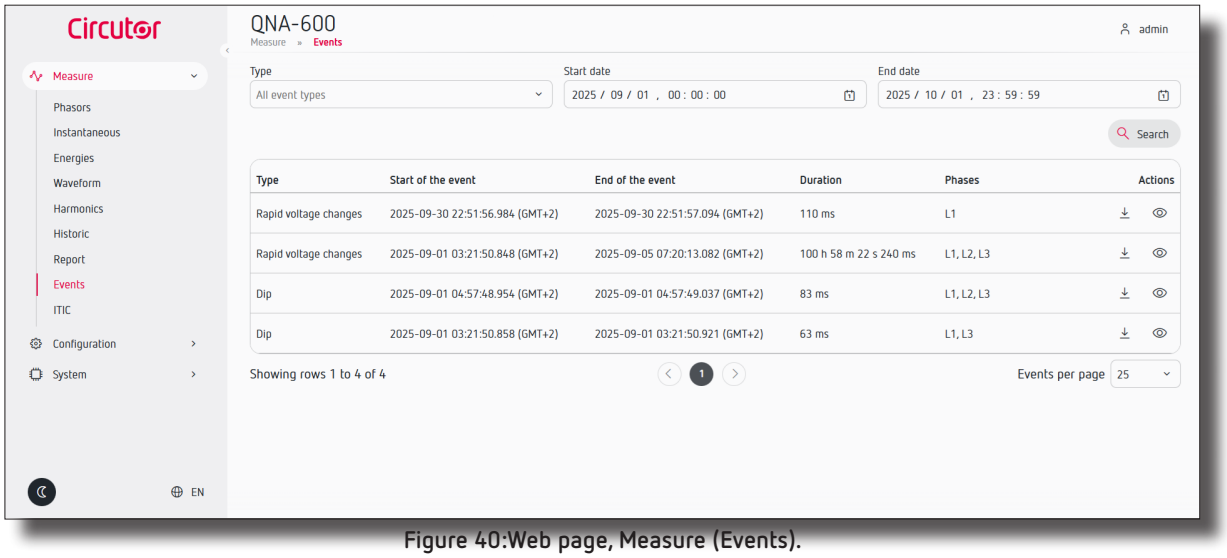


Figure 40:Web page, Measure (Events).

8.1.9.- ITIC

In this section, the ITIC voltage curve is displayed, **Figure 41**.

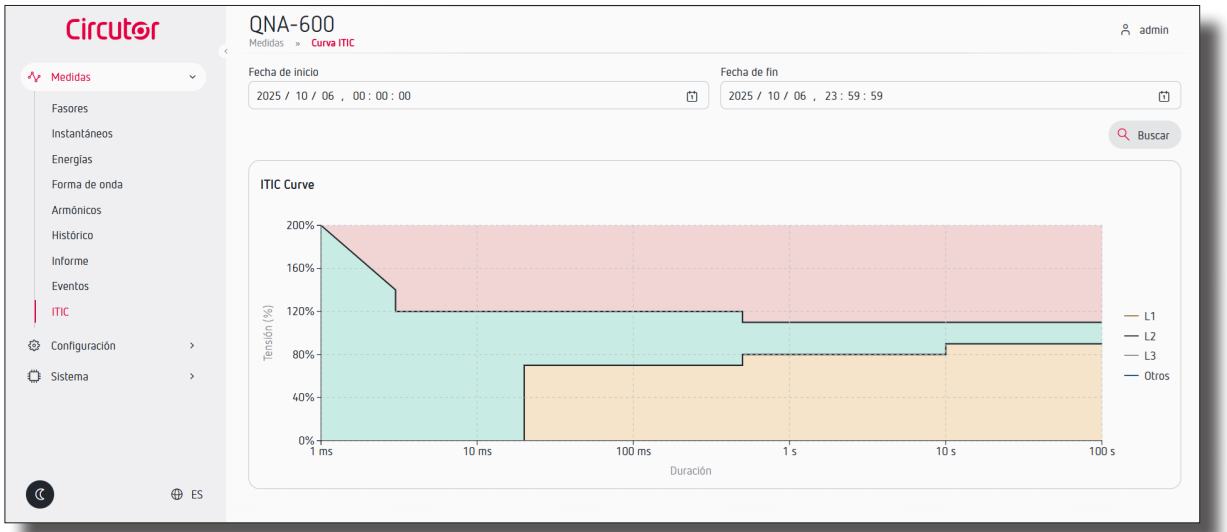


Figure 41:Web page, Measure (ITIC).

8.2.- CONFIGURATION

In the **Configuration** section, the different parameters of the device are configured.

8.2.1.- BIOS

This section is used to set the colors for each line, depending on the regulations in the country where the device is installed, **Figure 42**.

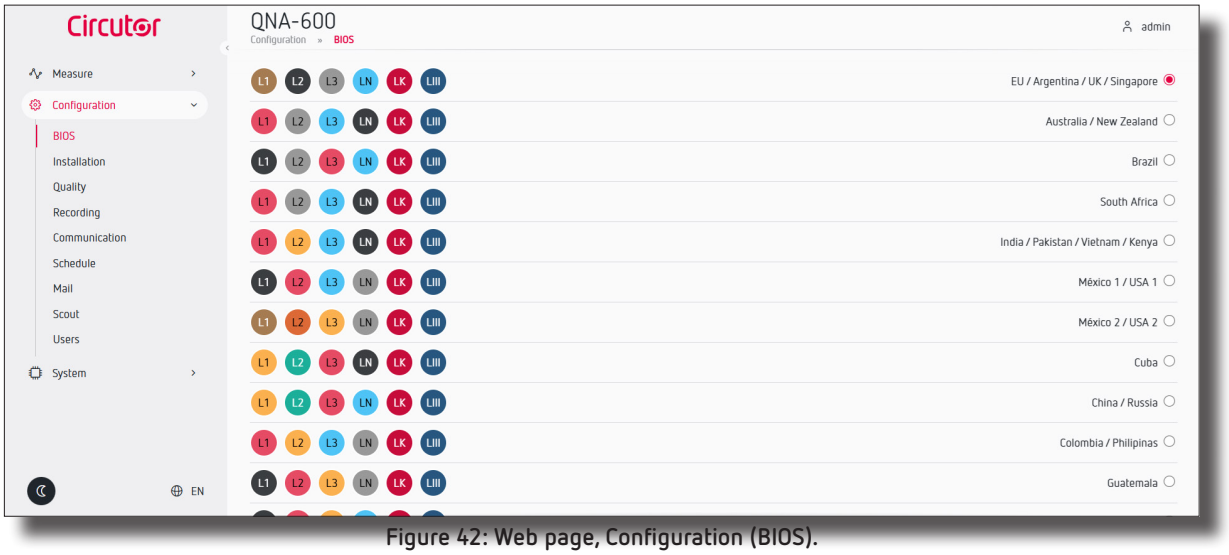


Figure 42: Web page, Configuration (BIOS).

Press **Save** to save the changes made.

8.2.2.- INSTALLATION

In this section the installation parameters of the **QNA 600** are configured, **Figure 43**.



Figure 43:Web page, Configuration (Installation).

8.2.2.1.- CONNECTION

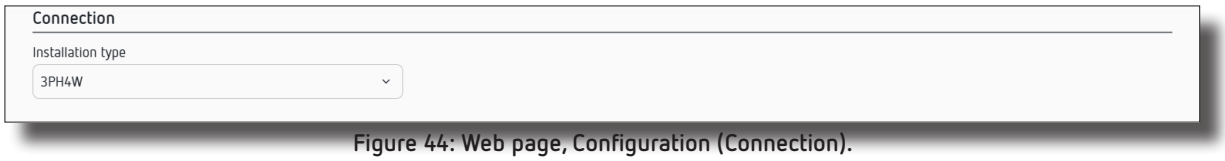


Figure 44: Web page, Configuration (Connection).

✓**Installation type:** configuration of the installation type:

3PH4W, Three-phase network measuring with a 4-wire connection.
3PH3W, Three-phase network measuring with a 3-wire connection.
2PH3W, Two-phase network measuring with a 3-wire connection.
1PH2W, Single-phase network measuring with a 2-wire connection.
ARON, Three-phase network measuring with a 3-wire connection and transformers in Aron connection.

Note: *When the installation type is changed, the database is automatically deleted.*

8.2.2.2.- VOLTAGE TRANSFORMER RATIO

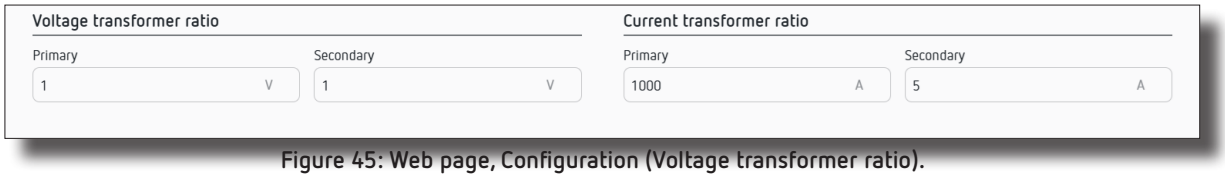


Figure 45: Web page, Configuration (Voltage transformer ratio).

✓**Primary:** voltage primary.
✓**Secondary:** voltage secondary.

8.2.2.3.- CURRENT TRANSFORMER RATIO

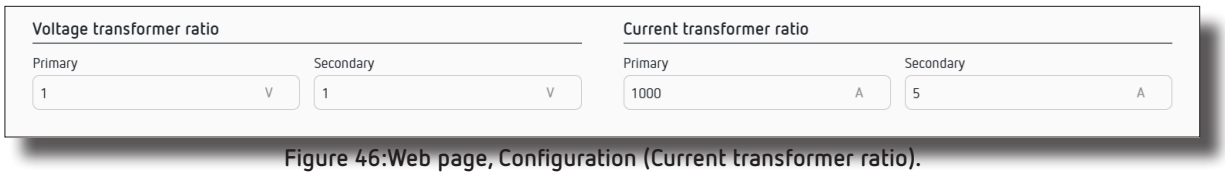


Figure 46:Web page, Configuration (Current transformer ratio).

✓**Primary:** current primary.
✓**Secondary:** current secondary.

8.2.2.4.- NEUTRAL CURRENT TRANSFORMER RATIO

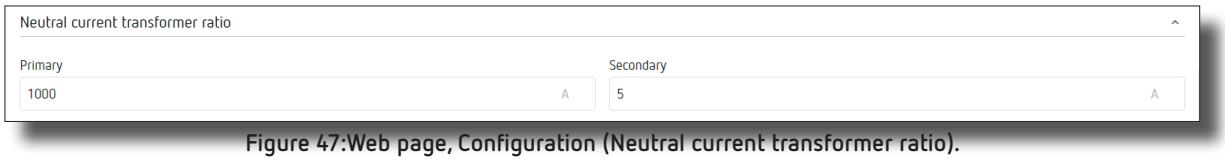


Figure 47:Web page, Configuration (Neutral current transformer ratio).

✓**Primary:** primary of the neutral current transformer.
✓**Secondary:** secondary of the neutral current transformer.

8.2.2.5.- EARTH CURRENT TRANSFORMER RATIO

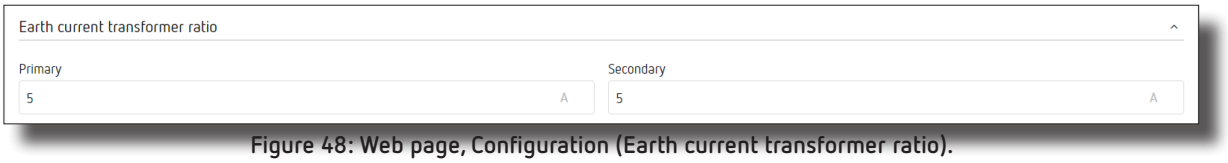


Figure 48: Web page, Configuration (Earth current transformer ratio).

✓**Primary:** primary of the earth current transformer.

✓**Secondary:** secondary of the earth current transformer.

8.2.2.6.- PRIMARY NOMINAL VALUES

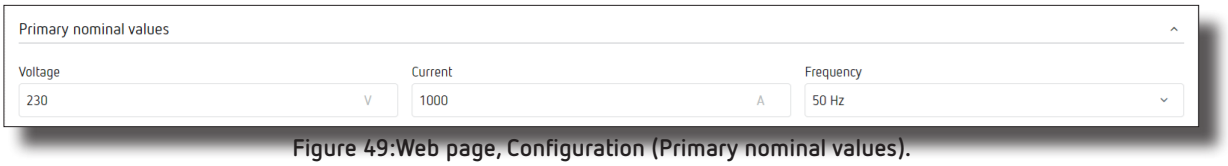


Figure 49:Web page, Configuration (Primary nominal values).

✓**Voltage:** Nominal voltage measured by the **QNA 600**. The value set must be Phase-Phase or Phase-Neutral, depending on the type of installation, but always referenced to the primary. This value is essential to the proper operation of the event log.

Example 1: *In a three-phase, 4-wire (**3PH4W**) installation with a medium-voltage line supply of 20000 V (phase-to-phase). If a 22000/110 voltage transformer is connected, the settings must be:*
***PRIMARY U** (Primary voltage) = 22000 V*
***SECONDARY U** (Secondary voltage) = 110 V*
NOMINAL VOLTAGE *(Nominal voltage) = 22000 / √3 = 11547 V*

Example 2: *In a three-phase, 3-wire (**3PH3W**) installation with a medium-voltage line supply of 20000 V (phase-to-phase). If a 22000/110 voltage transformer is connected, the settings must be:*
***PRIMARY U** (Primary voltage) = 22000 V*
***SECONDARY U** (Secondary voltage) = 110 V*
NOMINAL VOLTAGE *(Nominal voltage) = 22000 V*

✓**Current:** Nominal current being measured by the device, which will be used to set the maximum and minimum % to record disturbances. By default, this value is 5 A. It should be set to the same value as the measurement transformers.

✓**Frequency:** Nominal frequency of the mains being analyzed. This parameter is required to calculate the RMS value of the signal in extreme quality mains.

8.2.2.7.- CURRENT DIRECTION

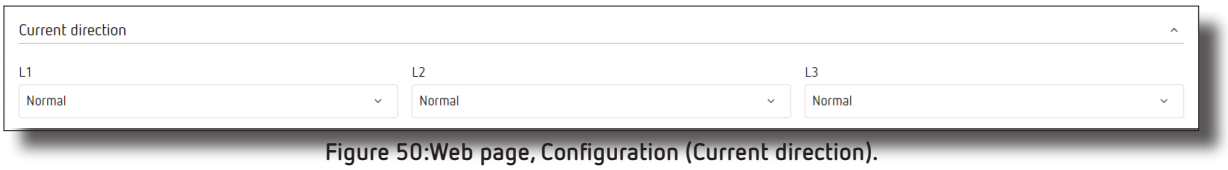


Figure 50:Web page, Configuration (Current direction).

✓**L1:** Select the direction of the current of L1: **Normal** or **Reserved**.

✓**L2:** Select the direction of the current of L2: **Normal** or **Reserved**.

✓**L3:** Select the direction of the current of L3: **Normal** or **Reserved**.

8.2.2.8.- PHASE SEQUENCE

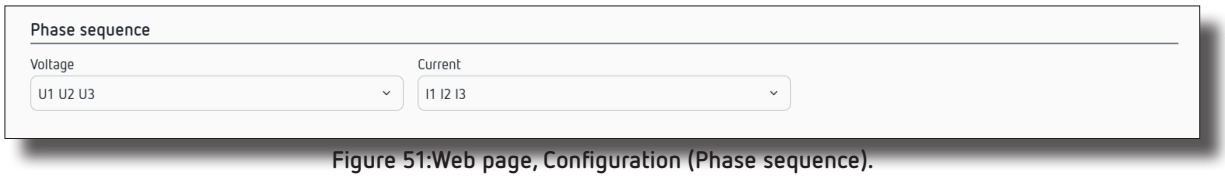


Figure 51:Web page, Configuration (Phase sequence).

✓**Voltage:** Select the phase sequence of the voltage: **U1 U2 U3**, **U1 U3 U2**, **U2 U1 U3**, **U2 U3 U1**, **U3 U2 U1** or **U3 U1 U2**.

✓**Current:** Select the phase sequence of the current: **I1 I2 I3**, **I1 I3 I2**, **I2 I1 I3**, **I2 I3 I1**, **I3 I2 I1** or **I3 I1 I2**.

8.2.2.9.- FULL LOAD CURRENT (I_L)

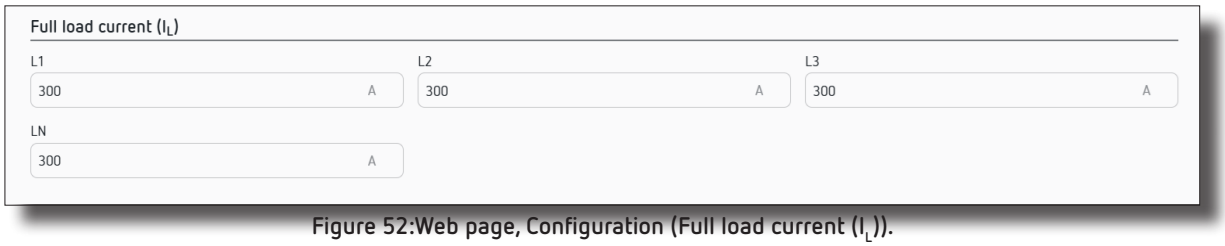


Figure 52:Web page, Configuration (Full load current (I_L)).

✓**L1:** Full load current on L1.

✓**L2:** Full load current on L2.

✓**L3:** Full load current on L3.

✓**LN:** Full load current on LN.

8.2.2.10.- SHORT CIRCUIT CURRENT (I_{cc})

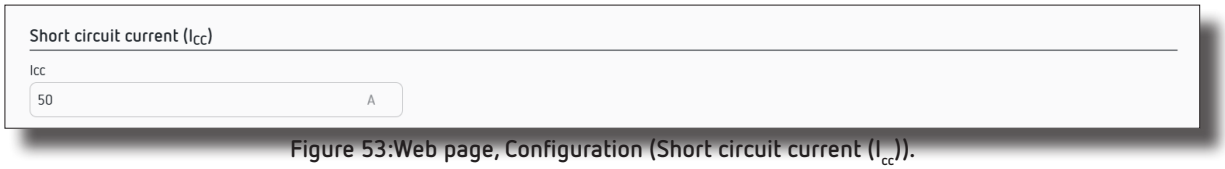


Figure 53:Web page, Configuration (Short circuit current (I_{cc})).

✓**Icc:** Short circuit current.

Press **Save** to save the changes made.

8.2.3.- QUALITY

In this section the quality parameters of the device are configured, **Figure 54**.

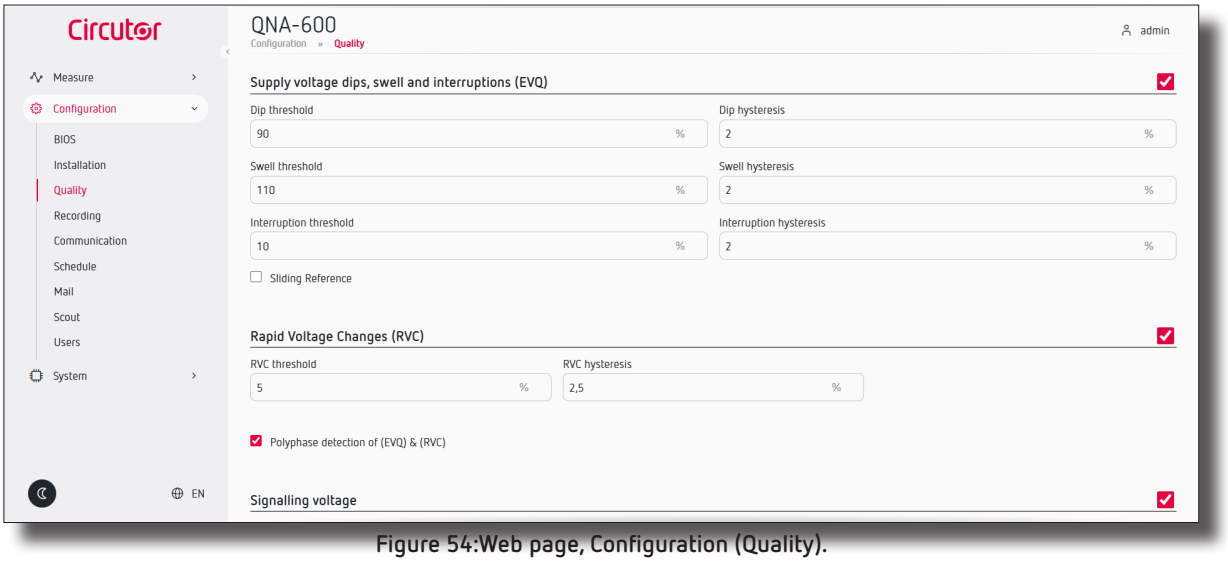


Figure 54:Web page, Configuration (Quality).

8.2.3.1.- SUPPLY VOLTAGE, DIPS, SWELL AMD INTERRUPTIONS (EVQ)

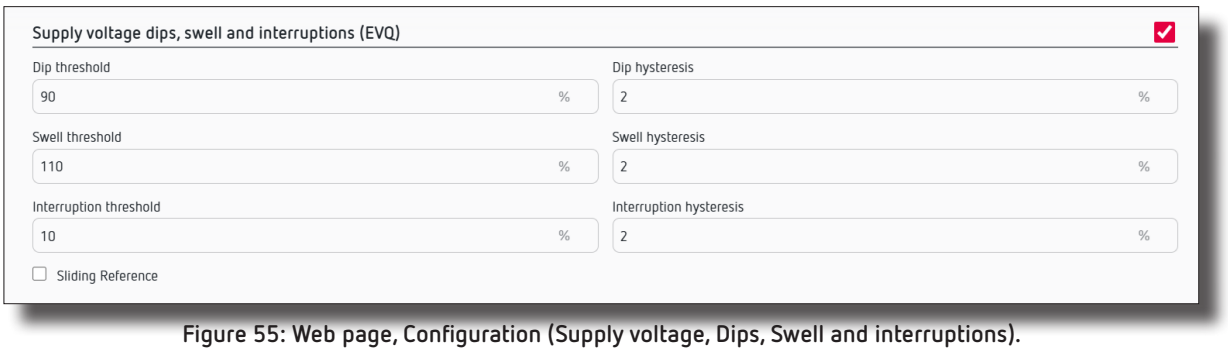


Figure 55: Web page, Configuration (Supply voltage, Dips, Swell and interruptions).

☑ Select to enable the dip voltage, swell and interrupt parameters or not.

✓**Dip threshold:** a dip is defined as a drop in the RMS voltage value below the threshold set in this parameter. The value is set as a % of the nominal voltage value.

✓**Dip hysteresis:** value of the dip hysteresis, so as to make the trip and reset values of the event different. The value is set as a % of the **Dip threshold** value.

✓**Swell threshold:** a swell is defined as a rise in the RMS voltage value above the threshold set in this parameter. The value is set as a % of the nominal voltage value.

✓**Swell hysteresis:** swell hysteresis value, so as to make the trip and reset values of the event different. The value is set as a % of the **Swell threshold** value.

✓**Interruption threshold:** an interruption is defined as a drop in the RMS voltage value below the threshold set in this parameter. The value is set as a % of the nominal voltage value.

✓**Interruption hysteresis:** interruption hysteresis value, so as to make the trip and reset values of the event different. The value is set as a % of the **Interruption threshold** value.

☑ **Sliding Reference:** select to enable the sliding reference or not.
The slider reference is the weighted average voltage value in the 1 minute that precedes a dip or a swell. If the sliding reference voltage is enabled, the voltage levels for detecting a dip or a swell will be calculated based on the threshold percentages with reference to this voltage.

8.2.3.2.- RAPID VOLTAGE CHANGES (RVC)

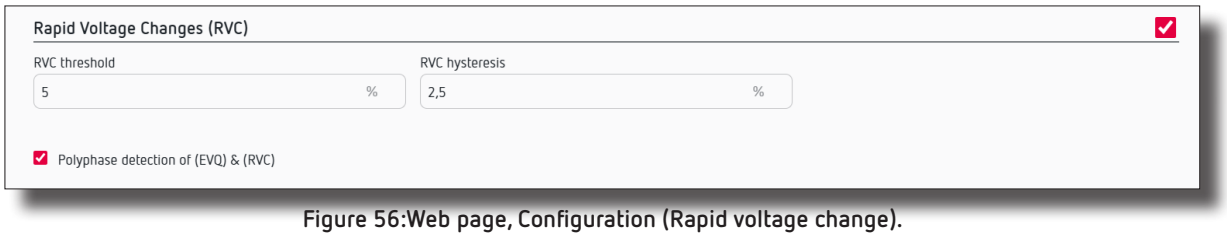


Figure 56:Web page, Configuration (Rapid voltage change).

☑ Select to enable the RVC parameters or not.

✓**RVC threshold:** a rapid voltage change (RVC) is defined as a drop in the RMS voltage value below the threshold set in this parameter. The value is set as a % of the arithmetic mean of the 100 previous Urms ½ values.

✓**RVC hysteresis:** value of the RVC hysteresis, so as to make the trip and reset values of the event different. The value is set as a % of the **RVC threshold** value.

☑ **Polyphase detection of (EVQ) & (RVC):** select to enable polyphase or not.

Polyphase is the polyphase detection of dips, swells, interruptions and RVC. This means that an event in any of the 3 phases, or in more than one simultaneously, will lead to a polyphase event as per the characteristics specified for each event in **IEC 61000-4-30**.

Note: *To achieve a stable measurement voltage close to the nominal voltage, the configuration values must be greater than those programmed for the dip detection. If not, when the device detects a dip, it no longer considers RVC detection.*

8.2.3.3.- SIGNALLING VOLTAGE

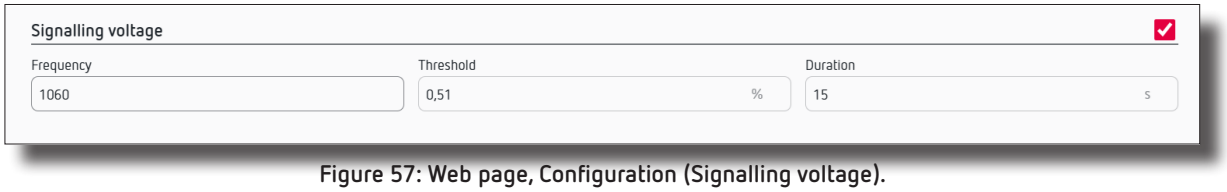


Figure 57: Web page, Configuration (Signalling voltage).

☑ Select to enable signaling voltages through the mains or not.

The transmission of signaling voltages that can travel through the supply mains are usually sent in bursts, applied at non-harmonic frequencies and used to control industrial devices or other devices remotely. The method applied by the **QNA 600** to detect signaling voltages measures the level of a signal voltage for a specified carrier.

