Iskra®

Quick Guide

GB

Portable Network Analyzer PNA 784

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CE

Table of Contents

Meaning of symbols ○ ◖ ● see page 5!

1 SECURITY ADVICE AND WARNINGS

1.1 Welcome

Please read this chapter carefully before starting work with a Portable Network Analyzer PNA784. This chapter deals with important information and warnings that should be considered for safe work with a Portable Network Analyzer PNA784.

1.2 Introduction

These instructions for use are written for the Portable Network Analyzer PNA784. Installation and use of Portable Network Analyzer PNA784 also includes work with dangerous currents and voltages, therefore such work shall be carried out by qualified persons. ***ISKRA d.d.*** Company assumes no responsibility in connection with installation and use of the product. If there is any doubt regarding installation and use of the system in which the instrument is used for measuring or supervision, please contact a person who is responsible for installation of such system.

1.3 Health and safety

The purpose of this chapter is to provide a user with information on safe installation and handling with the product in order to assure its correct use and continuous operation.

We expect that everyone using the product will be familiar with the contents of chapter »Security Advices and Warnings«.

If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

1.4 Safety warnings and instructions for use

Check the following before switching on the Portable Network Analyzer PNA784:

- Nominal voltage,
- Supply voltage,
- Nominal frequency,
- Voltage ratio and phase sequence,
- Current transformer ratio and terminals integrity,
- Protection fuse for voltage inputs (recommended maximal external fuse size is 6 A)
- External switch or circuit-breaker must be included in the installation for disconnection of the devices' aux. power supply. It must be suitably located and properly marked for reliable disconnection of the device when needed.
- Integrity of earth terminal
- Proper connection and voltage level of I/O modules

Warning for the Portable Network Analyzer PNA784 connection and disconnection

- Before use, check the Portable Network Analyzer PNA784, measuring voltage connection wires and accessories visually and make sure that there are no visible damages before use. Replace damaged measuring voltage connection wires and accessories with new ones of the same quality. Use only insulated current probes, safety measuring voltage connection wires and safety alligator clip terminals that are equal to those enclosed to the Portable Network Analyzer PNA784.
- For earthing the Portable Network Analyzer PNA784, use a special input terminal and do not connect live parts.
- Do not connect input voltages that exceed values specified for the Portable Network Analyzer PNA784. Maximum permitted voltage on safety voltage terminals towards ground: Input L1, L2, L3, N towards GND is 600 V Cat III.
- Do not connect input currents that exceed values specified for the Portable Network Analyzer PNA784. Maximum permitted current on current inputs K/L I1, K/L I2, K/L I3 and K/L IN is 12.5A.
- When mounting flexible current probes and safety measuring voltage connection wires with safety alligator clip terminals to the measuring object be careful to disconnect power supply on non-insulated conductors or use corresponding protection equipment (gloves, etc.) If possible, do not work alone.
- Do not use the Portable Network Analyzer PNA784 near explosive gasses and vapors.
- Do not insert metal parts in safety connection terminals and connectors.
- **Do not hang/mount Portable Network Analyzer PNA784 by the attached connections (cables).**

Waste

It is forbidden to deposit electrical and electronic equipment as municipal waste. The manufacturer or provider shall take waste electrical and electronic equipment free of charge. The complete procedure after lifetime should comply with the Directive 2002/96/EG about restriction on the use of certain hazardous substances in electrical and electronic equipment or a corresponding Url 118/04.

1.5 Warnings, information and notes regarding designation of Portable Network Analyzer PNA784

Used symbols:

	See Power Portable Network Analyzer PNA784 documentation.
	Double insulation in compliance with the EN 61010−1 standard.
	Functional ground potential. Note: This symbol is also used for marking a terminal for protective ground potential if it is used as a part of connection terminal or auxiliary supply terminals.
	Compliance of the product with directive 2002/96/EC, as first priority, the prevention of waste electrical and electronic equipment (WEEE), and in addition, the reuse, recycling and other forms of recovery of such wastes so as to reduce the disposal of waste. It also seeks to improve the environmental performance of all operators involved in the life cycle of electrical and electronic equipment.
	Compliance of the product with European CE directives.

The delivery includes:

- Portable Network Analyzer PNA784
  - 5 safety measuring voltage connection wires (4 x Voltage inputs, 1 x Ground input)
  - 8 safety measuring current connection wires
  - 5 safety alligator clip terminals
  - A1287 single phase flex current clamps (+ power supply cable)
  - A1257 three phase flex current clamps (+ power supply cable)
  - USB cable
  - Ethernet cable (non-GPRS version)
  - MiQen software on CD
  - Power supply cable
- Quick guide for Portable Network Analyzer PNA784
- Flex current clamps A1287 User Manual
- Flex current clamps A1179/A1257/A1395 User Manual

2 BASIC DESCRIPTION AND OPERATION OF PORTABLE NETWORK ANALYZER PNA784

2.1 Introduction

Description of symbols

In different chapters or tables different symbols may appear in Quick guide. According to the position of symbols, they have different meaning.

