



ELECTRICITY POWER SUPPLY QUALITY ANALYZER

QNA-413

(Code Q20411 / Q20413)

USER MANUAL

(M98155601-03-06C)

(c) CIRCUTOR S.A.

QNA-413 CONTENTS	page no.
1.- BASIC INSTRUCTIONS.....	3
1.1.- Checking the contents of your package.....	3
1.2.- QNA-413Models	3
1.3.- Safety warnings	4
1.4.- Operating instructions.....	4
2.- MAIN FEATURES	4
2.1.- Basic features.....	5
2.2.- Electrical features	6
3.- ANALYSIS MODES.....	7
4.- DATA STORAGE IN MEMORY (automatic mode).....	7
5.- INSTALLATION & START-UP.....	8
5.1.- Connection terminal.....	9
5.1.1.- Communications cables for RJ connectors	10
5.2.- Starting the QNA-413 analyzer	11
5.3.- Connection diagram for the QNA-413.....	12
5.3.1.- 4 wire three-phase power systems.....	12
5.3.1.1.- Direct connection.....	12
5.3.1.2.- Via voltage transformers.....	13
5.3.2.- 3 wire three-phase power systems.....	14
5.3.2.1.- Voltage transformers (installation recommended for MV)....	14
5.3.2.2.- Direct connection.....	15
5.3.2.3.- Via voltage transformers.....	16
6.- THE QNA-413 ANALYZER'S INTERNAL BATTERY	17
7.- OPERATING MODE	17
7.1.- Display and buttons	17
7.2.- Turning the analyzer on	18
7.3.- Display screens	18
8.- SETTING UP THE QNA-413.....	19
8.1.- Operating setup of the QNA-413 analyzer.....	19
8.1.1.- Voltage transformation ratio	19
8.1.2.- Features of the monitored electrical system.....	19
8.1.3.- Quality parameters	20
8.1.4.- Data to take into account for the periodical data recording process	22
8.2.- Selecting the parameters to be recorded.....	23
8.2.1.- Standard file (STD).....	23
8.2.2.- EVENTS file (EVQ)	24
8.2.3.- Incidents file (EVE).....	25
8.2.3.- Harmonic statistics file (H24).....	26
8.2.4.- Weekly average values file (STP)	26
8.2.5.- Setting and operation of the SMS alarms.....	26
8.2.6.- Setting and operation of the GPRS	26
9.- TECHNICAL SPECIFICATIONS	27
10.- SAFETY CONSIDERATIONS	29
11.- MAINTENANCE	29
12.- TECHNICAL SERVICE	29

A.- Appendix: Communication with the QNA-413 connected to an external modem.	30
B.- Appendix: Communications with QNA-413 (RS485).....	32
C.- Appendix: Communications with QNA-413 using a TCP-IP converter	33
D.- Appendix: Setting of a QNA-413 ETHERNET Analyzer.....	34
E.- Appendix: Installation and start up of the QNA-413-GSM.....	38
F.- Appendix: Installation and start up of the QNA-413-GPRS	40
G.- Appendix: Setting the SMS Alarms.....	41
H.- Appendix: QNA-413 measurement method	44

1.- BASIC INSTRUCTIONS

This manual is designed to familiarise the user with operating the power supply quality analyzer model **QNA-413** in order to get the best from its features.

QNA-413 is an analyzer specifically developed for supervising electrical power supply quality, which has been built with the most advanced technology in microelectronic components offering bench mark features in measuring and recording of electrical parameters in industrial power supply systems.

Please read this manual carefully before connecting and switching on the analyzer in order to avoid irreversible damage caused by improper use.

1.1.- Checking the contents of your package.

Please check the following points on receipt of the analyzer:

- a) The equipment delivered matches your order specifications.
- b) After unpacking, check that the equipment has not been damaged during delivery.
- c) Check that it is equipped with the following standard items:
 - 1 RS-232 Communications cable (female RJ-DB9)
 - 1 **QNA-413** User manual
 - 1 CD containing PC program and user guide
 - 1 GSM antenna (GPRS model only)

1.2.- QNA-413Models



Code	Model
Q20411	QNA– 413 RS485/RS232
Q20413	QNA – 413 GPRS / RS-232 (SIM not included)

1.3.- Safety warnings



This manual contains information and warnings about the **QNA-413** analyzer which must be followed to guarantee the proper operation of all instrument functions and to maintain it in a safe condition.

If the instrument is not used in accordance with manufacturer's specifications, the instrument's protection may be damaged.

Where any protection failure is suspected to exist (for example, if there are signs of external damage), the instrument must be immediately switched OFF. In the event of this contact a qualified technician.

1.4.- Operating instructions

QNA-413 is a programmable instrument, with operating modes which may be selected from the available programming menus.

Before starting the **QNA-413**, carefully read the paragraphs on **INSTALLATION & STARTUP** and **SETTING QNA-413**, to select the most suitable operating mode for your requirements.

Note that when the instrument is switched on, the terminals may be dangerous when touched and opening or removing parts may access dangerous areas. Therefore, the equipment must not be used until it is properly installed.

2.- MAIN FEATURES

The **QNA-413** is an analyzer specifically designed to check electrical power supply quality in accordance with the IEC 61000-4-30 standard.

- Harmonic measurement in accordance with IEC 61000-4-7
- Flicker measurement in accordance with IEC 61000-4-15
- High protection level against severe electrical conditions:
 - Wide range of supply and measurement voltages
 - High degree of overvoltage and transient protection
- Connection to either 3 or 4-wire distribution systems
- Wide voltage supply range: 100-400 V AC. $\pm 30\%$ / 90-730 V DC
- Internal battery. The equipment can continue recording in the event of no power supply voltage
- 2 Mbyte internal memory for saving all parameters measured by the **QNA-413** analyzer
- Communication via GPRS / GSM / RS-232 / RS-485 (according to model)
- Mounted inside a self-extinguishing case. Dimensions and fixing points according to DIN 43857

2.1.- Basic features

The **QNA-413** power supply quality analyzer is an analyzer specifically designed to check electrical power supply quality in accordance with the IEC 61000-4-30 standard.

It has voltage inputs only (insulated by transformers).

Its external design according to the DIN 43857 standard makes it ideal for any central energy meter board.

Moreover, the great variety of available models makes the **QNA-413** suitable for any situation and communication mode.

The instrument's internal battery ensures continuity of measurement by the **QNA-413** analyzer in the event of any loss in voltage supply (short or long-term line interruption).

QNA-413 is equipped with three A.C. **voltage** which permit simultaneous analysis for all three phases and the **frequency** in any power system.

To analyse electrical power supply quality in accordance with IEC 61000-4-30, the **QNA-413 uses a DSP** to analyse all cycles from all three voltage phases to detect the occurrence of any event (voltage dip, voltage interruption, overvoltage). **Harmonic and flicker is also calculated in accordance with IEC61000-4-7 and 61000-4-15**, respectively.

The **QNA-413** analyzer is equipped with a **built in 2 Mbyte memory** to receive quality parameters and incidents.

The different information recorded in the **QNA-413's** built in memory is distributed in four file types:

- *.STD files: this file contains all periodically recorded values (voltage, frequency, flicker, harmonic distortion, harmonic content and unbalance).
- *.EVE files: file containing all incidents referred to the **QNA-413** itself (file readout, setup modification, memory erasure, auxiliary power supply on/off, battery on/off...).
- *.EVQ files: this file contains all events observed in the electrical power supply (voltage dips, voltage interruptions, overvoltages...) together with supplementary information about these events (time of the event occurring, maximum/minimum voltage, average voltage, voltage prior to the event).
- *.H24: this file contains the data required to obtain a statistical analysis of the harmonic evolution in one day.
- *.STP files: this file stores average values for voltage, frequency,

flicker (pst and plt) and the THD over one week.

2.2.- Electrical features

Using the **QNA-413** as a recording instrument for evaluating electrical power supply quality means that the analyzer must have a high degree of protection against severe electrical conditions:

- High-energy varistors absorbing surges to avoid any costly repairs.
- Noise filters in voltage and current inputs to ensure reliable measurements even under the most adverse operation conditions.
- Power supply: transformers with extra power dissipation and insulation.
- Built-in battery power supply to ensure voltage supply to the **QNA-413** analyzer in the event of voltage loss.
- Insulation transformers guaranteeing the proper insulation of inputs.

3.- ANALYSIS MODES

QNA-413 series analyzers can be used in different operating modes according to their setting.

The most striking features of the analysers are:

- Measurement and storage in memory of main power quality parameters (voltage values, flicker, harmonics and unbalance).
- Setting a voltage threshold to define different events (voltage dips, voltage interruptions and overvoltages). Also an optional setting of an hysteresis value for each individual threshold.
- **QNA-413** can carry out **quality analyses** in 3-wire or 4-wire distribution systems. All quality measurements will be referred the line-to-neutral or line-to-line voltage according to selection.
- **QNA-413** can also be used to measure through **voltage measuring transformers**.

4.- DATA STORAGE IN MEMORY (automatic mode)

QNA-413 is equipped with an internal date and time clock to store automatic data recordings and quality events in the memory at regular time intervals.

The **QNA-413** storage memory is divided into four independent blocks. Each discrete block is allocated to every file type to be saved. Every file type contains the following information:

- *.STD files: this file contains all periodically recorded values (voltage, frequency, flicker, harmonic distortion, harmonic content and unbalance).
- *.EVE files: file containing all incidents referred to the **QNA-413** as they happen. (file readout, setup modification, memory erasure, auxiliary power supply on/off, battery on/off...).
- *.EVQ files: this file contains all events observed in the electrical power supply (voltage dips, voltage interruptions, overvoltages...) together with supplementary information about these events (time of the event occurring, maximum/minimum voltage, average voltage, voltage prior to the event).
- *.H24: this file contains the data required to obtain a statistical analysis of the harmonic evolution in one day.
- *.STP files: this file stores average values for voltage, frequency, flicker (pst and plt) and the THD over one week.

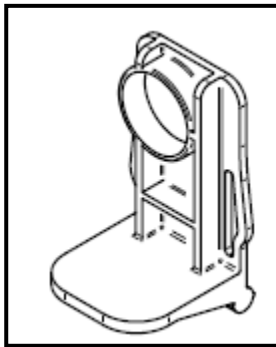
QNA-413 is equipped with a built in **rotating memory** for data collection. this means that once this memory is full, new values overwrite the oldest ones. Therefore, if no data is to be lost, data must be retrieved from the memory before the oldest values are overwritten.

5.- INSTALLATION & START-UP



This manual contains information and warnings about the QNA-413 analyzer which must be followed to guarantee the proper operation of all instrument functions and to maintain it in a safe condition.