✓**Frequency:** Frequency to be observed. It must be less than 3 KHz.

✓**Threshold:** Detection threshold as a % of the Nominal Voltage. It must be higher than 0.3% of the nominal voltage.

✓**Duration:** Length of time during which the specified values are recorded. Up to a maximum of 120 s.

8.2.3.4.- VOLTAGE TRANSIENTS

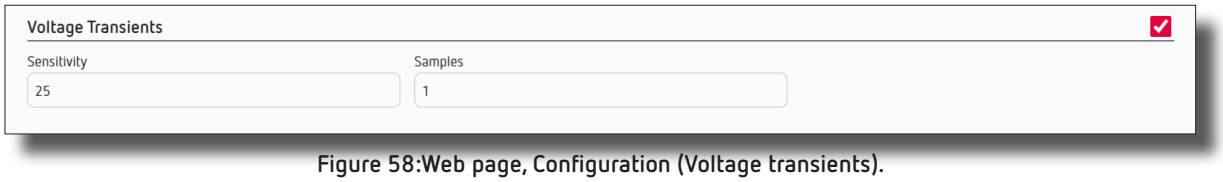


Figure 58:Web page, Configuration (Voltage transients).

☑ Select to enable voltage transients or not.

✓**Sensitivity:** This variable is used to weight the detection level of transients in order to avoid false positives. The value is entered in %, where 100% is the maximum sensitivity and 0% the minimum.

✓**Samples:** Number of samples to be used to detect voltage transients. Possible values: 1... 10.

For more information see ***"4.1.1.- QUALITY PARAMETERS".***

8.2.3.5.- CURRENT TRANSIENTS

The device detects fast and slow current transients independently, see ***"4.1.1 - QUALITY PARAMETERS".***

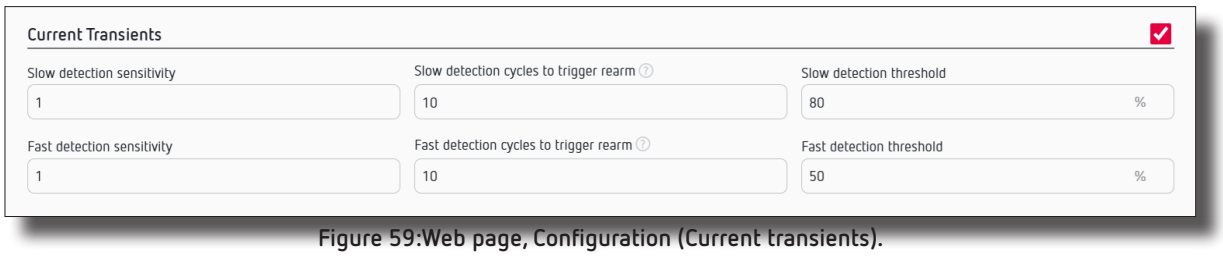


Figure 59:Web page, Configuration (Current transients).

☑ Select to enable current transients or not.

Parameters to calculate slow transients:

✓**Slow detection sensitivity:** value used to dampen sensitivity to false positives. ***Possible values:*** *1 ... 4.*

✓**Slow detection cycles to trigger rearm:** Number of cycles until the end of the transient that are inhibited to detect new current transients. ***Possible values:*** **1 ... 10.**

✓**Slow detection threshold:** Threshold value for detecting slow transients as a %. The value is set as a % of the nominal voltage value.

Parameters to calculate fast transients:

✓**Fast detection sensitivity:** value used to dampen sensitivity to false positives. ***Possible values:*** *1 ... 4.*

✓**Fast detection cycles to trigger rearm:** Number of cycles until the end of the transient that are inhibited to detect new current transients. ***Possible values:*** **1 ... 10**.

✓**Fast detection threshold:** Threshold value for detecting fast transients as a %. The value is set as a % of the nominal voltage value.

8.2.3.6.- WAVEFORM

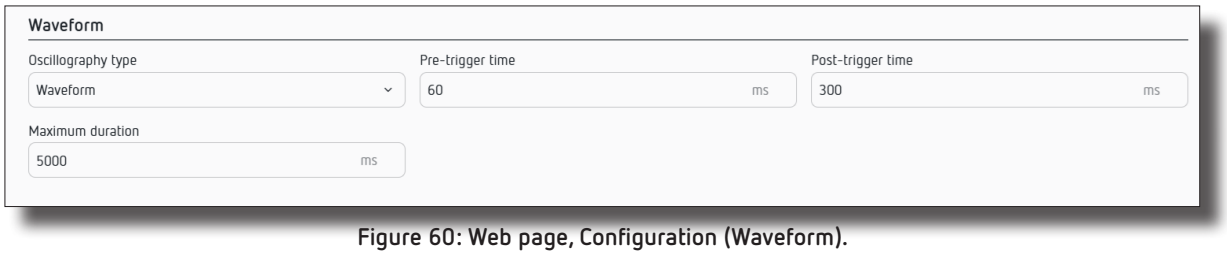


Figure 60: Web page, Configuration (Waveform).

✓**Oscillography type:** Select between: **Disabled, Waveform** or **RMS.**

- In **Waveform** mode, the device records the waveform of the input signal.
- In **RMS** Mode, the device records the 1-cycle RMS values, updated every ½ cycle.

✓**Pre-trigger time:** recording time before the trigger condition.
✓**Post-trigger time:** recording time after the trigger condition.
✓**Maximum duration:** Maximum waveform recording time (pre-trigger time + post-trigger time).

8.2.3.7.- THD/TDD HARMONICS

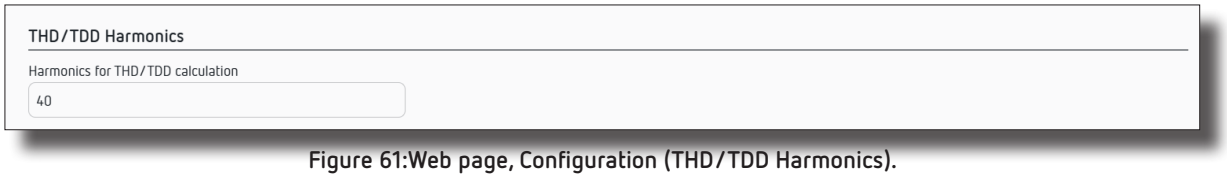


Figure 61:Web page, Configuration (THD/TDD Harmonics).

✓**Harmonics for THD/TDD calculation:** No. of harmonics used to calculate the THD.

Press **Save** to save the configuration and send it to the device.

8.2.4.- RECORDING

The parameters to record in the database are selected on this screen, **Figure 62**. Application note **M294E0101-03-xxx** details the APIs (*Application Programming Interface*) that can be used to access the database.
The API can also be downloaded from the link:

https://docs.circutor.com/docs/QNA_REST_API.yaml

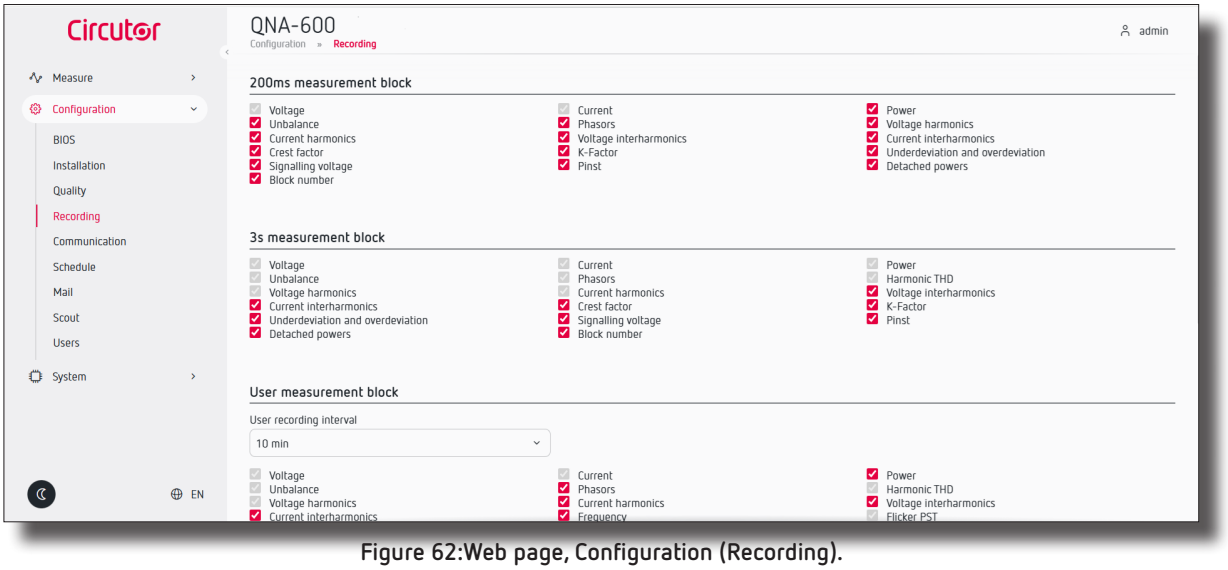


Figure 62:Web page, Configuration (Recording).

Depending on the section selected, the device records certain parameters, see **Table 45.**

Table 45: Parameters recorded based on the section.

☑ Section	Parameters	
☑ **Voltage** (7)	Voltage Phase - Neutral	Voltage Phase - Phase
	Voltage Earth - Neutral	
☑ **Current** (7)	Current	Leakage current
☑ **Power** (7)	Active power (P)	Fundamental Active Power (P_1)
	Reactive power (Q)	Nonactive power (N)
	Apparent power (S)	Fundamental Apparent Power (S_1)
	Power Factor (PF)	Fundamental Power Factor (DPF)
☑ **Unbalance** (7)	Positive sequence component in voltage	Negative sequence component in voltage
	Zero sequence component in voltage	Voltage unbalance
	Voltage asymmetry	Positive sequence component in current
	Negative sequence component in current	Zero sequence component in current
	Current unbalance	Current asymmetry
☑ **Phasors** (7)	Voltage phasors	Current phasors
☑ **Crest factor**	Crest factor Voltage	Crest factor current
☑ **K-Factor**	K-factor	
☑ **Underdeviation and overdeviation**	Underdeviation percentage	Overdeviation percentage
	Underdeviation voltage	Overdeviation voltage
☑ **Signalling Voltage**	Network signal transmission voltage	Counter values of transmission of signals through the network over the threshold
	Counter values of transmission of signals through the network below the threshold	
☑ **Pinst**	Instantaneous Flicker	

Table 45 (Continued): Parameters recorded based on the section.

☑ Section	Parameters	
☑ Detached powers	Harmonic Active Power	Current distortion power
	Voltage distortion power	Harmonic Distortion Reactive Power
	Effective Distortion Reactive Power	Fundamental Apparent Effective Power
	Unbalance Apparent Power	Nonfundamental Apparent Power
	Nonfundamental Apparent Effective Power	Harmonic Apparent Power
	Inductive Nonactive power	Inductive Reactive Power
	Capacitive Nonactive power	Capacitive Reactive Power
	Active Power Consumed	Active power Generated
	Fundamental Active Power consumed	Fundamental Active Power generated
	Harmonic Active Power Consumed	Harmonic Active Power generated
	Reactive Power Consumed	Reactive Power Generated
	Fundamental Reactive power Consumed	Fundamental Reactive power generated
	Inductive Reactive Power Consumed	Inductive Reactive Power Generated
	Fundamental Inductive Reactive Power consumed	Fundamental Inductive Reactive Power generated
	Capacitive Reactive Power Consumed	Capacitive Reactive Power Generated
	Fundamental Capacitive Reactive Power Consumed	Fundamental Capacitive Reactive Power generated
☑ Detached powers	Inductive Power Factor Consumed	Inductive Power Factor Generated
	Fundamental Inductive Power Factor Consumed	Fundamental Inductive Power Factor Generated
	Capacitive Power Factor Consumed	Capacitive Power Factor Generated
	Fundamental Capacitive Power Factor Consumed	Fundamental Capacitive Power Factor Generated
☑ Harmonics THD (7)	Voltage THD	Current THD
	Current TDD	
☑ Voltage harmonics (7)	Voltage harmonics	
☑ Current harmonics (7)	Current harmonics	
☑ Interharmonic voltage	Voltage interharmonics	
☑ Interharmonic current	Current interharmonics	
☑ Frequency (7)	Frequency	
☑ Flicker PST (7)	Short duration Flicker	
☑ Block number	Block counter 10/12 cycles	
ENERGY METER	Three-phase active energy consumed	Three-phase active energy generated
	Fundamental three-phase reactive energy in Q1, Q2, Q3, Q4	Three-phase apparent energy

(7) Parameters recorded by default in the database.

Press **Save** to save the configuration and send it to the device.

8.2.5.- COMMUNICATION

In this section, the communication parameters of the device are configured, **Figure 63**.



Figure 63:Web page, Configuration (Communication).

8.2.5.1.- DNS / NTP

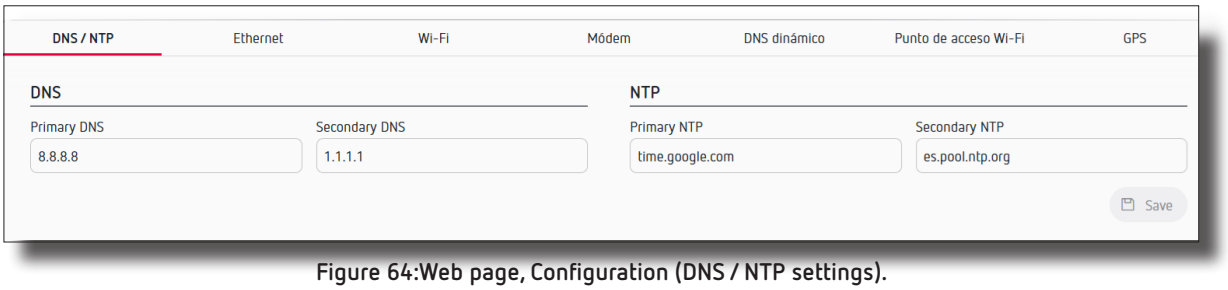


Figure 64:Web page, Configuration (DNS / NTP settings).

DNS

✓**Primary DNS:** primary DNS server address.
✓**Secondary DNS:** secondary DNS server address.

NTP

✓**Primary NTP:** address of the clock synchronization protocol, Network Time Provider.
✓**Secondary NTP:** secondary address of the Network Time Provider, in case the primary NTP fails.

Press **Save** to save the configuration and send it to the device.

8.2.5.2.- ETHERNET

Configuration of the Ethernet communications of the **Rear port** (located on the back of the device) and the **Front port** (located on the front of the device), **Figure 65**.

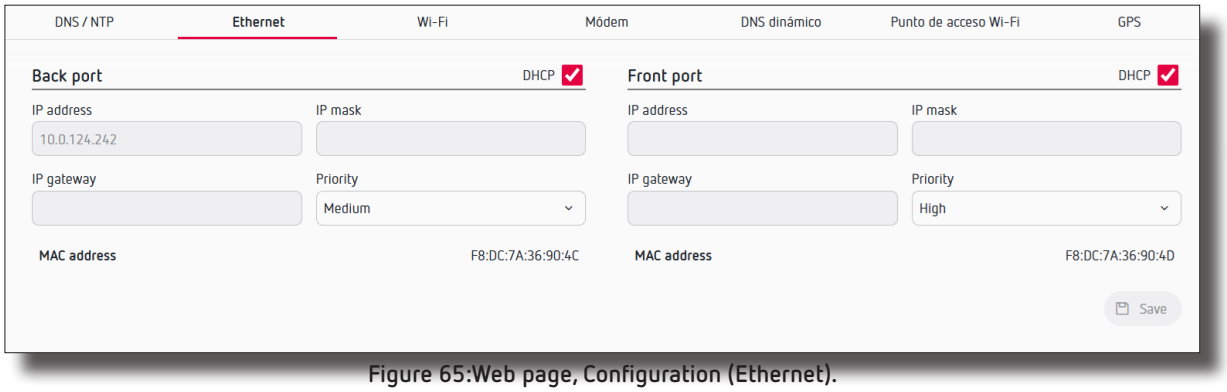


Figure 65:Web page, Configuration (Ethernet).

DHCP ☑**:** If DHCP is enabled, the IP address is dynamically assigned by a central server and no further parameters need to be configured.

If this option is disabled, the IP address is fixed and the following parameters need to be configured:

✓**IP Address:** IP address.
✓**IP mask:** IP mask.
✓**IP gateway:** gateway.
✓**Priority:** selects the priority of Ethernet communications when connecting to the internet. If the priorities of all the interfaces (Ethernet, Wi-Fi and modem) are the same, the **QNA 600** connects to the internet with the first interface that has a connection.
✓**MAC address:** MAC address of the device, parameter not configurable.

Press 🖫 **Save** to save the configuration and send it to the device.

8.2.5.3.- WI-FI

Configuration of Wi-Fi communications, **Figure 66**.

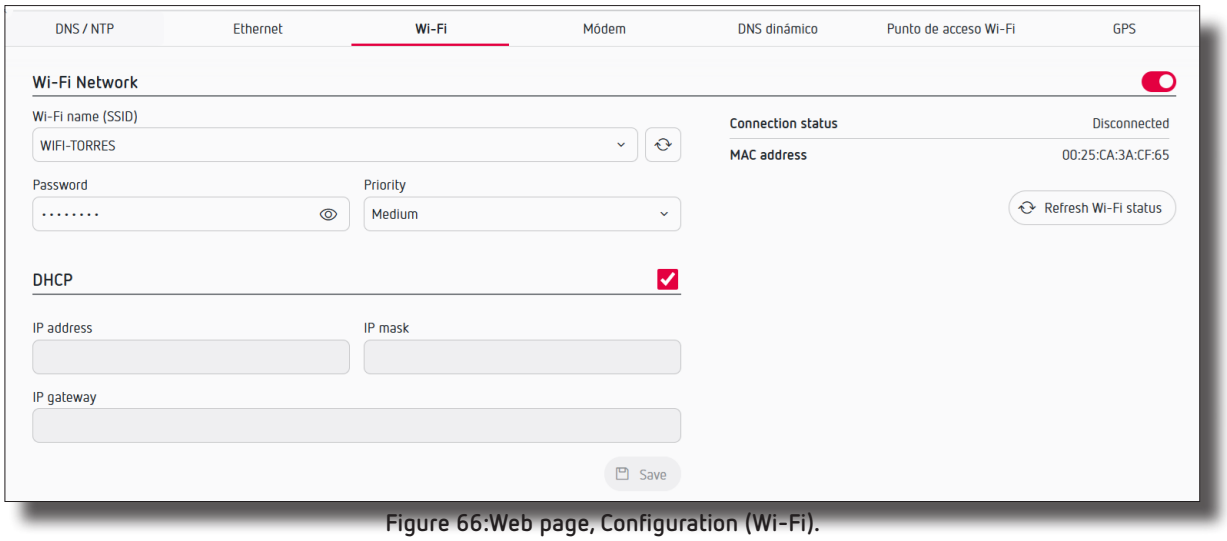


Figure 66:Web page, Configuration (Wi-Fi).

Wi-Fi Network : Select to enable Wi-Fi communications or not. If enabled, the following parameters need to be configured:

✓**Wi-Fi name (SSID):** Wi-Fi network name.
✓**Password:** Network access password.
✓**Priority:** selects the priority of Wi-Fi communications when connecting to the internet. If the priorities of all the interfaces (Ethernet, Wi-Fi and modem) are the same, the **QNA 600** connects to the internet with the first interface that has a connection.
✓**Connection Status:** Indicates whether the interface is connected to the internet or not.
✓**MAC address:** MAC address of the device, parameter not configurable.

Press **Refresh Wi-Fi status** to refresh the Wi-Fi status.

DHCP ☑ : If DHCP is enabled, the IP address is assigned dynamically by a central server and no further parameters need to be configured.

If this option is disabled, the IP address is fixed and the following parameters must be configured:

✓ **IP address:** IP address, non-configurable parameter.
✓**IP mask:** IP mask, non-configurable parameter.
✓**IP gateway:** gateway, non-configurable parameter.

Press **Save** to save the configuration and send it to the device.

8.2.5.4.- MODEM

Modem configuration, **Figure 67**.

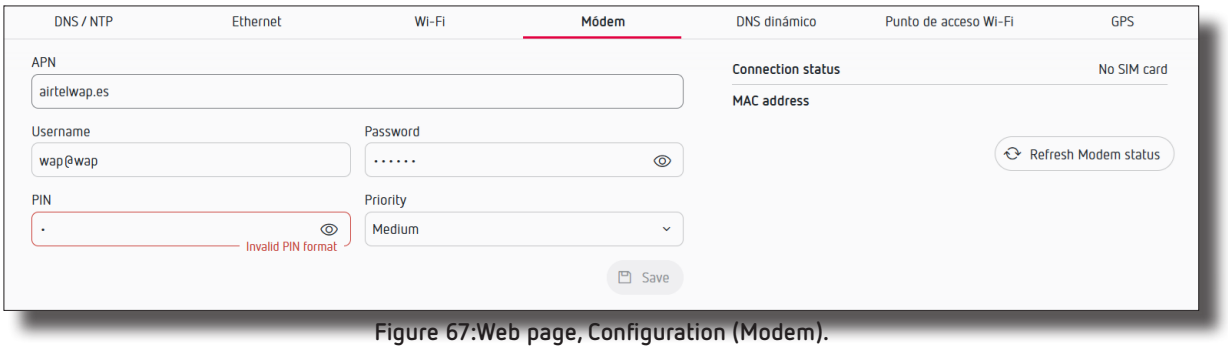


Figure 67:Web page, Configuration (Modem).

✓**APN:** Access point name.
✓**Username:** Username.
✓**Password:** Access password.
✓**PIN:** PIN code of the modem.
✓**Priority:** selects the priority of modem communications when connecting to the internet. If the priorities of all the interfaces (Ethernet, Wi-Fi and modem) are the same, the **QNA 600** connects to the internet with the first interface that has a connection.

✓**Connection Status:** The status of the modem is displayed.
✓**MAC address:** device MAC address, non-configurable parameter.

Press **Refresh Modem status** to update the modem status.

Press **Save** to save the configuration and send it to the device.

8.2.5.5.- DYNAMIC DNS

Dynamic DNS server configuration, **Figure 68**.

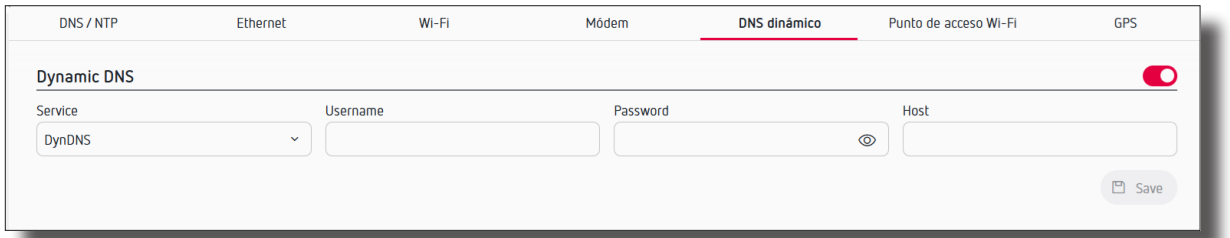


Figure 68: Web page, Configuration (DYNAMIC DNS).

Dynamic DNS : Select to enable a dynamic DNS or not. If enabled, the following parameters need to be configured:

✓**Service:** Select the type of service: DnyDNS, DNS-O-Matic, No-IP.
✓**Username:** DNS server username.
✓**Password:** Access password to the DNS server.
✓**Host:** Server host.

Press **Save** to save the configuration and send it to the device.

8.2.5.6.- Wi-Fi ACCESS POINT

Wi-Fi access point configuration, **Figure 69**.

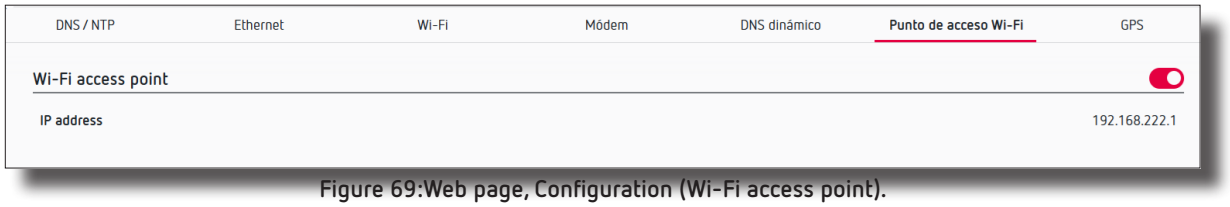


Figure 69:Web page, Configuration (Wi-Fi access point).

Wi-Fi access point : Enable or disable the device as a Wi-Fi access point.

✓**IP address:** IP address of the device, non-configurable parameter.

8.2.5.7.- GPS

In this section, the GPS to be used is selected, **Figure 70**.

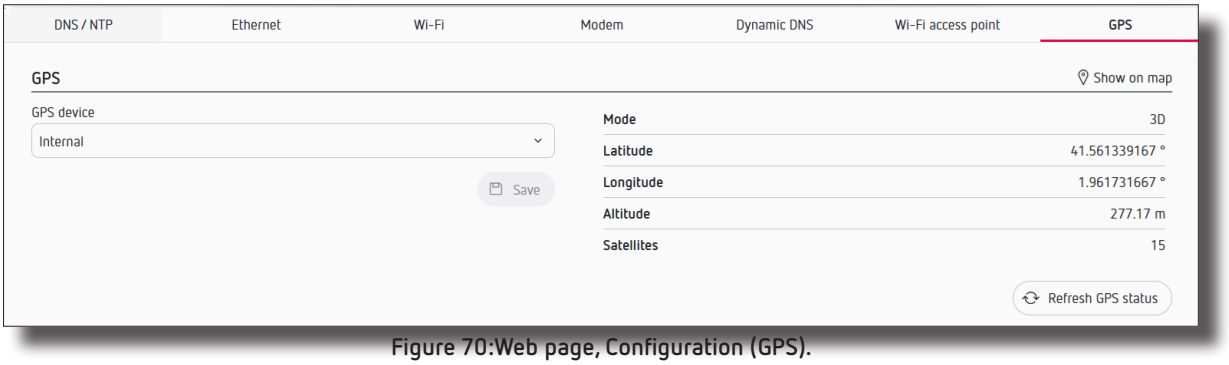


Figure 70:Web page, Configuration (GPS).

✓**GPS device:** Select whether the internal or external GPS is used.

Press ↻ **Refresh GPS status** to update the GPS status.

Press 🖫 **Save** to save the configuration and send it to the device.

8.2.6.- SCHEDULE

In this section you can schedule the generation of reports, **Figure 71**.