Chapter

Meaning of each symbol is:

○ – Function not supported
◖ – Function partially supported (see a note)
● – Function completely supported

Positions follow from left to right:

Subchapter

Symbols next to the subchapters indicate accessibility of functions described. Accessibility of functions is indicated with the following symbols:

PC – Function accessible via communication (MiQen software)
 – Function accessible via navigation keys on the instrument front side

Tables

Supported functions and measurements are listed in tables for all types. Symbols in tables indicate support of enabled functions for each type. Additionally a legend is placed below table of used symbols. Meaning of symbols is:

● – Function is supported
× – Function is not supported
○ – Symbol meaning varies and is described in the legend below the table

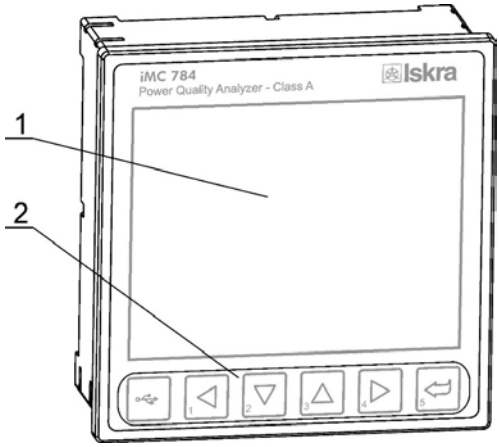
2.2 Description of the Portable Network Analyzer PNA784

Portable Network Analyzer PNA784 is a portable device intended for monitoring of power quality from its production, transmission, distribution all the way to the final consumers, which are most affected by inadequate voltage quality. It is mostly applicable in medium and low voltage applications.

Lack of information regarding supplied voltage quality can lead to unexplained production problems and malfunction or can even damage equipment being used during factory production process. Therefore, Portable Network Analyzer PNA784 can be used for the needs of electrical utilities (evaluation against standards) as well as for industrial purposes (e.g. for monitoring the level of supplied power quality).

Appearance

1 – Color TFT display
2 – Navigation keyboard



Color TFT display

5.7 inch color TFT display is used for displaying measuring quantities and for a display of selected functions when setting the Power Quality Analyzer iMC784.

Navigation keyboard

The "Enter" key is used for confirming/selecting the settings. Direction keys are used for navigating between screens and menus. Function of individual key may vary depending on the selected screen.

2.3 Meter functionality

General hardware Features	**Default / Optional**
General	
Class A measuring accuracy (0.1%) according to EN 61000-4-30 Ed.3	●
Voltage auto range up to 1000Vp-p_{RMS}	●
Current auto range up to 12.5 A	●
4 voltage and 4 current channels with 32 us sampling time	●
Auxiliary power supply	●
Two independent communication ports (see data below)	○
Support NTP real time synchronization	● / ● / ●
Up to 20 additional inputs and outputs (see data below)	○
Internal flash memory (8MB+8GB)	●
Real time clock (RTC)	●
Front panel	
5.7 inch color TFT display (iMC784)	●
Control keys on front panel (5 keys)	●
Communication	
COM1: Ethernet + USB	●

● Function is supported (default)
○ Optional (to be specified with an order)

General software Features	**Default / Optional**
EN 50160 power quality evaluation	●
Automatic PQ report generation	●
Disturbance, trend & PQ event recording	●
Waveform recorder with programmable sampling time (max 625 samples / cycle)	●
Standardized PQDIF and COMTRADE format support	●
MiQEN user friendly setting & analysis software	●
Setup wizard	●
Wrong connection warning	●
Custom screen settings (3 user defined screens on LCD)	●
Programmable refresh time	●
MODBUS and DNP3 communication protocols	●
MD calculation (TF, FW, SW)	●
Wide frequency measurement range 16 – 400 Hz	●
Programmable alarms (32 alarms)	●
Alarms recording	●
Measurements recording (128 quantities)	●
Measurements graphs (time / FFT)	●
Evaluation of voltage quality in compliance with EN 50160	●
NTP real time clock synchronization	●
EN61850 Ed.2 Server	○

● Function is supported (default)
○ Optional (to be specified with an order)

