Content
Power Quality Analysis

Good to know
Power Quality Testing

Find out more about modern power quality measurement techniques
There are quite a few reasons for measuring and analysing power quality nowadays. Potential interactions between end use equipment and electric distribution system, external electromagnetic interferences, resonant states between electrical circuits and some other factors call for a need to be analysed in order that harmful consequences can be omitted or prevented. Power quality analysing includes measurements of:

- Phase to ground voltages;
- Phase to neutral voltages;
- Neutral to ground voltages;
- Phase to phase voltages in three-phase systems;
- Phase currents;
- Current in a neutral conductor;
- Frequency;
- Power Factor, cos fi;
- Harmonic components of current and voltage and their direction;
- Waveform of current and voltage at specific circumstances (peak magnitude, primary frequency, time of occurrence, rising rate);
- Transients.

Active Power (P)
Active power is the power which is actually consumed or generated in an AC circuit over a resistive load . It is measured in watts (W) or kilowatts (kW).

Reactive Power (Q)
Reactive power is the power that is provided by generators, synchronous condensers, or electrostatic equipment such as capacitors and directly influences electric system voltage. The portion of electricity that establishes and sustains the electric and magnetic fields of alternating-current equipment. This is measured in Volt-Ampere (var).

Apparent Power (S)
Apparent power is the perceived power from a load that has both active and reactive components. Apparent power is the vector sum of both active and reactive power and is usually measured in Volt-Amperes (VA).

Power Factor
Power factor is a measure of a power system's efficiency and is the ratio of real power to apparent power.

Energy
Energy is the generation or use of electric power over a period of time. This is usually expressed in kilowatt-hours (kWh).

Fundamental frequency
The fundamental frequency is the lowest and most predominant frequency in a power system (e.g. the fundamental frequency of the mains voltage in the EU is 50 Hz). The fundamental frequency is also called the 1st harmonic of the system.

Voltage events
Dips
Supply voltage dip represents temporary drops of the voltage under the nominal level.

Swells
Supply voltage swells represents temporary voltage increases over the nominal level.

Interruptions
Interruption is classified as large decrease in the voltage supply level or a complete loss of voltage.

Unbalance
Supply voltage unbalance arises when rms values or phase angles between consecutive phases are not equal.

Harmonics
Harmonics are integer frequency multiplication of the fundamental frequency (e.g. with a fundamental of 50 Hz, the 2nd harmonic is 50 x 2 = 100 Hz, 3rd harmonic is 50 x 3 = 150 Hz). Harmonics can be caused by a variety of modern day equipment including resonating transformers, switch-mode power supplies, IT equipment, etc.

Interharmonics
Interharmonics are harmonics that are not an integer multiplication of the fundamental frequency. The main sources of interharmonic waveform distortion are static frequency converters, induction motors and arcing devices.

Total Harmonic Distortion (THD)
THD is the ratio of a wave's harmonic content (for voltage or current) to its fundamental component.

Total Demand Distortion (TDD)
Total Demand Distortion is calculated harmonic current distortion against the full load of the electrical system. TDD gives better insight about impact of harmonic distortion in the system.

Transients
Transient is a term for short, highly damped momentary voltage or current disturbance. They usually appear as a consequence of external electromagnetic interferences (atmospheric electric discharges, switching manoeuvres).

Flickers
Flicker appears as changing illumination intensity which is a reflection of a changing voltage level.

Inrush current
As a motor begins the current needed to start the motor can be 10 to 15 times the normal operating current. This initial surge of current can cause dips in voltage and can be hard to analyse with normal test instruments, for this reason an analyser with a fast logging function is required.

Instrument connection to the LV and MV Power Systems
When connecting the instrument it is essential that both current and voltage connections are correct. In particular the following rules have to be observed:

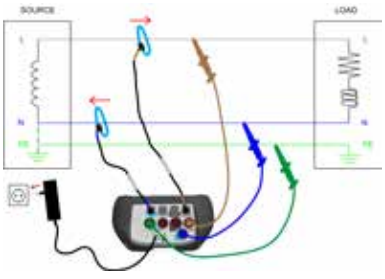
Current clamp-on current transformers

- The arrow marked on the clamp-on current transformer has to point in the direction of current flow, from supply to load;
- If the clamp-on current transformer is connected in reverse the measured power in that phase would normally appear negative.

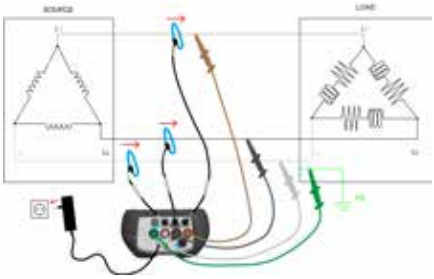
Phase relationships

- The clamp-on current transformer connected to current input connector I1 has to measure the current in the phase line to which the voltage probe from L1 is connected.

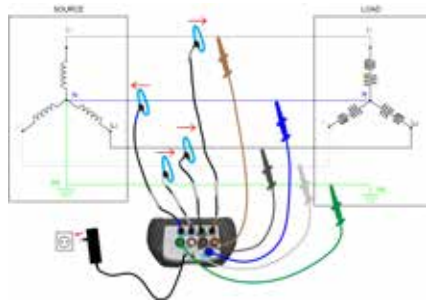
In case of events capturing, it is recommended to connect unused voltage inputs to N voltage input.



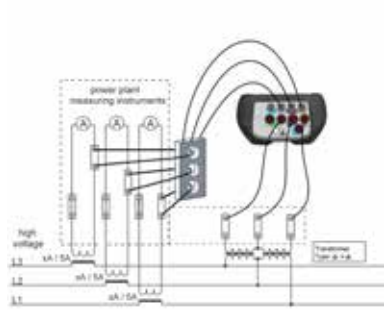
Connection to 1-phase 3-wire system



Connection to 3-phase 3-wire system



Connection to 3-phase 4-wire system



Connecting instrument to the existing current transformers in medium voltage system

Recommended Recording Practice

Power quality measurements are specific type of measurements, which can last several days or even up to several weeks. Usually recording campaign is performed to:

- Statistically analyse some point in the network.
- Troubleshoot malfunctioning device or machine.

Mostly long-term measurements are performed only once, so why it is very important to properly set measuring equipment. Measuring with wrong setting can lead to false or useless measurement results. In the following flow chart recommended recorder procedure is shown (with MI 2892 PowerMaster).

Power quality improvement

Captured with Power Analyser data can be used for improvement of supplied power quality. There are different ways to increase efficiency of power supply.

Cutting power peaks

One of the simplest and the most efficient way to decrease the electricity power bill is by lowering peaks of consumed power (peak demand). This can be achieved by:

- reorganization of production processes;
- embedded generation.

The first solution can be implemented in systems where some tasks can be stopped or rescheduled.
The second solution can be implemented in systems with generators that are often used as a back-up power supply.
Both solutions require additional monitoring and control systems that are designed upon previously conducted measurement and analysis of the situation in the field. Another possibility to increase efficiency is by increasing the power factor using corrective techniques.

Capacitor Banks

Capacitor banks are the devices most susceptible to the presence of harmonics. Since consumer's loads usually have inductive characteristics, capacitor banks are used for compensation of inductive currents. This feature allows:

- better overall system performance;
- increasing availability of active power;
- decreasing transmission loses;
- increasing voltage;
- decreasing financial penalty because of poor power factor.

EN 50160 Standard Overview

EN 50160 is one of the most important standards in field of power quality which defines, describes and specifies the main characteristics of the voltage at a network user's supply terminals in public low voltage and medium voltage distribution networks under normal operating conditions. This standard describes the limits or values within which the voltage characteristics can be expected to remain over the whole of the public distribution network and does not describe the average situation usually experienced by an individual network user.