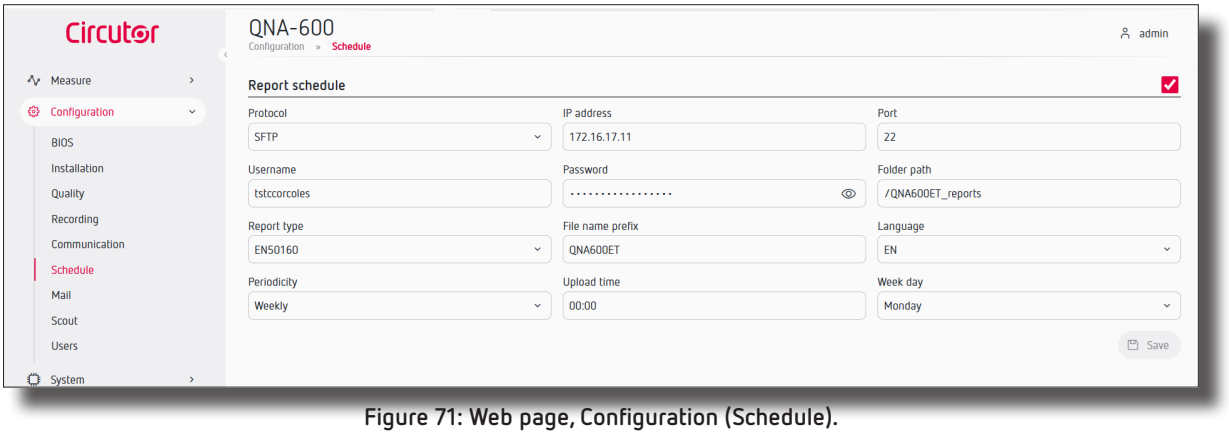


Figure 71: Web page, Configuration (Schedule).

Report schedule: ☑ Select to enable report scheduling or not. If they are enabled, the following parameters must be configured:

✓**Protocol:** Protocol to use for generating the report: **FTP** (File Transfer Protocol) or **SFTP** (Secure File Transfer Protocol).

✓**IP address:** IP address of the server where the reports are sent.

✓**Port:** Server port.

✓**Username:** Server user.

✓**Password:** Server user password.

✓**Folder path:** Server path.

✓**Report type:** Select the report type: **PQDIF, EN50160** or **Código Red México.**
The output file can be a **pdf** in accordance with the EN50160 standard when the **EN50160** type is selected, a **pqdif** (Power Quality Data Interchange Format) file when the **PQDIF** type is selected, or a **pdf** when the **Código Red México** is selected.

✓**File name prefix:** Prefix attached to the name of the report that is sent.
✓**Language:** Select the file language: **ES** (Spanish) o **EN** (English).
✓**Periodicity:** Periodicity of report generation: Daily, Weekly or Monthly.
✓**Upload time:** Time of sending the reports.
✓**Week day:** Day of the week for report delivery.

Press **Save** to save the configuration and send it to the device.

8.2.7.- MAIL

In this section, it is possible to schedule the sending of automatic emails, **Figure 72**.

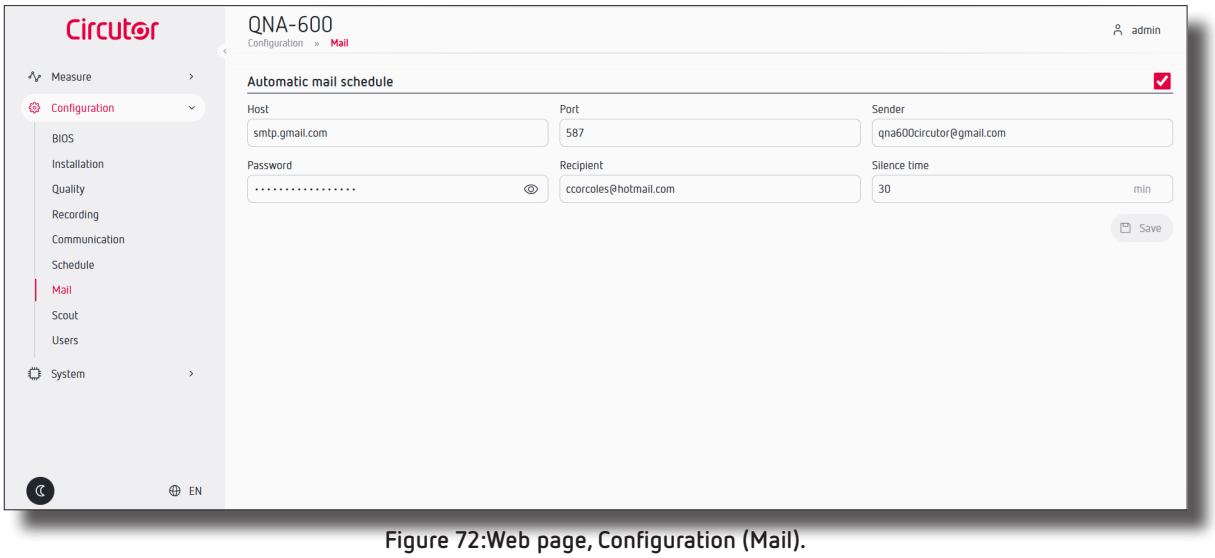


Figure 72:Web page, Configuration (Mail).

Automatic mail schedule: ☑ Select whether to enable or disable the sending of automatic emails. If enabled, the following parameters must be configured:

✓**Host:** Mail server host.
✓**Port:** Server port.
✓**Sender:** Email address of the sender.
✓**Password:** User password.
✓**Recipient:** Email address of the recipient.
✓**Silence time:** Minimum time interval between successive emails.

Press **Save** to save the configuration and send it to the device.

8.2.8.- SCOUT

In this section, the device's connection to the **Scout** platform can be programmed, **Figure 73**.

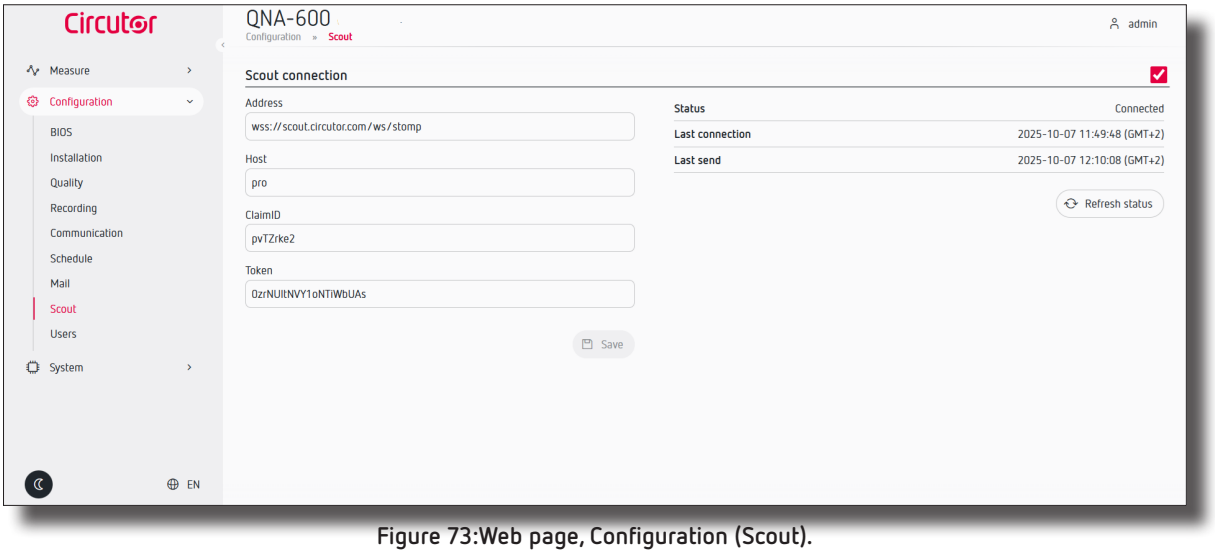


Figure 73:Web page, Configuration (Scout).

Scout connection: Select whether to enable the **QNA 600** connection to the platform. If this option is enabled, the following parameters must be configured:

✓**Address:** Platform URL.
✓**Host:** Domain of the server that manages communications.
✓**ClaimID:** Unique device identifier on the platform.
✓**Token:** Authorization key for communicating with the platform.
✓**Status:** Connection status with the platform.
✓**Last connection:** Date and time of the last connection.
✓**Last send:** Date and time of the last data transmission.

Press **Refresh status** to update the connection status.

Press **Save** to save the configuration and send it to the device.

8.2.9.- USERS ADMINISTRATION

The permissions for the various **QNA 600** users can be administered here, and new users can be created, **Figure 74**.

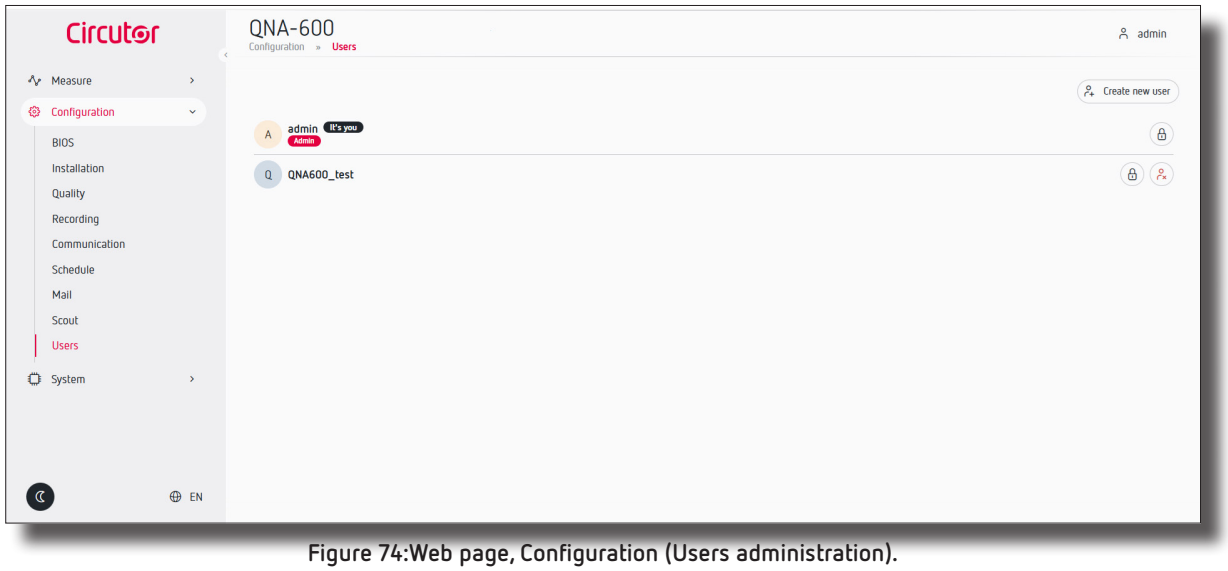


Figure 74:Web page, Configuration (Users administration).

8.3.- SYSTEM

The **System** section shows the information on the device, and it can be updated and rebooted.

8.3.1.- INFO

In this section you can view or modify the device information, **Figure 75**.

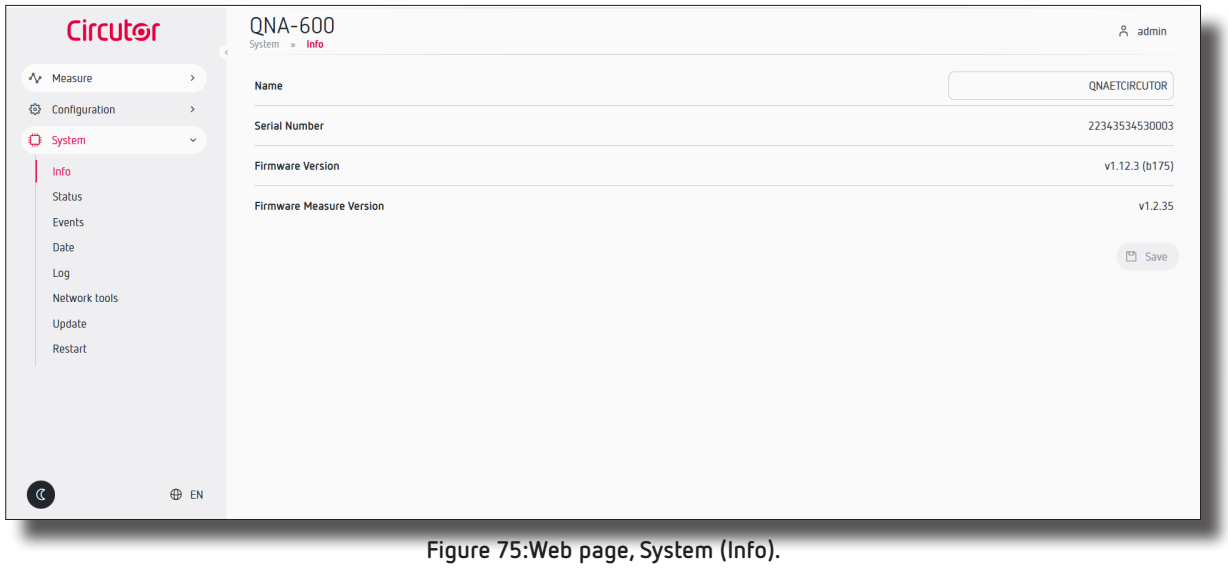


Figure 75:Web page, System (Info).

✓**Name:** name of the device.

✓**Serial number:** device serial number.

✓**Firmware Version:** firmware version of the device.

✓**Firmware Measure Version:** measurement software version.

Press **Save** to save the configuration and send it to the device.

8.3.2.- STATUS

This section shows information on the status of the device, **Figure 76**.

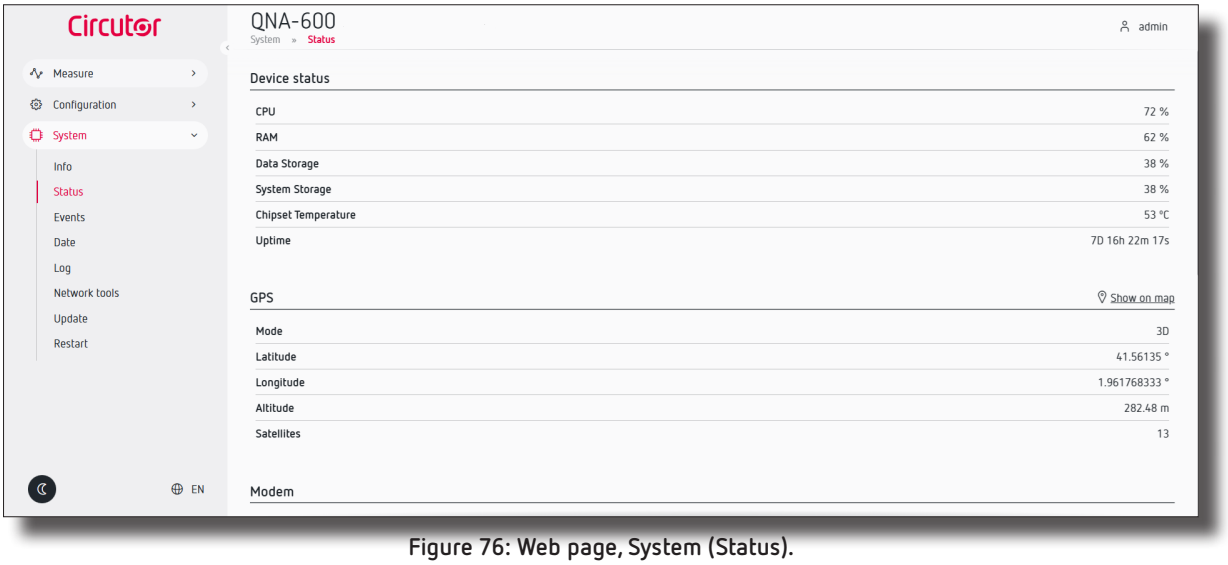


Figure 76: Web page, System (Status).

8.3.3.- EVENTS

This section shows the system events that were generated in the **QNA 600** on a specific date, **Figure 77**.

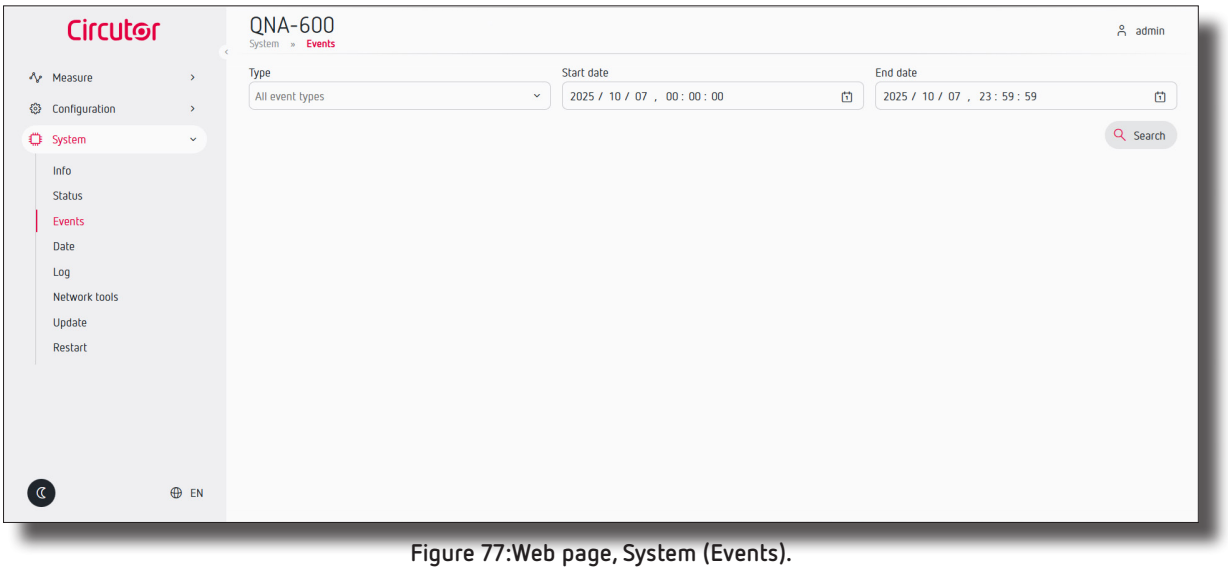


Figure 77:Web page, System (Events).

✓**Type:** Select from the available system events, **Table 46**:

Table 46: Event types.

Type		
Possible values	All event types	Delete database
	Start	GPS synchronisation
	Shutdown	No GPS synchronisation
	Battery on	Export connected
	Battery off	Firmware update successful
	Configuration change	Firmware update failed

✓**Start date:** Start date of the events.
✓**End date:** End date for event display.

Press **Search** to start the event search.

8.3.4.- DATE

In this section you configure the time zone, date and time of the device, **Figure 78**.

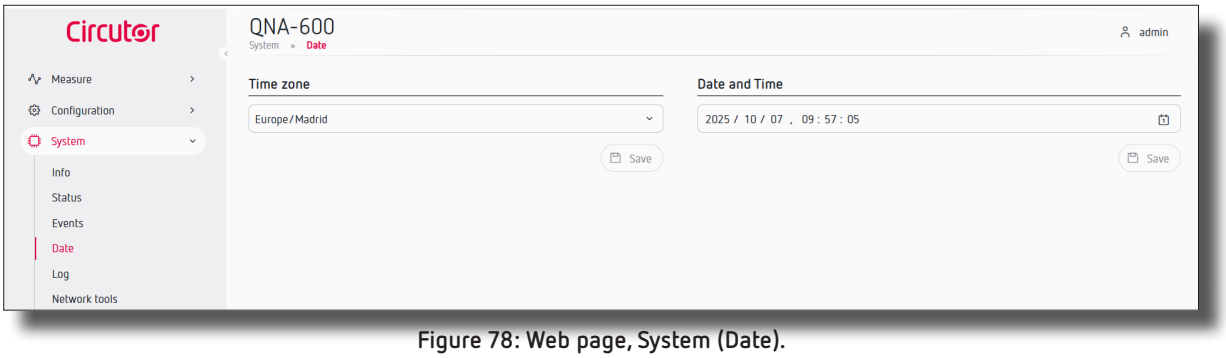


Figure 78: Web page, System (Date).

✓**Time zone:** Time zone where the device is located.
✓**Date and Time:** Date and Time of the device.

Press **Save** to save the configuration and send it to the device.

8.3.5.- LOG

All the events that occur on the device are recorded in this section, **Figure 79**.

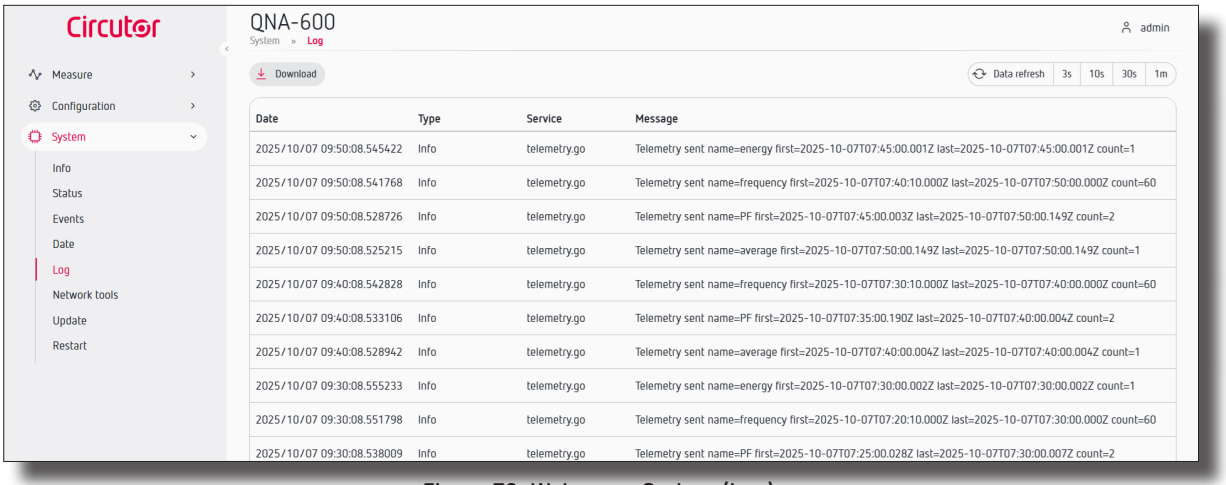


Figure 79: Web page, System (Log).

8.3.6.- NETWORK TOOLS

In this section, the network status is displayed, **Figure 80**.

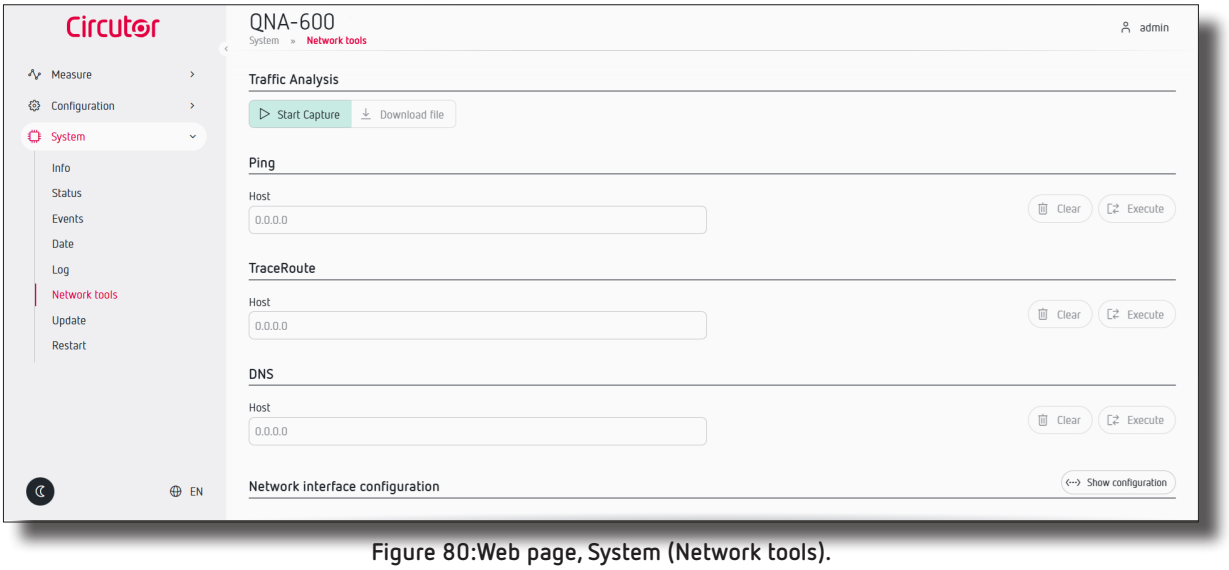


Figure 80:Web page, System (Network tools).

Traffic Analysis

Press ▷ **Start capture** to start a network traffic analysis.
Press ↓ **Download file** to download the network traffic analysis.

Ping

✓**Host:** Enter an IP address or a web address to check the device connection to the web or to an IP address.

This tool is useful for checking the device connection to the **Scout** platform.

Press **Execute** to start the check.

Trace Route

✓**Host:** Enter an IP address or a web address to view the path followed by the data from the device to the Internet server.

Press **Execute** to start the check.

DNS

✓**Host:** Enter a domain name (DNS) to translate it into its IP address.

Press **Execute** to start the check.

Network Interface Configuration

Press **Show configuration** to display the network interface configuration.

Routing Table

Press **Show table** to display the routing table.

Remote access for support (SSH)

Remote access for support (SSH): Select to enable the SSH port for remote support access.

8.3.7.- UPGRADE FIRMWARE

In this section, it is possible to update the device firmware, **Figure 81**.

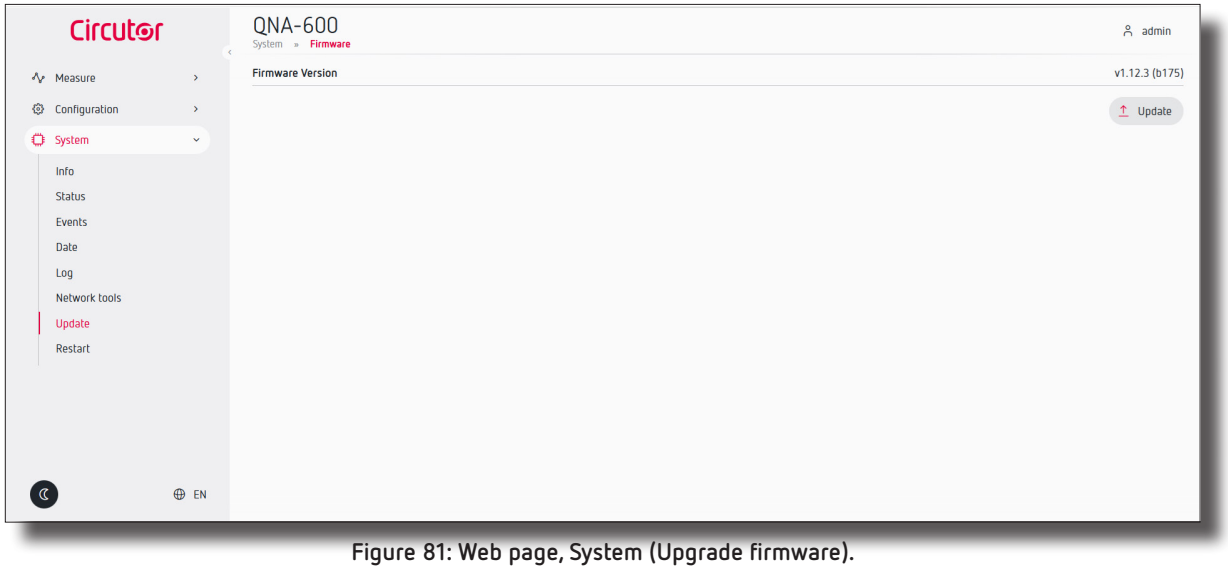


Figure 81: Web page, System (Upgrade firmware).