Supported measurements

Meas. type	Measurement	3-phase 4-wire	3-phase 3-wire	1-phase	comments
Phase measurements	*Voltage*				
	$U_{1\text{-}3\_RMS}$	☑		☑	
	U_{AVG_RMS}	☑		☑	
	$U_{unbalance\_neg\_RMS}$	☑	☑		
	$U_{unbalance\_zero\_RMS}$	☑			
	$U_{1\text{-}3\_DC}$	☑		☑	DC component of phase voltages
	$U_{0\_Zero\_sequance\_RMS}$	☑	☑		Zero sequence voltage
	$U_{1\_Positive\_sequence\_RMS}$	☑	☑		Positive sequence voltage
	$U_{2\_Negative\_sequence\_RMS}$	☑	☑		Negative sequence voltage
	Current				
	$I_{1\text{-}3\_RMS}$	☑	☑	☑	
	I_{TOT_RMS}	☑	☑	☑	
	I_{AVG_RMS}	☑	☑	☑	
	$I_{unbalance\_RMS}$	☑	☑		
	$I_{unbalance\_zero\_RMS}$	☑	☑		
	$I_{0\_Zero\_sequance\_RMS}$	☑	☑		Zero sequence current
	$I_{1\_Positive\_sequence\_RMS}$	☑	☑		Positive sequence current
	$I_{2\_Negative\_sequence\_RMS}$	☑	☑		Negative sequence current
	Power				
	$P_{1\text{-}3\_RMS}$	☑		☑	
	P_{TOT_RMS}	☑	☑	☑	
	$Q_{1\text{-}3\_RMS}$	☑		☑	Reactive power can be calculated as a squared difference between S and P or as sample delayed
	Q_{TOT_RMS}	☑	☑	☑	
	Qb_{t_RMS}	☑	☑		Budeanu reactive power Total
	$Qb_{1\text{-}3\_RMS}$	☑	☑		Budeanu reactive power Phase
	$S_{1\text{-}3\_RMS}$	☑		☑	
	S_{TOT_RMS}	☑	☑	☑	
	D_{t_RMS}	☑	☑		Deformed power Total
	$D_{1\text{-}3\_RMS}$	☑	☑		Deformed power Phase
	$PF_{1\text{-}3\_RMS}$	☑		☑	
	dPF_{t_RMS}	☑	☑		Displacement Power Factor Total
	$dPF_{1\text{-}3\_RMS}$	☑	☑		Displacement Power Factor Phase
	$\varphi_{1\text{-}3\_RMS}$	☑		☑	
	Harmonic analysis				
	THD-$U_{1\text{-}3}$	☑		☑	
	THD-$I_{1\text{-}3}$	☑	☑	☑	
	TDD-$I_{1\text{-}3}$	☑	☑	☑	
	$U_{1\text{-}3\_harmonic\_1\text{-}63\_\%}$	☑		☑	% of RMS or % of base
	$U_{1\text{-}3\_harmonic\_1\text{-}63\_ABS}$	☑		☑	
	$U_{1\text{-}3\_harmonic\_1\text{-}63\_\varphi}$	☑		☑	
	$U_{1\text{-}3\_inter\text{-}harmonic\_\%}$	☑		☑	Monitoring up to 10 different fixed frequencies
	$U_{1\text{-}3\_inter\text{-}harmonic\_ABS}$	☑		☑	
	$U_{1\text{-}3\_inter\text{-}harmonic\_1\text{-}63\_\%}$	☑		☑	% of RMS or % of base
	$U_{1\text{-}3\_inter\text{-}harmonic\_1\text{-}63\_ABS}$	☑		☑	
	$U_{1\text{-}3\_signaling\_\%}$	☑		☑	Monitoring of signaling (ripple) voltage of set frequency. % of RMS or % of base
	$U_{1\text{-}3\_signaling\_ABS}$	☑		☑	

Meas. type	Measurement	3-phase 4-wire	3-phase 3-wire	1-phase	comments
Phase measurements	*Harmonic analysis*				
	$I_{1-3\_harmonic\_1-63\_\%}$	☑	☑	☑	% of RMS or % of base
	$I_{1-3\_harmonic\_1-63\_ABS}$	☑	☑	☑	
	$I_{1-3\_harmonic\_1-63\_\varphi}$	☑	☑	☑	
	$I_{1-3\_inter-harmonic\_\%}$	☑	☑	☑	Monitoring up to 10 different fixed frequencies
	$I_{1-3\_inter-harmonic\_ABS}$	☑	☑	☑	
	$I_{1-3\_inter-harmonic\_1-63\_\%}$	☑	☑	☑	% of RMS or % of base
	$I_{1-3\_inter-harmonic\_1-63\_ABS}$	☑	☑	☑	
	$I_{1-3\_signaling\_\%}$	☑		☑	Monitoring of signaling (ripple) current of set frequency. % of RMS or % of base
	$I_{1-3\_signaling\_ABS}$	☑		☑	
	Flickers				
	Pi_{1-3}	☑		☑	Instantaneous flicker sensation measured with 150 samples / sec (original sampling is 1200 samples / sec)
	Pst_{1-3}	☑		☑	10 min statistical evaluation (128 classes of CPF)
	Plt_{1-3}	☑		☑	Derived from 12 Pst acc. to EN 61000-4-15
	Miscellaneous				
	K-factor$_{1-3}$	☑	☑	☑	
	Current Crest factor I_{1-3}	☑	☑	☑	
	Voltage Crest factor U_{1-3}	☑	☑	☑	
Phase to phase measurements	*Voltage*				
	Upp_{1-3_RMS}	☑	☑		
	Upp_{AVG_RMS}	☑	☑		
	THD-Upp_{1-3}	☑	☑		
	φ_{x-y_RMS}	☑			Phase-to-phase angle
	$Upp_{1-3\_harmonic\_1-63\_\%}$	☑	☑	☑	% of RMS or % of base
	$Upp_{1-3\_harmonic\_1-63\_ABS}$	☑	☑	☑	
	$Upp_{1-3\_harmonic\_1-63\_\varphi}$	☑	☑	☑	
	$Upp_{1-3\_interharmonic\_1-63\_\%}$	☑	☑	☑	% of RMS or % of base
	$Upp_{1-3\_interharmonic\_1-63\_ABS}$	☑	☑	☑	
	$U_{underdeviation}$	☑	☑	☑	$U_{under.}$ and $U_{over.}$ are calculated for phase or phase-to-phase voltages regarding connection mode.
	$U_{overdeviation}$	☑	☑	☑	
	Voltage Crest factor Upp_{1-3}	☑	☑	☑	
	Flickers				
	Pi_pp_{1-3}		☑		Phase-to-phase flickers.
	Pst_pp_{1-3}		☑		
	Plt_pp_{1-3}		☑		
Metering	*Energy*				
	Counter E_{1-8}	☑	☑	☑	Each counter can be dedicated to any of four quadrants (P-Q, import-export, L-C). Total energy is a sum of one counter for all tariffs. Tariffs can be fixed, date/time dependent or tariff input dependent
	E_TOT_1-8	☑	☑	☑	
	Active tariff	☑	☑	☑	