Power Quality Analysers
Selection Guide for Power Quality Analysers

MEASUREMENTS	MI 2893 Power Master XT	MI 2892 Power Master	MI 2885 Master Q4	MI 2884 Energy Master XA	MI 2883 Energy Master
					
STANDARD					
IEC 61000-4-30 Compliance; Ed. 3.0	Class A (Independent certificate)	Class A (Independent certificate)	Class S (Independent certificate - 0,1%)	Class S (0,2%)	Class S (0,2%)
INPUTS					
Number of current measuring channels	4	4	4	4	4
Number of voltage measuring channels	4	4	4	3	3
Automatic range selection/auto-ranging	• / •	• / •	• / •	• / •	• / •
1-phase flexible current clamps 3000/300/30 A (included in Advance set (AD) and Euro set (EU) set)	4	4	4	3	3
MEASUREMENTS					
TRMS Current measurement (Min., Max., AvgON)	•	•	•	•	•
TRMS Voltage measurement (Min., Max., AvgON)	•	•	•	•	•
Scope function	•	•	•	•	•
On-line harmonics measurement	•	•	•	•	•
Frequency measurement	•	•	•	•	•
Power measurement (W, VA, VAr)	•	•	•	•	•
THD and harmonics analysis	•	•	•	•	•
Interharmonics analysis	•	•	•	•	•
Power Factor cos fi and tg fi	•	•	•	•	•
Registration of voltage events (sags, swells, interruptions)	•	•	•	•	•
Statistical evaluation	•	•	•	•	•
Current in neutral conductor	•	•	•	With optional clamp	With optional clamp
Phase diagram	•	•	•	•	•
Unbalance	•	•	•	•	•
EN 50160 Analysis / IEEE 519 / Energy consumption optimization	• / • / •	• / • / •	• / • / •	• / • / •	• / • / •
Flicker measurement	•	•	•	•	•
Transients measurement	• (1 MSamples/sec)	• (49 kSamples/sec)	• (49 kSamples/sec)	• (30 kSamples/sec)	
Waveform recording	•	•	•	•	
Inrush currents	•	•	•	•	
VFD (variable frequency drives)	•	•	•		
Photo voltaic efficiency measurement	•	•	•		
Energy measurement	•	•	•	•	•
Signalling	•	•	•	•	•
Temperature measurement	•	•	Optional	Optional	Optional
Integration period	1 ... 7200 s	1 ... 7200 s	1 ... 7200 s	1 ... 7200 s	1 ... 7200 s
Power measurements in compliance with IEEE 1459 / Classic (vector or arithmetic)	• / •	• / •	• / •	• / •	• / •
Simultaneous General / waveform	•	•	•	•	
Conection check	•	•	•	•	•
Colour coding	•	•	•	•	•
COMMUNICATION PORTS					
USB	•	•	•	•	•
RS232	For GPS only	For GPS only	For GPS only		
GPS time synchronisation	Optional	Optional	Optional		
Remote instruments control (4G / WiFi)	Optional	Optional	Optional		
Remote instruments control (Ethernet / Intranet)	• / •	• / •	• / •		
GENERAL					
Graphical LCD with backlight (480x272 4.3" color TFT)	•	•	•	•	•
On-site analysis of recorded data	•	•	•	•	•
Built-in power supply for flexible clamps	•	•	•	•	•
Maximal recording time	Over a year	Over a year	Over a year	Over a year	Over a year
Memory module size 8 GB supplied (up to 32 GB)	•	•	•	•	•
PC Software PowerView3	•	•	•	•	•
Maximal test voltage – interphase value	1730 V rms	1730 V rms	1730 V rms	1730 V rms	1730 V rms
Maximal test voltage – between phase and N conductors	1000 V rms	1000 V rms	1000 V rms	1000 V rms	1000 V rms
Maximum transient peak voltage	6 kV	6 kV	6 kV	6 kV	
Frequency range	50 Hz /60 Hz 42.500Hz ... 69.000Hz VFD (5 Hz - 120 Hz) 400 Hz	50 Hz /60 Hz 42.500Hz ... 69.000Hz VFD (5 Hz - 120 Hz) 400 Hz	50 Hz /60 Hz 42.500Hz ... 69.000Hz VFD (5 Hz - 120 Hz) 400 Hz	50 Hz /60 Hz 42.500Hz ... 69.000Hz	50 Hz /60 Hz 42.500Hz ... 69.000Hz
Over voltage category	CAT IV / 600 V CAT III / 1000 V	CAT IV / 600 V CAT III / 1000 V	CAT IV / 600 V CAT III / 1000 V	CAT IV / 600 V CAT III / 1000 V	CAT IV / 600 V CAT III / 1000 V
AC power supply	•	•	•	•	•
Built-in battery charger	•	•	•	•	•
Rechargeable batteries (NiMH)	6 x AA	6 x AA	6 x AA	6 x AA	6 x AA
Weight	1.10 kg	0.96 kg	0.96 kg	0.96 kg	0.96 kg
Dimensions (mm)	230 x 140 x 80	230 x 140 x 80	230 x 140 x 80	230 x 140 x 80	230 x 140 x 80

Power Quality Analysers
Differences between Power Quality Analysers

Class A

MI 2893 Power Master XT

Flagship of our line of Class A power quality analyzers with high sampling rate for transient capturing intended for professorial users specialized for investigating transients in the network and high accuracy measurements.

- Class A 0,1 % (independent certificate)
- Top tier PQA instrument
- General recorder
- Waveform recorder
- Transient recorder working simultaneously with waveform and general recorder (1 MSamples/sec)

MI 2892 Power Master

Advanced selection of power quality analysers and aimed primarily at dedicated professionals, who specialize in high accuracy measurements and analysis, whose validity is backed by a Class A independent certificate.

- Class A 0,1 % (independent certificate)
- Advanced PQA instrument
- General recorder
- Waveform recorder
- Transient recorder (49 kSamples/sec)

Class S

MI 2885 Master Q4

Designed for power quality assessment and troubleshooting in low and middle voltage electrical systems and checking power correction equipment performance and verification of electrical system capacity before adding new loads.

- Class S 0,1% (independent certificate)
- Intermediate PQA instrument
- General recorder
- Waveform recorder
- Transient recorder (49 kSamples/sec)

MI 2884 Energy Master XA

For advanced users interested in long term monitoring and analysis of electrical systems for the purpose of energy quality and consumption management and formulation of cost saving measures with additional simultaneous waveform, inrush recording and transient detection.

- Class S (0,2%)
- Enhanced PQA instrument
- General recorder
- Waveform recorder
- Transient recorder (30 kSamples/sec)

MI 2883 Energy Master

For users interested in long term monitoring and analysis of electrical systems for the purpose of energy quality and consumption management and formulation of cost saving measures.