✓**Firmware version:** firmware version.

Press **Update** to start updating the device.

8.3.8.- RESTART

The device can be rebooted in this section, **Figure 82**.

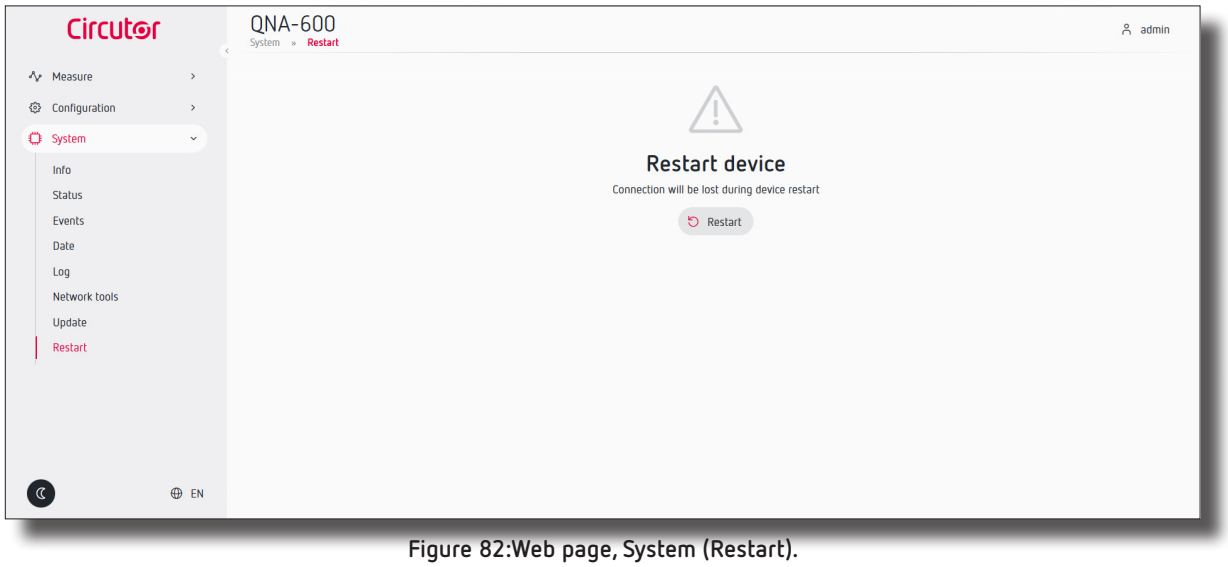


Figure 82:Web page, System (Restart).

9.- TECHNICAL FEATURES

AC Power supply	
Rated voltage	180 ... 300 V ~
Frequency	50 ... 60 Hz
Consumption	15 ... 25 VA
Consumption of the device while charging the battery	29.74 ... 38.92 VA
Installation category	CAT III 300V

DC Power supply	
Rated voltage	88 ... 162 V ⎓
Consumption	6 ... 14 W
Installation category	CAT III 300 V

Voltage measurement circuit	
Rated voltage (Un)	230 V ~
Voltage measurement margin	11 ... 500 V~ (V_{Ph-N}) , 19 ... 866 V~ (V_{Ph-Ph})
Frequency measurement margin	42.5 ... 69 Hz
Input impedance	1 MΩ
Min. voltage measurement (Vstart)	11 V~
Installation category	CAT IV 600V
Neutral Voltage measurement	
Measurement margin	2 ... 150 V

Current measurement circuit	
Rated current (In)	.../5A
Current measurement margin	0.05 ... 10 A ~
Maximum current, impulse < 1s	100 A
Min. current measurement (Istart)	0.05 A
Max. consumption of the voltage input	1 VA
Earth current measurement	
Measurement margin	0.5 ... 10 A
Neutral current measurement	
Measurement margin	0.5 ... 10 A

	Measurement accuracy	Resolution
Voltage (50 ... 500 V ~)	± 0.1% (IEC 61557-12, Class 0.1)	0.01 V
Voltage (11 ... 50 V ~)	± 0.1% Un	0.01 V
Voltage (10 ... 150% Un)	± 0.1% Un (IEC 61000-4-30, Class A)	0.01 V
Neutral voltage (2 ... 150 V)	± 1% FS	0.01 V
Current (0.5 ... 10 A~)	± 0.2% (IEC 61557-12, Class 0.2)	0.0001 A
Current (10 ... 120% FS)	± 0.2% (IEC 61000-4-30, Class A)	0.0001 A
Neutral current (0.5 ... 10 A~)	± 0.2% (IEC 61557-12, Class 0.2)	0.0001 A
Earth current (0.5 ... 10 A)	± 1% of reading	0.0001 A
Frequency (42.5 ... 69 Hz)	± 0.1% (IEC 61557-12, Class 0.1)	0.001 Hz
Frequency (42.5 ... 57.5 Hz) (50 Hz)	± 10 mHz (IEC 61000-4-30, Class A)	0.001 Hz
Frequency (51 ... 69 Hz) (60 Hz)		
Active Power	± 0.5% (IEC 61557-12, Class 0.5)	0.01 W
Reactive Power	± 1 % (IEC 61557-12, Class 1)	0.01 var

(Continuation)	Measurement accuracy	Resolution
Apparent power	± 0.5% (IEC 61557-12, Class 0.5)	0.01 W
Active energy	± 0.5% (IEC 62053-22, Class 0.5s)	0.01 Wh
Reactive energy	± 1% (IEC 62053-24, Class 1s)	0.01 Wh
Power factor	± 0.5% (IEC 61557-12, Class 0.5)	0.01
Voltage THD (0.2 ... 100%)	Class I (IEC 61000-4-7) Class A (IEC 61000-4-30)	0.01 %
Voltage harmonics (0.08 ... 200 %)	Class I (IEC 61000-4-7) Class A (IEC 61000-4-30)	0.01 %
Voltage interharmonics (0.08 ... 200 %)	Class I (IEC 61000-4-7) Class A (IEC 61000-4-30)	0.01 %
Voltage unbalance (0 ... 200%)	± 0.15% (IEC 61000-4-30, Class A)	0.01 %
Instantaneous Flicker (0 ... 10)	Class F1 (IEC 61000-4-15) Class A (IEC 61000-4-30)	0.01
Short duration Flicker (0 ... 10)		
Long duration flicker (0 ... 10)		
Voltage dip	± 0.2% Un (IEC 61000-4-30, Class A)	0.01 V
Voltage swell		
Interrupt		
Sliding reference	Class A (IEC 61000-4-30)	0.01 V
Rapid voltage changes (RVC)		
Voltage transients (848 Vpeak)	25600 Hz (50 Hz) 30720 Hz (60 Hz)	0.01 V
Current THD (0.2 ... 100%)	Class I (IEC 61000-4-7) Class A (IEC 61000-4-30)	0.01 %
Current harmonics (0.08 ... 200 %)	Class I (IEC 61000-4-7) Class A (IEC 61000-4-30)	0.01 %
Current interharmonics (0.08 ... 200 %)	Class I (IEC 61000-4-7) Class A (IEC 61000-4-30)	0.01 %
Current imbalance (0 ... 200%)	± 0.15% (IEC 61000-4-30, Class A)	0.01 %
Current transients (14 Apeak)	25600 Hz (50 Hz) 30720 Hz (60 Hz)	0.0001 A

Ethernet Communications	
Type	Ethernet 10BaseT - 100BaseTx self-detectable
Connector	RJ45
Protocol	HTTPS - NTP - SFTP - IEC61850
Connection mode to Network The device has dual IP	Service IP: 100.0.0.1
	Dynamic IP / Fixed IP (Dynamic by default)

Wi-Fi Communications	
Band	2.4 GHz
Standards	IEEE 802.11 b / g / n
Maximum output power	**IEEE 802.11 b:** 17.5 dBm **IEEE 802.11 g:** 14 dBm **IEEE 802.11 n:** 12.5 dBm

4G Communications	
Networks	LTE-FDD B12 / LTE-FDD B13 / LTE-FDD B28: 700 MHz LTE-FDD B18 / LTE-FDD B19 / LTE-FDD B20 / WCDMA B6 / WCDMA B19: 800 MHz LTE-FDD B5 / LTE-FDD B26 / WCDMA B5 / GSM / GSM(8-PSK): 850 MHz LTE-FDD B8 / WCDMA B8 / EGSM / EGSM(8-PSK): 900 MHz LTE-FDD B4 / LTE-FDD B66 / WCDMA B4: 1700 MHz LTE-FDD B3 / DCS / DCS(8-PSK): 1800 MHz LTE-FDD B2 / LTE-FDD B25 / LTE-TDD B39 / WCDMA B2 / PSC / PSC(8-PSK): 1900 MHz LTE-FDD B1 / LTE-TDD B34 / WCDMA B1: 2100 MHz LTE-TDD B40: 2300 MHz LTE-TDD B41: 2500 MHz LTE-FDD B7 / LTE-TDD B38: 2600 MHz
Protocols	HTTPS - NTP - SFTP - IEC61850
Max. output power	LTE-FDD / LTE-TDD: 23 dBm ± 2.7dB WCDMA: 24 dBm + 1 / - 3 dB GSM 850 / EGSM 900: 33 dBm ± 2dB DCS 1800 / PCS 1900: 30 dBm ± 2dB GSM 850(8-PSK) / EGSM 900(8-PSK) : 27 dBm ± 3dB DCS 1800 (8-PSK) / PCS 1900 (8-PSK): 26 dBm + 3 / -4dB

4G Antenna		
Band	700 - 850 - 900 MHz	1700 - 1800 - 1900 - 2100 MHz
Frequency	698 - 960 MHz	1710 - 2170 MHz
Return Loss	~- 5.8 dB	~- 13.9 dB
VSWR	~3.5:1	~2.1:1
Efficiency	~66.6 %	~66.1 %
Peak Gain	~0.9 dBi	~2.7 dBi
Average Gain	~1.9 dB	~1.8 dB
Impendance	50 Ω	
Polarisation	Linear	
Radiation Pattern	Omni-directional	
Max. Input Power	25 W	

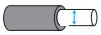
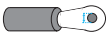
GPS Antenna	
Band	GPS / QZSS, GLONASS, Galileo, SBAS
Frequency	1575.42 ± 3 MHz
Bandwidth	10 MHz
VSWR	1.92 Maximum
Axial relationship	3 dB (Typical)
Gain @ Zenith	2 dBi (Typical)
Impendance	50 Ω
Polarisation	RHCP

User interface	
Display	240 x 128 points
Keyboard	7 keys
LED	6 LEDs

Battery	
Quantity	4
Type	Nickel-Metal Hydride
Voltage	1.2 V
Capacity (Typical)	2500 ... 2600 mAh

Battery (continuation)	
Charging time	1.1 h
Charging temperature	0 ... 40 °C
Autonomy	30 minutes

Environmental features (PQI-A-FI1-H (IEC 62586-1))	
Operating temperature	-10°C ... +45°C
Storage temperature	-40°C ... +70°C
Relative humidity (non-condensing)	0 ... 95%
Maximum altitude	2000 m
Protection degree IP	IP 20
Protection degree IK	IK 08
Pollution degree	2
Use	Indoor

Mechanical features			
Terminals			
Power Supply: 1, 2	2.5 mm^2	0.5 Nm	 M3
Voltage measurement: 3 ... 7 Current measurement: 8 ... 17	0.2 ... 10 mm^2 [8] 0.2 ... 6 mm^2 [9]	0.5 ... 0.8 Nm	 M3
Earth: DIN 46237 closed ring terminal	 5.20 mm	 2.50 mm^2	 2.2 Nm
Dimensions	Figure 83 (mm)		
Weight	3.4 kg.		
Enclosure	Zinc plated sheet steel		

[8] Rigid conductor.

[9] Flexible conductor.

Standard	
Degrees of protection provided by enclosures (IP Code)	IEC 60529
Electromagnetic compatibility (EMC) - Part 4-30: Testing and measurement techniques - Power quality measurement methods	IEC 61000-4-30
Electromagnetic compatibility (EMC) - Part 6-5: Generic standards - Immunity for equipment used in power station and substation environment	IEC 61000-6-5
Power quality measurement in power supply systems - Part 1: Power quality instruments (PQI)	IEC 62586-1
Power quality measurement in power supply systems - Part 2: Functional tests and uncertainty requirements	IEC 62586-2
Safety requirements for electrical equipment for measurement, control and laboratory use -- Part 1: General requirements	IEC 61010-1
Mechanical structures for electronic equipment - Dimensions of mechanical structures of the 482,6 mm (19 in) series -- Part 3-100: Basic dimensions of front panels, subracks, chassis, racks and cabinets	IEC 60297-3-100
Communication networks and systems for power utility automation	IEC 61850
IEEE Recommended Practice for Power Quality Data Interchange Format (PQDIF)	IEEE 1159.3
Electrical safety in low voltage distribution systems up to 1 000 V AC and 1 500 V DC - Equipment for testing, measuring or monitoring of protective measures - Part 12: Power metering and monitoring devices (PMD)	IEC 61557-12
Environmental testing -- Part 2-1: Tests - Test A: Cold	IEC 60068-2-1

Standard (Continuation)	
Environmental testing -- Part 2-2: Tests - Tests B: Dry heat.	IEC 60068-2-2
Environmental testing - Part 2-78: Tests - Test Cab: Damp heat, steady state	IEC 60068-2-78
Environmental testing- Part 2-6: Tests- Test Fc: Vibration (sinusoidal)	IEC 60068-2-6
Environmental testing - Part 2-57: Tests - Test Ff: Vibration - Time-history and sine-beat method	IEC 60068-2-57
ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard for ElectroMagnetic Compatibility	ETSI EN 301 489-1 Ver. 2.2.3
ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for Broadband Data Transmission Systems; Harmonised Standard for ElectroMagnetic Compatibility	ETSI EN 301 489-17 Ver. 3.2.4
ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 19: Specific conditions for Receive Only Mobile Earth Stations (ROMES) operating in the 1,5 GHz band providing data communications and GNSS receivers operating in the RNSS band providing positioning, navigation, and timing data; Harmonised Standard for ElectroMagnetic Compatibility	ETSI EN 301 489-19 Ver. 2.2.1
ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 52: Specific conditions for Cellular Communication User Equipment (UE) radio and ancillary equipment; Harmonised Standard for ElectroMagnetic Compatibility	ETSI EN 301 489-52 Ver. 1.2.1
Environmental testing -- Part 2-14: Tests - Test N: Change of temperature	UNE-EN 60068-2-14
Amendment 1 - Electromagnetic compatibility of multimedia equipment - Emission requirements	CISPR 32:2015/AMD1:2019

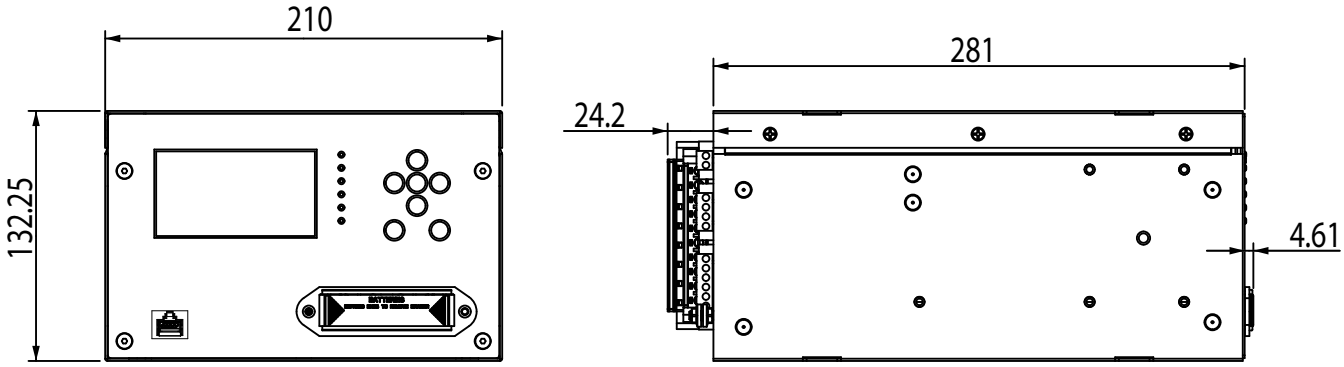


Figure 83: QNA 600 dimensions.

10.- MAINTENANCE AND TECHNICAL SERVICE

In the case of any query in relation to device operation or malfunction, please contact the **CIRCUTOR S.A.U.** Technical Support Service.

Technical Assistance Service
Vial Sant Jordi, s/n, 08232 - Viladecavalls (Barcelona)
Tel: 902 449 459 (Spain) / +34 937 452 919 (outside of Spain)
email: sat@circutor.com

11.- GUARANTEE

CIRCUTOR guarantees its products against any manufacturing defect for two years after the delivery of the units.

CIRCUTOR will repair or replace any defective factory product returned during the guarantee period.



- No returns will be accepted and no unit will be repaired or replaced if it is not accompanied by a report indicating the defect detected or the reason for the return.
- The guarantee will be void if the units has been improperly used or the storage, installation and maintenance instructions listed in this manual have not been followed. "Improper usage" is defined as any operating or storage condition contrary to the national electrical code or that surpasses the limits indicated in the technical and environmental features of this manual.
- **CIRCUTOR** accepts no liability due to the possible damage to the unit or other parts of the installation, nor will it cover any possible sanctions derived from a possible failure, improper installation or "improper usage" of the unit. Consequently, this guarantee does not apply to failures occurring in the following cases:
  - Overvoltages and/or electrical disturbances in the supply;
  - Water, if the product does not have the appropriate IP classification;
  - Poor ventilation and/or excessive temperatures;
  - Improper installation and/or lack of maintenance;
  - Buyer repairs or modifications without the manufacturer's authorisation.

CIRCUTOR, S.A.U. – Vial Sant Jordi, s/n
08232 Viladecavalls (Barcelona) Spain
(+34) 937 452 900 – info@circutor.com

(ES) DECLARACIÓN UE DE CONFORMIDAD

La presente declaración de conformidad se expide bajo la exclusiva responsabilidad de CIRCUTOR con dirección en **Vial Sant Jordi, s/n – 08232 Viladecavalls (Barcelona) España**

Producto:

Analizar de calidad de suministro

Serie:

QNA 600

Marca:

CIRCUTOR

EL objeto de la declaración es conforme con la legislación de armonización pertinente en la UE, siempre que sea instalado, mantenido y usado en la aplicación para la que ha sido fabricado, de acuerdo con las normas de instalación aplicables y las instrucciones del fabricante

2014/35/EU: Low Voltage Directive	2014/30/EU: EMC Directive
2011/65/EU: RoHS2 Directive	2015/863/EU: RoHS3 Directive

Está en conformidad con la(s) siguiente(s) norma(s) u otro(s) documento(s) normativos(s):

IEC 61010-1:2010+AMD1:2016	IEC 61000-6-5:2015
CISPR 32:2015+AMD1:2019	IEC 62586-1:2017
ETSI EN 301 489-1 Ver. 2.2.3	ETSI EN 301 489-17 Ver. 3.2.4
ETSI EN 301 489-19 Ver. 2.2.1	ETSI EN 301 489-52 Ver. 1.2.1
IEC 63000:2016+AMD1:2022	

Año de marcado "CE":

2024

(EN) EU DECLARATION OF CONFORMITY

This declaration of conformity is issued under the sole responsibility of CIRCUTOR with registered address at **Vial Sant Jordi, s/n – 08232 Viladecavalls (Barcelona) Spain**

Product:

Power quality analyzer

Series:

QNA 600

Brand:

CIRCUTOR

The object of the declaration is in conformity with the relevant EU harmonisation legislation, provided that it is installed, maintained and used for the application for which it was manufactured, in accordance with the applicable installation standards and the manufacturer's instructions

2014/35/EU: Low Voltage Directive	2014/30/EU: EMC Directive
2011/65/EU: RoHS2 Directive	2015/863/EU: RoHS3 Directive

It is in conformity with the following standard(s) or other regulatory document(s):

IEC 61010-1:2010+AMD1:2016	IEC 61000-6-5:2015
CISPR 32:2015+AMD1:2019	IEC 62586-1:2017
ETSI EN 301 489-1 Ver. 2.2.3	ETSI EN 301 489-17 Ver. 3.2.4
ETSI EN 301 489-19 Ver. 2.2.1	ETSI EN 301 489-52 Ver. 1.2.1
IEC 63000:2016+AMD1:2022	

Year of CE mark:

2024

(FR) DÉCLARATION UE DE CONFORMITÉ

La présente déclaration de conformité est délivrée sous la responsabilité exclusive de CIRCUTOR dont l'adresse postale est **Vial Sant Jordi, s/n – 08232 Viladecavalls (Barcelone) Espagne**

Produit:

Analyseur de qualité de distribution

Série:

QNA 600

Marque:

CIRCUTOR

L'objet de la déclaration est conforme à la législation d'harmonisation pertinente dans l'UE, à condition d'avoir été installé, entretenu et utilisé dans l'application pour laquelle il a été fabriqué, conformément aux normes d'installation applicables et aux instructions du fabricant

2014/35/EU: Low Voltage Directive	2014/30/EU: EMC Directive
2011/65/EU: RoHS2 Directive	2015/863/EU: RoHS3 Directive

Il est en conformité avec la(les) suivante (s) norme(s) ou autre(s) document(s) réglementaire (s):

IEC 61010-1:2010+AMD1:2016	IEC 61000-6-5:2015
CISPR 32:2015+AMD1:2019	IEC 62586-1:2017
ETSI EN 301 489-1 Ver. 2.2.3	ETSI EN 301 489-17 Ver. 3.2.4
ETSI EN 301 489-19 Ver. 2.2.1	ETSI EN 301 489-52 Ver. 1.2.1
IEC 63000:2016+AMD1:2022	

Année de marquage « CE »:

2024

Viladecavalls (Spain), 19/3/2024
Chief Executive Officer: Joan Comellas Cabeza

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(DE)

KONFORMITÄTSERKLÄRUNG UE

Vorliegende Konformitätserklärung wird unter alleiniger Verantwortung von CIRCUTOR mit der Anschrift, Vial Sant Jordi, s/n – 08232 Viladecavalls (Barcelona) Spanien, ausgestellt

Produkt:

Analysator für lieferqualität

Serie:

QNA 600

Marke:

CIRCUTOR

Der Gegenstand der Konformitätserklärung ist konform mit der geltenden Gesetzgebung zur Harmonisierung der EU, sofern die Installation, Wartung undVerwendung der Anwendung seinem Verwendungszweck entsprechend gemäß den geltenden Installationsstandards und der Vorgaben des Herstellers erfolgt

2014/35/EU: Low Voltage Directive	2014/30/EU: EMC Directive
2011/65/EU: RoHS2 Directive	2015/863/EU: RoHS3 Directive

Es besteht Konformität mit der/den folgender/folgenden Norm/Normen oder sonstigem/sonstiger Regelwerk/Regelwerken

IEC 61010-1:2010+AMD1:2016	IEC 61000-6-5:2015
CISPR 32:2015+AMD1:2019	IEC 62586-1:2017
ETSI EN 301 489-1 Ver. 2.2.3	ETSI EN 301 489-17 Ver. 3.2.4
ETSI EN 301 489-19 Ver. 2.2.1	ETSI EN 301 489-52 Ver. 1.2.1
IEC 63000:2016+AMD1:2022	

Jahr der CE-Kennzeichnung:

2024

(PT)

DECLARAÇÃO DA UE DE CONFORMIDADE

A presente declaração de conformidade é expedida sob a exclusiva responsabilidade da CIRCUTOR com morada em **Vial Sant Jordi, s/n – 08232 Viladecavalls (Barcelona) Espanha**

Producto:

Analisador de qualidade de fornecimiento

Série:

QNA 600

Marca:

CIRCUTOR

O objeto da declaração está conforme a legislação de harmonização pertinente na UE, sempre que seja instalado, mantido e utilizado na aplicação para a qual foi fabricado, de acordo com as normas de instalação aplicáveis e as instruções do fabricante.

2014/35/EU: Low Voltage Directive	2014/30/EU: EMC Directive
2011/65/EU: RoHS2 Directive	2015/863/EU: RoHS3 Directive

Está em conformidade com a(s) seguinte(s) norma(s) ou outro(s) documento(s) normativo(s):

IEC 61010-1:2010+AMD1:2016	IEC 61000-6-5:2015
CISPR 32:2015+AMD1:2019	IEC 62586-1:2017
ETSI EN 301 489-1 Ver. 2.2.3	ETSI EN 301 489-17 Ver. 3.2.4
ETSI EN 301 489-19 Ver. 2.2.1	ETSI EN 301 489-52 Ver. 1.2.1
IEC 63000:2016+AMD1:2022	

Ano de marcação "CE":

2024

(IT)

DICHIARAZIONE DI CONFORMITÀ UE

La presente dichiarazione di conformità viene rilasciata sotto la responsabilità esclusiva di CIRCUTOR, con sede in **Vial Sant Jordi, s/n – 08232 Viladecavalls (Barcellona) Spagna**

prodotto:

Analizzatore della qualità dell'energia

Serie:

QNA 600

MARCHIO:

CIRCUTOR

L'oggetto della dichiarazione è conforme alla pertinente normativa di armonizzazione dell'Unione Europea, a condizione che venga installato, mantenuto e utilizzato nell'ambito dell'applicazione per cui è stato prodotto, secondo le norme di installazione applicabili e le istruzioni del produttore.