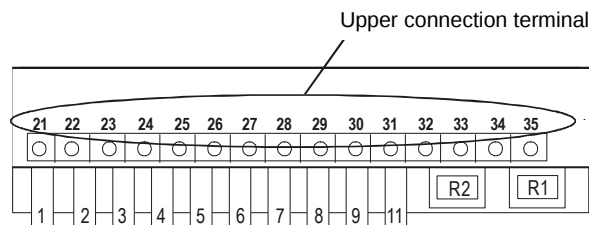
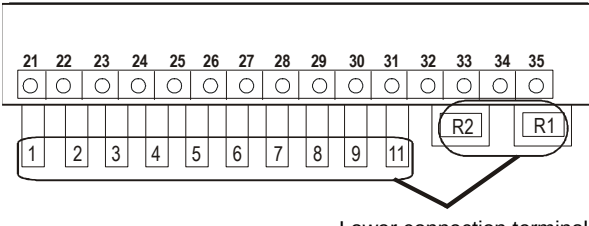
If the instrument is not used in accordance with manufacturer's specifications, the instrument's protection may be damaged. Note that when the instrument is switched on, the terminals may be dangerous when touched and opening or removing parts may access dangerous areas. Therefore, the instrument must not be used until it is properly installed.



IMPORTANT: This part must be removed so that the instrument's bank can operate. It must be removed when installing the instrument, just before the equipment is powered. The instrument's power supply must be connected for at least 8 hours the first time it is connected to ensure that the battery is correctly charged.

Where any protection failure is suspected to exist (for example, if there are signs of external damage), the instrument must be immediately switched OFF. In the event of this contact a qualified technician.

5.1.- Connection terminal

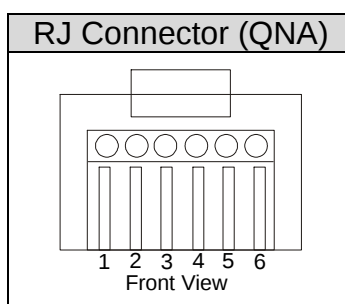
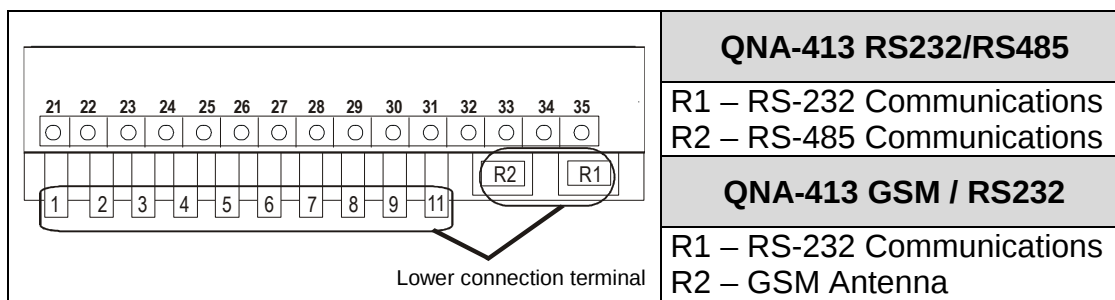
	Terminal No.	Terminal description
	Upper connection terminal	
	21	Measurement VL1
	22	Common L1
	23	Measurement VL2
	24	Common L2
	25	Measurement VL3
	26	Common L3
	27	Not used
	28	Ground
	29	Not used
	30	Not used
	31	Not used
	32	Digital input 1
	33	Common input 1
	34	Digital input 2
	35	Common input 2
	Lower connection terminal	
	1	Not used
	2	Not used
	3	Not used
	4	Not used
	5	Not used
	6	Not used
	7	Not used
	8	Not used
	9	Power supply voltage input
	11	Power supply voltage input
	R1	RS-232
	R2	RS-485 / GSM Antenna (According to the model)

The **QNA-413** analyzer may be installed in any three-phase distribution line with neutral conductor (4 wires) or without neutral conductor (3 wires). Measurements solely depend on the connection mode and the analyzer configuration.

The connection of an earth terminal is essential to ensure the efficiency of QNA-413 protection elements.

5.1.1.- Communications cables for RJ connectors

The RJ connection is different for each **QNA-413** model. Thus:



The most usual configurations for **QNA-413** communication cables are as follows:

- RS-232 connection to PC or to an external modem:

QNA-413	PC		External Modem	
	DB9	DB25	DB9	DB25
1-DSR	5-GND	7-GND	5-GND	7 - GND
2-Rx	3-Tx	2-Tx	2-Rx	3 - Rx
3-TX	2-Rx	3-Rx	3-Tx	2 - Tx
4-CTS	7-RTS	4-RTS	8-CTS	5 - CTS
5-RTS	8-CTS	5-CTS	7-RTS	4 - RTS
6-GND	5-GND	7-GND	5-GND	7 - GND

- RS-485:

QNA- 413	RS-232/485 (DB9) Converter
2-Tx/Rx(-)	2-Tx/Rx (-)
3-Tx/Rx(+)	1-Tx/Rx (+)
6-GND	5-GND

The RS-232 communication cables must always be disconnected to establish communication with a QNA-413-GSM via a mobile phone. If the RS-232 is connected, then modem operation is completely disabled.

5.2.- Starting the QNA-413 analyzer

Please check following points before switching on the analyzer:

- 1) Mains supply voltage:
Voltage: 100-400 V AC. $\pm 30\%$ / 90-730 V DC.
Frequency: 50... 60 Hz.
- 2) Earth terminal: the earth terminal of the analyzer must be connected to earth. If it is not connected some of the protective parts may not work properly.
- 3) Maximum voltage in the voltage measurement circuit: 500 V AC. between phase and common:
 - ☒ 4-wire configuration: 500 VAC. line-to-neutral. / 866 VAC. line-to-line.
 - ☒ 3-wire configuration: 500 VAC. line-to-line.
- 3) Burden: 16 VA – 8 W.
- 4) Operating conditions:
 - Operating temperature range: 0°C to 50°C.
 - Storage temperature: -20° to +70°C
 - Operating humidity: 0% to 90 % RH.
- 5) Safety: designed to meet protection class III according to EN 61010.

Points to check during the installation process:

- 6) Check that the earth terminal of QNA-413 is connected to earth to avoid any possible interference to the analyzer. If this earth terminal is not connected, then the effectiveness of the **QNA-413** protection elements may be reduced.
- 7) Verify the **QNA-413** setup.

Points to consider:

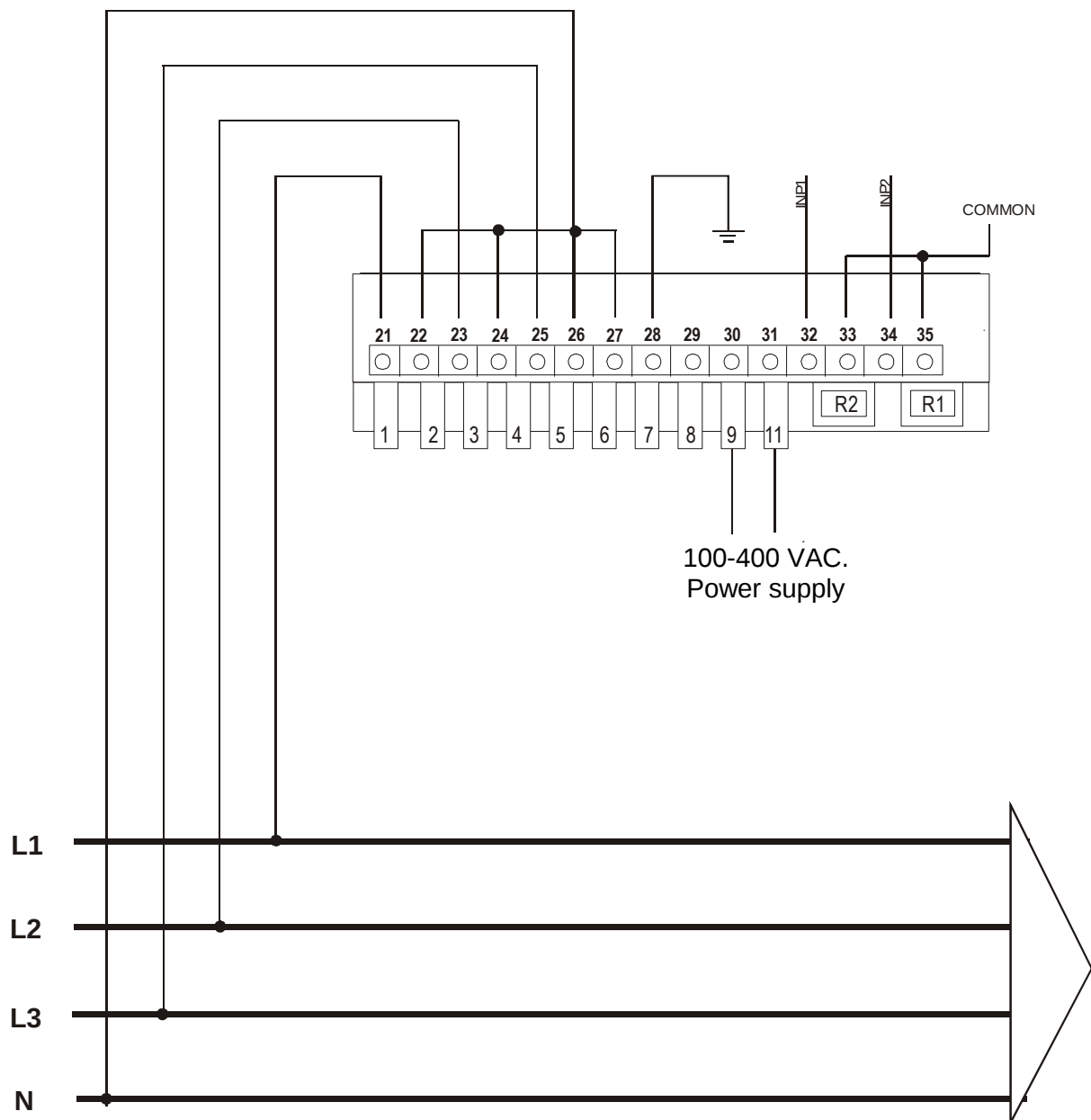
Voltage **values flashing on the display** is a sign that the analyzer is incorrectly installed or configured. Possible causes might be:

- The analyzer detects an event. This can mean a real event in the system, or a wrong rated voltage setting where the set value does not match the actual system voltage.
- If **the unbalance screen displays dashes**, there is an incorrect phase sequence.