- Class S (0,2%)
- Basic PQA instrument
- General recorder

Power Quality Analysers
Comparison between Power Quality Analysers

MODEL		MI 2893 Power Master XT	MI 2892 Power Master	MI 2885 Master Q4	MI 2884 Energy Master XA	MI 2883 Energy Master
						
STANDARD	IEC 61000-4-30 Compliance	Class A (independent certificate)	Class A (independent certificate)	Class S (Ind. certificate - 0,1%)	Class S (0.2%)	Class S (0.2%)
	EN 50160	•	•	•	•	•
GENERAL RECORDER MEASUREMENTS	Limited / Standard profile	• / •	• / •	• / •	• / •	• / •
	Voltage AC + DC	•	•	•	•	•
	Current AC +DC	•	•	•	•	•
	Frequency	•	•	•	•	•
	Power measurements in compliance with IEEE 1459 / Classic (vector or arithmetic)	• / •	• / •	• / •	• / •	• / •
	Energy	•	•	•	•	•
	Harmonics	•	•	•	•	•
	Interharmonics	•	•	•	•	•
	Flickers and RVC	•	•	•	•	•
	Phase diagram	•	•	•	•	•
	Signalling	•	•	•	•	•
	Under/Over voltage deviation	•	•	•	•	•
	Interrupts, Dips, Swells	•	•	•	•	•
	Alarms	•	•	•	•	•
	Phase diagram	•	•	•	•	•
	Neutral current	•	•	•	Optional	Optional
	Temperature	•	•	Optional	Optional	Optional
WAVEFORM RECORDER (TRIGGERS ON)	Events	•	•	•	•	
	Alarms	•	•	•	•	
	Level I (Inrush recorder)	•	•	•	•	
	Level U (Inrush recorder)	•	•	•	•	
	Time interval	•	•	•	•	
TRANSIENT RECORDER (TRIGGERS ON)	Envelope	•	•	•	•	
	Level (I, In, U, Un)	•	•	•	•	
	Transient selection between N / GND	• / •				
TROUBLESHOOTING FEATURES	On-line scope mode	•	•	•	•	•
	Waveform snapshoot	•	•	•	•	•
	GPS receiver	Optional	Optional	Optional		
	WiFi / 4G modem	Optional	Optional	Optional		
REMOTE COM	Ethernet / Intranet	• / •	• / •	• / •		
MICROSD CARD	8 GB	•	•	•	•	•
PC SW	PowerView3	•	•	•	•	•

Power Quality Analysers
Selection Guide for Clamps

Part No.		Smart Clamps	Description	Target application	MI 2893	MI 2892	MI 2885	MI 2884	MI 2883
A 1501		•	1-phase mini flexible current clamp 3000/300/30 A / 1V	Single phase flexible current clamp with three selectable measuring ranges. Does not require external power supply as it is powered by the measuring instrument.	•	•	•	•	•
A 1502		•	1-phase mini flexible current clamp 3000/300/30 A / 1V	Single phase flexible current clamp with three selectable measuring ranges. Does not require external power supply as it is powered by the measuring instrument.	•	•	•	•	•
A 1609		•	1-phase mini flexible current clamp 3000/300/30 A / 1V	Single phase flexible current clamp with three selectable measuring ranges. Does not require external power supply as it is powered by the measuring instrument.	•	•	•	•	•
A 1503		•	1-phase mini flexible current clamp 6000/600/60 A / 1V	Single phase flexible current clamp with three selectable measuring ranges. Does not require external power supply as it is powered by the measuring instrument.	•	•	•	•	•
A 1227		•	1-phase flexible current clamp 3000/300/30 A / 1 V	Single phase flexible current clamp with three selectable measuring ranges. Does not require external power supply as it is powered by the measuring instrument.	•	•	•	•	•
A 1445		•	1-phase flexible current clamp 3000/300/30 A / 1 V	Single phase flexible current clamp with three selectable measuring ranges. Does not require external power supply as it is powered by the measuring instrument.	•	•	•	•	•
A 1446		•	1-phase flexible current clamp 6000/600/60 A / 1 V	Single phase flexible current clamp with three selectable measuring ranges. Does not require external power supply as it is powered by the measuring instrument.	•	•	•	•	•
A 1582		•	1-phase flexible current clamp 3000/300/30 A / 1 V; high temperature	Single phase, high temperature (sensor: -20 to 200 °C, module: -20 to 70 °C) flexible current clamp with three selectable measuring ranges. Does not require external power supply as it is powered by the measuring instrument	•	•	•	•	•
A 1281		•	Current clamp 0.5/5/100/1000 A / 1 V	High accuracy current clamp for precise current and power measurements including leakage current measurement.	•	•	•	•	•
A 1588		•	Current clamp 0.5/5/50A / 1V	High accuracy current clamp for precise current and power measurements including leakage current measurement. Does not require external power supply as it is powered by the measuring instrument.	•	•	•	•	•
A 1783			Mini current clamps 20/200A	Mini current clamp for power measurements	•	•	•	•	•
A 1398 PQA			Current clamp 10A / 1V	High accuracy current clamp for precise current and power measurements including leakage current measurements.	•	•	•	•	•
A 1391 PQA			Current clamp AC/DC 40/300 A / 1 V	AC + DC current clamp for power measurements. Battery 9V.	•	•	•	•	•
A 1636			Current clamp AC/DC 1500 A	AC+DC current clamp intended for power measurements, specially for photo-voltaic inverters (DC side). Battery operated (9 V)	•	•	•	•	•
A 1717		•	Current clamp AC/DC 100/1000A / 1V	AC+DC current clamp intended for power measurements, specially for photo-voltaic inverters and DC/AC converters /DC side). Battery operated (9V). Requires A 1561 connection cable.	•	•	•	•	•
A 1037			Current transformer 5 A / 1 V	3-phase transformer for power measurements on distribution panels.	•	•	•	•	•

SMART CLAMPS KEY FEATURES:

- Cover wide current range;
- Are automatically recognized by the instrument;
- Are switchless (range selection on the instrument);
- Do not require external power supply.

Power Quality Analysers
Selection Guide for Clamps

Part No.		Type	Jaw opening/loop	Ranges	Measurement Ranges	RMS accuracy 50/60 Hz	Phase accuracy 50/60 Hz	RMS accuracy 1500 Hz	Phase accuracy 1500 Hz	Overvoltage category; IP
A 1501		s-Flex	fi 7 cm Sensor length: 25 cm	30 A 300 A 3000 A	3 A ... 60 A 5 A ... 600 A 50 A ... 6000 A	± 1 % ± 1 % ± 1 %	< 1°	± 3 %	< 10°	CAT IV / 600 V; IP 64
A 1502		s-Flex	fi 14 cm Sensor length: 48 cm	30 A 300 A 3000 A	3 A ... 60 A 5 A ... 600 A 50 A ... 6000 A	± 1 % ± 1 % ± 1 %	< 1°	± 3 %	< 10°	CAT IV / 600 V; IP 64
A 1609		s-Flex	fi 54 cm Sensor length: 175 cm	30 A 300 A 3000 A	3 A ... 60 A 5 A ... 600 A 50 A ... 6000 A	± 1 % ± 1 % ± 1 %	< 1°	± 3 %	< 10°	CAT IV / 600 V; IP 64
A 1503		s-Flex	fi 27 cm Sensor length: 90 cm	60 A 600 A 6000 A	6 A ... 120 A 10 A ... 1200 A 100 A ... 12000 A	± 1 % ± 1 % ± 1 %	< 1°	± 3 %	< 10°	CAT IV / 600 V; IP 64
A 1227		Flex	fi 14 cm Sensor length: 48 cm	30 A 300A 3000 A	3 A ... 60 A 10 A ... 600 A 60 A ... 6000 A	± 1 % ± 1 % ± 1 %	< 1°	± 3 %	< 10°	CAT IV / 600 V; IP 64
A 1445		Flex	fi 19 cm Sensor length: 61 cm	30 A 300A 3000 A	3 A ... 60 A 10 A ... 600 A 60 A ... 6000 A	± 1 % ± 1 % ± 1 %	< 1°	± 3 %	< 10°	CAT IV / 600 V; IP 64
A 1446		Flex	fi 27 cm Sensor length: 90 cm	60 A 600A 6000 A	6 A ... 120 A 20 A ... 1200 A 120 A ... 12000 A	± 1 % ± 1 % ± 1 %	< 1°	± 3 %	< 10°	CAT IV / 600 V; IP 64
A 1582		Flex	fi 19 cm Sensor length: 61 cm	30 A 300A 3000 A	3 A ... 60 A 10 A ... 600 A 60 A ... 6000 A	± 1 % ± 1 % ± 1 %	< 1°	± 3 %	< 10°	CAT IV / 600 V; IP 64
A 1281		Iron	Jaw opening: 5.2 cm Max. conductor size < 50 mm	0.5 A 5 A 100 A 1000 A	50 mA ... 1 A 0.5 A ... 10 A 10 A ... 175 A 100 A ... 1200 A	± 0,5 % ± 0,5 % ± 0,5 % ± 1,2 %	< 0.5°	± 1.5 %	< 1.5°	CAT III / 600 V; IP 20
A 1588		Iron	Jaw opening: 40 mm Max. conductor size < 50 mm	0.5A 5A 50A	50 mA ... 1 A 0.5 A ....10 A 5 A ... 100 A	± 0.5 % ± 0.5 % ± 0.5 %	< 0.5 °	± 1.5 %	< 3 °	CAT II / 600 V; IP 40
A 1783		Iron	Jaw opening: 24 mm Max. conductor size < 24 mm	20 A 200 A	50 mA ... 20A 500 mA ... 200 A	± 0,5 %	< 0.5 °	± 1.5 %	< 0.5°	CAT III / 600 V; IP 40
A 1398 PQA			Jaw opening: 13 mm Max. conductor size < 13 mm	10 A	0.5A .... 20 A	± 0.5%	< 0.45°	± 1.5 %	< 3°	CAT II / 300 V; IP 40
A 1391 PQA		Iron	Jaw opening: 2.5 cm Max. conductor size < 22mm	AC/DC 40 A 300 A	2 A ... 40 A 20 A ... 300 A	± 3 % ± 3 %	< 3°	± 3 %	< 10°	CAT IV / 600 V; IP 64
A 1636		Iron	Jaw opening: 7,3 cm Max. conductor size < 68 mm	AC/DC 1500 A	45 ... 1500 A	±3 % FS	< 3 °	±3 % FS	< 6°	CAT III / 600 V; IP 40
A 1717		Iron	Jaw opening: 5.1 cm Max. conductor size < 52 mm	AC/DC 100 A 1000 A	3 A ... 100 A 30 A ... 1000 A	±1 % m.v. ±1 A	< 0.5°	± 2 %	< 1.5°	CAT III / 600 V; IP 40
A 1037		Iron	N/A	0.5 A 5 A	10 mA ... 1 A 0.5 A ... 10 A	±0,3 % ±0,3 %	< 0.5°	± 1 %	< 1.0°	CAT III / 600 V; IP 40