2014/35/EU: Low Voltage Directive	2014/30/EU: EMC Directive
2011/65/EU: RoHS2 Directive	2015/863/EU: RoHS3 Directive

È conforme alle seguenti normative o altri documenti normativi:

IEC 61010-1:2010+AMD1:2016	IEC 61000-6-5:2015
CISPR 32:2015+AMD1:2019	IEC 62586-1:2017
ETSI EN 301 489-1 Ver. 2.2.3	ETSI EN 301 489-17 Ver. 3.2.4
ETSI EN 301 489-19 Ver. 2.2.1	ETSI EN 301 489-52 Ver. 1.2.1
IEC 63000:2016+AMD1:2022	

Anno di marcatura "CE":

2024

Viladecavalls (Spain), 19/3/2024
Chief Executive Officer: Joan Comellas Cabeza

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DEKLARACJA ZGODNOŚCI UE

Niniejsza deklaracja zgodności zostaje wydana na wyłączną odpowiedzialność firmy CIRCUTOR z siedzibą pod adresem: **Vial Sant Jordi, s/n – 08232 Viladecavalls (Barcelona) Hiszpania**

produk:

Analizator jakości energii

Seria:

QNA 600

marka:

CIRCUTOR

Przedmiot deklaracji jest zgodny z odnośnymi wymaganiami prawodawstwa harmonizacyjnego w Unii Europejskiej pod warunkiem, że będzie instalowany, konserwowany i użytkowany zgodnie z przeznaczeniem, dla którego został wyprodukowany, zgodnie z mającymi zastosowanie normami dotyczącymi instalacji oraz instrukcjami producenta

2014/35/EU: Low Voltage Directive	2014/30/EU: EMC Directive
2011/65/EU: RoHS2 Directive	2015/863/EU: RoHS3 Directive

Jest zgodny z następującą(ymi) normą(ami) lub innym(i) dokumentem(ami) normatywnym(i):

IEC 61010-1:2010+AMD1:2016	IEC 61000-6-5:2015
CISPR 32:2015+AMD1:2019	IEC 62586-1:2017
ETSI EN 301 489-1 Ver. 2.2.3	ETSI EN 301 489-17 Ver. 3.2.4
ETSI EN 301 489-19 Ver. 2.2.1	ETSI EN 301 489-52 Ver. 1.2.1
IEC 63000:2016+AMD1:2022	

Rok oznakowania "CE":

2024

Viladecavalls (Spain), 19/3/2024
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ANNEX A.- CALCULATION FORMULAS

A.1.- SIGNAL SAMPLING, MEASURE AND PARAMETER AGGREGATION

The device samples every voltage and current input signal at a rate of 512 samples per cycle, which becomes a sampling frequency of 25600 Hz per signal for 50Hz and a frequency of 30720 Hz per signal for 60Hz.

The time aggregations are based on IEC 61000-4-30 class A:

- ✓ Full cycle updated every half cycle.
- ✓ 10 / 12 cycles values (for nominal frequencies of 50Hz / 60Hz).
- ✓ 150 / 180 cycles values (for nominal frequencies of 50Hz / 60Hz).
- ✓ 10 second values.
- ✓ 10 minute values (or a period selected by the customer).
- ✓ 2 hour values.

Note: *Power is calculated according to* ***IEEE1459***.

The objective of this annex is to define the measuring method of the main values within the device.

A.2.- 10/12 CYCLE INTERVAL MEASURES (50 Hz/60 Hz)

For a 50Hz measure, the basic period will be a 10 cycle period with a total number of samples: **N = 5120**
For a 60Hz measure, the basic period will be a 12 cycle period with a total number of samples: **N = 6144**

A.2.1.- VOLTAGE PHASE-NEUTRAL (U_{Ph-N})

The 10/12 cycle RMS **Voltage to neutral** of every phase is calculated by the root mean square of the period interval samples.

$$Up = \sqrt{\frac{1}{N} x \sum_{j=1}^{N} {u_p}_j^2}$$ Units: **V**

Equation 8: Voltage Phase - Neutral.

A.2.2.- VOLTAGE PHASE-PHASE (U_{Ph-Ph})

The 10/12 cycle RMS **Voltage phase to phase** is calculated by making the vector difference of the two involved phases. This RMS value is calculated by the root mean square of the whole cycle period interval difference samples.

$$Upg = \sqrt{\frac{1}{N} \sum_{j=1}^{N} \left({u_p}_j - {u_g}_j \right)^2}$$ Units: **V**

Equation 9: Voltage Phase - Phase.

A.2.3.- CURRENT (*I*)

The 10/12 cycle RMS **current** of every phase is calculated by the root mean square of the whole period interval samples.

$$Ip = \sqrt{\frac{1}{N} x \sum_{j=1}^{N} {i_p}_j^2}$$ Units: **A**

Equation 10: Current.

A.2.4.- COMBINED ACTIVE POWER (*P*)

The 10/12 cycle RMS **Active Power** of every phase is calculated by the scalar product of the whole interval samples of Voltage and Current.

Phase Combined Active Power:

$$Pp = \sqrt{\frac{1}{N} x \sum_{j=1}^{N} {u_p}_j \, x {i_p}_j}$$ Units: **W**

Equation 11: Phase combined Active Power.

Three-phase Combined Active Power:

$$P_{TOT} = P_A + P_B + P_C$$ Units: **W**

Equation 12: Three-phase combined Active Power.

A.2.5.- APPARENT POWER (*S*)

The 10/12 cycle **Apparent Power** of every phase is calculated by the product of the 10/12 cycles RMS Voltage and Current.

Phase Apparent Power:

$$Sp = UpxIp$$ Units: **VA**

Equation 13: Phase apparent power.

Three-phase Apparent Power:

$$S_e = 3xV_exI_e$$ Units: **VA**

Equation 14: Three-phase apparent power.

A.2.6.- NONACTIVE POWER (*N*)

The 10/12 cycle RMS **Nonactive Power** of every phase is calculated from the Active Power and the Apparent Power.

Phase Nonactive Power:

$$Np = \sqrt{S_p^2 - P_p^2}$$ Units: **var**

Equation 15: Phase nonactive power.

Three-phase Nonactive Power:

$$N_{TOT} = N_A + N_B + N_C$$ Units: **var**

Equation 16: Three-phase Nonactive Power.

A.2.7.- POWER FACTOR (*PF*)

The 10/12 cycle **Power Factor** of every phase is calculated by the division of the 10/12 cycles RMS Active Power and Apparent Power.

Phase Power Factor:

$$PFp = \frac{Pp}{Sp}$$

Equation 17: Phase Power Factor.

Three-phase Power Factor:

$$PF_{TOT} = \frac{P_{TOT}}{S_e}$$

Equation 18: Three-phase Power Factor.

A.2.8.- FUNDAMENTAL ACTIVE POWER (P_1)

The 10/12 cycle **fundamental Active Power** of every phase is calculated from the fundamental voltage, fundamental current and the angle between both.

Phase Fundamental Active Power:

$$Pp_1 = Vp_1 x Ip_1 x cos\theta_{1p}$$ Units: **W**

Equation 19: Phase Fundamental Active Power.

Positive Sequence Active Power:

$$P^{pos} = 3 x V^{pos} x I^{pos} x cos\theta^{pos}$$ Units: **W**

Equation 20: Positive Sequence Active Power.

A.2.9.- FUNDAMENTAL REACTIVE POWER (*Q*)

The 10/12 cycle **fundamental Reactive Power** of every phase is calculated from the fundamental voltage, fundamental current, and the angle between both.

Phase Fundamental Reactive Power:

$$Qp = Vp_1 x Ip_1 x sin\theta_1$$ Units: **var**

Equation 21: Phase Fundamental Reactive Power.

Positive Sequence Reactive Power:

$$Q^{pos} = 3xV^{pos}xI^{pos}xsin\theta^{pos}$$ Units: **var**

Equation 22: Positive Sequence Reactive Power.

A.2.10.- FUNDAMENTAL APPARENT POWER (S_1)

The 10/12 cycle **fundamental Apparent Power** of every phase is calculated from the fundamental voltage and fundamental current.

Phase Fundamental Apparent Power:

$$Sp_1 = Vp_1xIp_1$$ Units: **VA**

Equation 23: Phase Fundamental Apparent Power.

Fundamental Effective Apparent Power:

$$Se_1 = 3xVe_1xIe_1$$ Units: **VA**

Equation 24: Fundamental Effective Apparent Power.

A.2.11.- DISPLACEMENT POWER FACTOR (*DPF*)

The 10/12 cycle **DPF** of every phase is calculated from the fundamental Active Power and the fundamental Apparent values.

Phase Displacement Power Factor:

$$DPFp = \frac{Pp_1}{Sp_1}$$

Equation 25: Phase Displacement Power Factor.

Positive Sequence Power Factor:

$$DPF_{TOT} = \frac{P^{pos}}{P^{pos}}$$

Equation 26: Positive Sequence Power Factor.

A.2.12.- VOLTAGE AND CURRENT HARMONICS

The 10/12 cycle **Voltage and Current harmonics** are calculated by means of a 10/12 cycle window FFT without gaps between windows as is specified in **IEC 61000-4-30** class A method. Making the harmonics soubgroups specified in the **IEC 61000-4-7.**

The final values are given in % relative to the fundamental value.

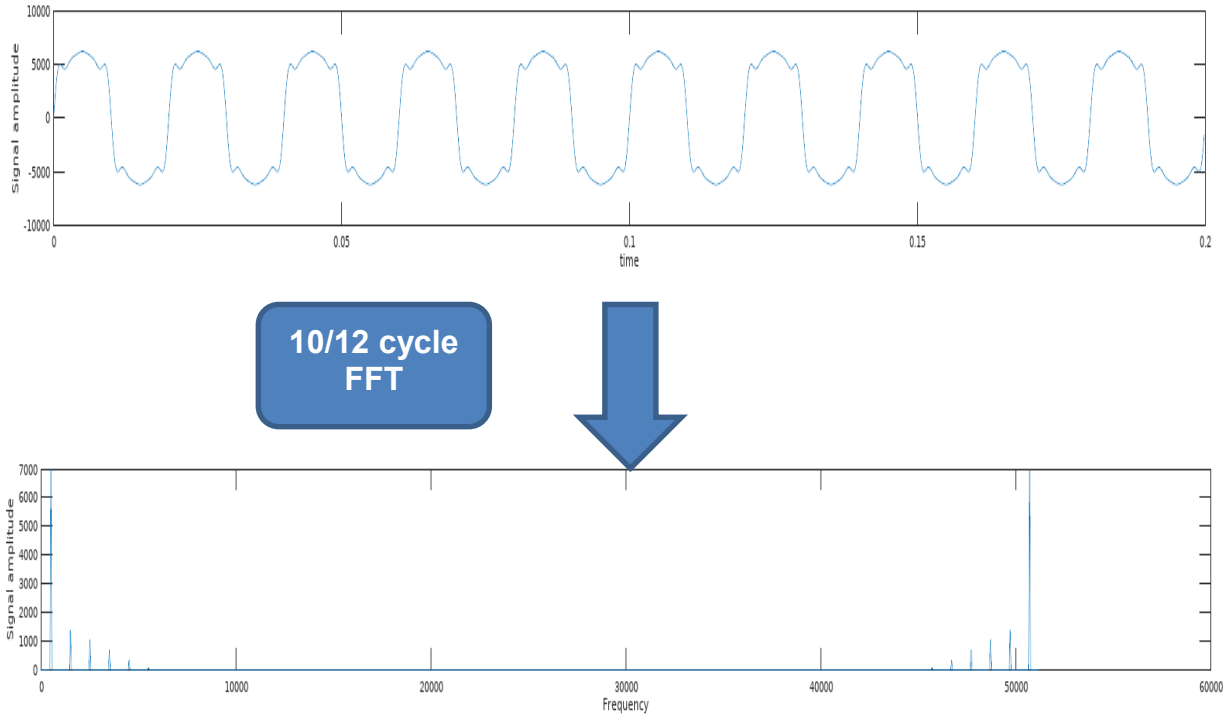


Figure 84: Voltage and current harmonics.

$$f(t) = c_0 + \sum_{m=1}^{1024} c_m \, sin\left(\frac{m}{N} w_1 t + \varphi_1\right)$$

Equation 27: Voltage and current harmonics.

Where:

w_1 : Angular frequency of the fundamental $w_1=2\pi f_1$ $(f_1=50Hz)$

T_w : Width or duration of the time window $T_w=NT_1$ $T_1=1/f_1$ $(T_w=200ms)$
Over which the Fourier Transform I performed.

c_m : Frequential component amplitude $f_{m=\frac{m}{N}f_m}$

N : Number of fundamental periods within the window width. (**N** = 10 periods)

c_0 : DC component

M : Ordinal number (order of the spectral line) related to the frequency basis $f=1/T_w$

The voltage magnitude of the power system may fluctuate spreading out the energy of harmonic components to adjacent interharmonic frequencies.
To improve the assessment accuracy of the voltage, the output components C_k for each 5Hz of the DFT are grouped as follows:

$$G_{sg,n} = \sqrt{\sum_{i=-1}^{1} C_{k+i}^2}$$

Equation 28: $G_{s,g,n}$

When the individual harmonic is given in % format, this percentage has been calculated referred to the fundamental value:

$$H_n(\%) = \frac{G_{sg,n}}{G_{sg,1}} x100$$

Equation 29: $H_n(\%)$

The Total Harmonic Distorsion:

$$THD = \sqrt{\sum_{n=2}^{50} \left(\frac{G_n}{G_1}\right)^2}$$

Equation 30: THD.

Where **G** is the RMS value of the harmonic component.

Direction of harmonics:

Non-linear loads can cause a distorted current waveform; if this distortion is large enough, the voltage could fall during this current distortion.
In this case, voltage and current harmonics are generated with the same frequency, generating unwanted power.
It is therefore useful to know whether this harmonic comes from the load or the source, which is called **Direction of harmonics**.

To identify the direction of the harmonics, the power angle is calculated at the harmonic frequency. Depending on this angle, the current harmonic may come from the load or the source.

The Direction of harmonics calculation is more accurate if the power in this harmonic is high enough and if the angle of this power is sufficiently far from 90° or 270°.
For this reason, the **QNA 600** will only calculate the harmonic direction for secondary power harmonics greater than 1 W and angles greater than 15° away from 90° or 270°.

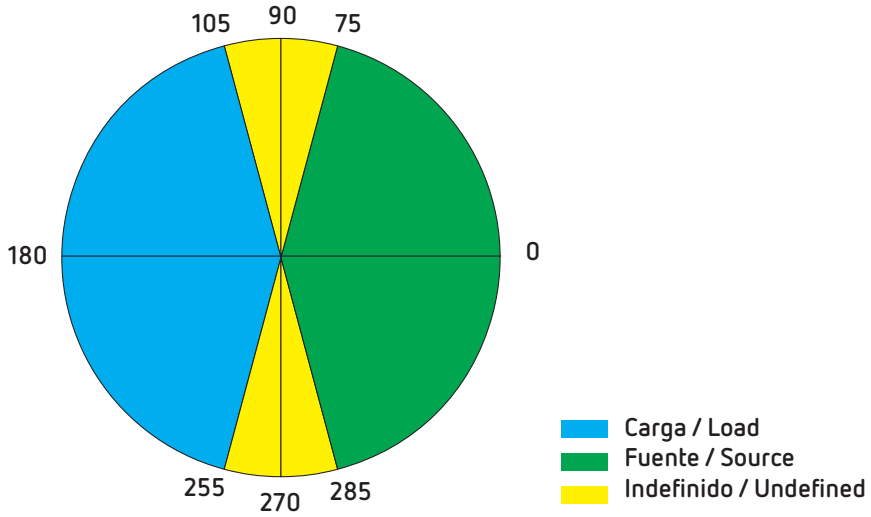


Figure 85:Direction of harmonics.

The **QNA 600** represents the harmonic from the source with a positive sign and the % calculated.
The harmonic from the load is represented with a negative sign and the % calculated.

If the power harmonic is not large enough or its angle is too close to 90º or 270º, the sign of the % harmonic is positive.

A.2.13.- VOLTAGE AND CURRENT INTERHARMONICS

The 10/12 cycle **Voltage and Current interharmonics** are calculated through a 10/12 cycle window FFT without gaps between windows as is specified in **IEC 61000-4-30** class A method.
Making the interharmonics soubgroups specified in the **IEC 61000-4-7** class I

As specified in **IEC61000-4-30** class A, group **Y isg,h** is used.

The output interharmonics components C_k for each 5Hz of the DFT are grouped as follows:

$$G_{isg,n} = \sqrt{\sum_{i=2}^{8} C_{k+i}^2}$$

Equation 31: $G_{isg,n.}$

Leaving the immediate harmonics bin as harmonic content.

When the individual interharmonic is given in % format, this percentage has been calculated referred to the fundamental value:

$$IH_n(\%) = \frac{G_{isg,n}}{G_{sg,1}} x100$$

Equation 32: $IH_n(\%)$.

A.2.14.- VOLTAGE AND CURRENT UNBALANCE

The 10/12 cycle **unbalance** is evaluated using the method of symmetrical components specified in **IEC 61000-4-30** class A, where:

U_1 : Positive sequence component
U_2 : Negative sequence component
U_0 : Zero sequence component

Are calculated based on the FFT development (fundamental component module and angle).

Direct Voltage / Current:

$$U_1 = \frac{V1_{\propto 1} + V2_{\propto 2-240º} + V3_{\propto 3-120º}}{3}$$

Equation 33: Direct Voltage / Current.

Inverse Voltage / Current:

$$U_2 = \frac{V1_{\propto 1} + V2_{\propto 2-120^{\circ}} + V3_{\propto 3-240^{\circ}}}{3}$$

Equation 34: Inverse Voltage / Current.

Homopolar Voltage / Current:

$$U_0 = \frac{V1_{\propto 1} + V2_{\propto 2} + V3_{\propto 3}}{3}$$

Equation 35: Homopolar Voltage / Current.

Negative sequence unbalance ratio u_2 (voltage / current unbalance):

$$K_d = u_2 = \frac{U_2}{U_1} x100\% = \frac{negativesequence}{positivesequence} x100\%$$

Equation 36: Negative sequence unbalance ratio.

Zero sequence unbalance ratio u_0 (voltage / current asimmetry):

$$K_a = u_0 = \frac{U_0}{U_1} x100\% = \frac{zerosequence}{positivesequence} x100\%$$

Equation 37: Zero sequence unbalance ratio.

A.2.15.- VOLTAGE AND CURRENT CREAST FACTOR

It is the ratio between the peak value and the RMS value.

$$VoltageCF = \frac{MAX\left(\left|u_{p_1}\right|, \ldots, \left|u_{p_{1280}}\right|\right)}{U_p}$$

Equation 38: Voltage CF.

$$CurrentCF = \frac{MAX\left(|i_1|, \ldots, \left|i_{p_{1280}}\right|\right)}{I_p}$$

Equation 39: Current CF.

A.2.16.- K-FACTOR

K-factor is a weighting of the harmonic load currents according to their effects on transformer heating.
The algorithm used to compute **K-factor** is based on **IEEE C57.110**.
The 10/12 cycle **K-factor** calculation is based on the 10/12 cycle harmonics results.

$$K - factor(\%) = \frac{\sum_{h=1}^{25}\left(G_{sg,h} x h\right)^2}{\sum_{h=1}^{25} {G_{sg,h}}^2} x100$$

Equation 40: K-Factor.

A.2.17.- FLICKER Pinst

The magnitude of **flicker** measures the annoyment provoked by the mains voltage signal to a human eye. This magnitude is measured according to **IEC61000-4-15 Class F1**.

Pinst is the instant value of flicker magnitude. It is the result of filtering every signal sample through the flicker filters. After some decimations, the 10/12 cycles **Pinst** is the maximum **Pinst** value wich will be classified to calculate the 10 min **Pst** (Short Term Flicker).

A.3.- 150 / 180 CYCLES INTERVAL MEASURES (50 Hz/60 Hz)

150 cycles for a 50 Hz signal and 180 cycles for a 60 Hz signal.
The data for the 150/180-cycle time interval shall be aggregated without gap from fifteen 10/12-cycle time intervals.

A.3.1.- VOLTAGE PHASE - NEUTRAL (U_{Ph-N})

The 150/180 cycles **Voltage** value is the square mean of the 10/12 cycle Voltage values and it is updated every 3 seconds.

$$Up_{150/180c} = \sqrt{\frac{1}{15} x \sum_{j=1}^{15} Up_j^2}$$ Units: **V**

Equation 41: Voltage Phase - Neutral.

Where 15 is the number of groups of 10/12 cycles included in a period of 150/180 cycles.

A.3.2.- VOLTAGE PHASE -PHASE (U_{Ph-Ph})

The 150/180 cycles **Voltage phase to phase** value is the square mean of the 10/12 cycle Voltage phase to phase values and it is updated every 3 seconds.

$$Upg_{150/180c} = \sqrt{\frac{1}{15} x \sum_{j=1}^{15} Upg_j^2}$$ Units: **V**

Equation 42: Voltage Phase - Phase.

Where 15 is the number of groups of 10/12 cycles included in a period of 150/180 cycles.

A.3.3.- CURRENT (*I*)

The 150/180 cycles **Current** value is the square mean of the 10/12 cycles Current values and it is updated every 3 seconds.

$$Ip_{150/180c} = \sqrt{\frac{1}{15} x \sum_{j=1}^{15} Ip_j^2}$$ Units: **A**

Equation 43: Current.

Where 15 is the number of groups of 10/12 cycles included in a period of 150/180 cycles.

A.3.4.- ACTIVE POWER (*P*)

The 150/180 cycles **Active Power** value is the mean of the 10/12 cycle Active Power values and it is updated every 3 seconds.

Phase Active Power:

$$Pp_{150/180c} = \frac{1}{15} x \sum_{j=1}^{15} Pp_j$$ Units: **W**

Equation 44: Phase Active Power.

Where 15 is the number of groups of 10/12 cycles included in a period of 150/180 cycles.

Three-phase Combined Active Power:

$$P_{TOT} = P_{A150/180} + P_{B150/180} + P_{C150/180}$$ Units: **W**

Equation 45: Three-phase Combined Active Power.

A.3.5.- APPARENT POWER (*S*)

The 150/180 cycles **Apparent Power** value calculation is based on the 10/12 cycle Voltage and Current RMS values.

Phase Apparent Power:

$$Sp_{150/180c} = Up_{150/180c} x Ip_{150/180c}$$ Units: **VA**

Equation 46: Phase Apparent Power.

Three-phase Apparent Power:

$$S_{e150/180c} = 3 x V_{e150/180c} x I_{e150/180c}$$ Units: **VA**

Equation 47: Three-phase Apparent Power.

A.3.6.- NONACTIVE POWER (*N*)

The 150/180 cycles **Nonactive Power** value is the mean of the 10/12 cycle Nonactive Power values and it is updated every 3 seconds.

Phase Nonactive Power:

$$Np_{150/180c} = \frac{1}{15} x \sum_{j=1}^{15} Np_j$$

Units: **var**

Equation 48: Phase Nonactive Power.

Where 15 is the number of groups of 10/12 cycles included in a period of 150/180 cycles.

Three-phase Nonactive Power:

$$N_{TOT} = N_{A150/180c} + N_{B150/180c} + N_{C150/180}$$

Units: **var**

Equation 49: Three-phase Nonactive Power.

A.3.7.- POWER FACTOR (*PF*)

The 150/180 cycles **Power Factor** value calculation is based on the 150/180 cycles Active Power and Apparent Power RMS values.

Phase Power Factor:

$$PFp_{150/180c} = \frac{Pp_{150/180c}}{Sp_{150/180c}}$$

Equation 50: Phase PF.

Three-phase Power Factor:

$$PF_{TOT150/180c} = \frac{P_{TOT150/180c}}{S_{e150/180c}}$$

Equation 51: Three-phase Power Factor.

A.3.8.- FUNDAMENTAL ACTIVE POWER (P_1)

The 150/180 cycle **fundamental Active Power** of every phase is calculated as a mean of the 10/12 cycle fundamental active power values.

Phase Fundamental Active Power:

$$Pp_{1150/180c} = \frac{1}{15} x \sum_{j=1}^{15} Pp_1$$

Units: **W**

Equation 52: Phase Fundamental Active Power.

Positive Sequence Active Power:

$$P^{pos}_{150/180c} = 3xV^{pos}_{150/180c}xI^{pos}_{150/180c}xcos\theta^{pos}_{150/180c}$$ Units: **W**

Equation 53: Positive Sequence Active Power.

A.3.9.- FUNDAMENTAL REACTIVE POWER (*Q*)

The 150/180 cycle **Fundamental Reactive Power** of every phase is calculated as a mean of the 10/12 cycle fundamental reactive power values.

Phase Fundamental Reactive Power:

$$Qp_{1150/180c} = \frac{1}{15}x\sum_{j=1}^{15} Qp_1$$ Units: **var**

Equation 54: Phase Fundamental Reactive Power.

Positive Sequence Reactive Power:

$$Q^{pos}_{TOT150/180c} = 3xV^{pos}_{TOT150/180c}xI^{pos}_{TOT150/180c}xsin\theta^{pos}_{150/180c}$$ Units: **var**

Equation 55: Positive Sequence Reactive Power.

A.3.10.- FUNDAMENTAL APPARENT POWER (S_1)

The 150/180 cycle **Fundamental Apparent Power** of every phase is calculated from the 150/180 cycle fundamental voltage and fundamental current.

Phase Fundamental Apparent Power:

$$Sp_{1150/180c} = Vp_{1150/180c}Ip_{1150/180c}$$ Units: **VA**

Equation 56: Phase Fundamental Apparent Power.

Fundamental Effective Apparent Power:

$$Se_{1150/180c} = 3xVersb1\ 150/180\ cxIe_{1150/180c}$$ Units: **VA**

Equation 57: Fundamental Effective Apparent Power.

A.3.11.- DISPLACEMENT POWER FACTOR (*DPF*)

The 150/180 cycle **DPF** of every phase is calculated from the 150/180 fundamental Active Power and the fundamental Apparent values.

Phase Displacement Power Factor:

$$DPFp_{150/180c} = \frac{Pp_{1150/180c}}{Sp_{1150/180c}}$$

Equation 58: Phase Displacement Power Factor.

Positive Sequence Power Factor:

$$DPF_{TOT150/180c} = \frac{P^{pos}_{150/180c}}{P^{pos}_{150/180c}}$$

Equation 59: Positive Sequence Power Factor.

A.3.12.- VOLTAGE AND CURRENT HARMONICS

The 150/180 cycle Voltage and Current Harmonics value calculation is the square mean of the 10/12 cycles harmonics result.

$$G_{sg,n_{150/180c}} = \frac{1}{N}\sqrt{\sum_{i=1}^{N} C_{sg,n_i}^{2}}$$

Equation 60: $G_{sg,n.}$

Where **N** is the number of groups of 10 or 12 cycles (depending on the frequency) included in the second.

$$H_{n150/180c}(\%) = \frac{G_{sg,n150/180c}}{G_{sg,1150/180c}} x100$$

Equation 61: $H_n(\%)$.

The 150/180 cycle **Total Harmonic Distortion** calculation is based on the 150/180 harmonics result.

$$THD_{150/180c} = \sqrt{\sum_{n=2}^{50}\left(\frac{G_{sg,n_{150/180c}}}{G_{sg,1_{150/180c}}}\right)^{2}}$$

Equation 62: THD.

Where **G** is the rms value of the harmonic component in 150/180 cycle.

A.3.13.- VOLTAGE AND CURRENT INTERHARMONICS

The 150/180 cycle **Voltage and Current interharmonics** value calculation is the square mean of the 10/12 cycles interarmonics result.

$$G_{isg,n_{150/180c}} = \frac{1}{N}\sqrt{\sum_{i=1}^{N} C_{isg,n_i}^{2}}$$

$$IH_{n150/180c}(\%) = \frac{G_{isg,n150/180c}}{G_{isg,1150/180c}} x100$$

Equation 63: Voltage and current Interharmonics.