Meas. type	Measurement	3-phase 4-wire	3-phase 3-wire	1-phase	comments
Auxiliary Channel measurements	*Aux. line*				
	$U_{NEUTRAL-EARTH}$	☑		☑	Aux. voltage is dedicated for neutral-earth meas. only
	$I_{NEUTRAL\_meas}$	☑		☑	Measured neutral current with 4th current input
	$I_{NEUTRAL\_calc}$	☑	☑	☑	Calculated neutral current
	$I_{NEUTRAL\_err}$	☑		☑	Error neutral current (difference between measured and calculated)
Maximum demand measurements	*Maximum demand*				
	MD_I_{1-3}	☑	☑	☑1ph	
	MD_P_{import}	☑	☑	☑	
	MD_P_{export}	☑	☑	☑	
	MD_Q_{ind}	☑	☑	☑	
	MD_Q_{cap}	☑	☑	☑	
	MD_S	☑	☑	☑	
Min and max measurements	*Min and max*				
	$U_{1-3\_RMS\_MIN}$	☑		☑1ph	
	$U_{1-3\_RMS\_MAX}$	☑		☑1ph	
	$U_{0\_Zero\_sequance\_RMS\_MIN}$	☑	☑		Max/Min Zero sequence voltage
	$U_{0\_Zero\_sequance\_RMS\_MAX}$	☑	☑		
	$U_{1\_Positive\_sequence\_RMS\_MIN}$	☑	☑		Max/Min Positive sequence voltage
	$U_{1\_Positive\_sequence\_RMS\_MAX}$	☑	☑		
	$U_{2\_Negative\_sequence\_RMS\_MIN}$	☑	☑		Max/Min Negative sequence voltage
	$U_{2\_Negative\_sequence\_RMS\_MAX}$	☑	☑		
	$Upp_{1-3\_RMS\_MIN}$	☑	☑	☑	
	$Upp_{1-3\_RMS\_MAX}$	☑	☑	☑	
	$I_{1-3\_RMS\_MIN}$	☑	☑	☑1ph	
	$I_{1-3\_RMS\_MAX}$	☑	☑	☑1ph	
	$I_{NEUTRAL\_meas\_RMS\_MIN}$	☑	☑	☑	
	$I_{NEUTRAL\_meas\_RMS\_MAX}$	☑	☑	☑	
	$I_{0\_Zero\_sequance\_RMS\_MIN}$	☑	☑		Max/Min Zero sequence current
	$I_{0\_Zero\_sequance\_RMS\_MAX}$	☑	☑		
	$I_{1\_Positive\_sequence\_RMS\_MIN}$	☑	☑		Max/Min Positive sequence current
	$I_{1\_Positive\_sequence\_RMS\_MAX}$	☑	☑		
	$I_{2\_Negative\_sequence\_RMS\_MIN}$	☑	☑		Max/Min Negative sequence current
	$I_{2\_Negative\_sequence\_RMS\_MAX}$	☑	☑		

Meas. type	Measurement	3-phase 4-wire	3-phase 3-wire	1-phase	comments
Min and max measurements	$P_{1\text{-}3\_RMS\_MIN}$	☑		☑1ph	
	$P_{1\text{-}3\_RMS\_MAX}$	☑		☑1ph	
	$P_{TOT\_RMS\_MIN}$	☑	☑	☑1ph	
	$P_{TOT\_RMS\_MAX}$	☑	☑	☑1ph	
	$Qb_{t\_RMS\_MIN}$	☑	☑		Max/Min Budeanu reactive power Total
	$Qb_{t\_RMS\_MAX}$	☑	☑		
	$Qb_{1\text{-}3\_RMS\_MIN}$	☑	☑		Max/Min Budeanu reactive power Phase
	$Qb_{1\text{-}3\_RMS\_MAX}$	☑	☑		
	$S_{1\text{-}3\_RMS\_MIN}$	☑		☑1ph	
	$S_{1\text{-}3\_RMS\_MAX}$	☑		☑1ph	
	$S_{TOT\_RMS\_MIN}$	☑	☑	☑1ph	
	$S_{TOT\_RMS\_MAX}$	☑	☑	☑1ph	
	$D_{t\_RMS\_MIN}$	☑	☑		Max/Min Deformed power Total
	$D_{t\_RMS\_MAX}$	☑	☑		
	$D_{1\text{-}3\_RMS\_MIN}$	☑	☑		Max/Min Deformed power Phase
	$D_{1\text{-}3\_RMS\_MAX}$	☑	☑		
	$dPF_{t\_RMS\_MIN}$	☑	☑		Max/Min Displacement Power Factor Total
	$dPF_{t\_RMS\_MAX}$	☑	☑		
	$dPF_{1\text{-}3\_RMS\_MIN}$	☑	☑		Max/Min Displacement Power Factor Phase
	$dPF_{1\text{-}3\_RMS\_MAX}$	☑	☑		
	$freq_{MIN}$	☑	☑	☑	
	$freq_{MAX}$	☑	☑	☑	
Other measurements	*Miscellaneous*				
	Internal temp.	☑	☑	☑	
	Date, Time	☑	☑	☑	
	Last Sync. time	☑	☑	☑	UTC