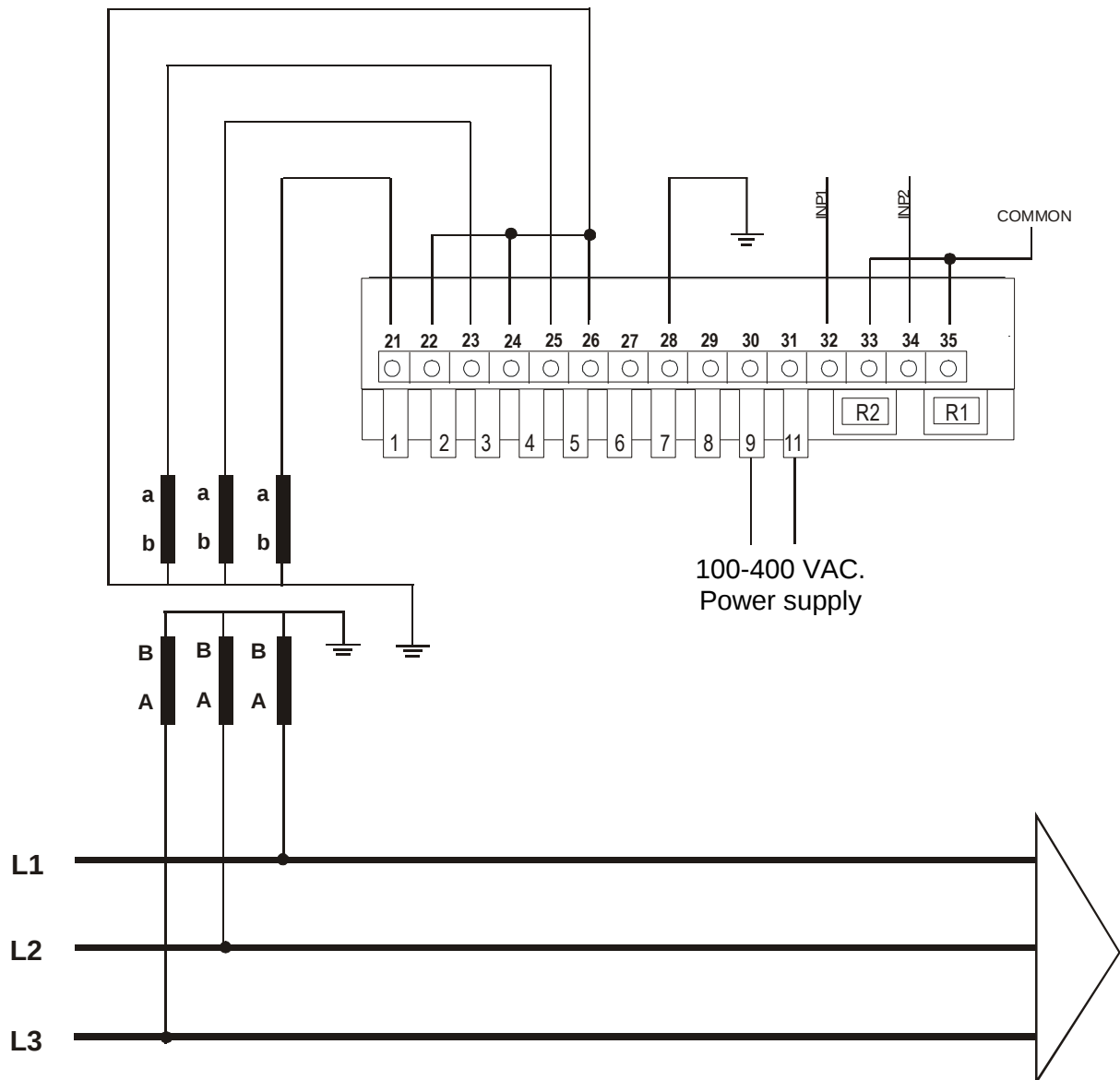
5.3.- Connection diagram for the QNA-413