A.3.14.- VOLTAGE AND CURRENT UNBALANCE

The 150/180 cycle Voltage and Current Positive sequence component (direct), Negative sequence component (inverse) and Zero sequence component (homopolar) value calculation are the square mean of the 10/12 cycles values result composing the 150/180 cycle period.

U_1 : Positive sequence component.
U_2 : Negative sequence component.
U_0 : Zero sequence component.

$$U1_{150/180c} = \sqrt{\frac{1}{N} x \sum_{j=1}^{N} U1_j^2}$$

Equation 64: Direct Voltage / Current.

$$U2_{150/180c} = \sqrt{\frac{1}{N} x \sum_{j=1}^{N} U2_j^2}$$

Equation 65: Inverse Voltage / Current.

$$U0_{150/180c} = \sqrt{\frac{1}{N} x \sum_{j=1}^{N} U0_j^2}$$

Equation 66: Homopolar Voltage / Current.

With the above values, the Voltage / Current unbalance and asymmetry are calculated:

Negative sequence unbalance ratio u_2 (voltage / current unbalance):

$$K_{d_{150/180c}} = u_{2_{150/180c}} = \frac{U2_{150/180c}}{U1_{150/180c}} x100\% = \frac{negativesequence}{positivesequence} x100\%$$

Equation 67: Negative sequence unbalance ratio.

Zero sequence unbalance ratio u_0 (voltage / current asimmetry):

$$K_{a_{150/180c}} = u_{0_{150/180c}} = \frac{U0_{150/180c}}{U1_{150/180c}} x100\% = \frac{zerosequence}{positivesequence} x100\%$$

Equation 68: Zero sequence unbalance ratio.

A.3.15.- VOLTAGE AND CURRENT CREST FACTOR

The 150/180 cycle Voltage and Current crest factor are the maximum of every 10/12 cycles values included in the 150/180 cycles period interval.

$$VoltageCF_{150/180c} = MAX(CF_1, \dots, CF_N)$$

Equation 69: Voltage CF.

$$CurrentCF_{150/180c} = MAX(CF_1, \dots, CF_N)$$

Equation 70: Current CF.

Where **N** is the number of groups of 10 or 12 cycles (depending on the frequency) included in the 150/180 cycles period and **samples** is the number of samples observed in one time window, 1280 for 50Hz and 1536 for 60Hz.

A.3.16.- K-FACTOR

K-factor is a weighting of the harmonic load currents according to their effects on transformer heating. The algorithm used to compute **K-factor** is based on **IEEE C57.110**.
The 150/180 cycle **K-factor** calculation is based on the 150/180 cycle harmonics results

$$K-factor_{150/180c}(\%) = \frac{\sum_{h=1}^{25}\left(G_{sg,h}{}_{150/180c}xh\right)^2}{\sum_{h=1}^{25} G_{sg,h}{}_{150/180c}{}^2} x100$$

Equation 71: K-Factor.

A.3.17.- FLICKER Pinst

The 150/180 cycles **flicker Pinst** is the average of every 10/12 cycles **flicker Pinst** included into the 150/180 cycle period.

A.4.- 1 SECOND INTERVAL MEASURES

A.4.1.- SAMPLING FREQUENCY

1 s **Frequency** is measured counting the number of cycles by detecting zero crossing during the 1 s interval. This frequency is only used to update the **sampling frequency** and the related flicker filters.

This interval frequency is only available for the user into the 10min max / min frequency period.

$$f_{1s} = \frac{\sum_{t=0}^{1sclock} Zerocrossings}{timeelapsed}$$

Units: **Hz**

Equation 72: Sampling frequency.

A.5.- 10 SECONDS INTERVAL MEASURES

A.5.1.- FREQUENCY

Frequency is measured counting the number of cycles by detecting zero crossing during the 10s time clock interval. The **frequency** is calculated by dividing the number of whole periods by the time duration of whole periods.

$$f_{10s} = \frac{\sum_{t=0}^{10sclock} Zerocrossings}{timeelapsed}$$

Units: **Hz**

Equation 73: Frequency.

A.6.- 10 MINUTES INTERVAL MEASURES

A.6.1.- POWER FACTOR (*PF*)

The 5 minutes **Power Factor** value is the quotient between the 5 minutes Active Power value and Apparent Power value.

$$PFp_{5min} = \frac{Pp_{5min}}{Sp_{5min}}$$

Equation 74: Power Factor.

A.7.- 10 MINUTES INTERVAL MEASURES

A.7.1.- VOLTAGE PHASE-NEUTRAL ($U_{Ph\text{-}N}$)

The 10 minutes **Voltage** value is the square mean of the 10/12 cycles voltage value.

$$Up_{10min} = \sqrt{\frac{1}{N} x \sum_{j=1}^{N} Up_j^2}$$

Units: **V**

Equation 75: Voltage Phase-Neutral.

Where **N** is the number of groups of 10 or 12 cycles (depending on the frequency) included in 10 minutes period.

A.7.2.- VOLTAGE PHASE-PHASE ($U_{Ph\text{-}Ph}$)

The 10 minutes **Voltage phase to phase** value is the square mean of the 10/12 cycle **Voltage phase to phase** values.

$$Upg_{10min} = \sqrt{\frac{1}{N} x \sum_{j=1}^{N} Upg_j^2}$$

Units: **V**

Equation 76: Voltage Phase-Phase.

Where **N** is the number of groups of 10 or 12 cycles (depending on the frequency) included in 10 minutes period.

A.7.3.- CURRENT (*I*)

The 10 minutes **Current** value is the square mean of the 10/12 cycle **Current** values.

$$Ip_{10min} = \sqrt{\frac{1}{N} x \sum_{j=1}^{N} Ip_j^2}$$

Units: **A**

Equation 77: Current

Where **N** is the number of groups of 10 or 12 cycles (depending on the frequency) included in 10 minutes period.

A.7.4.- ACTIVE POWER (*P*)

The 10 minutes **Active Power** value is the mean of the 10/12 cycle **Active Power** values.

Phase Combined Active Power:

$$Pp_{10min} = \frac{1}{N} x \sum_{j=1}^{N} Pp_j$$

Units: **W**

Equation 78: Phase Combined Active Power.

Where **N** is the number of groups of 10 or 12 cycles (depending on the frequency) included in 10 minutes period.

Three-phase Combined Active Power:

$$P_{TOT10min} = P_{A10min} + P_{B10min} + P_{C10min}$$

Units: **W**

Figure 86: Three-phase Combined Active Power.

A.7.5.- APPARENT POWER (*S*)

The 10 minutes **Apparent Power** value is the product of the 10 minutes Voltage and Current values.

Phase Apparent Power:

$$Sp_{1s10min} = Up_{10min} x Ip_{10min}$$

Units: **VA**

Figure 87: Phase Apparent Power.

Three-phase Apparent Power:

$$S_{e10min} = 3 x V_{e10min} x I_{e10min}$$

Units: **VA**

Equation 79: Three-phase Apparent Power.

A.7.6.- NONACTIVE POWER (*N*)

The 10 minutes Nonactive Power value is the mean of the 10/12 cycle Nonactive Power values.

$$Np_{10min} = \frac{1}{N} x \sum_{j=1}^{N} Np_j$$

Units: **var**

Equation 80: Nonactive Power.

Where **N** is the number of groups of 10 or 12 cycles (depending on the frequency) included in 10 minutes period.

A.7.7.- POWER FACTOR (*PF*)

The 10 minutes **Power Factor** value is the division of the 10 minutes Active Power value and Apparent Power value.

Phase Power Factor:

$$PFp_{10min} = \frac{Pp_{10min}}{Sp_{10min}}$$

Equation 81: Phase Power Factor.

Three-phase Power Factor:

$$PF_{TOT10min} = \frac{P_{TOT10min}}{S_{e10min}}$$

Equation 82: Three-phase Power Factor.

A.7.8.- FUNDAMENTAL ACTIVE POWER (P_1)

The 10 minutes **Fundamental Active Power** of every phase is calculated as a mean of the 10/12 cycle fundamental active power values.

Phase Fundamental Active Power:

$$Pp_{10min} = \frac{1}{N} x \sum_{j=1}^{N} Pp_1$$

Units: **W**

Equation 83: Phase Fundamental Active Power.

Where **N** is the number of 10/12 cycle blocks included in the 10 min period.

Positive Sequence Active Power:

$$P_{10min}^{pos} = 3xV_{10min}^{pos} xI_{10min}^{pos} xcos\theta_{10min}^{pos}$$

Units: **W**

Equation 84: Positive Sequence Active Power.

A.7.9.- FUNDAMENTAL REACTIVE POWER (*Q*)

The 10 minutes **Fundamental Reactive Power** of every phase is calculated as a mean of the 10/12 cycle fundamental reactive power values.

Phase Fundamental Reactive Power:

$$Qp_{110min} = \frac{1}{N} x \sum_{j=1}^{N} Qp_1$$

Units: **var**

Equation 85: Phase Fundamental Reactive Power.

Where **N** is the number of 10/12 cycle blocks included inthe 10min period.

Positive Sequence Reactive Power:

$$Q_{10min}^{pos} = 3xV_{10min}^{pos} xI_{10min}^{pos} xsin\theta_{10min}^{pos}$$

Units: **var**

Equation 86: Positive Sequence Reactive Power.

A.7.10.- FUNDAMENTAL APPARENT POWER (S_1)

The 10 minutes **Fundamental Apparent Power** of every phase is calculated from the 10 minutes fundamental voltage and fundamental current.

Phase Fundamental Apparent Power:

$$Sp_{110min} = Vp_{110min} Ip_{110min}$$

Units: **VA**

Equation 87: Phase Fundamental Apparent Power.

Fundamental Effective Apparent Power:

$$Se_{110min} = 3xVe_{110min} xIe_{110min}$$

Units: **VA**

Equation 88: Fundamental Effective Apparent Power.

A.7.11.- DISPLACEMENT POWER FACTOR (DPF)

The 10 minutes **DPF** of every phase is calculated from the 10 minutes fundamental Active Power and the fundamental Apparent values.

Phase Displacement Power Factor:

$$DPFp_{10min} = \frac{Pp_{110min}}{Sp_{110min}}$$

Equation 89: Phase Displacement Power Factor.

Positive Sequence Power Factor:

$$DPF_{TOT10min} = \frac{P^{pos}_{10min}}{P^{pos}_{10min}}$$

Equation 90: Positive Sequence Power Factor.

A.7.12.- VOLTAGE AND CURRENT HARMONICS

The 10 minutes **Voltage and Current harmonics** values are the square mean of the 10/12 cycle **Voltage and Current harmonic** values.

$$G_{sg,n_{10min}} = \frac{1}{N}\sqrt{\sum_{i=1}^{N} {C_{sg,n}}_i^2}$$

Equation 91: $G_{sg,n}$.

Where **N** is the number of groups of 10 or 12 cycles (depending on the frequency) included in 10 minutes period.

$$H_{10minn}(\%) = \frac{G_{sg,n10min}}{G_{sg,110min}} x100$$

Equation 92: H(%).

The 10 minutes **Total Harmonic Distortion** is calculated through the 10 minutes single harmonics values:

$$THD_{10min} = \sqrt{\sum_{n=2}^{50} \left(\frac{G_{sg,n_{10min}}}{G_{sg,1_{10min}}}\right)^2}$$

Equation 93: THD.

Where **G** is the rms value of the harmonic component in the 10 min period.

A.7.13.- VOLTAGE AND CURRENT INTERHARMONICS

The 10 minutes **Voltage and Current interharmonics** value calculation is the square mean of the 10/12 cycles interarmonics result.

$$G_{isg,n_{10min}} = \frac{1}{N}\sqrt{\sum_{i=1}^{N} {C_{isg,n}}_i^2}$$

$$IH_{n10min}(\%) = \frac{G_{isg,n10min}}{G_{isg,110min}} x100$$

Equation 94: Voltage and current Interharmonics.

A.7.14.- VOLTAGE AND CURRENT UNBALANCE

The 10 minute Voltage and Current Positive sequence component (direct), Negative sequence component (inverse) and Zero sequence component (homopolar) value calculation are the square mean of the 10/12 cycles values result during the 10 minute interval.

U_1 : Positive sequence component
U_2 : Negative sequence component
U_0 : Zero sequence component

$$U1_{10min} = \sqrt{\frac{1}{N} x \sum_{j=1}^{N} U1_j^2}$$

Equation 95: U_1.

$$U2_{10min} = \sqrt{\frac{1}{N} x \sum_{j=1}^{N} U2_j^2}$$

Equation 96: U_2.

$$U0_{10min} = \sqrt{\frac{1}{N} x \sum_{j=1}^{N} U0_j^2}$$

Equation 97: U_0.

With the above values, the Voltage / Current unbalance and asymmetry are calculated:

Negative sequence unbalance ratio u_2 (voltage / current unbalance):

$$K_{d_{10min}} = u_{2_{10min}} = \frac{U2_{10min}}{U1_{10min}} x100\% = \frac{negativesequence}{positivesequence} x100\%$$

Equation 98: Negative sequence unbalance ratio.

Zero sequence unbalance ratio u_0 (voltage / current asimmetry):

$$K_{a_{10min}} = u_{0_{10min}} = \frac{U0_{10min}}{U1_{10min}} x100\% = \frac{zerosequence}{positivesequence} x100\%$$

Equation 99: Zero sequence unbalance ratio.

A.7.15.- VOLTAGE AND CURRENT CREST FACTOR

The 10 minutes **Voltage and Current Crest factor** are the maximum of every 10/12 cycles values included in the 10 minutes period interval.

$$VoltageCF_{10min} = MAX(CF_{1}, \dots, CF_N)$$

Equation 100: Voltage CF.

$$CurrentCF_{10min} = MAX(CF_1, \dots, CF_N)$$

Equation 101: Current CF.

Where **N** is the number of groups of 10 or 12 cycles (depending on the frequency) included in the 10min period and **samples** is the number of samples observed in one time window.

A.7.16.- K-FACTOR

K-factor is a weighting of the harmonic load currents according to their effects on transformer heating.
The algorithm used to compute **K-factor** is based on IEEE C57.110.
The 10 min **K-factor** calculation is based on the 10 minutes harmonics results.

$$K - factor_{10min}(\%) = \frac{\sum_{h=1}^{25}\left(G_{sg,h_{10min}} xh\right)^2}{\sum_{h=1}^{25} G_{sg,h_{10min}}{}^2} x100$$

Equation 102: K-Factor.

A.7.17.- FLICKER Pinst

The 10min **flicker Pinst** is the average of every 10/12 cycles **flicker Pinst** included into the 10 min period.

A.7.18.- FLICKER Pst

Flicker is the visual human sensation of unsteadiness caused by a fluctuating light stimulus.
Flicker is measured according to IEC 61000-4-15.

It is calculated with the Voltage samples which are filtered, classified and weighted to simulate the human visual response and gives a **Pst** result every 10 minutes as IEC 61000-4-30 class A.

A.7.19.- FREQUENCY

The 10 minute **Frequency** value is the means of every 10 second frequency result.

$$f_{10min} = \frac{\sum_0^N f_{10s}}{N}$$

Equation 103: Frequency.

Where **N** is the number of groups of 10 seconds included in 10 minutes period.

A.8.- 10 MINUTES MAXIMUM AND MINIMUM VALUES

A.8.1.- MAXIMUM AND MINIMUM VALUES

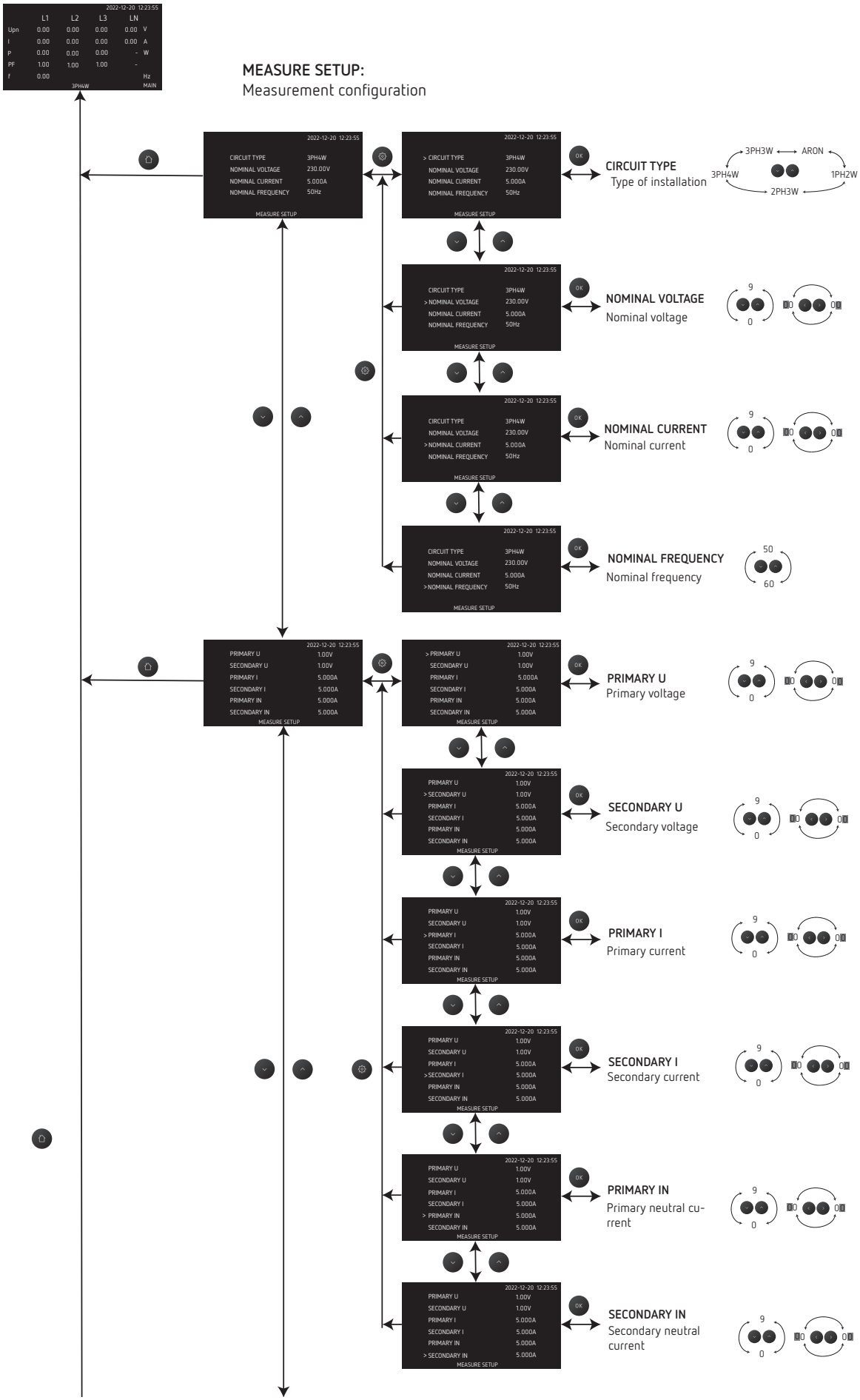
The 10 minutes **maximum and minimum values** are calculated from the 10/12 cycles values included into the 10 minutes period. With the special case of the frequency.

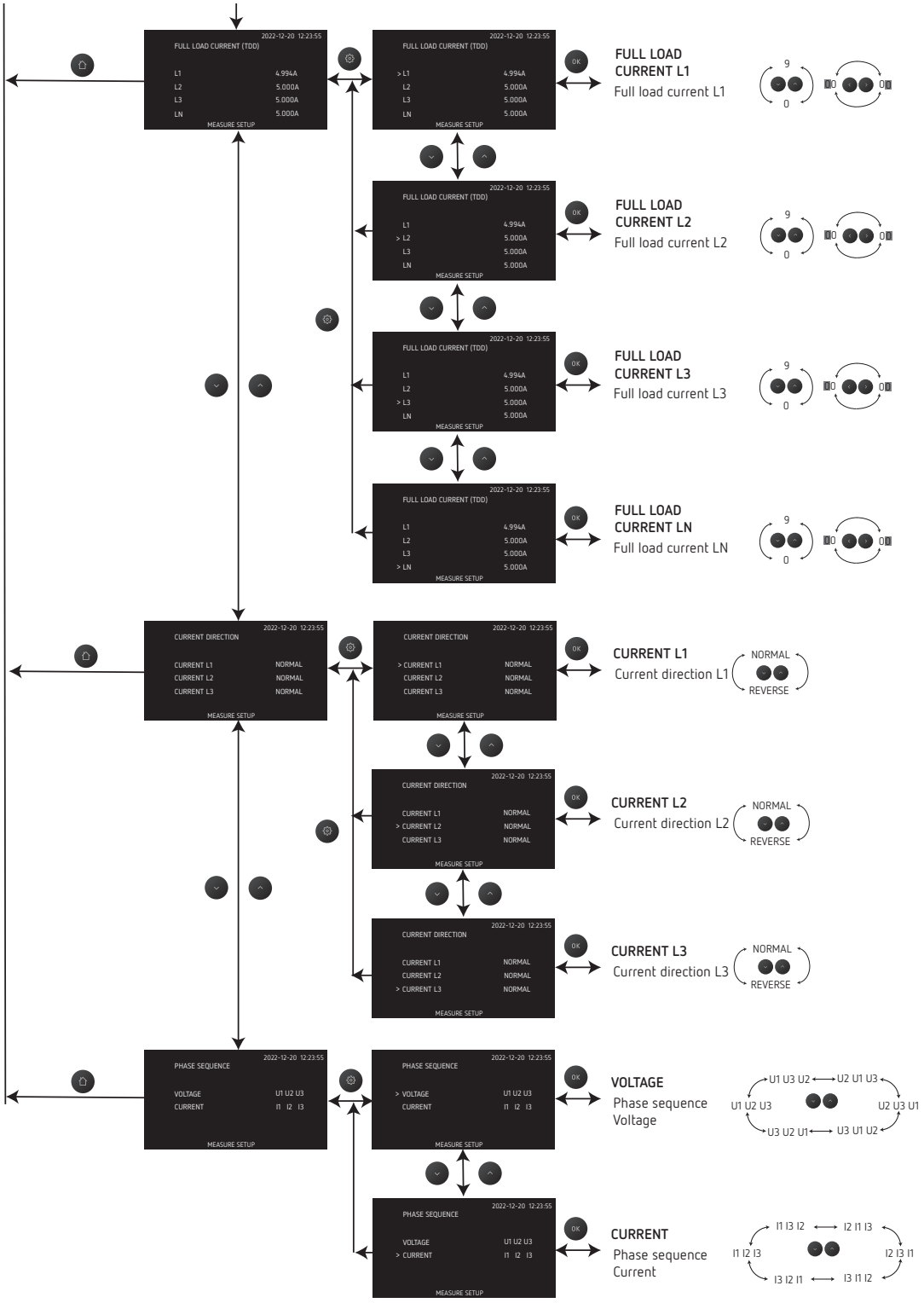
A.8.2.-FREQUENCY MAXIMUM AND MINIMUM VALUES

The 10 minute **maximum and minimum** frequency are calculated from the 1s sampling frequency.