Ranges are specified for pure sine wave, reduced crest factor (< 1.5),

Power Quality Analysers
MI 2893 Power Master XT

The MI 2893 Power Master XT is a hand-held three phase power quality analyzer with a large easy-to-read graphical color display enabling the user to detect harmonics, phasors, waveforms and transients with sampling frequency 1 MSamples/sec in the installation simply by connecting the device. The instrument is designed for a long term recording as well as for troubleshooting power quality problems in three-phase and single-phase power distribution systems. The handy Quick Set buttons makes the instrument more user friendly and are allowing faster data overview for troubleshooting. Advanced PC SW package PowerView3 enables detailed analysis of recorded data, direct and remote reading from the micro SD memory card, analysis of long term records and automatic creation of professional test report.

MEASURING FUNCTIONS

- Voltage: TRMS, peak, crest factor (4-channel);
- Current: TRMS, peak, crest factor (4-channel);
- Power (active, reactive, apparent);
- **Power measurements fully compliant with IEEE 1459 (active, non active, fundamental, harmonic, load un-balance) and classic (vector or arithmetic) method;**
- **VFD (variable frequency drive, 5 Hz – 120 Hz), 400 Hz;**
- Unbalance, flicker measurement;
- Harmonic and interharmonic analysis up to **50th harmonics, THD** and **TDD measurements;**
- **Energy (active, apparent, reactive, apparent, generated, consumed);**
- Capturing and recording of power supply events (shutdowns, interruptions, swells, dips);
- Inrush currents monitoring and recording;
- Waveform/inrush displaying, snapshot and recording;
- **Transients with sampling frequency 1 MSamples/sec;**
- Power quality analysis according to EN 50160, IEEE 519;
- Recording up to 7 adjustable alarms;
- Temperature measurement;
- Power factor, cos fi and tg fi.

KEY FEATURES

- 4-voltage channels with wide measurement range;
- 4-current channels with support for automatic clamp recognition and "on instrument" range selection;
- Automatic Smart Clamp detection and Smart Clamp range selection;
- Current clamp auto range selection;
- **Sampling frequency on transients recording > 1 MSamples/sec, on 8 channels simultaneously;**
- **Compliance with power quality standard IEC 61000-4-30 Class A;**
- Complete power quality analysis according to EN 50160 including signalling and interharmonics;
- Support for microSD memory card (8-GB supplied with the instrument) up to 32GB;
- Color-coded input terminals and terminal labels to suit your application region;
- Intuitive main menu and large icons that makes the equipment very easy to navigate and configure;
- Powerful PC SW PowerView3 enables downloading, view, analysis of recorded data and professional report creation;
- Flexible clamps (without additional power supply) are included in the AD/EU set;
- Remote communication via Ethernet:
- GPS clock synchronization (optional).

APPLICATION

- **High speed transient capturing;**
- Energy consumption optimization;
- Power quality assessment and trou-bleshooting in low and middle voltage electrical systems;
- Checking power correction equipment performance;
- Long-term analysis;
- Predictive maintenance;
- Verification of electrical system capacity before adding loads.

STANDARDS

Safety:
- EN 61010-1

Measurements:
- IEC/EN 61000-4-30,Class A;
- IEC/EN 61557-12;
- IEC/EN 61000-4-7, Class I;
- IEC/EN 61000-4-15;
- EN 50160;
- IEEE 1459;
- IEEE 519

Electromagnetic compatibility (EMC):
- EN 61326

TECHNICAL DATA

FUNCTION		
Voltage inputs	**AC+DC**	
Number of inputs	5	
Nominal voltage range		
Three phase connection	Phase (L-N): 50 ... 1000 V RMS Line (L-L): 87 ... 1730 V	
Single phase connection	Phase (L-N): 50 ... 500 V RMS	
Measuring range		
Three phase connection	10 % ... 150 % of nominal voltage	
Single phase connection	10 % ... 110 % of nominal voltage	
Max. transient peak voltage	±6 kV	
Accuracy	IEC 61000-4-30 Class A, ±0.1% of nominal voltage,	
Sampling rate	7 kSamples per second @ 50/60 Hz, synchronization with main frequency 1.7 kSamples per second @ VFD (5 Hz - 120 Hz) 12.2 kSamples per second @ 400 Hz	
Mains frequency range	42,5 ... 69,0 Hz ±10 mHz 5 ... 120 Hz ± 10 mHz (VFD) 335,0 ... 465,0 Hz ± 100 mHz	
Current inputs	**AC+DC**	
Number of inputs	4	
Measuring range:		
Range 1	10.0 mV_{RMS} ... 300.0 mV_{RMS} ±0.25 % U_{RMS}	
Range 2	50.0 mV_{RMS} ... 3.000 V_{RMS} ±0.25 % U_{RMS}	
Functions	**Measuring range**	**Accuracy**
Power (P, Q, S, cos ϕ, PF...)	Depends on voltage and selected clamps	IEC 61557-12 Class 1
Energy	Depends on voltage and selected clamps	Active: IEC 62053-21 Class 1 Reactive: IEC 62053-23 Class 2
Harmonics (DC ... 50th) @50/60 Hz Harmonics (DC ... 13th) @400 Hz Harmonics (DC ... 20th) @VFD (5 - 16 Hz) Harmonics (DC ... 13th) @VFD (16 - 33 Hz) Harmonics (DC ... 5th) @VFD (33 - 120 Hz)	0 ... 20% of nom. voltage	IEC 61000-4-7 Class 1
Interharmonics (1 ... 50th) @ 50/60 Hz Interharmonics (1 ... 20th) @VFD (5 - 16 Hz) Interharmonics (1 ... 13th) @VFD (16 - 33 Hz) Interharmonics (1 ... 5th) @VFD (33 - 120 Hz)	0 ... 20% of nom. voltage	IEC 61000-4-7 Class 1
Flicker	0.2 ... 10	IEC 61000-4-15 Class F3
Mains signalling	0 ... 15% of nom. voltage	IEC 61000-4-30 Class A
Unbalance	Voltage: 0 ... 5% Current: 0 ... 20%	
Temperature	-10 ... 85 °C	±0.5 °C
Dips, Swell	10 ... 150% of nom. voltage	±0.2 % of nominal voltage ±1 cycle
Interrupts	0 ... 10% of nom. voltage	±1 cycle
Recorders		
Memory	8GB microSD, up to 32GB supported	
General recorder		
Integration period	1s ... 2h	
Recorded signals	>1000 (voltages, currents, harmonics, power...) Minimal, maximal, average and average ON value per interval, including - Voltage events (dip, swell, interupt) - Custom alarms (up to 7 programmable alarms) - Signalling (up to two selectable frequecies) - Transients - Inrush	
Duration	>1 year (depends on size of SD card at 10 min registration period)	
Waveform recorder		
Duration	Up to 60 seconds duration and 30 seconds pretrigger of voltage and current waveform Up to 1500 records	
Trigger	Manual, Voltage Events, Custom Alarms, Voltage or current level (inrush), Time interval	
Transient recorder		
Sampling rate	1 MSamples/sec; simultaneously on all 8 channels	
Duration	One cycle of voltage and current waveforms	
Trigger	Transient selection measurement between L-N/L-GND Envelope and level trigger simultaneously Transient recorder runs simultaneously with general and waveform recorder Set & go transient setup; predefined setup (low and high level) for current and voltage trigger	
General		
Display	4.3 inch color TFT (480 x 272)	
Communication	USB, Ethernet	
Time synchronisation	GPS receiver (A 1355)	
Power supply	With power supply adapter or 6 x NiMh rechargable batteries, size AA	
Overvoltage category	CAT IV / 600 V For three phase connection CAT III / 1000 V	
Weight	1,1 kg	
Dimensions	230 x 140 x 80 mm	