3 CONNECTION

3.1 Introduction

This chapter deals with the instructions for Portable Network Analyzer PNA784 connections. Both the use and connection of the device includes handling with dangerous currents and voltages. Only a qualified person shall therefore perform connection. ***ISKRA d.d.*** does not take any responsibility regarding the use and connection. If any doubt occurs regarding connection and use in the system which device is intended for, please contact a person who is responsible for such installations.

Before use: Check voltages and phase rotation, supply voltage and nominal frequency.
Check protective fuse rating (the recommended maximum rating of the external protective fuse for this equipment is 4A-slow).

WARNING

Wrong or incomplete connection of voltage or other terminals can cause non-operation or damage to the Portable Network Analyzer PNA784.

PLEASE NOTE

After connection, settings have to be performed via a keyboard on the front side of the device that reflects connection of device to voltage network (connection mode, current and voltage transformers ratio …). Portable Network Analyzer PNA784 is also configurable via communication.

Remove protection foil from a display.

3.2 Electric connection

Connection

If possible, switch off a measuring object. Always consider safety instructions and avoid working alone.
Apply auxiliary power supply, select corresponding connection from the figures listed below and connect corresponding voltage and current inputs.

Current inputs

Setting up current range on Portable Network Analyzer PNA784:

Choose a primary side of a current range on the Portable Network Analyzer PNA784 corresponding to selected current range on A1257/A1287 flex current clamps. There are three current ranges and they refer to A1257/A1287 flex current clamps. Current range can be entered by means of the keys on the Portable Network Analyzer PNA784 or via communication on PC (for more information please refer to Power Quality Analyzer MC784/iMC784 user's manual, chapter CONNECTION > Connection).

Setting up current range on A1257/A1287 flex current clamps:

Choose the same current range for A1257/A1287 flex current clamps as for the Portable Network Analyzer PNA784. Choose a current range by pressing a blue key. The selected measuring range is indicated with a red LED on the A1257/A1287 flex current clamps interface. Move within measuring ranges by pressing a blue key. To switch off A1257/A1287 flex current clamps, keep pressing a blue for 5 seconds. Portable Network Analyzer PNA784 is adapted to A1257/A1287 flex current clamps, therefore no other clamps may be used, otherwise the Portable Network Analyzer PNA784 could be damaged.

Example: Setting up current range to 30A on A1257/A1287 flex current clamps corresponds to 30A primary and 5A secondary current range on the Portable Network Analyzer PNA784.

Apart from A1257/A1287 flex current clamps, external measuring current transformers (X/5A), measuring current clams (X/5A) or direct connection (max 12.5A) can be connected to Portable Network Analyzer PNA784.

PLEASE NOTE

Current clamps bridges have to be inserted when using A1257/A1287 flex current clamps. Using external current transformers (X/5A), current clamps (X/5A) or direct connection (max 12.5A), these bridges have to be removed unless summation of both inputs is required (flex current clamps + external current transformer/current clamps. Transformation ratio of flex current clamps has to be the same as transformation ratio of external current transformer/current clamps. In cases like this, we advise usage of A1122 X/5A /1A flex current clams, which can be connected to secondary side of any transformer. To achieve proper summation of both current inputs, transformation ratio of both inputs has to be the same). Wrong connection of current clamps can also be solved by rearranging current clamps bridges (rearranging is not possible when using external current transformer or current clamps).

WARNING

Do not connect current or voltage sources to current clamps bridges.

Examples of electric connections

Three phase, four wire connection with unbalanced load

Connect wires and flex current clamps in a three-phase system in compliance with ***figure 3.3***.

First connect the earth terminal to the Portable Network Analyzer PNA784 and connect it with the earth terminal on a measuring object.

Then connect supply for A1257/A1287 flex current clamps. A supply output from the Portable Network Analyzer PNA784 for A1257/A1287 flex current clamps is provided - inscription CLAMPS $12V_{DC}$. Connect this output with input for supplying A1257/A1287 flex current clamps by means of the enclosed connection cable. Then connect current terminals of A1257/A1287 flex current clamps to current terminals on the Portable Network Analyzer PNA784. Designations I1, I2, I3 are

provided on connectors of A1257 flex current clamps; A1287 flex current clamp has a single output connector with no indication. Connect corresponding A1257/A1287 flex current clamps outputs to Portable Network Analyzer PNA784 current clamps inputs I1, I2, I3 and IN. Connect a connector of A1257 flex current clamps I1 to the Analyzer current clamps input terminal I1. Connect a connector of A1257 flex current clamps I2 to the Analyzer current clamps input terminal I2. Connect a connector of A1257 flex current clamps I3 to the Analyzer current clamps input terminal I3. Connect a connector of A1287 flex current clamp to the Analyzer current clamps input terminal IN.