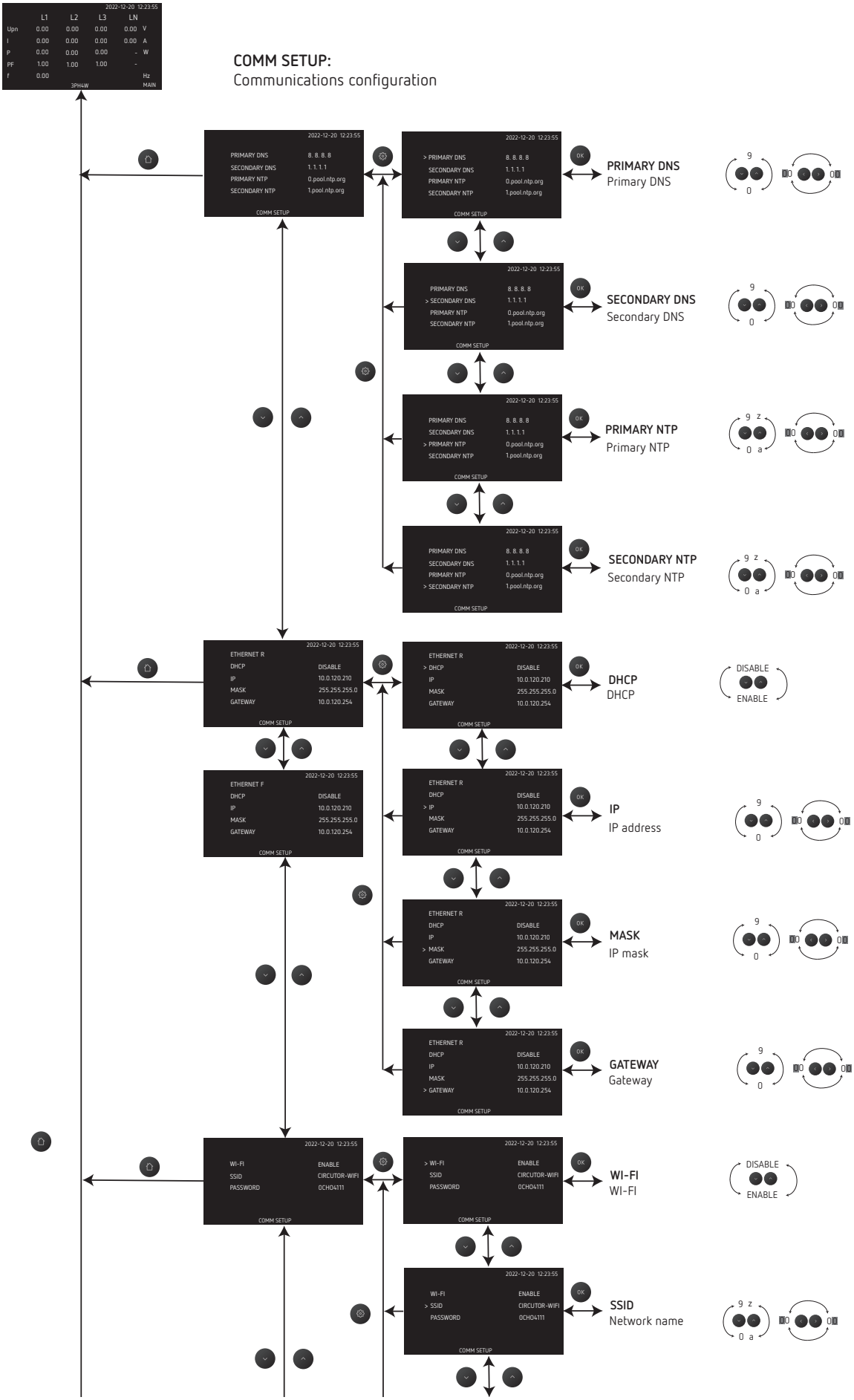
ANNEX B.- CONFIGURATION MENU

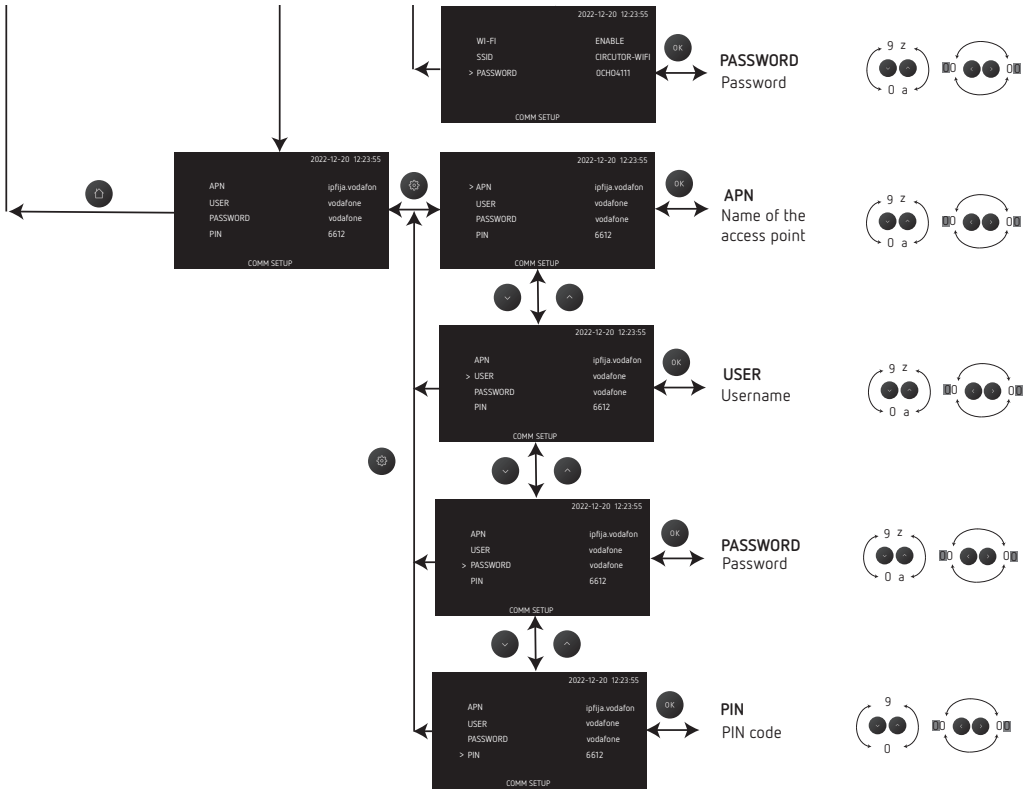
B.1.- MEASURE SETUP: MEASUREMENT CONFIGURATION



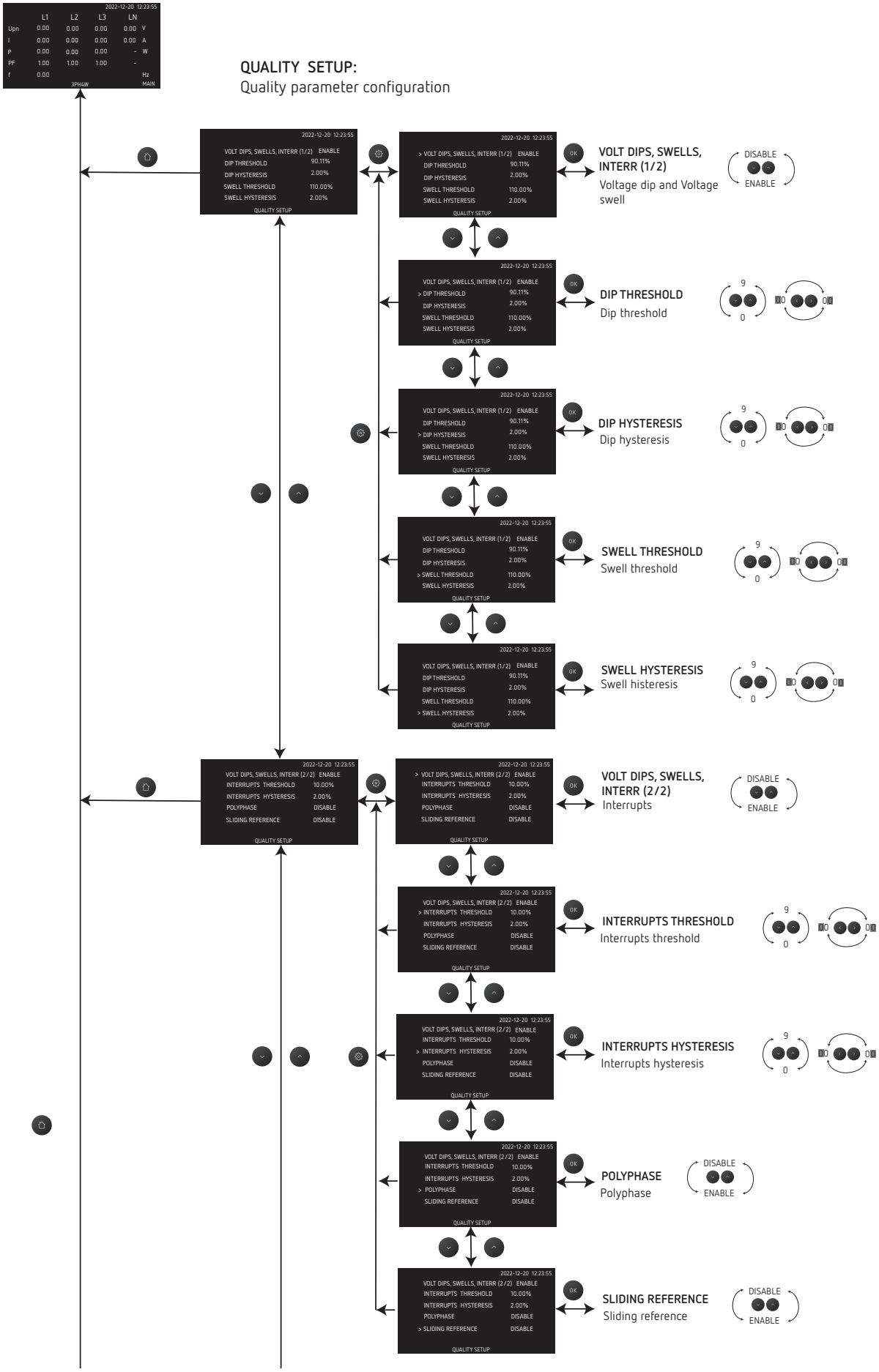

FULL LOAD CURRENT (TDD)
L1 4.994A
L2 5.000A
L3 5.000A
LN 5.000A
MEASURE SETUP
FULL LOAD CURRENT L1
Full load current L1
FULL LOAD CURRENT L2
Full load current L2
FULL LOAD CURRENT L3
Full load current L3
FULL LOAD CURRENT LN
Full load current LN
CURRENT DIRECTION
CURRENT L1 NORMAL
CURRENT L2 NORMAL
CURRENT L3 NORMAL
CURRENT L1
Current direction L1
CURRENT L2
Current direction L2
CURRENT L3
Current direction L3
NORMAL
REVERSE
PHASE SEQUENCE
VOLTAGE U1 U2 U3
CURRENT I1 I2 I3
VOLTAGE
Phase sequence Voltage
CURRENT
Phase sequence Current
U1 U3 U2
U2 U1 U3
U1 U2 U3
U2 U3 U1
U3 U2 U1
U3 U1 U2
I1 I3 I2
I2 I1 I3
I1 I2 I3
I2 I3 I1
I3 I2 I1
I3 I1 I2

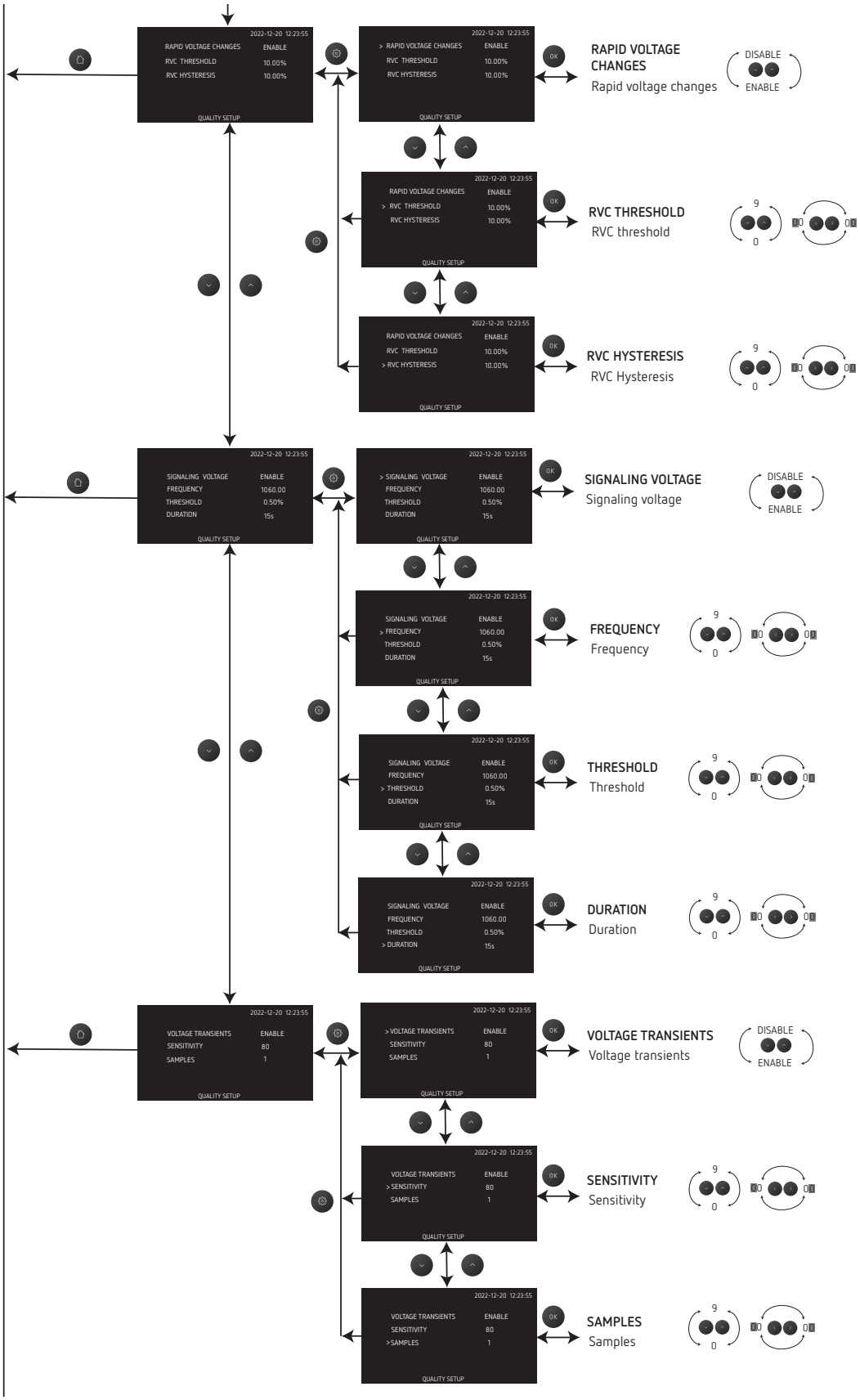
B.2.- COMM SETUP: COMMUNICATIONS CONFIGURATION

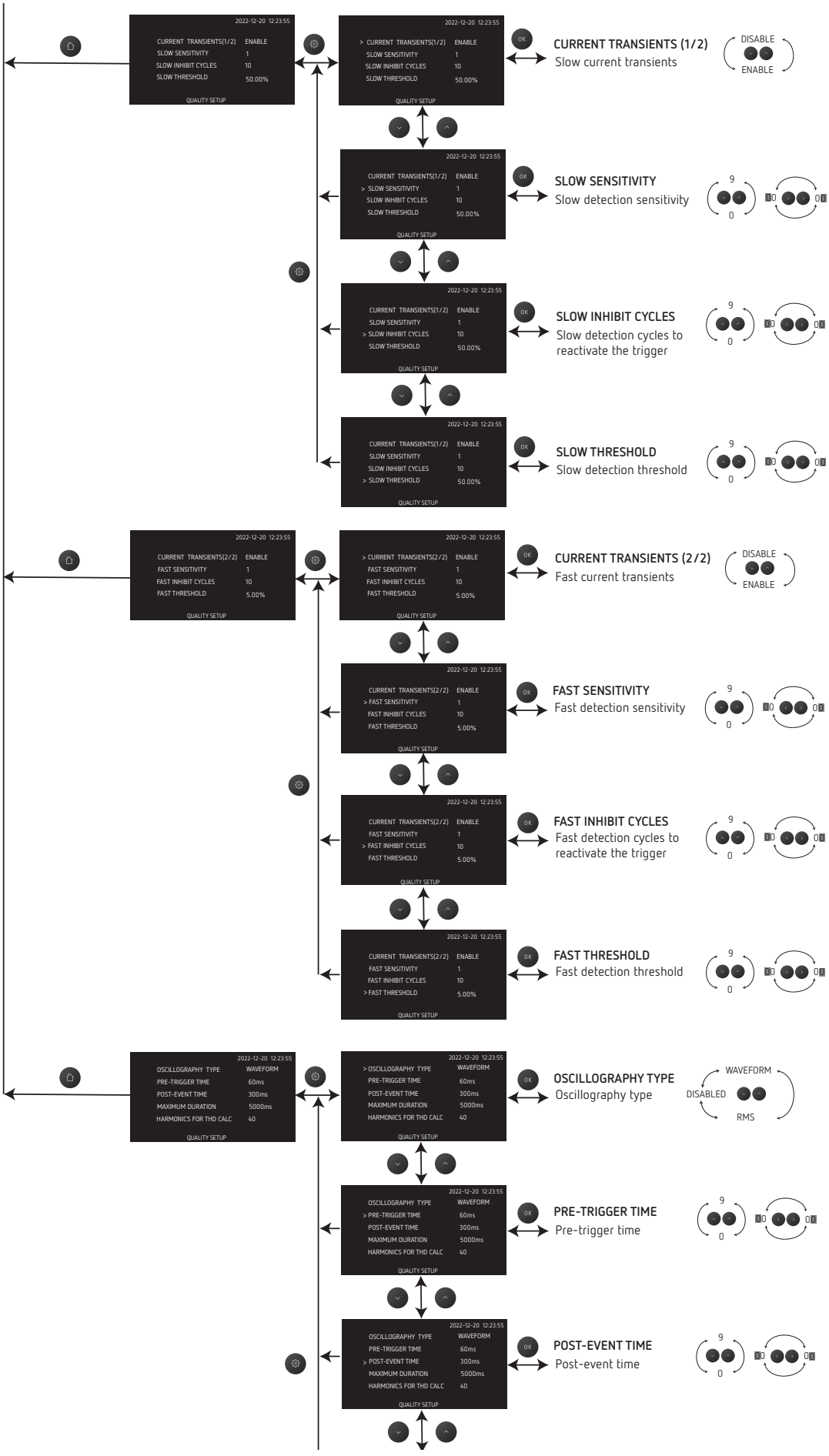


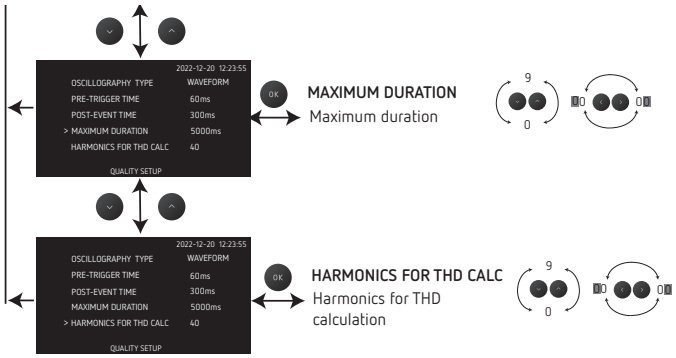

2022-12-20 12:23:55
APN ipfija.vodafon
USER vodafone
PASSWORD vodafone
PIN 6612
COMM SETUP
WI-FI ENABLE
SSID CIRCUTOR-WIFI
> PASSWORD 0CH04111
OK
PASSWORD
Password
> APN
APN
Name of the access point
> USER
USER
Username
> PASSWORD
PASSWORD
Password
> PIN
PIN
PIN code
9 z
0 a
0

B.3.- QUALITY SETUP: QUALITY PARAMETER CONFIGURATION

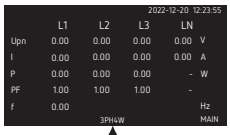



2022-12-20 12:23:55
RAPID VOLTAGE CHANGES ENABLE
RVC THRESHOLD 10.00%
RVC HYSTERESIS 10.00%
QUALITY SETUP
RAPID VOLTAGE CHANGES
Rapid voltage changes
DISABLE
ENABLE
RVC THRESHOLD
RVC threshold
RVC HYSTERESIS
RVC Hysteresis
SIGNALING VOLTAGE ENABLE
FREQUENCY 1060.00
THRESHOLD 0.50%
DURATION 15s
SIGNALING VOLTAGE
Signaling voltage
FREQUENCY
Frequency
THRESHOLD
Threshold
DURATION
Duration
VOLTAGE TRANSIENTS ENABLE
SENSITIVITY 80
SAMPLES 1
VOLTAGE TRANSIENTS
Voltage transients
SENSITIVITY
Sensitivity
SAMPLES
Samples

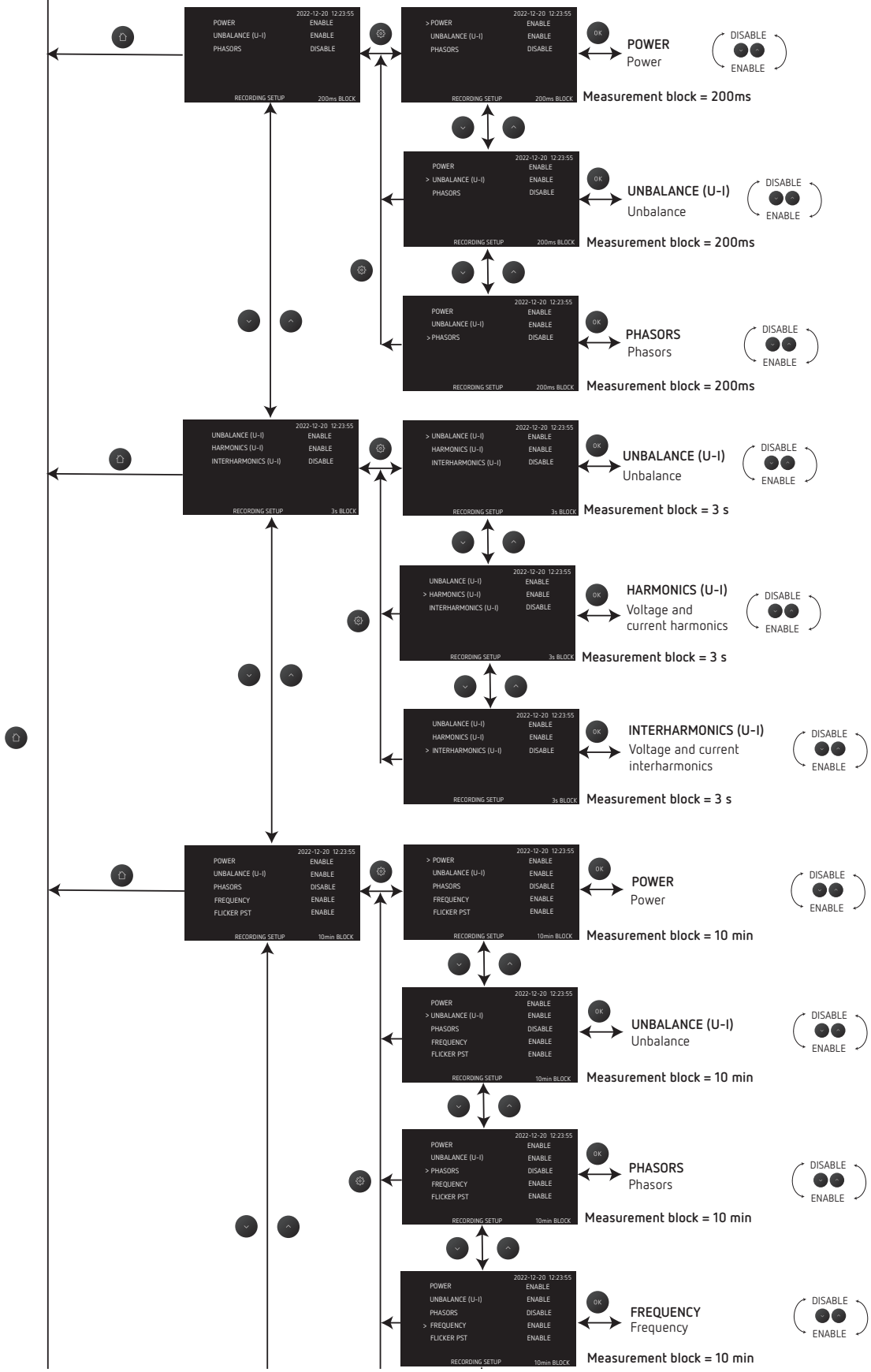

2022-12-20 12:23:55
CURRENT TRANSIENTS(1/2) ENABLE
SLOW SENSITIVITY 1
SLOW INHIBIT CYCLES 10
SLOW THRESHOLD 50.00%
QUALITY SETUP
> CURRENT TRANSIENTS(1/2) ENABLE
> SLOW SENSITIVITY 1
> SLOW INHIBIT CYCLES 10
> SLOW THRESHOLD 50.00%
CURRENT TRANSIENTS (1/2)
Slow current transients
DISABLE
ENABLE
SLOW SENSITIVITY
Slow detection sensitivity
SLOW INHIBIT CYCLES
Slow detection cycles to reactivate the trigger
SLOW THRESHOLD
Slow detection threshold
CURRENT TRANSIENTS(2/2) ENABLE
FAST SENSITIVITY 1
FAST INHIBIT CYCLES 10
FAST THRESHOLD 5.00%
> CURRENT TRANSIENTS(2/2) ENABLE
> FAST SENSITIVITY 1
> FAST INHIBIT CYCLES 10
> FAST THRESHOLD 5.00%
CURRENT TRANSIENTS (2/2)
Fast current transients
FAST SENSITIVITY
Fast detection sensitivity
FAST INHIBIT CYCLES
Fast detection cycles to reactivate the trigger
FAST THRESHOLD
Fast detection threshold
OSCILLOGRAPHY TYPE WAVEFORM
PRE-TRIGGER TIME 60ms
POST-EVENT TIME 300ms
MAXIMUM DURATION 5000ms
HARMONICS FOR THD CALC 40
> OSCILLOGRAPHY TYPE WAVEFORM
OSCILLOGRAPHY TYPE
Oscillography type
WAVEFORM
DISABLED
RMS
PRE-TRIGGER TIME
Pre-trigger time
POST-EVENT TIME
Post-event time

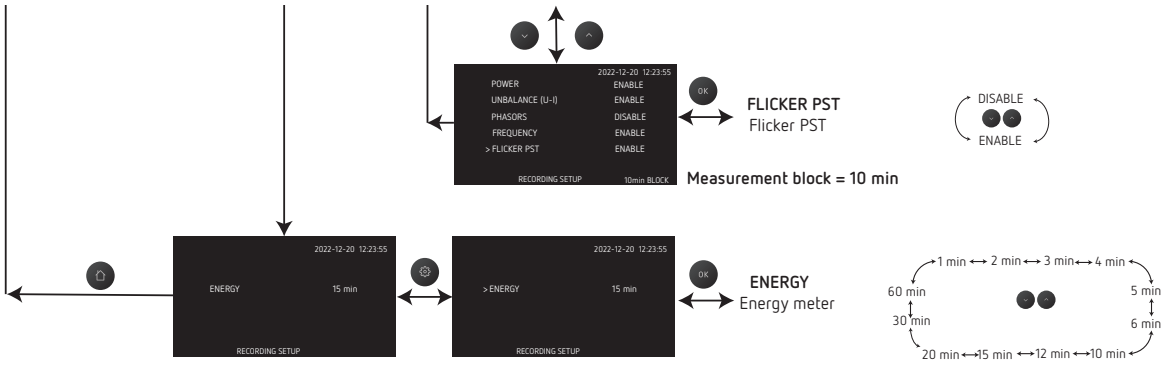

2022-12-20 12:23:55
OSCILLOGRAPHY TYPE WAVEFORM
PRE-TRIGGER TIME 60ms
POST-EVENT TIME 300ms
> MAXIMUM DURATION 5000ms
HARMONICS FOR THD CALC 40
QUALITY SETUP
OK
MAXIMUM DURATION
Maximum duration
2022-12-20 12:23:55
OSCILLOGRAPHY TYPE WAVEFORM
PRE-TRIGGER TIME 60ms
POST-EVENT TIME 300ms
MAXIMUM DURATION 5000ms
> HARMONICS FOR THD CALC 40
QUALITY SETUP
OK
HARMONICS FOR THD CALC
Harmonics for THD calculation