STANDARD SET

MI 2893 Standard set (ST)
- Instrument Power Master XT
- Test probe, (brown, black, grey, green, blue), 5 pcs
- Crocodile clip, (brown, black, grey, green, blue), 5 pcs
- Voltage measurement lead, (brown, black, grey,
- green, blue), 5 pcs
- Labels for colour coding
- Temperature probe
- microSD memory card 8.0GB
- microSD card reader
- PC SW PowerView3
- USB and Ethernet patch cable
- Power supply adapter
- 1.2 V NiMH rechargeable battery, 6 pcs
- Professional protective waterproof case (A 1685)
- Instruction manual
- Calibration certificate

MI 2893 Euro set (EU)
- MI 2893 ST
- With 1-phase flexible current clamps 3000 / 300 / 30 A (A 1227), 4 pcs

MI 2893 Advanced set (AD)
- MI 2893 ST
- With 1-phase flexible current clamps 3000 / 300 / 30 A (A 1502), 4 pcs

Picture of MI 2893 AD set

Power Quality Analysers
MI 2892 Power Master

The MI 2892 Power Master is a hand-held three phase power quality analyser with a large easy-to-read graphical colour display enabling the user to detect harmonics, phasors and waveforms anomalies in the installation simply by connecting the device. The instrument is designed for a long term recording as well as for troubleshooting power quality problems in three-phase and single-phase power distribution systems. The handy Quick Set buttons makes the instrument more user friendly and are allowing faster data overview for troubleshooting. Advanced PC SW package PowerView3 enables detailed analysis of recorded data, direct reading from the microSD memory card, analysis of long term records and automatic creation of professional test report.

MEASURING FUNCTIONS

- Voltage: TRMS, peak, crest factor (4-channel);
- Current: TRMS, peak, crest factor (4-channel);
- Power (active, reactive, apparent);
- Power measurements fully compliant with IEEE 1459 (active, non active, fundamental, harmonic, load unbalance) and classic (vector or arithmetic) method;
- VFD (variable frequency drive, 5 Hz – 120 Hz), 400 Hz;
- Unbalance, flicker measurement;
- Harmonic and interharmonic analysis up to 50th harmonics, THD and TDD measurement;
- Energy (active, reactive, generated, consumed);
- Capturing and recording of power supply events (shutdowns, interruptions, swells, dips);
- Inrush currents monitoring and recording;
- Waveform/inrush displaying, snapshot and recording;
- Transients recording;
- Power quality analysis according to EN 50160, IEEE 519;
- Recording up to 7 adjustable alarms;
- Temperature measurement;
- Photo-voltaic inverter efficiency measurements;
- Power factor cos fi and tg fi.

KEY FEATURES

- 4-voltage channels with wide measurement range: 0 ... 1000 Vrms (CAT III / 1000 V);
- 4-current channels with support for automatic clamp recognition and “on instrument“ range selection;
- Automatic Smart Clamp detection and Smart Clamp range selection;
- Sampling frequency on transients recording 49 kSamples/sec on 8 channels simultaneously;
- Compliance with power quality standard IEC 61000-4-30 Class A;
- Complete power quality analysis according to EN 50160 including signalling and interharmonics;
- Support for microSD memory card (8-GB supplied with the instrument) up to 32GB;
- Color-coded input terminals and terminal labels to suit your application region;
- Intuitive main menu and large icons that makes the equipment very easy to navigate and configure;
- Current clamp auto range selection;
- Powerful PC SW PowerView3 enables downloading, view, analysis of recorded data and professional report creation;
- Flexible clamps (without additional power supply) are included in the Euro set;
- Remote communication via Ethernet (GPS clock synchronization - optional).

APPLICATION

- Energy consumption optimization;
- Power quality assessment and troubleshooting in low and middle voltage electrical systems;
- Checking power correction equipment performance;
- Long-term analysis;
- Predictive maintenance;
- Verification of electrical system capacity before adding loads.

STANDARDS

Safety:
- EN 61010-1

Measurements:
- IEC/EN 61000-4-30,Class A;
- IEC/EN 61557-12;
- IEC/EN 61000-4-7, Class I;
- IEC/EN 61000-4-15;
- EN 50160;
- IEEE 1459;
- IEEE 519