Embrace the L1 phase conductor with I1 flex current clamps A1257.
Embrace the L2 phase conductor with I2 flex current clamps A1257.
Embrace the L3 phase conductor with I3 flex current clamps A1257.
Embrace the LN phase conductor with flex current clamps A1287.
Flex current clamps are provided with an arrow indicating energy direction. If connection is wrong, displayed power on the Analyzer is negative.

Check that current clamps are clamped well, otherwise the measurement will not be correct.
Perform voltage connections. First, connect an N neutral terminal and then phases L1, L2 and L3. Always connect a measuring voltage connection wire to a measuring terminal on the Portable Network Analyzer PNA784 and only then connect the measuring object. Use only enclosed safety measuring voltage connection wires. Voltage inputs of Portable Network Analyzer PNA784 can be connected directly to low-voltage network or via a voltage measuring transformer to a high-voltage network.

To disconnect the Portable Network Analyzer PNA784 from the measuring object use the opposite order. First, disconnect measuring voltage connection wires from the measuring object and only then from the Portable Network Analyzer PNA784. Then remove A1257/A1287 flex current clamps from the measuring object. Hold down a blue key for 5 seconds in order to switch off A1257/A1287 flex current clamps. Then disconnect a cable for supplying A1257/A1287 flex current clamps. At the end, disconnect A1257/A1287 flex current clamps from the Portable Network Analyzer PNA784 terminals. Switch off the Portable Network Analyzer PNA784 auxiliary power supply.

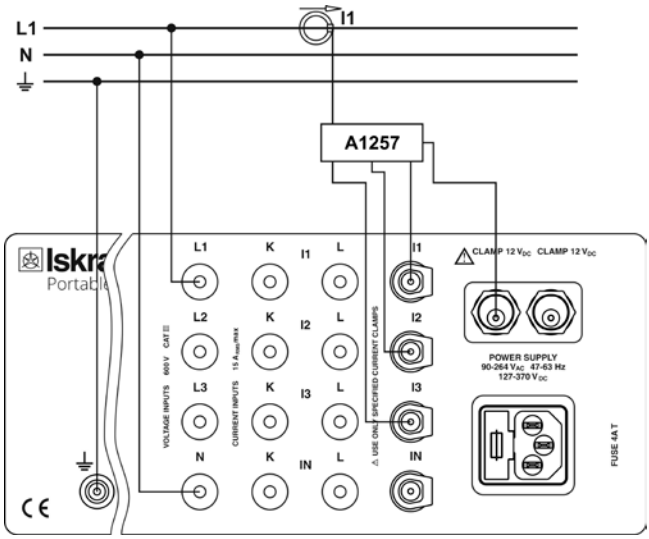
Please refer to ***figure 3.6*** for wired three phase, four wire connection with unbalanced load - connecting external current transformers to current inputs K/L I1, K/L I2, K/L I3 and K/L IN.

Single-phase measurements

For a single-phase connection, use only current I1, voltage L1, neutral conductor N and earth terminal. The connection procedure is similar to three-phase connection; the only difference is that only one phase is connected in this case. Choose 1b connection by means of the keys on the Portable Network Analyzer PNA784.
Please refer to ***figure 3.1*** for single phase connection with flex current clams and to ***figure 3.4*** for wired single phase connection.

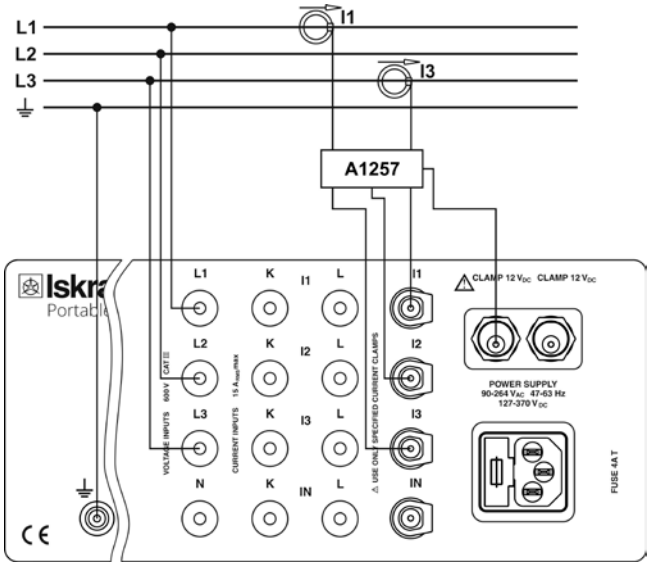
Choose a corresponding meter connection from the figures below and connect voltage and current conductors.