B.4.- RECORDING SETUP: CONFIGURATION OF PARAMETERS TO RECORD

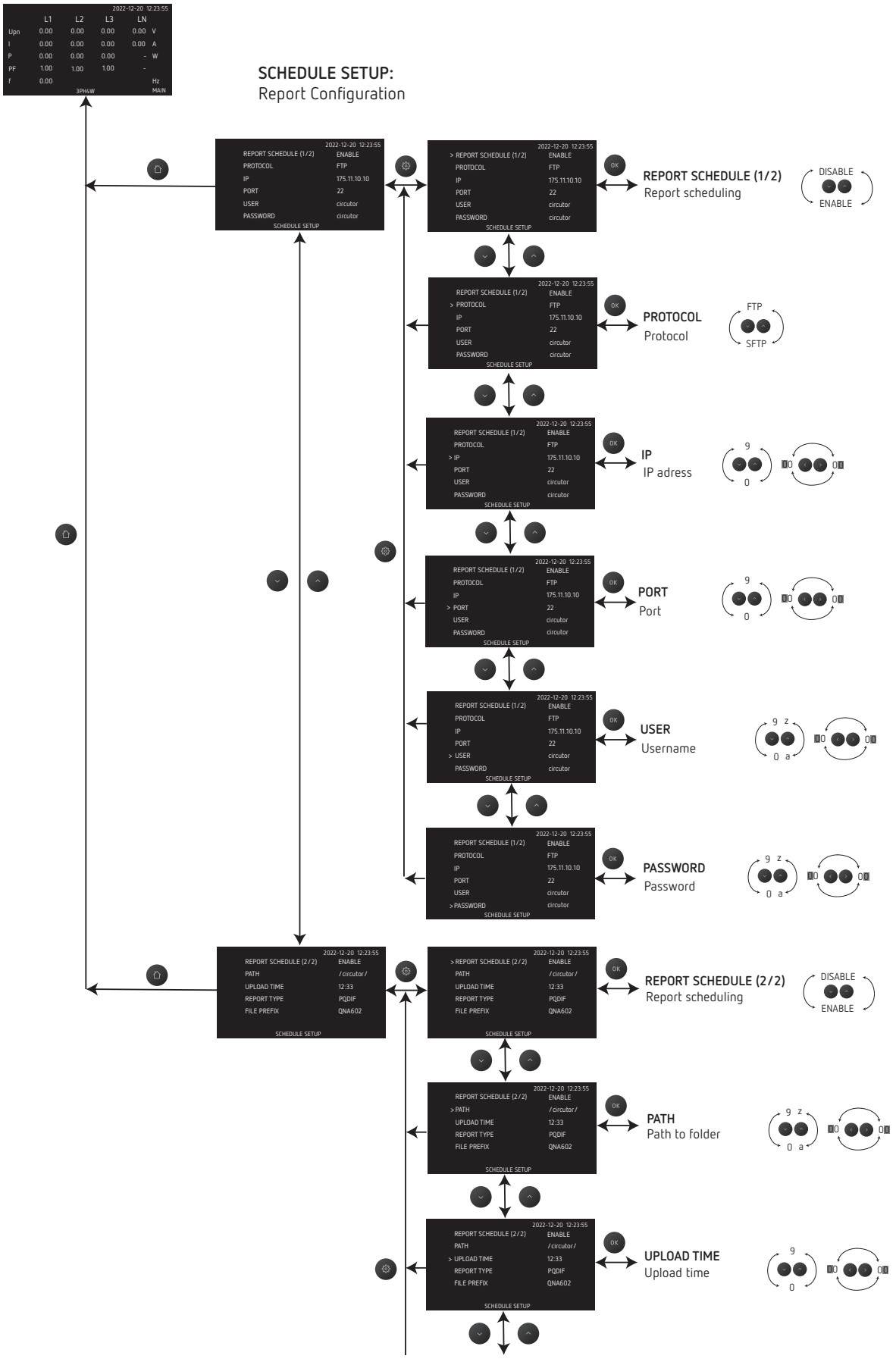


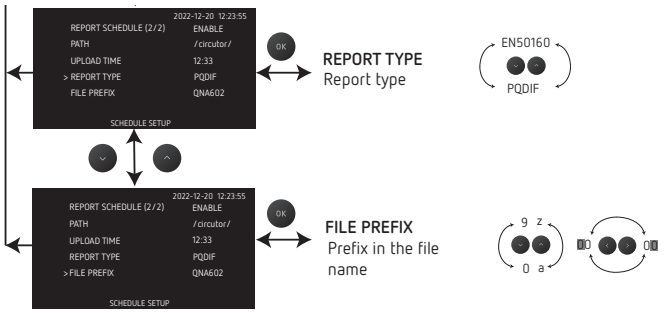
RECORDING SETUP:
Configuration of the parameters to be recorded



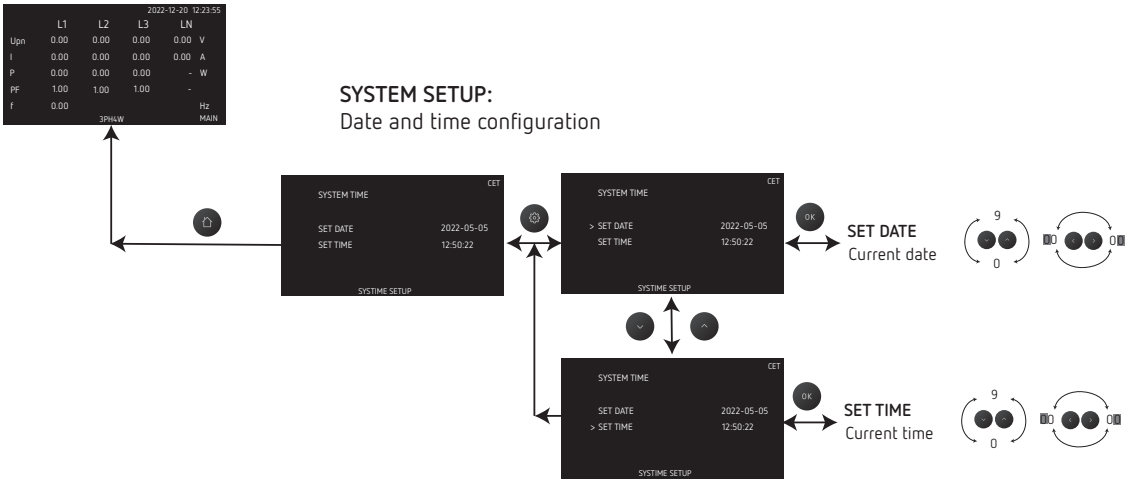

2022-12-20 12:23:55
POWER ENABLE
UNBALANCE (U-I) ENABLE
PHASORS DISABLE
FREQUENCY ENABLE
> FLICKER PST ENABLE
RECORDING SETUP
10min BLOCK
OK
FLICKER PST
Flicker PST
DISABLE
ENABLE
Measurement block = 10 min
2022-12-20 12:23:55
ENERGY 15 min
RECORDING SETUP
2022-12-20 12:23:55
> ENERGY 15 min
RECORDING SETUP
OK
ENERGY
Energy meter
1 min 2 min 3 min 4 min
5 min
6 min
10 min 12 min 15 min 20 min
30 min
60 min

B.5.- SCHEDULE SETUP: REPORT CONFIGURATION





B.6.- SYSTEM SETUP: DATE AND TIME CONFIGURATION



ANNEX C.- .ICD FILE

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 <Communication>
        <SubNetwork name="W01" type="8-MMS">
                <Text>Station bus</Text>
                <BitRate unit="b/s">10</BitRate>
                <ConnectedAP iedName="QNA600server" apName="iecserver">
                        <Address>
                                <P type="IP">193.168.113.3</P>
                                <P type="IP-SUBNET">255.255.255.0</P>
                                <P type="IP-GATEWAY">193.168.0.1</P>
                                <P type="OSI-TSEL">0001</P>
                                <P type="OSI-PSEL">00000001</P>
                                <P type="OSI-SSEL">0001</P>
                        </Address>
                        <GSE ldInst="LDevice1" cbName="gooseOut">
                <Address>
                  <P type="MAC-Address">01-0C-CD-01-00-01</P>
                  <P type="APPID">1000</P>
                  <P type="VLAN-ID">1</P>
                  <P type="VLAN-PRIORITY">4</P>
                </Address>
                        </GSE>
                </ConnectedAP>
        </SubNetwork>
 </Communication>
 <IED name="QNA600server">
        <Services>
                <DynAssociation />
    <GetDirectory />
    <GetDataObjectDefinition />
    <GetDataSetValue />
    <DataSetDirectory />
        <ConfDataSet max="50" maxAttributes="150" modify="true" />
    <ReadWrite />
        <ConfReportControl max="20" />
        <ReportSettings bufTime="Conf" cbName="Conf" rptID="Conf" datSet="Conf" intgPd="Conf" optFields="Conf" trgOps="Conf" />
    <GetCBValues />
        <GSSE max="5" />
        <GOOSE max="5" />
        <GSEDir />
    <FileHandling />
        </Services>
  <AccessPoint name="iecserver">
        <Server>
            <Authentication />
            <LDevice inst="LDevice1" desc="">
                <LN0 lnClass="LLN0" lnType="LLN01" inst="">
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                        <FCDA ldInst="LDevice1" lnClass="MMXU" fc="MX" lnInst="1" doName="PPV" daName="phsAB.f" />
                        <FCDA ldInst="LDevice1" lnClass="MMXU" fc="MX" lnInst="1" doName="PPV" daName="phsBC.f" />
                        <FCDA ldInst="LDevice1" lnClass="MMXU" fc="MX" lnInst="1" doName="PPV" daName="phsCA.f" />

                        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="1" doName="Amp" daName="mag.f" />
                        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="2" doName="Amp" daName="mag.f" />
                        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="3" doName="Amp" daName="mag.f" />
                        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="1" doName="Watt" daName="mag.f" />
                        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="2" doName="Watt" daName="mag.f" />
                        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="3" doName="Watt" daName="mag.f" />
                        <FCDA ldInst="LDevice1" lnClass="MMXU" fc="MX" lnInst="1" doName="TotW" daName="mag.f" />
                        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="1" doName="VolAmpr" daName="mag.f" />
                        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="2" doName="VolAmpr" daName="mag.f" />
```

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        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="3" doName="VolAmpr" daName="mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MMXU" fc="MX" lnInst="1" doName="TotVAr" daName="mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="1" doName="VolAmp" daName="mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="2" doName="VolAmp" daName="mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="3" doName="VolAmp" daName="mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MMXU" fc="MX" lnInst="1" doName="TotVA" daName="mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="1" doName="PwrFact" daName="mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="2" doName="PwrFact" daName="mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="3" doName="PwrFact" daName="mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MMXU" fc="MX" lnInst="1" doName="TotPF" daName="mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="1" doName="CosPhy" daName="mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="2" doName="CosPhy" daName="mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="3" doName="CosPhy" daName="mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MMXU" fc="MX" lnInst="1" doName="TotCosPhy" daName="mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="1" doName="Phy" daName="mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="2" doName="Phy" daName="mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="3" doName="Phy" daName="mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MMXU" fc="MX" lnInst="1" doName="Theta" daName="phsAB.f" />
        <FCDA ldInst="LDevice1" lnClass="MMXU" fc="MX" lnInst="1" doName="Theta" daName="phsBC.f" />
        <FCDA ldInst="LDevice1" lnClass="MMXU" fc="MX" lnInst="1" doName="Theta" daName="phsCA.f" />
</DataSet>
<DataSet name="Dataset10m" desc="">
        <FCDA ldInst="LDevice1" lnClass="MMXU" fc="MX" lnInst="1" doName="Hz" daName="mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MSQI" fc="MX" lnInst="1" doName="SeqV.c1" daName="cVal.mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MSQI" fc="MX" lnInst="1" doName="SeqV.c2" daName="cVal.mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MSQI" fc="MX" lnInst="1" doName="SeqV.c3" daName="cVal.mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MSQI" fc="MX" lnInst="1" doName="ImbNgV" daName="mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MHAI" fc="MX" lnInst="1" doName="ThdA.phsA" daName="cVal.mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MHAI" fc="MX" lnInst="1" doName="ThdA.phsB" daName="cVal.mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MHAI" fc="MX" lnInst="1" doName="ThdA.phsC" daName="cVal.mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MHAI" fc="MX" lnInst="1" doName="ThdPhV.phsA" daName="cVal.mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MHAI" fc="MX" lnInst="1" doName="ThdPhV.phsB" daName="cVal.mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MHAI" fc="MX" lnInst="1" doName="ThdPhV.phsC" daName="cVal.mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MHAI" fc="MX" lnInst="1" doName="HCfPhV.phsA" daName="cVal.mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MHAI" fc="MX" lnInst="1" doName="HCfPhV.phsB" daName="cVal.mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MHAI" fc="MX" lnInst="1" doName="HCfPhV.phsC" daName="cVal.mag.f" />
</DataSet>
<DataSet name="Dataset10mHA1" desc="">
        <FCDA ldInst="LDevice1" lnClass="MHAI" fc="MX" lnInst="1" doName="HA" daName="phsAHar" />
</DataSet>
<DataSet name="Dataset10mHA2" desc="">
        <FCDA ldInst="LDevice1" lnClass="MHAI" fc="MX" lnInst="1" doName="HA" daName="phsBHar" />
</DataSet>
<DataSet name="Dataset10mHA3" desc="">
        <FCDA ldInst="LDevice1" lnClass="MHAI" fc="MX" lnInst="1" doName="HA" daName="phsCHar" />
</DataSet>
<DataSet name="Dataset10mHV1" desc="">
        <FCDA ldInst="LDevice1" lnClass="MHAI" fc="MX" lnInst="1" doName="HPhV" daName="phsAHar" />
</DataSet>
<DataSet name="Dataset10mHV2" desc="">
        <FCDA ldInst="LDevice1" lnClass="MHAI" fc="MX" lnInst="1" doName="HPhV" daName="phsBHar" />
</DataSet>
<DataSet name="Dataset10mHV3" desc="">
        <FCDA ldInst="LDevice1" lnClass="MHAI" fc="MX" lnInst="1" doName="HPhV" daName="phsCHar" />
</DataSet>
<DataSet name="DatasetGoose" desc="">
        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="1" doName="Vol" daName="mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="2" doName="Vol" daName="mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="3" doName="Vol" daName="mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MMXU" fc="MX" lnInst="1" doName="PPV" daName="phsAB.f" />
        <FCDA ldInst="LDevice1" lnClass="MMXU" fc="MX" lnInst="1" doName="PPV" daName="phsBC.f" />
        <FCDA ldInst="LDevice1" lnClass="MMXU" fc="MX" lnInst="1" doName="PPV" daName="phsCA.f" />

        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="1" doName="Amp" daName="mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="2" doName="Amp" daName="mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="3" doName="Amp" daName="mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="1" doName="Watt" daName="mag.f" />
        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="2" doName="Watt" daName="mag.f" />
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                        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="3" doName="Watt" daName="mag.f" />
                        <FCDA ldInst="LDevice1" lnClass="MMXU" fc="MX" lnInst="1" doName="TotW" daName="mag.f" />
                        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="1" doName="VolAmpr" daName="mag.f" />
                        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="2" doName="VolAmpr" daName="mag.f" />
                        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="3" doName="VolAmpr" daName="mag.f" />
                        <FCDA ldInst="LDevice1" lnClass="MMXU" fc="MX" lnInst="1" doName="TotVAr" daName="mag.f" />
                        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="1" doName="VolAmp" daName="mag.f" />
                        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="2" doName="VolAmp" daName="mag.f" />
                        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="3" doName="VolAmp" daName="mag.f" />
                        <FCDA ldInst="LDevice1" lnClass="MMXU" fc="MX" lnInst="1" doName="TotVA" daName="mag.f" />
                        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="1" doName="PwrFact" daName="mag.f" />
                        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="2" doName="PwrFact" daName="mag.f" />
                        <FCDA ldInst="LDevice1" lnClass="MMXN" fc="MX" lnInst="3" doName="PwrFact" daName="mag.f" />
                        <FCDA ldInst="LDevice1" lnClass="MMXU" fc="MX" lnInst="1" doName="TotPF" daName="mag.f" />
                </DataSet>
                <ReportControl name="Report_data3secs"  rptID="Rep3s" confRev="1" datSet="Dataset3s" buffered="false"  intgPd="10000" desc="">
                        <TrgOps dchg="true" dupd="true" period="true" />
                        <OptFields dataSet="true" />
                        <RptEnabled max="1" />
                </ReportControl>
                <GSEControl appID="Goose_data3secs" name="gooseOut" type="GOOSE" datSet="DatasetGoose" confRev="2" />

                <DOI name="Mod" desc="">
                        <DAI name="ctlModel" >
                           <Val>status-only</Val>
                        </DAI>
                </DOI>
                <DOI name="NamPlt" desc="">
                        <DAI name="ldNs" desc="">
                           <Val>IEC 61850-7-4:2003</Val>
                        </DAI>
                </DOI>
        </LN0>
        <LN lnClass="LPHD" lnType="LPHD1" inst="1" prefix="">
                <DOI name="PhyHealth" desc="">
                        <DAI name="stVal">
                                <Val>Ok</Val>
                        </DAI>
                </DOI>
        </LN>
        <LN lnClass="MMXN" lnType="MMXN1" inst="1" prefix="">
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                        <DAI name="ctlModel" desc="" >
                                <Val>direct_with_normal_security</Val>
                        </DAI>
                </DOI>
        </LN>
        <LN lnClass="MMXN" lnType="MMXN1" inst="2" prefix="">
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                        <DAI name="ctlModel" desc="" >
                                <Val>direct_with_normal_security</Val>
                        </DAI>
                </DOI>
        </LN>
        <LN lnClass="MMXN" lnType="MMXN1" inst="3" prefix="">
                <DOI name="Mod" desc="">
                        <DAI name="ctlModel" desc="" >
                                <Val>direct_with_normal_security</Val>
                        </DAI>
                </DOI>
        </LN>
        <LN lnClass="MMXU" lnType="MMXU1" inst="1" prefix="">
                <DOI name="Mod" desc="">
                        <DAI name="ctlModel" desc="" >
                                <Val>direct_with_normal_security</Val>
                        </DAI>
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                </DOI>
        </LN>
        <LN lnClass="MSQI" lnType="MSQI1" inst="1" prefix="">
                <DOI name="Mod" desc="">
                        <DAI name="ctlModel" desc="" >
                                <Val>direct_with_normal_security</Val>
                        </DAI>
                </DOI>
        </LN>
        <LN lnClass="MHAI" lnType="MHAI1" inst="1" prefix="">
                <DOI name="Mod" desc="">
                        <DAI name="ctlModel" desc="" >
                                <Val>direct_with_normal_security</Val>
                        </DAI>
                </DOI>
                <DOI name="HA">
                        <DAI name="numHar">
                                <Val>49</Val>
                        </DAI>
                </DOI>
                <DOI name="HPhV">
                        <DAI name="numHar">
                                <Val>49</Val>
                        </DAI>
                </DOI>
        </LN>
    </LDevice>
  </Server>
 </AccessPoint>
</IED>
<DataTypeTemplates>
 <LNodeType id="LLN01" lnClass="LLN0">
                <DO name="Mod" type="INC_2_Mod" />
                <DO name="Beh" type="INS_2_Beh" />
                <DO name="Health" type="INS_2_Beh" />
                <DO name="NamPlt" type="LPL_2_NamPlt" />
 </LNodeType>
 <LNodeType id="LPHD1" lnClass="LPHD">
                <DO name="PhyNam" type="DPL_2_PhyNam" />
                <DO name="PhyHealth" type="INS_2_PhyHealth" />
                <DO name="Proxy" type="SPS_2_Proxy" />
 </LNodeType>
 <LNodeType id="MMXN1" lnClass="MMXN">
                <DO name="Mod" type="INC_2_Mod" />
                <DO name="Beh" type="INS_2_Beh" />
                <DO name="Health" type="INS_2_Beh" />
                <DO name="NamPlt" type="LPL_3_NamPlt" />
                <DO name="Vol" type="MV_2_Vol" />
                <DO name="Amp" type="MV_2_Vol" />
                <DO name="Watt" type="MV_2_Vol" />
                <DO name="VolAmpr" type="MV_2_Vol" />
                <DO name="VolAmp" type="MV_2_Vol" />
                <DO name="PwrFact" type="MV_2_Vol" />
                <DO name="CosPhy" type="MV_2_Vol" />
                <DO name="Phy" type="MV_2_Vol" />
                <DO name="Hz" type="MV_2_Vol" />
 </LNodeType>
 <LNodeType id="MMXU1" lnClass="MMXU">
                <DO name="Mod" type="INC_2_Mod" />
                <DO name="Beh" type="INS_2_Beh" />
                <DO name="Health" type="INS_2_Beh" />
                <DO name="NamPlt" type="LPL_3_NamPlt" />
                <DO name="PPV" type="MU_2_Vol" />
                <DO name="Hz" type="MV_2_Vol" />
                <DO name="TotW" type="MV_2_Vol" />
                <DO name="TotVAr" type="MV_2_Vol" />
                <DO name="TotVA" type="MV_2_Vol" />
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                <DO name="TotPF" type="MV_2_Vol" />
                <DO name="TotCosPhy" type="MV_2_Vol" />
                <DO name="Theta" type="MU_2_Vol" />
</LNodeType>
<LNodeType id="MSQI1" lnClass="MSQI">
                <DO name="Mod" type="INC_2_Mod" />
                <DO name="Beh" type="INS_2_Beh" />
                <DO name="Health" type="INS_2_Beh" />
                <DO name="NamPlt" type="LPL_3_NamPlt" />
                <DO name="SeqV" type="SEQ_1_SeqV" />
                <DO name="ImbNgV" type="MV_2_Vol" />
</LNodeType>
<LNodeType id="MHAI1" lnClass="MHAI">
                <DO name="Mod" type="INC_2_Mod" />
                <DO name="Beh" type="INS_2_Beh" />
                <DO name="Health" type="INS_2_Beh" />
                <DO name="NamPlt" type="LPL_3_NamPlt" />
                <DO name="Hz" type="MV_2_Vol" />
                <DO name="HA" type="HWYE_1_HA" />
                <DO name="HPhV" type="HWYE_1_HA" />
                <DO name="ThdA" type="WYE_1_ThdA" />
                <DO name="ThdPhV" type="WYE_1_ThdA" />
                <DO name="HCfPhV" type="WYE_1_ThdA" />
</LNodeType>
        <DOType id="INC_2_Mod" cdc="INC">
                <DA name="stVal" bType="INT32" fc="ST" dchg="true" />
                <DA name="q" bType="Quality" fc="ST" dchg="true" />
                <DA name="t" bType="Timestamp" fc="ST" />
                <DA name="ctlModel" type="ctlModel" bType="Enum" fc="CF" />
</DOType>
<DOType id="INS_2_Beh" cdc="INS">
                <DA name="stVal" bType="INT32" fc="ST" dchg="true" />
                <DA name="q" bType="Quality" fc="ST" dchg="true" />
                <DA name="t" bType="Timestamp" fc="ST" />
</DOType>
<DOType id="LPL_2_NamPlt" cdc="LPL">
                <DA name="vendor" bType="VisString255" fc="DC" />
                <DA name="swRev" bType="VisString255" fc="DC" />
                <DA name="d" bType="VisString255" fc="DC" />
                <DA name="configRev" bType="VisString255" fc="DC" />
                <DA name="ldNs" bType="VisString255" fc="EX" />
</DOType>
<DOType id="DPL_2_PhyNam" cdc="DPL">
  <DA name="vendor" bType="VisString255" fc="DC" />
        </DOType>
<DOType id="INS_2_PhyHealth" cdc="INS">
                <DA name="stVal" type="PhyHealth" bType="Enum" fc="ST" dchg="true" />
                <DA name="q" bType="Quality" fc="ST" dchg="true" />
                <DA name="t" bType="Timestamp" fc="ST" />
</DOType>
<DOType id="SPS_2_Proxy" cdc="SPS">
                <DA name="stVal" bType="BOOLEAN" fc="ST" dchg="true" />
                <DA name="q" bType="Quality" fc="ST" qchg="true" />
                <DA name="t" bType="Timestamp" fc="ST" />
        </DOType>
<DOType id="LPL_3_NamPlt" cdc="LPL">
                <DA name="vendor" bType="VisString255" fc="DC" />
                <DA name="swRev" bType="VisString255" fc="DC" />
                <DA name="d" bType="VisString255" fc="DC" />
</DOType>
<DOType id="MV_2_Vol" cdc="MV">
                <DA name="mag" type="AnalogueValue_1" bType="Struct" fc="MX" dchg="true" />
                <DA name="q" bType="Quality" fc="MX" dchg="true" />
                <DA name="t" bType="Timestamp" fc="MX" />
</DOType>
        <DOType id="MU_2_Vol" cdc="DEL">
                <DA name="phsAB" type="AnalogueValue_1" bType="Struct" fc="MX" dchg="true" />
                <DA name="phsBC" type="AnalogueValue_1" bType="Struct" fc="MX" dchg="true" />
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                <DA name="phsCA" type="AnalogueValue_1" bType="Struct" fc="MX" dchg="true" />
  </DOType>
        <DOType id="CMV_1_c1" cdc="CMV">
                <DA name="cVal" type="Vector_1" bType="Struct" fc="MX" dchg="true" />
                <DA name="q" bType="Quality" fc="MX" dchg="true" />
                <DA name="t" bType="Timestamp" fc="MX" />
  </DOType>
        <DOType id="SEQ_1_SeqV" cdc="SEQ">
                <SDO name="c1" type="CMV_1_c1" />
                <SDO name="c2" type="CMV_1_c1" />
                <SDO name="c3" type="CMV_1_c1" />
                <DA name="seqT" type="seqT" bType="Enum" fc="MX" />
  </DOType>
        <DOType id="HWYE_1_HA" cdc="HWYE">
           <SDO name="phsAHar" type="CMV_1_phsAHar" count="50" />
           <SDO name="phsBHar" type="CMV_1_phsAHar" count="50" />
           <SDO name="phsCHar" type="CMV_1_phsAHar" count="50" />
                <DA name="numHar" bType="INT16U" fc="CF" dchg="true" />
                <DA name="numCyc" bType="INT16U" fc="CF" dchg="true" />
                <DA name="evalTm" bType="INT16U" fc="CF" dchg="true" />
                <DA name="frequency"  bType="FLOAT32" fc="CF" dchg="true" />
        </DOType>
        <DOType id="CMV_1_phsAHar" cdc="CMV">
        <DA name="cVal" bType="Struct" type="Vector_1" fc="MX" dchg="true" dupd="true" />
     <DA name="q" bType="Quality" fc="MX" qchg="true" />
     <DA name="t" bType="Timestamp" fc="MX" />
  </DOType>

        <DOType id="WYE_1_ThdA" cdc="WYE">
                <SDO name="phsA" type="CMV_1_c1" />
                <SDO name="phsB" type="CMV_1_c1" />
                <SDO name="phsC" type="CMV_1_c1" />
  </DOType>
  <DAType id="AnalogueValue_1" >
                <BDA name="f" bType="FLOAT32" />
  </DAType>
  <DAType id="Vector_1" >
                <BDA name="mag" type="AnalogueValue_1" bType="Struct" />
                <BDA name="ang" type="AnalogueValue_1" bType="Struct" /> <!-- no info from angle coming from uC yet -->
 </DAType>
  <EnumType id="ctlModel">
                <EnumVal ord="0">status-only</EnumVal>
                <EnumVal ord="1">direct_with_normal_security</EnumVal>
                <EnumVal ord="2">sbo_with_normal_security</EnumVal>
                <EnumVal ord="3">sbo_with_enhanced_security</EnumVal>
                <EnumVal ord="4">direct_with_enhanced_security</EnumVal>
  </EnumType>
  <EnumType id="PhyHealth">
                <EnumVal ord="0">Ok</EnumVal>
                <EnumVal ord="1">Warning</EnumVal>
                <EnumVal ord="2">Alarm</EnumVal>
  </EnumType>
  <EnumType id="stValEnum">
    <EnumVal ord="0">on</EnumVal>
    <EnumVal ord="1">blocked</EnumVal>
    <EnumVal ord="2">test</EnumVal>
    <EnumVal ord="3">test_blocked</EnumVal>
    <EnumVal ord="4">off</EnumVal>
  </EnumType>
        <EnumType id="seqT">
                <EnumVal ord="0">pos-neg-zero</EnumVal>
                <EnumVal ord="1">dir-quad-zero</EnumVal>
  </EnumType>
 </DataTypeTemplates>
</SCL>
```

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