5.3.1.- 4 wire three-phase power systems

5.3.1.1.- Direct connection

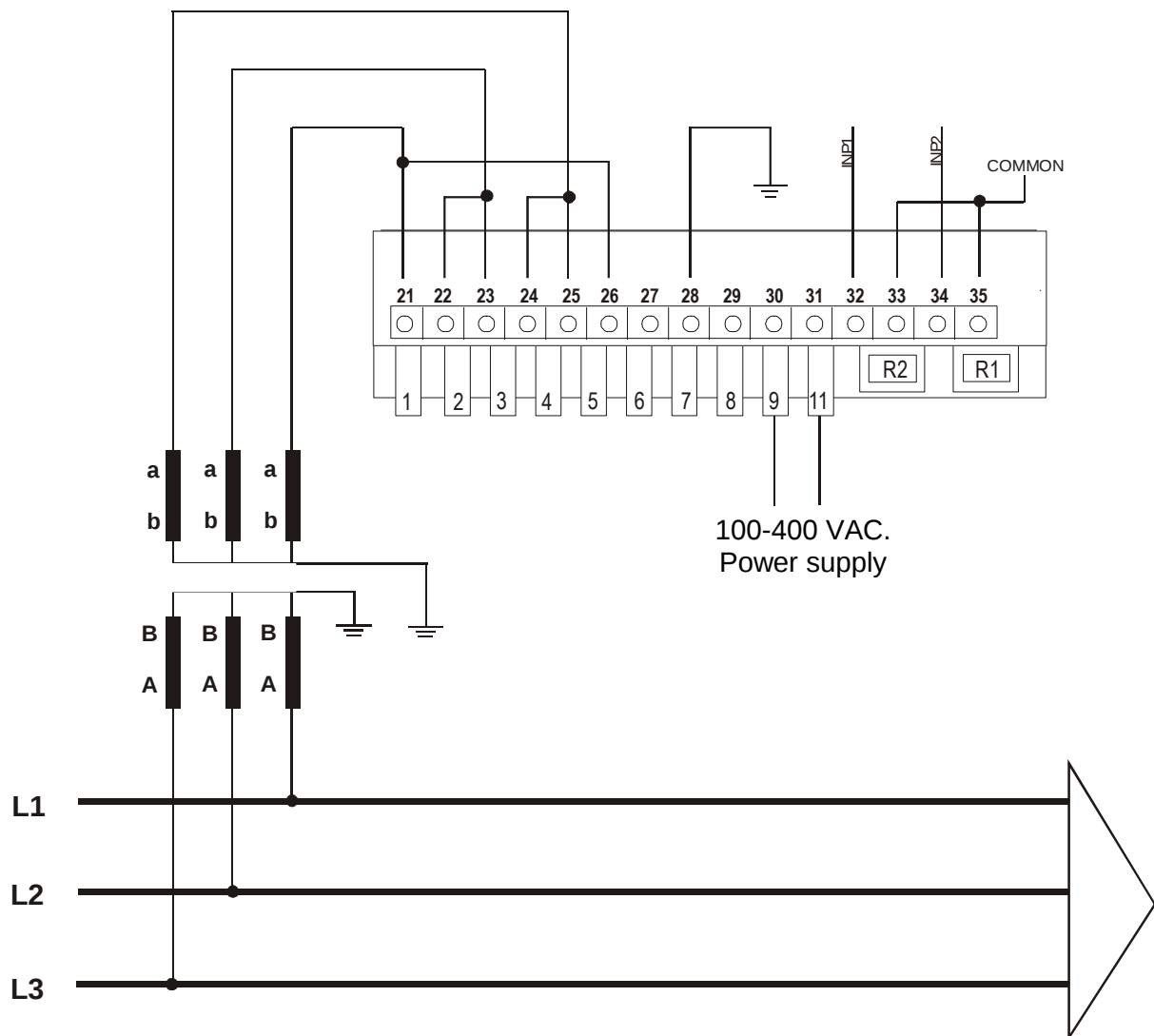


5.3.1.2.- Via voltage transformers

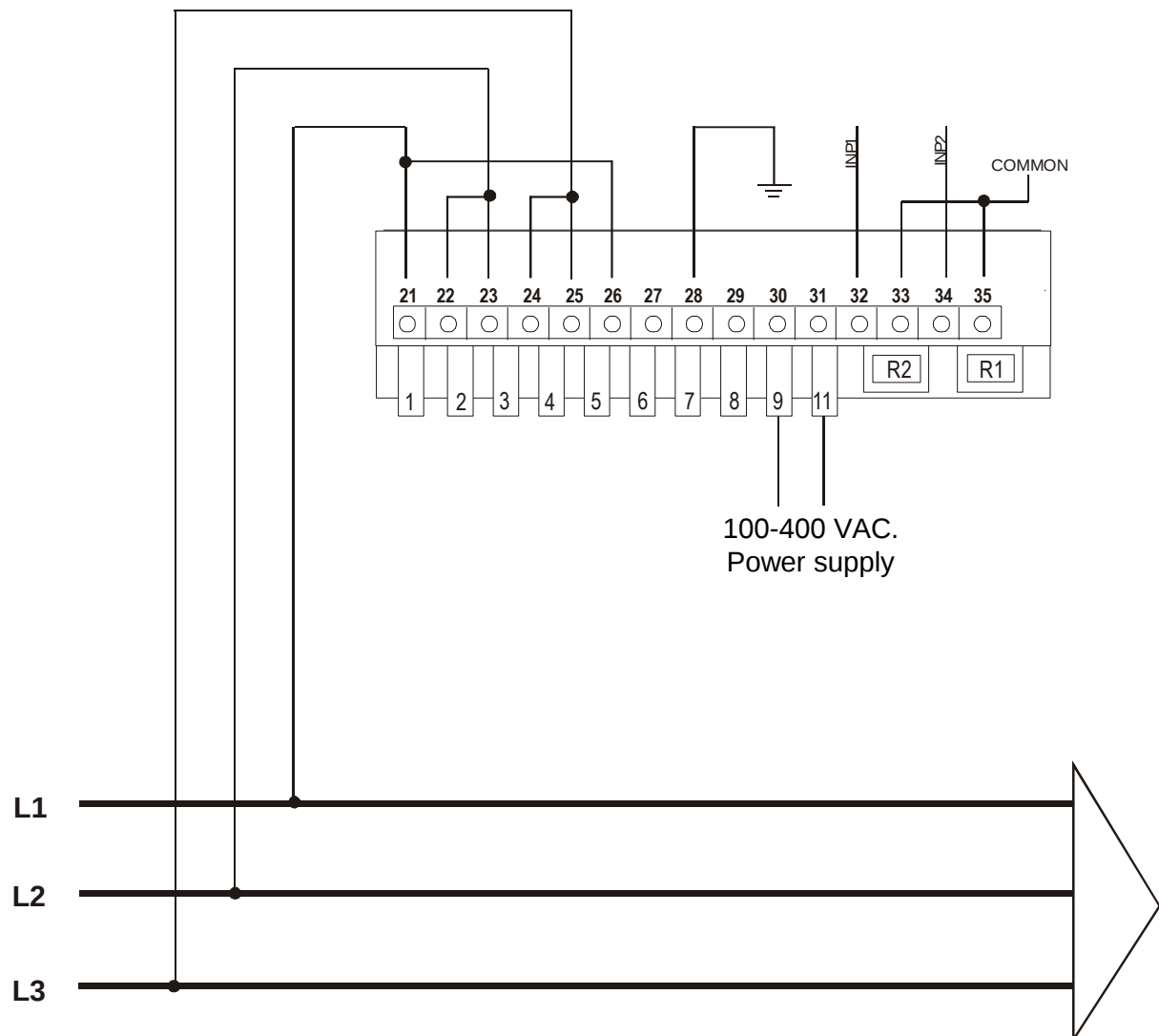


5.3.2.- 3 wire three-phase power systems

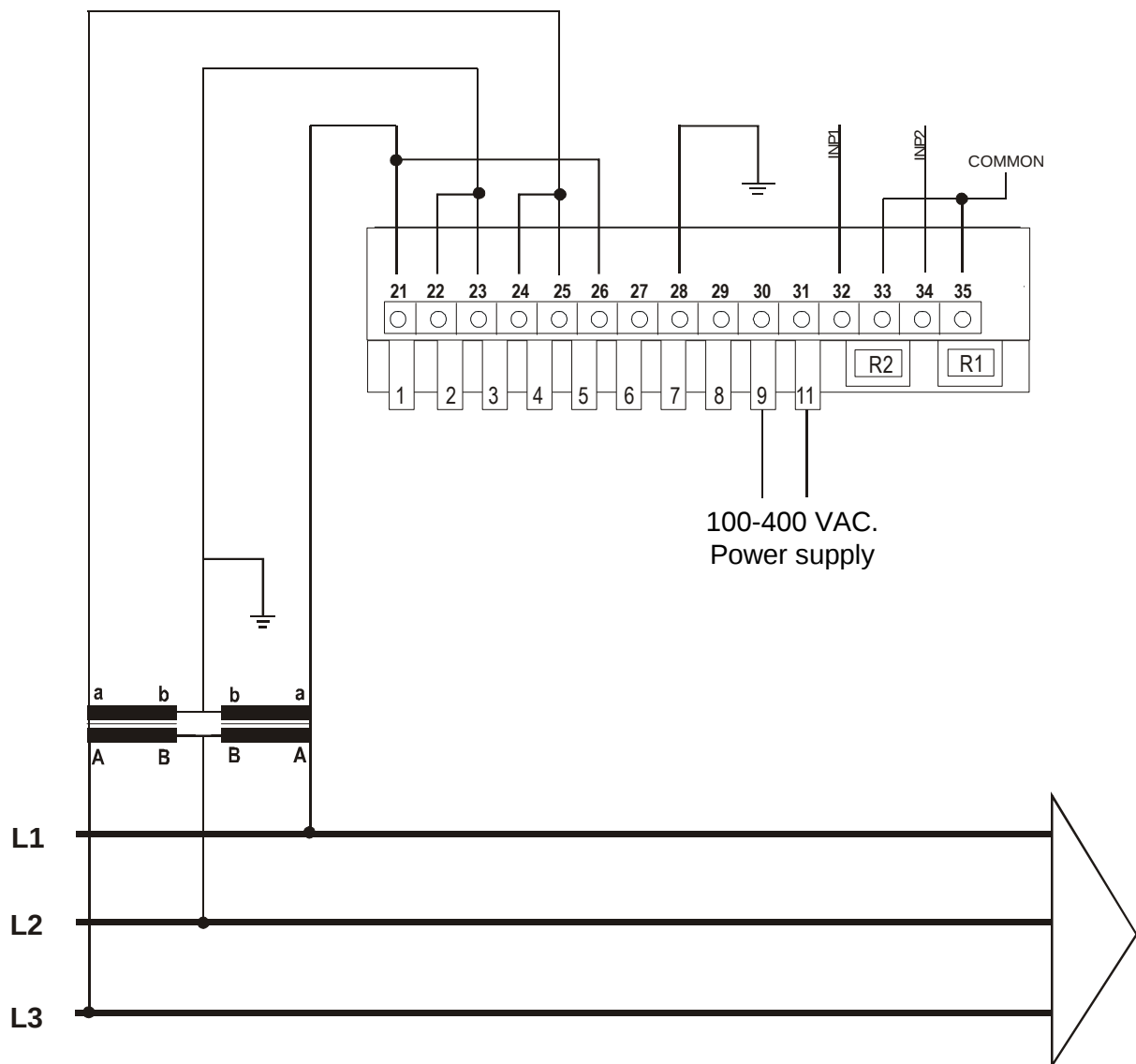
5.3.2.1.- Voltage transformers (installation recommended for MV)



5.3.2.2.- Direct connection



5.3.2.3.- Via voltage transformers



6.- THE QNA-413 ANALYZER'S INTERNAL BATTERY

The analyzer has an internal battery to ensure power supply to the analyzer when any event occurs. This battery keeps the analyzer continuously powered as a default for 15 minutes without mains supply for a maximum of 9999 seconds in the event of the mains power supply being cut. This operating period after voltage supply loss is user-programmable in order to save the battery and to ensure that any possible intermittent voltage interruptions are detected.

The guarantee of a 9999 second operating period is essential to ensure the proper detection and recording of multiple and long-term voltage interruptions.

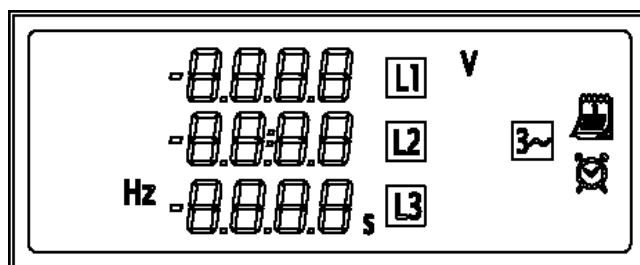
The battery is charging when the analyzer is connected to the mains.

The **QNA-413** analyzer is equipped with an **intelligent energy charging** system. This means that the instrument continuously and automatically checks the status of the battery. This means that the charging process stops when the battery is on maximum charge level and, therefore, the life of the battery is increased.

7.- OPERATING MODE

7.1.- Display and buttons

QNA-413 is equipped with a display to show all information being measured by the analyzer using different buttons.



The function of each button on the **QNA-413** analyzer is:

-  (Next screen): the next display screen is accessed.
-  (Previous screen): the previous display screen is accessed.

7.2.- Turning the analyzer on

When the **QNA-413** is turned on, the first screen appears with the analyzer's identification.

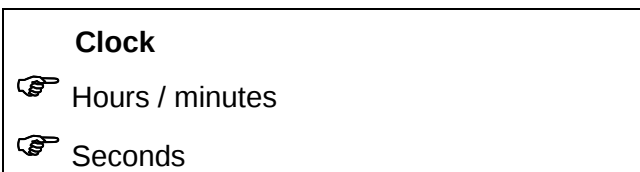
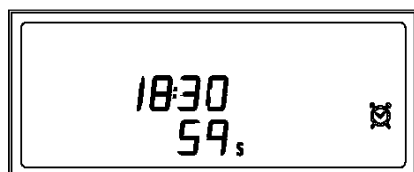
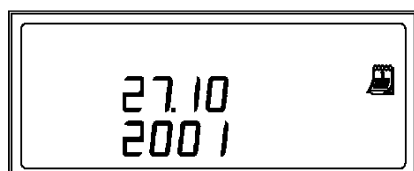
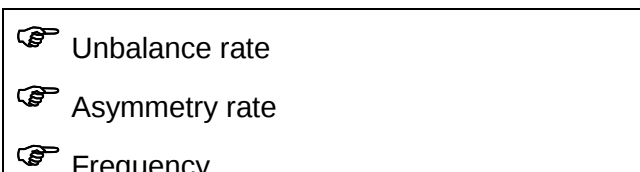
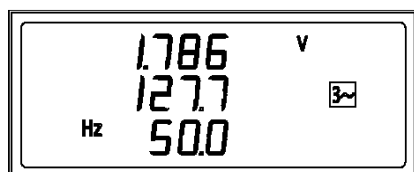
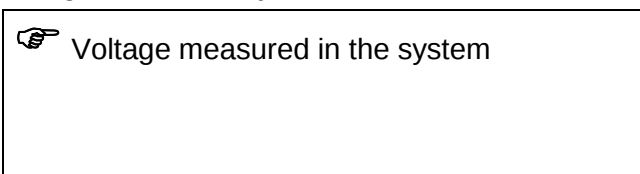
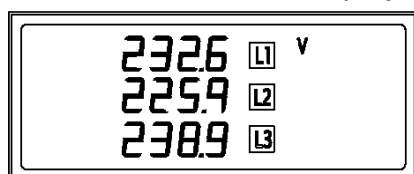


After a few seconds, the display will show a screen displaying the three voltages measured by **QNA-413** in each phase.

Use the  and  buttons to move through each available display screen.

7.3.- Display screens

The available display screens on the **QNA-413** analyzer are as follows:



Notes

Voltage **values flashing on the display** is a sign that the analyzer is incorrectly installed or configured. Possible causes might be:

- The analyzer detects an event. This can mean a real event in the system, or a wrong rated voltage setting where the set value does not match the actual system voltage.
- If the **unbalance screen displays dashes**, there is an incorrect phase sequence.

8.- SETTING UP THE QNA-413

Any setup action for the QNA-413 analyzer must be always done via a PC.

The **QNA-413** analyzer's performance will depend on the user-configuration of the instrument. There are two different setup procedures for configuring the analyzer:

- Operating Setup: to define the **QNA-413** analyzer's operating mode.
- File Setup: to define the data collection procedure of the **QNA-413** analyzer in the internal memory. (For this model, the variables are fixed and cannot be changed).

8.1.- Operating setup of the QNA-413 analyzer

The user defined procedures are listed below:

8.1.1.- Voltage transformation ratio

The **QNA-413** analyzer can measure via transformers.

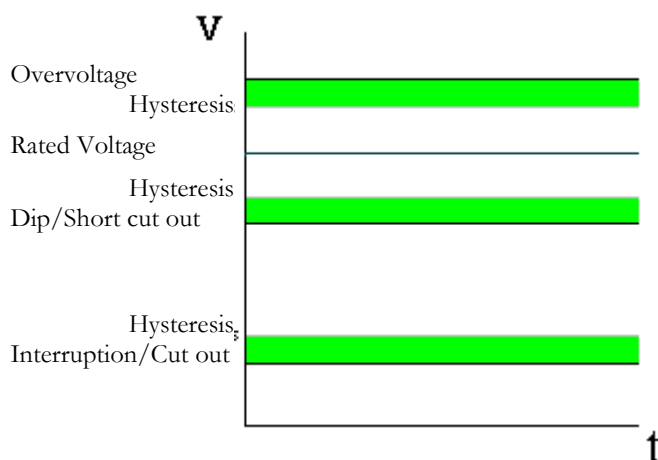
- **Voltage primary value / Voltage secondary value:** setting the transformation ratio for voltage transformers used in measuring. Set 1/1 for direct voltage measurement (no voltage transformer used). This ratio must not exceed 9999.

8.1.2.- Features of the monitored electrical system

- **Rated voltage:** the rated voltage of the power system to be monitored by the QNA-413 analyzer. For a 3-wire configuration the line-to-line voltage must be set (ex. 400 V~), and for a 4-wire configuration the line-to-neutral voltage must be set (ex. 230 V~). If a voltage measurement transformer is used, then the rated voltage to be set must be referred to the secondary side (ex. 63.5 V~). Correct configuration is essential because the limits for the analysis of the quality of electrical power supply are to be analysed.
- **Rated frequency:** the rated frequency of the power system to be monitored by the QNA-413 analyzer. This parameter is necessary for the calculation of the RMS signal value in extreme quality systems.
- **3 Wire / 4 Wire:** the **QNA-413** analyzer must be set according to the distribution system to be monitored, whether with neutral conductor (4 wires) or without neutral conductor (3 wires). The proper setting of this point is essential to ensure the correct detection of events. This choice must also match the external connection configuration.

8.1.3.- Quality parameters

In order to determine electrical power supply quality, the voltage levels defining the event must be set beforehand.