Flex current clamps connections



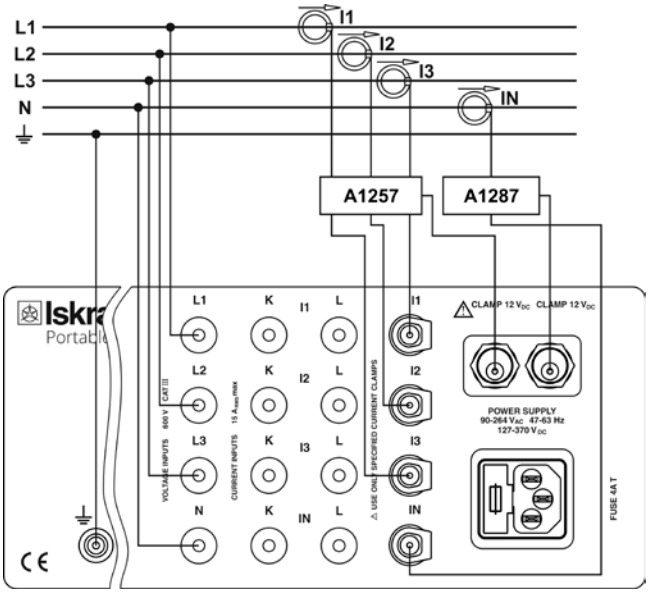
Picture 3.1

Connection 1b (1W)
Single phase connection



Picture 3.2

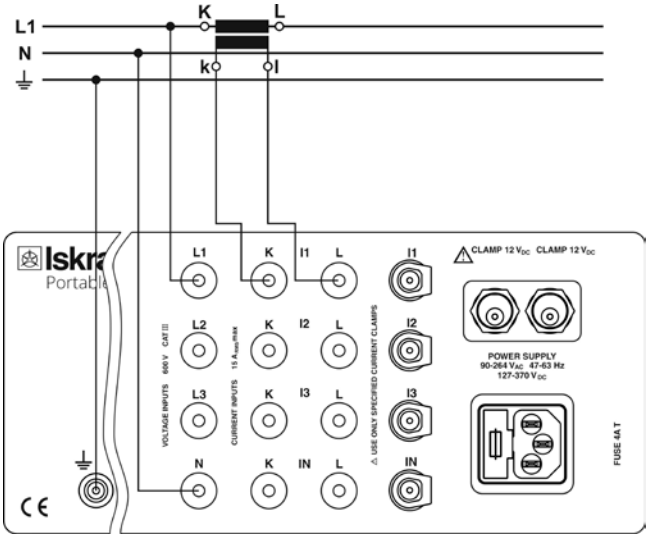
Connection 3u (2W3)
Three phase, three wire connection with unbalanced load



Connection 4u (3W4)
Three phase, four wire connection with unbalanced load

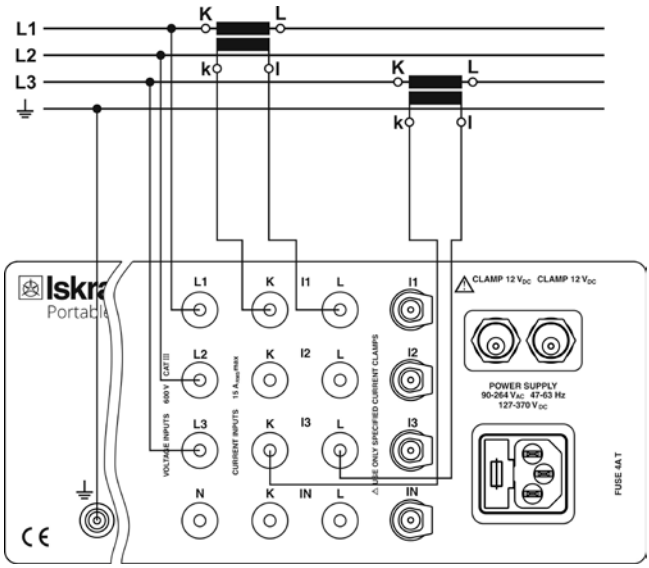
Picture 3.3

External current transformer/current clamps connection



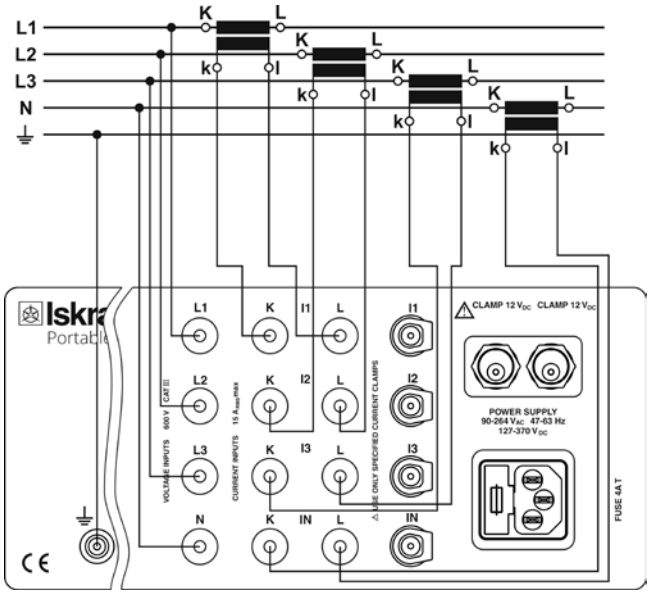
Connection 1b (1W)
Single phase connection

Picture 3.4



Picture 3.5

Connection 3u (2W3)
Three phase, three wire connection with unbalanced load



Picture 3.6

Wire connection

Connection 4u (3W4)
Three phase, four wire connection with unbalanced load

Measurement inputs

Frequency

Nominal frequency range	50, 60 Hz
Measuring frequency range	16 … 400 Hz

Voltage measurements

Number of channels	4 (1)
Min. voltage for sync.	1 V_{rms}
Nominal value (U_N)	500 V_{LN} , 866 V_{LL}
Max. measured value (cont.)	600 V_{LN} ; 1000 V_{LL}
Max. allowed value	1.2 × U_N permanently
	2 × U_N ; 10 s
Consumption	< U^2 / 4.2 MΩ per phase
Input impedance	4.2 MΩ per phase