Electromagnetic compatibility (EMC):
- EN 61326

TECHNICAL DATA

FUNCTION		
Voltage inputs	**AC+DC**	
Number of inputs	5	
Nominal voltage range (L – N)	Phase (L-N): 50 ... 1000 Vrms / Line (L-L): 50 ... 1730 Vrms	
Measuring range	10% ... 150% of nominal voltage	
Accuracy	IEC 61000-4-30 Class A, ±0.1% of nominal voltage,	
Sampling rate	7 kSamples per sec @ 50/60 Hz, sync with mains freq. 1.7 kSamples per sec @ VFD (5 Hz - 120 Hz) 12.2 kSamples per sec @ 400 Hz	
Mains frequency range	42,5 ... 69,0 Hz ±10 mHz 5 ... 120 Hz ± 10 mHz (VFD) 335,0 ... 465,0 Hz ± 100 mHz	
Current inputs	**AC+DC**	
Number of inputs	4	
Measuring range:		
Range 1	10.0 mV_{RMS} ... 300.0 mV_{RMS} ±0.25 % U_{RMS}	
Range 2	50.0 mV_{RMS} ... 3.000 V_{RMS} ±0.25 % U_{RMS}	
Functions	**Measuring range**	**Accuracy**
Power (P, Q, S, cos fi, PF...)	Depends on voltage and selected clamps	IEC 61557-12 Class 1
Energy	Depends on voltage and selected clamps	Active: IEC 62053-21 Class 1 Reactive: IEC 62053-23 Class 2
Harmonics (DC ... 50th) @50/60 Hz Harmonics (DC ... 13th) @400 Hz Harmonics (DC ... 20th) @VFD (5 - 16 Hz) Harmonics (DC ... 13th) @VFD (16 - 33 Hz) Harmonics (DC ... 5th) @VFD (33 - 120 Hz)	0 ... 20% of nom. voltage	IEC 61000-4-7 Class 1
Interharmonics (1 ... 50th) @ 50/60 Hz Interharmonics (1 ... 20th) @VFD (5 - 16 Hz) Interharmonics (1 ... 13th) @VFD (16 - 33 Hz) Interharmonics (1 ... 5th) @VFD (33 - 120 Hz)	0 ... 20% of nom. voltage	IEC 61000-4-7 Class 1
Flicker	0.2 ... 10	IEC 61000-4-15 Class F3
Mains signalling	0 ... 15% of nom. voltage	IEC 61000-4-30 Class A
Unbalance	Voltage: 0 ... 5% Current: 0 ... 20%	
Temperature	-10 ... 85 °C	±0.5 °C
Dips, Swell	10 ... 150% of nom. voltage	±0.2 % of nominal voltage ±1 cycle
Interrupts	0 ... 10% of nom. voltage	±1 cycle
Recorders		
Memory	8GB microSD, up to 32GB supported	
General recorder		
Integration period	1s ... 2h	
Recorded signals	> 1000 (voltages, currents, harmonics, power...) Minimal, maximal and average value per interval - Voltage events - Custom alarms	
Duration	> 1 year (depends on size of SD card)	
Waveform recorder		
Duration	Up to 60 seconds of voltage and current waveform	
Trigger	Manual, Voltage Events, Custom Alarms, voltage or current level (inrush)	
Transient recorder		
Sampling rate	> 49ksamples/sec	
Duration	Up to 50 cycles of voltage and current waveform	
Trigger	Manual, voltage envelope or level	
General		
Display	4.3 inch colour TFT (480 x 272)	
Communication	USB, Ethernet, RS-232	
Time synchronisation	GPS receiver (A 1355)	
Power supply	110 ... 240 Vac or 6 x NiMh rechargeable batteries, size AA	
Overvoltage category	CAT IV / 600 V or CAT III / 1000 V	
Weight	0,96 kg	
Dimensions	230 x 140 x 80 mm	

STANDARD SET

MI 2892 Standard set (ST)
- Instrument Power Master
- Test probe, (brown, black, grey, green, blue), 5 pcs
- Crocodile clip, (brown, black, grey, green, blue), 5 pcs
- Voltage measurement lead, (brown, black, grey, green, blue), 5 pcs
- Labels for color coding
- Temperature probe
- microSD memory card 8.0GB
- microSD card reader
- PC SW PowerView3
- USB and Ethernet patch cable
- Power supply adapter
- 1.2 V NiMH rechargeable battery, 6 pcs
- Professional protective waterproof case (A 1685)
- Instruction manual
- Calibration certificate

MI 2892 Euro set (EU)
- MI 2892 ST
- With 1-phase flexible current clamps 3000 / 300 / 30 A (A 1227), 4 pcs

MI 2892 Advanced set (AD)
- MI 2892 ST
- With 1-phase flexible current clamps 3000 / 300 / 30 A (A 1502), 4 pcs

Picture of MI 2892 AD set

Power Quality Analysers
MI 2885 Master Q4

The MI 2885 Master Q4 is an ideal troubleshooting tool. The recorders are designed to automatically record all important data and waveforms of voltage events like Dips and Swells. In addition the user can set 7 optional triggers for capturing waveforms of selected quantities. A large easy-to-read graphical colour display enabling the user to detect harmonics, phasors and waveforms anomalies in the installation simply by connecting the device. The handy Quick Set buttons makes the instrument more user friendly and are allowing faster data overview. The instrument is designed for a long term recording as well as for troubleshooting power quality problems in three-phase and single-phase power distribution systems. Advanced PC SW package PowerView3 enables detailed analysis of recorded data, direct reading from the microSD memory card, analysis of long term records and automatic creation of professional test report.

MEASURING FUNCTIONS

- Voltage: TRMS, peak, crest factor (4-channel);
- Current: TRMS, peak, crest factor (4-channel);
- Power (active, reactive, apparent);
- Power measurements fully compliant with IEEE 1459 (active, non active, fundamental, harmonic, load unbalance) and classic (vector or arithmetic) method;
- VFD (variable frequency drive, 5 Hz – 120 Hz), 400 Hz;
- Unbalance, flicker measurement;
- Harmonic and interharmonic analysis up to 50th harmonics, THD and THD measurement;
- Energy (active, reactive, generated, consumed);
- Capturing and recording of power supply events (shutdowns, interruptions, swells, dips);
- Inrush currents monitoring and recording;
- Waveform/inrush displaying, snapshot and recording;
- Transients recording;
- Power quality analysis according to EN 50160, IEEE 519; ;
- Recording up to 7 adjustable alarms;
- Temperature measurement;
- Photo-voltaic inverter efficiency measurements;
- Power factor cos fi and tg fi.

KEY FEATURES

- 4-voltage channels with wide measurement range: 0 ... 1000 Vrms (CAT III / 1000 V);
- 4-current channels with support for automatic clamp recognition and “on instrument“ range selection;
- Automatic Smart Clamp detection and Smart Clamp range selection;
- Sampling frequency on transients recording 49 kSamples/sec on 8 channels simultaneously;
- Compliance with power quality standard IEC 61000-4-30 Class S (0.1%);
- Complete power quality analysis according to EN 50160 including signalling and interharmonics;
- Support for microSD memory card (8-GB supplied with the instrument) up to 32 GB;
- Color-coded input terminals and terminal labels to suit your application region;
- Intuitive main menu and large icons that makes the equipment very easy to navigate and configure;
- Current clamp auto range selection;
- Powerful PC SW PowerView3 enables downloading, view, analysis of recorded data and professional report creation;
- Flexible clamps (without additional power supply) are included in the Euro set;
- Remote communication via Ethernet (GPS clock synchronization - optional).

APPLICATION

- Energy consumption optimization;
- Power quality assessment and troubleshooting in low and middle voltage electrical systems;
- Checking power correction equipment performance;
- Long-term analysis;
- Predictive maintenance;
- Verification of electrical system capacity before adding loads.

STANDARDS

Safety:
- EN 61010-1

Measurements:
- IEC/EN 61000-4-30,Class S;
- IEC/EN 61557-12;
- IEC/EN 61000-4-7, Class I;
- IEC/EN 61000-4-15;
- EN 50160;
- IEEE 1459;
- IEEE 519