Therefore, following points must be user-defined:

- **% of overvoltage threshold:** the detection of an overvoltage depends on the value set for this point (% of the rated voltage). Every semi-cycle with a RMS value over this threshold is said to be an overvoltage. A record will be kept in the events file (EVQ) every time this limit is exceeded, with the indication of the phase, the maximum voltage value detected, the voltage average value, voltage value previous to the event and the duration of the overvoltage event.
- **Overvoltage hysteresis:** an overvoltage hysteresis value can be defined at a different value for the overvoltage event starting and finishing. Therefore, an overvoltage event starts when the overvoltage threshold is exceeded and ends when the voltage value is below the value defined by subtracting the overvoltage hysteresis value from the overvoltage threshold.
- **% of voltage dip threshold:** the detection of a voltage dip depends on the value set for this point (% of the rated voltage). Every semi-cycle where the RMS value is below this threshold is said to be a voltage dip. A record will be saved in the events file (EVQ) every time this limit is exceeded indicating the minimum voltage value detected, the average voltage value and the duration of the voltage dip event.
- **Voltage dip hysteresis:** a voltage dip hysteresis value can be defined at a different value for the voltage dip event starting and finishing. Therefore, a voltage dip event starts when the voltage dip threshold is not reached and ends when the voltage value is over the value defined by adding the voltage dip hysteresis value to the voltage dip threshold.
- **% of interruption threshold:** the detection of a voltage dip depends on the value set for this point (% of the rated voltage). Every semi-cycle where the RMS value is below the defined limit is said to be an interruption. A record will be saved in the events file (EVQ) every time this limit is exceeded indicating the minimum voltage value detected, the average voltage value and the duration of the voltage dip event.
- **Interruption hysteresis:** an interruption hysteresis value can be defined at a different value for the interruption event starting and finishing. Therefore, an interruption event starts when the interruption threshold is not reached and

ends when the voltage value is over this threshold by adding this threshold plus the hysteresis set here.

- **STD file recording period:** part of the memory allocated for this file, expressed in days. This is a not modifiable value, and it will depend on the recording period and the memory allotted for other files and the variables selected in Setup.
- **Number of recordings in the EVE file:** part of the memory allocated for the incidents file, expressed as the number of incidents.
- **Number of recordings in the EVQ file:** part of the memory allocated for the events file, expressed as the number of events.
- **No. of days in the H24 file:** display of the H24 file showing maximum number of days in the recording.
- **No. of weeks in the STP file:** display of the maximum number of weeks of recording for the STP file.

QNA 413 (with default variables)	Default
STD	33 days 18 hours
EVE	4655 recordings
EVQ	12330 recordings
H24	32 days
STP	16 weeks

(*) The STD file has been calculated assuming a 10-minute recording period and the number of recordings for the EVE, EVQ, H24 and STP files with the default values.

8.1.4.- Data to take into account for the periodical data recording process

Some points to allow the user to precisely define the information to be used for the recording calculation procedure.

Therefore, the user can define:

- **Description of the measurement site:** an identifying field to be filled in by the user.
- **Note:** an information field to be filled by the user.
- **Recording period:** (affecting the .STD file only). This is the period in which the averaged values are stored. The recording period is, by default, set at 10 minutes, but this value is user-settable from 1 minute to 2 hours.
- **Integration of 10-cycle blocks with events (all except for voltage):** (affecting the .STD file only). An event might occur (overvoltage, dip,...) while the analyzer is calculating the voltage, flicker, harmonic averages. The **QNA-413** allows the 10-cycle block where the event occurred to be added to the integration. If this option is disabled ("No"), then the 10-cycle block would be only added to the voltage average.
- **Integration of 10-cycle blocks with events (voltage):** (affecting the .STD file only). An event (overvoltage, dip,...) may occur while the analyzer is calculating the average voltage. The **QNA-413** allows the 10-cycle block where the event occurred to be added to the integration (this may be for one or more event, depending on the duration of the event). If this option is disabled ("No"), then the 10-cycle block would be ignored, and, therefore, it would not be added to the integration for this periodical recording. This option does not affect the other parameters.
- **Date type:** (affecting the .STD file only). Permits the user to select date/time to be saved together with each recording (affecting the .STD file only). This date can be the initial or final recording.
- **Ignoring incomplete records in the STP file:** (affecting the .STP file only). Records which are incomplete may be ignored ("SI") or ("NO") incomplete files not ignored.
- **Battery auto-power off timer:** the user can set the time for the **QNA-413** battery auto-power to switch off in the event of supply voltage loss, in order to save the battery and to ensure the detection of possible intermittent voltage interruptions. The usual time is about 15-30 min.

8.2.- Selecting the parameters to be recorded

The **QNA-413** saves all quality parameter recordings in its internal memory. The different information recorded by the QNA-413 is distributed in three file types.

8.2.1.- Standard file (STD)

The standard file (STD) is used to store all periodically recorded parameters.

The following electrical parameters will be saved in the memory during the user-defined recording period:

➤ **Voltage**

- **Average:** average value of voltage in the recording period.

➤ **Flicker**

- **Pst:** the **QNA-413** saves the Flicker value (Pst) obtained over the recording period. The Plt value will be calculated by the data analysis software in the PC.

➤ **Harmonics**

- **Harmonic distortion:** the **QNA-413** will calculate and record in the memory the value of the average voltage harmonic distortion detected in the monitored power system.
- **Harmonic content:** the **QNA-413** will calculate and record in the memory the average value of the individual harmonic distortion rate for each voltage harmonic in the monitored power system (up to the 40th harmonic). (Harmonic content of each 10-cycle blocks which have been integrated over a recording period).

➤ **Unbalance**

- **Asymmetry rate:** ratio of homo-polar voltage to direct voltage.
- **Unbalance rate:** ratio of inverse voltage to direct voltage.

8.2.2.- EVENTS file (EVQ)

The analyzer also records an events file containing information on any event detected in the monitored power system. The following data is saved about each event.

Event date: indication of the time of the event. This value is obtained with an accuracy of one cycle.

Type of event: indication of the event type, i.e. a voltage interruption, a voltage dip or an overvoltage. These events are defined in accordance with the **QNA-413** setup. (See section: 8.2.2.-) The type of event also identifies the phase where this event occurred.

Duration of the event: period of time in milliseconds that the event lasted.

Average voltage for the event: the average RMS^{1/2} (*) voltage value during the event.

Maximum/minimum voltage for the event: in the event of an interruption or voltage dip, the minimum RMS^{1/2} (*) voltage value obtained during the event. In the event of an overvoltage, the maximum values will be recorded.

Voltage prior to the event: the RMS^{1/2} (*) voltage value before the event occurrence is recorded.

Graph of the Vrms semi-cycle value for the event: this option shows the setting for the event. The Vrms value for each semi-cycle during the event may be seen. The equipment also records 1.5 seconds before the event starting and 0.5 seconds after it finishes. This way the setting for the event is obtained for better analysis.

(*) RMS ¹/₂ cycle value: RMS value of a complete cycle, refreshed every semi-cycle.

8.2.3.- Incidents file (EVE)

All incidents sent to the QNA-413 are automatically saved in this file, with an indication of the time and type of incident. The following incidents may be detected and recorded by the **QNA-413**.

Battery OFF: indication of the time when **QNA-413** stopped operating. This time depends on the value set by the user for the operating period after a voltage supply loss.

Auxiliary power supply ON: indication of the time when the **QNA-413** analyzer was connected to an external power supply.

Auxiliary power supply OFF: indication of the time when the external power supply for the **QNA-413** analyzer was interrupted. The analyzer is supplied from the internal battery from this time.

Setup modification: record of the time when the instrument's setup was modified.

Memory formatting: indication of the time when the user decided to format the **QNA-413's internal memory**.

Forced memory formatting: the **QNA-413's** internal memory will be automatically formatted if any error in this internal memory is detected.

File deletion: indication of the time when the user deleted a file from the **QNA-413's** internal memory. If the first data shown by the .EVE file indicates that a file has been deleted, then the deleted file was the events file.

Time change: indication of any change to the date or time of the analyzer's internal clock. Recording this event type is quite important, because if the time intervals between two successive readouts are observed to be erroneous, this might be due to a change to the time of the internal clock.

GPRS setup modification: (for GSM instruments only). Record of the time when the instrument's GPRS setup was modified.

Alarms setup modification: (for GSM instruments only). Record of the time when the instrument's alarms setup was modified.

8.2.3.- Harmonic statistics file (H24)

A series of values to be subsequently used by the PC's software will be stored in this file. The software will calculate typical deviation, the statistical distribution curve and the effective values at 50%, 95% and 99% of each and every harmonic recorded by the QNA-413.

8.2.4.- Weekly average values file (STP)

This file will save the averaged weekly values for voltage variables (L1, L2 and L3), frequency, flicker (pst and plt) (L1, L2 y L3), harmonic distortion rate (L1, L2, L3 and three-phase), unbalance and the total number of recordings used for calculations. The 0%, 5%, 95% and 100% values may also be obtained individually and as a whole taking into account all recordings, i.e. the whole week or just those recordings with no voltage events. There is also the option for taking into account incomplete or complete recordings, selected beforehand in the setup (per week).

8.2.5.- Setting and operation of the SMS alarms

The QNA-413 (GPRS / GSM model only) may configure up to 8 different alarms. A maximum and minimum limit and a time period may also be set for each alarm. They also may be sent to 4 different telephone numbers.

8.2.6.- Setting and operation of the GPRS

The QNA-413 (GPRS model only) allows information to be sent to an FTP server via GPRS. This means that every X minutes the instrument automatically sends recorded information to an IP address defined by the user. The time period and the IP address are defined by the user. A user name and password supplied by the FTP server administrator to save the information must also be defined. This mode of communication avoids the user having to use a modem to download information, because it is the equipment itself which sends the information to the FTP server. This means that the user only requires an Internet connection to connect with the FTP server and to download the information.

It is recommended that coverage is over 15 for this use.

9.- TECHNICAL SPECIFICATIONS

Power supply:

Supply voltage: Independent from the measuring circuit 100-400 V AC. $\pm 30\%$
90-730 V DC.

Frequency: 50...60 Hz.

Burden: 16 VA-8 W

Operating temperature: 0°C to 50°C

Storage temperature: -20° to +70°C

Auxiliary power supply:

Battery: Ni-M-H

Independent operating period: 9999 seconds continuous operation

Voltage measurement:

Measuring system: 3 wire or 4 wire arrangement (choice by external connection)

Measuring range : 0 to 500 V AC. (phase-to-common)

4-wire system: 0 to 500 V AC. (line-to-neutral)

0 to 866 V AC. (line-to-line)

3-wire system: 0 to 500 V AC. (line-to-line)

Scale switch : Automatic

Other voltages : Via measurement transformers

Frequency : 42.5 – 69 Hz

Accuracy:

Voltage: 0.1 % of nominal (Class A according to IEC 61000-4-30).

Frequency: 0.1% ± 10 mHz (Class A according to IEC 61000-4-30)

Unbalance: $\pm 0.15\%$ (Class A according to IEC 61000-4-30)

Flicker: 5% according to IEC 61000-4-15

Class A according to IEC 61000-4-30

Harmonics: Class I according to IEC 61000-4-7

Class A according to IEC 61000-4-30

Measurement conditions to ensure accuracy class:

- Errors due to external voltage transformers not being included.
- Temperature range : 5 to 45 °C.
- Measurement range: between 5 % and 100 %.