(1) 4th channel is used for measuring $U_{EARTH-NEUTRAL}$

Current measurements (direct connection)

Number of channels	4
Nominal value (I_{NOM})	1 A, 5 A
Max. measured value (I_1-I_3 only)	12.5 A sin.
Max. allowed value (thermal)	15 A cont.
	≤ 300 A; 1s
Consumption	< I^2 × 0.01 Ω per phase

PLEASE NOTE

For technical details of flex current clamps, please refer to attached documents:

- Flex current clamps A1287 User Manual
- Flex current clamps A1179/A1257/A1395 User Manual

Sampling and resolution

Transient sampling	32 µs (625 Samples per Cycle)
ADC resolution	24 bit 8-ch simultaneous inputs
Reading refresh rate	100 ms … 5 s (User defined)

Mechanical

Dimensions	48.5 x 39.2 x 19.2 cm
Weight	10.4 kg

Backup battery

Nominal voltage	12 V
Capacity	0.8 Ah (20-hr rate capacity to 1.75VPC at 20°C)
Operating temperature range	- 20 ˚C … + 60 ˚C (discharge)
Capacity loss per month	approx. 3 % (at 20 ˚C)

3.3 Connection of communication

Portable Network Analyzer PNA784 supports Ethernet communication designed as standard RJ-45 terminal and USB communication designed as standard USB-B type terminal.

USB-B

USB communication is intended for direct connection of the Portable Network Analyzer PNA784 to the personal computer. USB communication serves as a fast peer-to-terminal data link. Portable Network Analyzer PNA784 is detected by host as a USB 2.0 compatible device. The USB connection is provided through a USB standard Type B connector.

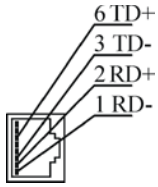
Ethernet

Ethernet communication is intended for connection of Portable Network Analyzer PNA784 to Ethernet network for remote configuration and inspection.

PLEASE NOTE

When Portable Network Analyzer PNA784 with USB communication is connected to a computer for the first time, Portable Network Analyzer PNA784 driver will be installed automatically. If installation is correct Portable Network Analyzer PNA784 presents its self in an operating system (Device manager - Ports (COM and LPT)) as a Measuring device. If Portable Network Analyzer PNA784 is not recognized automatically or wrong driver is installed, valid installation drivers are located in MiQen installation directory, subdirectory Drivers.
With this driver installed, USB is redirected to a serial port, which should be selected when using MiQen software.

Survey of communication connection

<table>
<tr><td rowspan="8">Ethernet</td><td rowspan="8">RJ−45</td><td rowspan="8"> 
</td><td>1</td><td>From</td><td>Data transmission (TD+)</td></tr>
<tr><td>2</td><td>From</td><td>Data transmission (TD−)</td></tr>
<tr><td>3</td><td>To</td><td>Data reception (RD+)</td></tr>
<tr><td>4</td><td>Not connected</td><td>−</td></tr>
<tr><td>5</td><td>Not connected</td><td>−</td></tr>
<tr><td>6</td><td>To</td><td>Data reception (RD−)</td></tr>
<tr><td>7</td><td>Not connected</td><td>−</td></tr>
<tr><td>8</td><td>Not connected</td><td>−</td></tr>
<tr><td>USB</td><td>USB-B</td><td>  </td><td colspan="3">Standard USB 2.0 compatible cable recommended (Type B plug)</td></tr>
</table>

3.4 Record button

Portable Network Analyzer PNA784 enables users to record waveform and disturbance recorders by push of a button. Record button triggers Waveform and disturbance recorder. By default, following parameters are set:

Waveform recorder

Data format:	Pqdif
Recorder resolution:	156 samples / cycle

Disturbance recorder

Data format:	Pqdif
Recorder resolution:	Half cycle

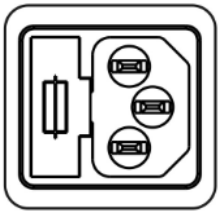
For more information on recorders, setting them up and generated files location, please refer to Power Quality Analyzer MC784/iMC784 user's manual, chapter Advanced recorders.

3.5 Connection of auxiliary power supply

Portable Network Analyzer PNA784 is equipped with auxiliary power supply.

Voltage range:	90...264 V AC 127...370 V DC; 47...63 Hz
Power consumption:	35 W

Connect power supply to IEC inlet:



PLEASE NOTE

Portable Network Analyzer PNA784 has integrated battery that provides backup power supply in case of auxiliary power supply drop out. Additional 20min of run time is provided.
After finishing your measurements, please do not forget to power off Portable Network Analyzer PNA784. Set power switch to position 0, otherwise integrated battery will get discharged.

4 MORE DATA

Since we take care for the environment, we printed only short instructions. More detailed instructions for use of Portable Network Analyzer PNA784 functionalities and settings, are available within Power Quality Analyzer MC784/iMC784 user's manual – available on: www.iskra.si.

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