Electromagnetic compatibility (EMC):
- EN 61326

TECHNICAL DATA

FUNCTION		
Voltage inputs	**AC+DC**	
Number of inputs	5	
Nominal voltage range (L – N)	Phase (L-N): 50 ... 1000 VRMS Line (L-L): 50 ... 1730 VRMS	
Measuring range	10% ... 150% of nominal voltage	
Accuracy	IEC 61000-4-30 Class S, ±0.1% of nominal voltage,	
Sampling rate	7 kSamples per sec @ 50/60 Hz, sync with mains freq. 1.7 kSamples per sec @ VFD (5 Hz - 120 Hz)	
Mains frequency range	12.2 kSamples per sec @ 400 Hz 42,5 ... 69,0 Hz ±10 mHz 5 ... 120 Hz ± 10 mHz (VFD) 335,0 ... 465,0 Hz ± 100 mHz	
Current inputs	**AC+DC**	
Number of inputs	4	
Measuring range:		
Range 1	10.0 mV_{RMS} ... 300.0 mV_{RMS} ±0.25 % U_{RMS}	
Range 2	50.0 mV_{RMS} ... 3.000 V_{RMS} ±0.25 % U_{RMS}	
Functions	**Measuring range**	**Accuracy**
Power (P, Q, S)	Depends on voltage and selected clamps	IEC 61557-12 Class 1
Energy	Depends on voltage and selected clamps	Active: IEC 62053-21 Class 1 Reactive: IEC 62053-23 Class 2
Harmonics (DC ... 50th) @50/60 Hz Harmonics (DC ... 20th) @VFD (5 - 16 Hz) Harmonics (DC ... 13th) @VFD (16 - 33 Hz) Harmonics (DC ... 5th) @VFD (33 - 120 Hz)	0 ... 20% of nom. voltage	IEC 61000-4-7 Class 1
Interharmonics (1 ... 50th) @ 50/60 Hz Interharmonics (1 ... 20th) @VFD (5 - 16 Hz) Interharmonics (1 ... 13th) @VFD (16 - 33 Hz) Interharmonics (1 ... 5th) @VFD (33 - 120 Hz)	0 ... 20% of nom. voltage	IEC 61000-4-7 Class 1
Flicker	0.2 ... 10	IEC 61000-4-15 Class F3
Mains signalling	0 ... 15% of nom. voltage	IEC 61000-4-30 Class S
Unbalance	Voltage: 0 ... 5% Current: 0 ... 20%	
Temperature	-10 ... 85 °C	±0.5 °C
Dips, Swell	10 ... 150% of nom. voltage	±0.2 % of nominal voltage ±1 cycle
Interrupts	0 ... 10% of nom. voltage	±1 cycle
Recorders		
Memory	8GB microSD, up to 32GB supported	
General recorder		
Integration period	1s ... 2h	
Recorded signals	> 1000 (voltages, currents, harmonics, power...) Minimal, maximal and average value per interval - Voltage events - Custom alarms	
Duration	> 1 year (depends on size of SD card)	
Waveform recorder		
Duration	Up to 60 seconds of voltage and current waveform	
Trigger	Manual, Voltage Events, Custom Alarms, Voltage or current level (inrush), Time interval	
Transient recorder		
Sampling rate	> 49ksamples/sec	
Duration	Up to 50 cycles of voltage and current waveform	
Trigger	Manual, voltage envelope or level	
General		
Display	4.3 inch color TFT (480 x 272)	
Communication	USB, Ethernet	
Time synchronisation	GPS receiver (A 1355)	
Power supply	110 ... 240 Vac or 6 x NiMh rechargable batteries, size AA	
Overvoltage category	CAT IV / 600 V or CAT III / 1000 V	
Weight	0,96 kg	
Dimensions	230 x 140 x 80 mm	

STANDARD SET

MI 2885 Standard set (ST)
- Instrument Power Q4
- Test probe, (brown, black, grey, green, blue), 5 pcs
- Crocodile clip, (brown, black, grey, green, blue), 5 pcs
- Voltage measurement lead, (brown, black, grey, green, blue), 5 pcs
- Labels for color coding
- microSD memory card 8.0GB
- microSD card reader
- PC SW PowerView3
- USB and Ethernet patch cable
- Power supply adapter
- 1.2 V NiMH rechargeable battery, 6 pcs
- Soft carrying bag
- Instruction manual
- Calibration certificate

MI 2885 Euro set (EU)
- MI 2885 ST
- With 1-phase flexible current clamps 3000 / 300 / 30 A (A 1227), 4 pcs

MI 2885 Advanced set (AD)
- MI 2885 ST
- With 1-phase flexible current clamps 3000 / 300 / 30 A (A 1502), 4 pcs

Picture of MI 2885 AD set

Power Quality Analysers
MI 2884 Energy Master XA

The MI 2884 Energy Master XA is a hand-held three phase power quality analyser, specially designed for energy logging detection of harmonics, phasors and waveforms anomalies in the installation simply by connecting the device. Reducing energy use reduces energy costs and may result in a financial cost saving. Energy Master XA serves as a perfect tool for long term recording and later post processing of recorded data. Large easy-to-read graphical colour display enabling the user on site analysis and data checks. The handy Quick Set buttons makes the instrument more user friendly and are allowing faster data overview. Advanced PC SW package PowerView3 enables detailed analysis of recorded data, direct reading from the microSD memory card, analysis of long-term records and automatic creation of professional test report.

MEASURING FUNCTIONS

- Voltage: TRMS, peak, crest factor (3-channel);
- Current: TRMS, peak, crest factor (4-channel);
- Power (active, reactive, apparent);
- Power measurements fully compliant with IEEE 1459 (active, non active, fundamental, harmonic, load unbalance) and classic (vector or arithmetic) method;
- Unbalance, flicker measurement;
- Harmonic and interharmonic analysis up to 50th harmonics, THD and TDD measurement;
- Energy (active, reactive, generated, consumed);
- Capturing and recording of power supply events (shutdowns, interruptions, swells, dips);
- Inrush currents monitoring and recording;
- Waveform/inrush displaying, snapshot and recording;
- Transients recording;
- Power quality analysis according to EN 50160, IEEE 519;
- Recording up to 7 adjustable alarms;
- Temperature measurement;
- Power factor cos fi and tg fi.

KEY FEATURES

- 3-voltage channels with wide measurement range: 0 ... 1000 Vrms (CAT III / 1000 V);
- 4-current channels with support for automatic clamp recognition and “on instrument“ range selection;
- Automatic Smart Clamp detection and Smart Clamp range selection;
- Sampling frequency on transients recording 30 kSamples/sec;
- Compliance with power quality standard IEC 61000-4-30 Class S;
- Complete power quality analysis according to EN 50160 including signalling and interharmonics;
- Support for microSD memory card (8-GB supplied with the instrument) up to 32GB;
- Color-coded input terminals and terminal labels to suit your application region;
- Intuitive main menu and large icons that makes the equipment very easy to navigate and configure;
- Current clamp auto range selection;
- Powerful PC SW PowerView3 enables downloading, view, analysis of recorded data and professional report creation;
- Flexible clamps (without additional power supply) are included in the Euro set.

APPLICATION

- Energy consumption optimization;
- Power quality assessment and troubleshooting in low and middle voltage electrical systems;
- Checking power correction equipment performance;
- Long-term analysis;
- Predictive maintenance;
- Verification of electrical system capacity before adding loads.

STANDARDS

Safety:
- EN 61010-1

Measurements:
- IEC/EN 61000-4-30,Class S;
- IEC/EN 61557-12;
- IEC/EN 61000-4-7, Class I;
- IEC/EN 61000-4-15;
- EN 50160;
- IEEE 1459;
- IEEE 519