Internal memory:

Memory size: 2Mb

Memory configuration: rotating

QNA 413 (with default variables)	Default
STD	33 days 18 hours
EVE	4655 recordings
EVQ	12330 recordings
H24	32 days
STP	16 weeks

(*) The STD file has been calculated assuming a 10-minute recording period and the number of recordings for the EVE, EVQ and H24 files with the default values.

Micro-processor:

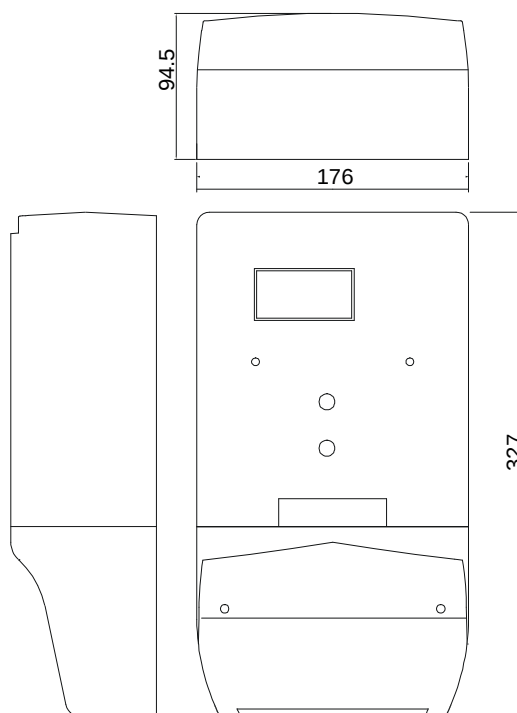
Sampling frequency : 10.24 k samples/second in each channel (6 channels)

Converter : 16 bit (Sigma delta)

Assembly features:

Casing : according to DIN 43859

Dimensions : according to DIN 43857



Weight: 2.3 kg

STANDARDS

Quality: IEC 61000-4-30

Harmonics: IEC 61000-4-7

Flicker: IEC 61000-4-15

Other standards:

EN 60664, EN 61036, VDE 110, UL 94

EN 61010: Electrical safety Category III 500V

ELECTROMAGNETIC EMISSION

- EN 61000-3-2 (1995), Harmonics
- EN 61000-3-3 (1995), Voltage fluctuations
- EN 50081-2 (1993), Industrial emission
 - EN 55011 (1994): Conducted (EN 55022- Class B)
 - EN 55011 (1994): Radiated (EN 55022 - Class A)

ELECTROMAGNETIC IMMUNITY

- EN 50082-2 (1995), Industrial immunity
 - EN 61000-4-2 (1995), Electrostatic discharge
 - ENV 50140 (1993), EM Radiated field of RF
 - EN 61000-4-4 (1995), EFT burst
 - ENV 50141 (1993), RF common mode
 - EN 61000-4-8 (1995), 50 Hz H-field
 - EN 50082-1 (1997), Residential immunity
 - EN 61000-4-5 (1995), Surges
 - EN 61000-4-11 (1994), Supply voltage interruptions
-

10.- SAFETY CONSIDERATIONS



The user should take into account all installation instructions indicated in the INSTALLATION & STARTUP and TECHNICAL SPECIFICATIONS sections in this manual.

Note that when the instrument is switched on, the terminals may be dangerous when touched and opening or removing parts may access dangerous areas. The analyzer has been designed and tested to meet IEC 348 standard and is factory-shipped in proper operating conditions.

11.- MAINTENANCE

The **QNA-413** does not require any special maintenance. No adjustment, maintenance or repair should be carried out while the instrument is open and switched on. Qualified technicians must carry out these actions when they are necessary.

Before any adjustment, replacement, maintenance or repair, the instrument must be totally disconnected from any power supply source.

If any protection failure is suspected, the instrument must be immediately placed out of service. The instrument's design allows it to be quickly replaced in the event of any breakdown.

The design of the analyzer allows it to be easily replaced in the event of breakdown.

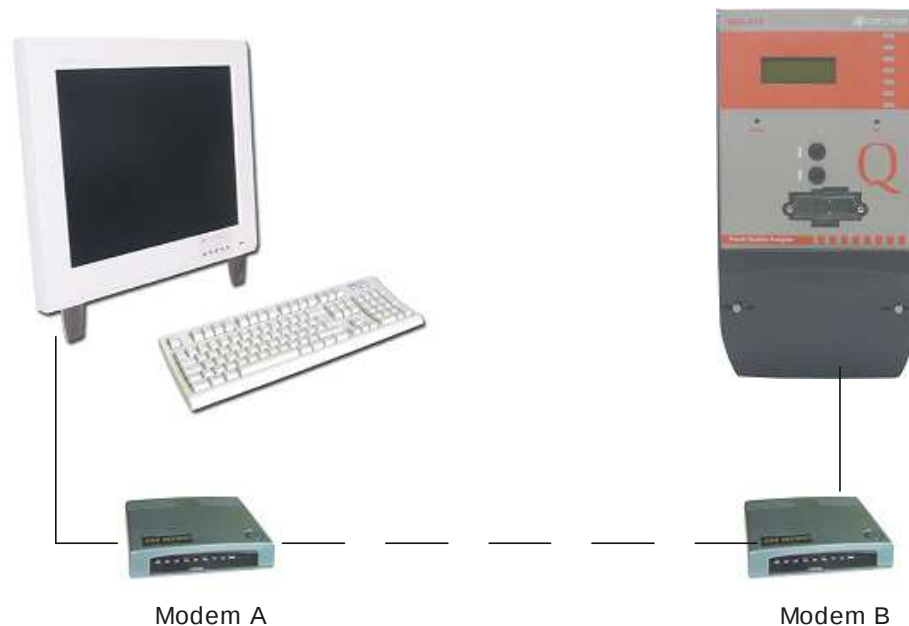
12.- TECHNICAL SERVICE

For any information on the instrument's performance or in the event of breakdown, please contact CIRCUTOR's technical service.

CIRCUTOR S.A. - After-sales service.
Vial Sant Jordi, s/n
08232 - Viladecavalls.
Tel. – (+34) 93 745 29 00
Fax – (+34) 93 745 29 14
E-mail - central@circutor.es

A.- Appendix: Communication with the QNA-413 connected to an external modem

One of the most common configurations of the QNA-413 is to connect the analyzer to an external modem.



In order to connect and prior to start up, the user must take into account that both modems must have correctly established the communication link. Therefore, the modem making the call and the modem connected to the QNA-413 analyzer must be configured.

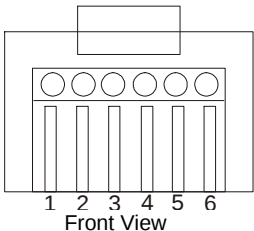
This configuration must be carried out using Windows's HyperTerminal program or equivalent. Modem settings must therefore be:

- **MODEM A (PC):**
 - AT&F** Default configuration
 - AT&D2** Enables DTR operations *Data Terminal Ready*
 - AT&S0** Enables DSR *Data Set Ready*
 - AT&W0** Saves configuration
- **MODEM B (QNA):**
 - AT& F** Default configuration
 - AT&D0** DTR overcontrol
 - AT&K3** Disables data compression
 - AT&R1** The modem ignores the RTS
 - AT&N6** Forces modem baud rate to 9600 bps
 - ATS0=1** Enables modem to answer on the first ring
 - AT& W0** Saves configuration

The above AT commands might vary for different modem models.

Therefore, to ensure the correct configuration, please consult your modem's user manuals.

Communication cable:

RJ Connector	QNA	Modem (DB9)	Modem (DB25)
	1 – DSR	5–GND	7 – GND
	2 – Rx	2–Rx	3 – Rx
	3 – TX	3–Tx	2 – Tx
	4 – CTS	8–CTS	5 – CTS
	5 –RTS	7–RTS	4 – RTS
	6 – GND	5–GND	7 – GND

Troubleshooting:

Most of problems may be caused by the modem units.

Problem	Solutions
The Modem A does not call.	Check that the used port in the PC matches the one connected in the modem.
	Check the correct performance of the PC and Modem ports using the HyperTerminal program or equivalent.
	Check the modem cabling.
	Check the phone line.
The Modem B does not answer.	Check that the modem is switched on.
	Check the command entry making the modem answer on the first ring (ATS0=1)
The Modem B answers the call but does not receive any response from the analyzer.	Check that the used port is the R1 port.
	Check the QNA-413 communication port configuration. Check that this is set at 9,600 bauds.

Given that it is impossible to ensure compatibility with all modems available on the market, Circutor recommends that the modem type is checked prior to using it.

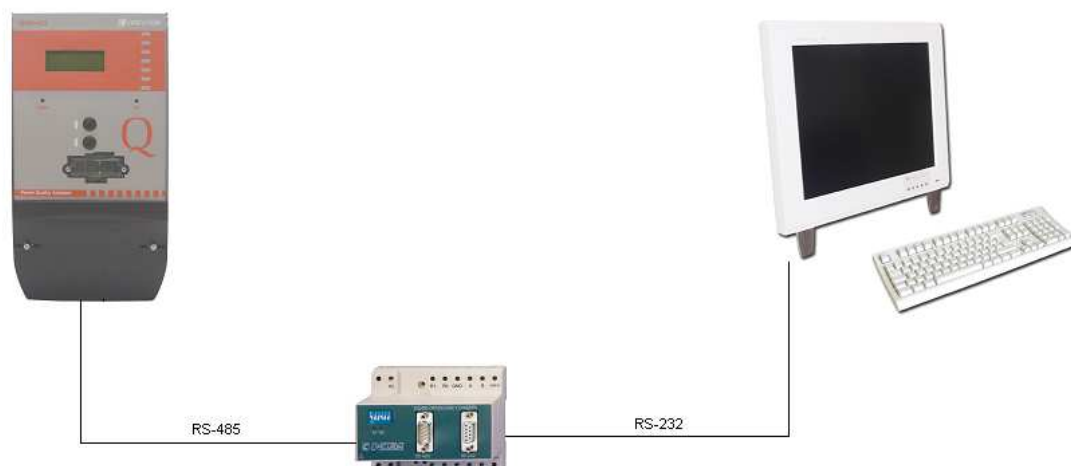


Local Modem (A) cannot make a call through a telephone switchboard. It must be via a direct line.

B.- Appendix: Communications with QNA-413 (RS485)

QNA-413 can also establish a communication to a PC via an RS-485 network. This connection is done via the QNA-413's RS port.

This kind of communication link is usually used where the analyzer is far away (1200 m, as maximum) from the PC set to be used for data viewing and management.

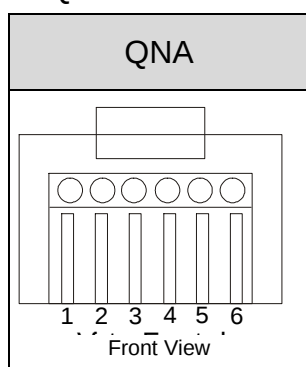


The following cables must be used for this configuration:

- PC → RS-232 / RS-485 Converter

RS-232		
PC (DB9)	PC (DB25)	RS-232/485 Converter (DB9)
3-Tx	2-Tx	2-Rx
2-Rx	3-Rx	3-TX
		7-RTS
		8-CTS
5-GND	5-GND	5-GND

- QNA → RS-232 / RS-485 Converter



RS-485	
QNA	RS-232/485 Converter (DB9)
2-Tx/Rx(-)	2-Tx/Rx (-)
3-Tx/Rx(+)	1-Tx/Rx (+)
6-GND	5-GND

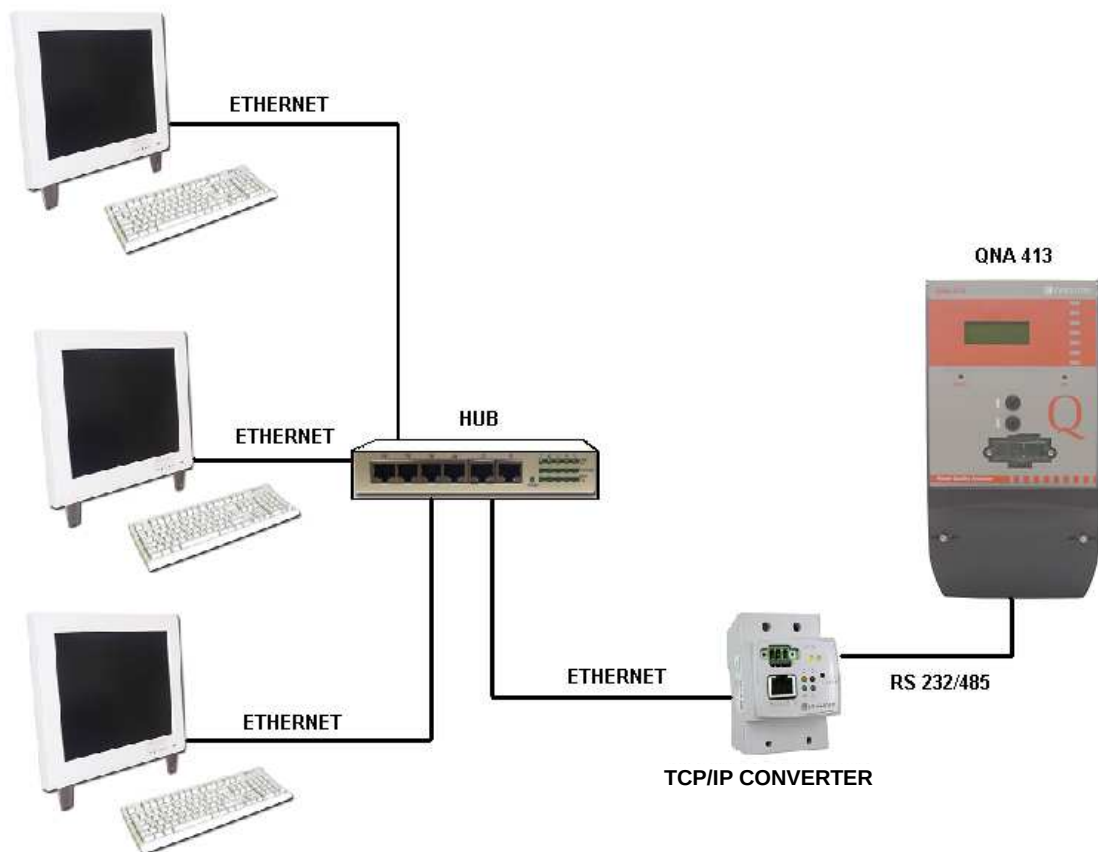
Check that the RS-232 cable is not connected to the PC. This port has priority over the RS-485 port.

The QNA-413 will not be able to communicate via the RS-485 port when connected.

C.- Appendix: Communications with QNA-413 using a TCP-IP converter

QNA-413 can also establish a communication to a PC via an ETHERNET network.

For this configuration, CIRCUTOR S.A. can supply a TCP-IP / RS 232-485 (TCP2RS) converter allowing the connection of any device equipped with RS-232 or RS-485 communication to a PC via an ETHERNET network.



Use the switch on the converter to change the RS-232 signal into an RS-485 signal. Always check that the cable linking the QNA-413 analyzer to the TCP/IP converter matches the Tx/Rx connection.

TCP/IP	
QNA	TCP/IP Converter
3	A (+)
2	B (-)
6	S (GND)

D.- Appendix: Setting of a QNA-413 ETHERNET Analyzer

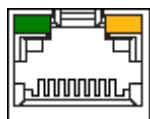
The QNA-413 Ethernet, is specifically designed to communicate in Ethernet networks. This system can optimize all RS485 communication bus wiring, thereby also optimizing already created computer infrastructures and facilitating installation.

A CD is supplied with the instrument, which contains different elements:

TCPSetup: setting program for communication parameters.

Com Redirector: setting program for *virtual ports.

The QNA-413-Ethernet has an RJ Connector45 Ethernet 10Base-T/100Base-TX (self detecting), which connects the device to the Ethernet network (hub or switch), or using a direct cable (braided cable), to the computer which will be a master or will store the application.



The connection with the master system is via four pair braided Ethernet cable (shielded). One end is connected to the Ethernet QNA-413 device and the other to the network's electronics (hub or switch) on the corporate network.

Where direct connection with a computer or device with Ethernet input is required, the wires in the Ethernet cable must be specially adapted for such communication.

STANDARD ETHERNET CABLE			DIRECT ETHERNET CABLE		
1-Orange	--	1-Orange	1-Orange	--	1-Green
2-Orange/White	--	2-Orange/White	2-Orange/White	--	2-Green/White
3-Green	--	3-Green	3-Green	--	3-Orange
4-Blue	--	4-Blue	4-Blue	--	4-Blue
5-Blue/White	--	5-Blue/White	5-Blue/White	--	5-Blue/White
6-Green/White	--	6-Green/White	6-Green/White	--	6-Orange/White
7-Brown	--	7-Brown	7-Brown	--	7-Brown
8-Brown/White	--	8-Brown/White	8-Brown/White	--	8-Brown/White

NOTE: For communication with the QNA-413, it is essential that the analyzer's speed and the Ethernet module's speed are the same (9600b as a default). Read the following section to set the baud rate: **SETTING THE PARAMETERS – TCPSetup**.

SETTING THE PARAMETERS – TCPSetup

The instrument within the company network (LAN) must be identified, with an assigned IP Address. If the IP address is not known, the network administrator must be contacted to obtain the address.

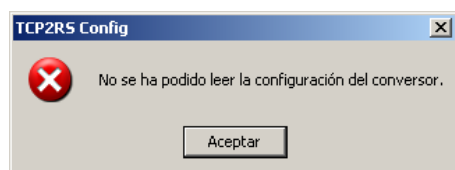
To assign the IP Address, the TCPSetup program must be run and the following screen will appear:



To assign the IP address to the peripheral, the *machine address* must be known (also known as the “MAC ADDRESS”). This machine address appears on the unremoveable label attached to the front of the instrument.

Press *Program* once the IP Address and the machine's address have been assigned.

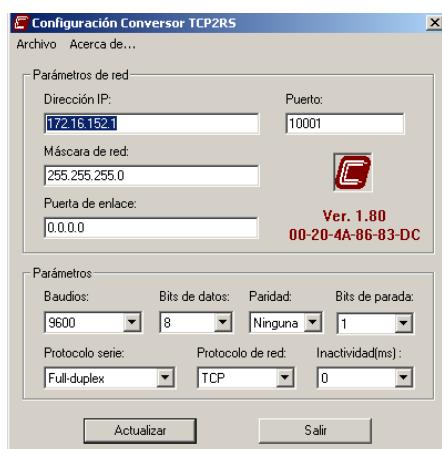
(Detail of setting screen)



Once the programmable button has been pressed, the software will search for the instrument in the Corporate Network; in the event of a connection problem the device will not be detected and the following screen will appear.

If the instrument has been detected, all communication settings will be displayed:

The options for programming will be displayed on the setting screen:



ETHERNET SETTING

Identity IP.

Subnet mask.

Gateway, if communicating using external communications (Router).

Port (14000 - 14009 for TCP communications).

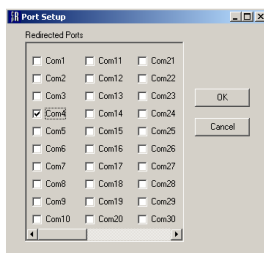
As default 9600-8-none-1.

Network protocol (UDP or TCP). As default TCP.

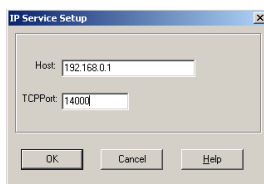
Setting of TCP Network Protocol

The port redirection software will be installed (Com Redirector), this software allows the PC or master application to use the IP Address for the QNA-413-Ethernet as though it were a computer's physical COM port. This will create a communications tunnel between both peripherals using a transparent connection.

- Start installing and running the Com Port Redirector software from the disk supplied with the instrument. Once it is installed the Com Port Redirector located in *Start\Programs\Com Redirector\Configuration* run.



Clicking on *Com Setup* and selecting the virtual series port/s to be created; once created click on "ok" (different virtual ports are created, one per piece of instrument, depending on the number of QNA-413-Ethernet's installed).



Then the "Add IP" button is clicked for each virtual port created; In *Host* the IP for each of the installed instrument is assigned. In *TCP Port* com port 11000, units are entered less than the assigned Local port in the QNA-413-Ethernet; i.e. a Local Port must be assigned to the QNA-413-Ethernet that may vary between 14000 and 14009. Then a local port varying between 3000 and 3009 is assigned in the Com Port redirector.

- Therefore if Local Port 14003 is assigned to the QNA-413-Ethernet, in *TCP Port*, 3003 must be entered as Local Port. Then OK is clicked.
- To avoid unwanted disconnections or disconnections from the amount of traffic, the communication tunnel reconnection options are enabled from the *Port Settings* option; The following is selected when the setting screen is opened:
 - i. *Timeout Reconnect.*
 - ii. *Server Reconnect*
- After setting this last option, all information is then saved by clicking the *Save* button. The machine is restarted so that the ports become active. From now on any application operating via series ports will have the virtual ports set in the software available.

Example (Addressing the virtual port address):

COM4 --- IP 192.168.0.1

- After having followed these steps, the virtual ports will automatically open when there is any application that makes use of the computer's series ports, thus making them available to the software.

E.- Appendix: Installation and start up of the QNA-413-GSM

Configure the QNA-413 analyzer before inserting the new SIM card

The GSM line used must be capable of data transmission!!!

First the SIM on the phone line to be used must be configured to enable communication with the **QNA-413** GSM/RS-232's GSM modem.

This action will always be required when a new SIM card is inserted in the **QNA-413** GSM analyzer, regardless of whether it is the first installation or a replacement SIM.

Proceed as follows:

1. With no SIM card inserted:

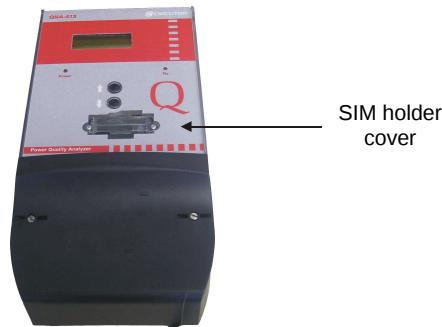
- 1) Turn on the **QNA-413** analyzer.
- 2) Connect to the **QNA-413** analyzer via the RS-232 serial port using a communication cable.
- 3) Use the PC software to add a **QNA-413** or, for a SIM change, modify the configuration on the existing **QNA-413** analyzer.
- 4) Access the "general parameter" option in the software field, and select the option called "PIN change".

The following screen will be then shown:

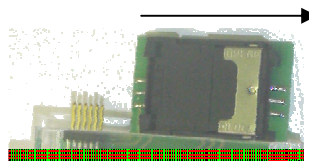
- 5) Select options "SIM change" and "Enable use of PIN".
- 6) Enter the PIN and PUK numbers for the SIM to be inserted.
- 7) Accept the action and follow the steps shown by the software:
 - Insert the new SIM card and then remove the RS-232 communication cable from the analyzer.

2. Inserting the SIM card:

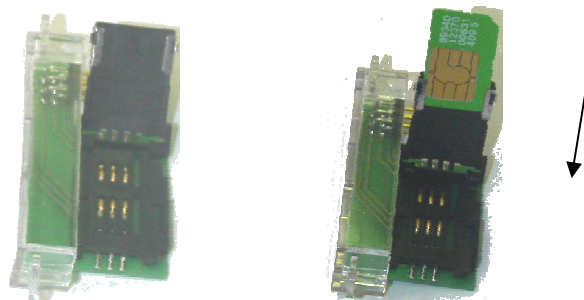
- 8) Loosen the screws on the SIM holder cover.



- 9) Carefully pull out the piece.
- 10) Release the SIM holding lock.



- 11) This position of the lock permits the user to open the holding piece and insert the SIM card.



- 12) Close the holding piece and place the lock back into its initial position.
- 13) Put the SIM holder cover back into the **QNA-413** analyzer.
- 14) Tighten the cover screws to avoid any possible malfunction of the SIM.

3. With the new card SIM inserted:

- 15) Remove the RS-232 cable from the analyzer.
- 16) Wait until the PC software issues a warning (About 60 s).
- 17) Reconnect the RS-232 communication cable to the **QNA-413** analyzer.
- 18) Check that the PC software notifies the results of the operation. The result may be:
 - Successful: the **QNA-413** modem is ready to operate.
 - Error: the SIM card has not been initialized. Check the configuration again, carefully following all steps.

Upon completion of the installation, ensure that the RS-232 cable is not still connected to the PC.
This connection will prevent the QNA-413 communicating via the GSM modem.

Note: it is recommended that coverage is a minimum of 15 when using this signal.

F.- Appendix: Installation and start up of the QNA-413-GPRS

Steps to be followed when setting the **QNA-413** analyzer so that it sends recorded information via GPRS to an FTP server.

1.- Apply power supply voltage to the **QNA-413** (it is important that when this is done, the RS-232 communications cable is not connected. If it is, then the modem will not start correctly).

2.- Wait for about 3 minutes so that the instrument starts the modem. Press the two keys at the same time until the screen display the message "SIGNAL XX", XX being equal to the value of the existing cover (this may be between 0 and 30). When this message appears, it means that the modem start up process has been correctly carried out.

3.- Connect the RS-232 communications cable to the instrument.

4.- Using the PowerVision software, enter the device's general parameters and then press "GPRS".

5.- The following message will then appear on the screen to allow the GPRS parameters to be changed:

This information is supplied by the telephone company. For example, Vodafone in Spain has the access point server: airtel.es. The user name and password is: [vodafone](#) in both cases.

IP of the FTP server from which the information is to be

Configuración de GPRS

Punto de Acceso
Servidor del punto de acceso : airtel.es
Nombre de usuario del punto de acceso : vodafone
Contraseña punto de acceso : ****

Ftp
Servidor de Ftp : 80 . 37 . 247 . 5
Nombre de usuario de Ftp : qnagprs
Contraseña Ftp : ****

Ficheros a enviar
☒ Fichero std
☒ Fichero eve
☒ Fichero evq
☒ Fichero h24
☒ Fichero stp

Fecha de inicio de envío : viernes, 27 de mayo de 200 2:00:00
Cadencia (1-24 h): 24

Enviar Recibir Exportar Importar Aceptar

User name and password for the FTP Server file to where the information is to be downloaded.

Indicates the date of the first piece of information sent. Every X hours from then on (as indicated in the frequency) a file is sent to the FTP server with the information.

Indicates the frequency in which the QNA is to send information to the server.

G.- Appendix: Setting the SMS Alarms

The equipment may be set so that it sends an SMS message when a preset condition is met.

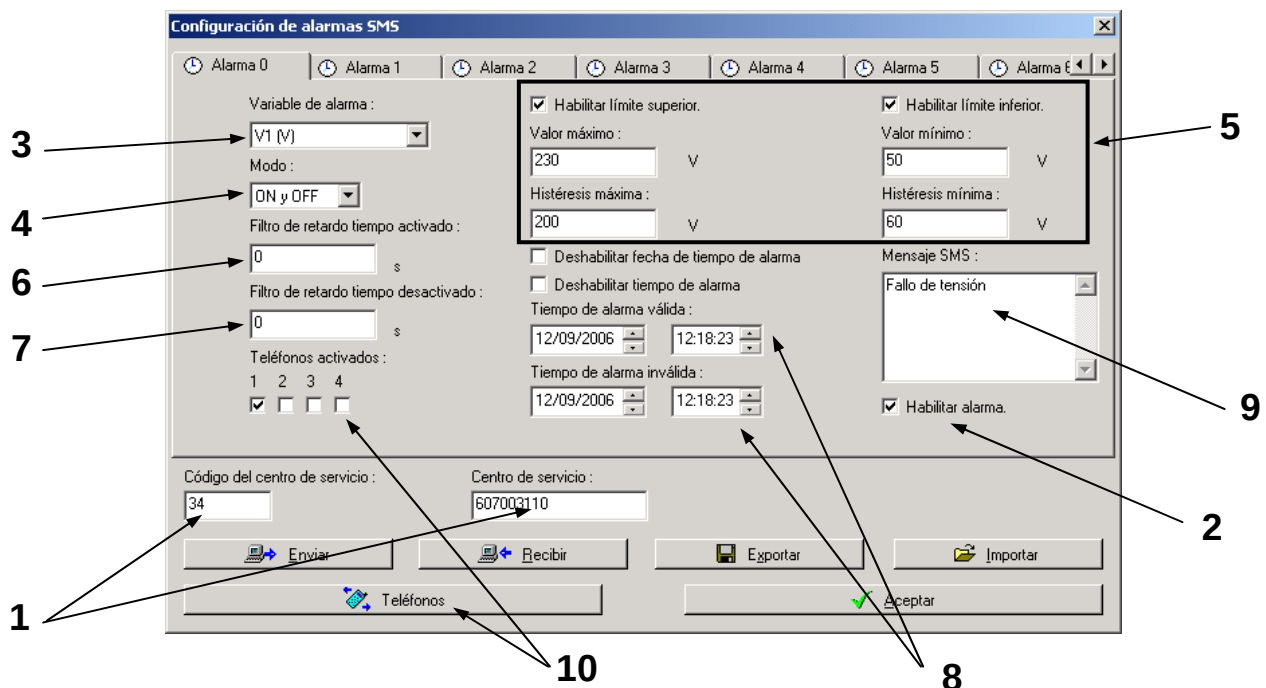
Follow the steps below to activate and set the alarms.

1.- Connect the RS-232 communications cable to the instrument or set it to communicate via GSM.

2.- Using the PowerVision software, enter the device's general parameters and then press "SMS Alarms".

4.- The following message will then appear on the screen to allow the SMS Alarms parameters to be changed.

5.- Up to 8 alarms may be enabled at the same time. Once an alarm is enabled, it may be set.



SMS alarms menu (Steps to be followed):

1. Service Centre Telephone:

Country code for service centre (for example, 34 for Spain)

Contracted company service centre (for example for Vodafone 607003110)

2. Enable Alarm

The different parameters may be set once the alarm is enabled.

3. Select the type of alarm

Drop down menu with the available types of alarm:

Parameters	Variables to be selected	No. of decimals accepted
Voltage	V1, V2, V3, VIII	0
Voltage THD	VTHD1, VTHD2, VTHD3, VTHDIII	1
Unbalance		3
Frequency		2
EVQ	IntV1, IntV2, IntV3, IntVIII, HueV1, HueV2, HueV3, HueVIII, SobreV1, SobreV2, SobreV3, SobreVIII	0

Conditions to be taken into account before setting:

- The three-phase interruption is activated when the three lines are interrupted and ends when one of these exits this status.
- The three-phase dip and overvoltage appears when one phase enters this status and is deactivated when all phases exits this status.
- The remaining variables produce a three-phase alarm using the three lines.

4. Select the SMS send mode

Possible modes:

ON An SMS is sent when an alarm is activated.

OFF An SMS is sent when an alarm is deactivated.

ON and OFF An SMS is sent when an alarm is activated and deactivated.

5. Defining Maximum, Minimum and Hysterisis limits

The maximum and/or minimum values to set off an alarm are now set. The hysteresis value is the margin value to fulfil the alarm condition.

Values entered must be numerical and positive.

6. Delay from reaching the alarm level to activating the alarm

Time in which the alarm condition is met. If the day/month/year fields are zero, the time is daily. If these variables are 0, the alarm is always on.

If the selected variable is EVQ, the unit for this variable must be stated in ms.

Note: time and level conditions (limits) have to be met if the alarm is to be activated, taking into account transformer ratios.

7. Delay in which the alarm goes back to OK and is deactivated

If the selected variable is EVQ, the unit for this variable will be 0.

8. Validity period for the alarm

The trip time may be set. The schedule when the alarm is to be active is indicated.

Alarm On time: time when the alarm is to be active.

Alarm Off time: time when the alarm is to end.

Note: If the alarm time date is disabled, the alarm shall be active every day during the preset time slot.

If the alarm time is disabled, the alarm will be active all the time.

9. Alarm message

Received message text.

10. Telephone number(s) to which the SMS is to be sent and their activation

Note: A log is made in the EVE file every time an alarm condition is met or SMS message sent.

FOR EXAMPLE: Example of a voltage alarm setting and the different conditions which may be set.

1. The following parameters are set:

Variable V1

ON and OFF mode

Upper limit: Maximum value: 240, maximum hysteresis: 230

Lower limit: Minimum value: 90, minimum hysteresis: 100

Activated delay time: 5 seconds

Deactivated delay time: 5 seconds

Maximum	_____	240 V
Maximum hysteresis	-----	230 V
Minimum hysteresis	-----	100 V
Minimum value	_____	90 V

The alarm will be activated under these conditions and an SMS will be sent when, for example, 240 V is exceeded for more than 5 seconds.

The alarm will be deactivated and an SMS sent when V1 is below 230 V for more than 5 seconds.

H.- Appendix: QNA-413 measurement method