Electromagnetic compatibility (EMC):
- EN 61326

TECHNICAL DATA

FUNCTION		
Voltage inputs	**AC+DC**	
Number of inputs	4	
Nominal voltage range (L – N)	Phase (L-N): 50 ... 1000 VRMS Line (L-L): 50 ... 1730 VRMS	
Measuring range	10% ... 150% of nominal voltage	
Accuracy	IEC 61000-4-30 Class S, ±0.2% of nominal voltage,	
Sampling rate	7 kSamples per sec @ 50/60 Hz, sync with mains freq.	
Mains frequency range	42,5 ... 69,0 Hz ±10 mHz	
Current inputs	**AC+DC**	
Number of inputs	4	
Measuring range:		
Range 1	10.0 mVRMS ... 300.0 mVRMS ±0.5 % URMS	
Range 2	50.0 mVRMS ... 3.000 VRMS ±0.5 % URMS	
Functions	**Measuring range**	**Accuracy**
Power (P, Q, S)	Depends on voltage and selected clamps	IEC 61557-12 Class 2
Energy	Depends on voltage and selected clamps	Active: IEC 62053-21 Class 2 Reactive: IEC 62053-23 Class 3
Harmonics (DC ... 50th)	0 ... 20% of nom. voltage	IEC 61000-4-7 Class 1
Interharmonics (1 ... 50th)	0 ... 20% of nom. voltage	IEC 61000-4-7 Class 1
Flicker	0.2 ... 10	IEC 61000-4-15 Class F3
Mains signalling	0 ... 15% of nom. voltage	IEC 61000-4-30 Class S
Unbalance	Voltage: 0.5 ... 5.0% Current: 0.0 ... 20%	
Temperature	-10 ... 85 °C	±0.5 °C
Dips, Swell	10 ... 150% of nom. voltage	±0.2 % of nominal voltage ±1 cycle
Interrupts	0 ... 10% of nom. voltage	±1 cycle
Recorders		
Memory	8GB microSD, up to 32GB supported	
General recorder		
Integration period	1s ... 2h	
Recorded signals	> 1000 (voltages, currents, harmonics, power...) Minimu, maximum, average and average ON value - Voltage events - Custom alarms	
Duration	> 1 year (depends on size of SD card)	
Waveform recorder		
Duration	Up to 60 seconds of voltage and current waveform	
Trigger	Manual, Voltage Events, Custom Alarms, voltage or current level (inrush)	
Transient recorder		
Sampling rate	30ksamples/sec	
Duration	Up to 50 cycles of voltage and current waveform	
Trigger	Manual, voltage envelope or level	
General		
Display	4.3 inch color TFT (480 x 272)	
Communication	USB	
Power supply	110 ... 240 Vac or 6 x NiMh rechargable batteries, size AA	
Overvoltage category	CAT IV / 600 V or CAT III / 1000 V	
Weight	0,96 kg	
Dimensions	230 x 140 x 80 mm	

STANDARD SET

MI 2884 Standard set (ST)
- Instrument Energy Master XA
- Test probe, (brown, black, grey, blue), 4 pcs
- Crocodile clip, (brown, black, grey, blue), 4 pcs
- Voltage measurement lead, (brown, black, grey, blue), 4 pcs
- Labels for color coding
- microSD memory card 8.0GB
- microSD card reader
- PC SW PowerView3
- USB cable
- Power supply adapter
- 1.2 V NiMH rechargeable battery, 6 pcs
- Soft carrying bag
- Instruction manual
- Calibration certificate

MI 2884 Euro set (EU)
- MI 2884 ST
- With 1-phase flexible current clamps 3000 / 300 / 30 A (A 1227), 3 pcs

MI 2884 Advanced set (AD)
- MI 2884 ST
- With 1-phase flexible current clamps 3000 / 300 / 30 A (A 1502), 4 pcs

Picture of MI 2884 EU set

Power Quality Analysers
MI 2883 Energy Master

The MI 2883 Energy Master is a hand-held three phase power quality analyser, specially designed for energy logging and subsequently efficiency calculation. Reducing energy use reduces energy costs and may result in a financial cost saving. Energy Master serves as a perfect tool for long term logging and later post processing of recorded data. Large easy-to-read graphical colour display enabling the user on site analysis and data checks. The handy Quick Set buttons makes the instrument more user friendly and are allowing faster data overview. Advanced PC SW package PowerView3 enables detailed analysis of recorded data, direct reading from the microSD memory card, analysis of long term records and automatic creation of professional test report.

MEASURING FUNCTIONS

- Voltage: TRMS, peak, crest factor (3-channel);
- Current: TRMS, peak, crest factor (4-channel);
- Power (active, reactive, apparent);
- Power measurements fully compliant with IEEE 1459 (active, non active, fundamental, harmonic, load unbalance) and classic (vector or arithmetic) method;
- Unbalance, flicker measurement;
- Harmonic and interharmonic analysis up to 50th harmonics THD and TDD measurement;
- Energy (active, reactive, generated, consumed);
- Capturing and recording of power supply events (shutdowns, interruptions, swells, dips);
- Power quality analysis according to EN 50160;
- Recording up to 7 adjustable alarms;
- Temperature measurement;
- Power factor cos fi and tg fi.

KEY FEATURES

- 3-voltage channels with wide measurement range: 0 ... 1000 Vrms (CAT III / 1000 V);
- 4-current channels with support for automatic clamp recognition and “on instrument“ range selection;
- Automatic Smart Clamp detection and Smart Clamp range selection;
- Compliance with power quality standard IEC 61000-4-30 Class S;
- Complete power quality analysis according to EN 50160 including signalling and interharmonics;
- Support for microSD memory card (8-GB supplied with the instrument) up to 32GB;
- Color-coded input terminals and terminal labels to suit your application region;
- Intuitive main menu and large icons that makes the equipment very easy to navigate and configure;
- Current clamp auto range selection;
- Powerful PC SW PowerView3 enables downloading, view, analysis of recorded data and professional report creation;
- Flexible clamps (without additional power supply) are included in the Euro set.

APPLICATION

- Energy consumption optimization;
- Checking power correction equipment performance;
- Long-term analysis;
- Predictive maintenance;
- Verification of electrical system capacity before adding loads.

STANDARDS

Safety:
- EN 61010-1

Measurements:
- IEC/EN 61000-4-30,Class S;
- IEC/EN 61557-12;
- IEC/EN 61000-4-7, Class I;
- IEC/EN 61000-4-15;
- EN 50160;
- IEEE 1459;
- IEEE 519

Electromagnetic compatibility (EMC):
- EN 61326

TECHNICAL DATA

FUNCTION		
Voltage inputs	**AC+DC**	
Number of inputs	4	
Nominal voltage range (L – N)	Phase (L-N): 50 ... 1000 VRMS Line (L-L): 50 ... 1730 VRMS	
Measuring range	10% ... 150% of nominal voltage	
Accuracy	IEC 61000-4-30 Class S, ±0.2% of nominal voltage,	
Sampling rate	7 kSamples per sec @ 50/60 Hz, sync with mains freq.	
Mains frequency range	42,5 ... 69,0 Hz ±10 mHz	
Current inputs	**AC+DC**	
Number of inputs	4	
Measuring range:		
Range 1	10.0 mV_{RMS} ... 300.0 mV_{RMS} ±0.5 % U_{RMS}	
Range 2	50.0 mV_{RMS} ... 3.000 V_{RMS} ±0.5 % U_{RMS}	
Functions	**Measuring range**	**Accuracy**
Power (P, Q, S)	Depends on voltage and selected clamps	IEC 61557-12 Class 2
Energy	Depends on voltage and selected clamps	Active: IEC 62053-21 Class 2 Reactive: IEC 62053-23 Class 3
Harmonics (DC ... 50th)	0 ... 20% of nom. voltage	IEC 61000-4-7 Class 1
Interharmonics (1 ... 50th)	0 ... 20% of nom. voltage	IEC 61000-4-7 Class 1
Flicker	0.2 ... 10	IEC 61000-4-15 Class F3
Mains signalling	0 ... 15% of nom. voltage	IEC 61000-4-30 Class S
Unbalance	Voltage: 0.5 ... 5.0% Current: 0.0 ... 20%	
Temperature	-10 ... 85 °C	±0.5 °C
Dips, Swell	10 ... 150% of nom. voltage	±0.2 % of nominal voltage ±1 cycle
Interrupts	0 ... 10% of nom. voltage	±1 cycle
Recorders		
Memory	8GB microSD, up to 32GB supported	
General recorder		
Integration period	1s ... 2h	
Recorded signals	> 1000 (voltages, currents, harmonics, power...) Minimu, maximum, average and average ON value - Voltage events - Custom alarms	
Duration	> 1 year (depends on size of SD card)	
General		
Display	4.3 inch color TFT (480 x 272)	
Communication	USB	
Power supply	110 ... 240 Vac or 6 x NiMh rechargable batteries, size AA	
Overvoltage category	CAT IV / 600 V or CAT III / 1000 V	
Weight	0,96 kg	
Dimensions	230 x 140 x 80 mm	

STANDARD SET

MI 2883 Standard set (ST)
- Instrument Energy Master
- Test probe, (brown, black, grey, blue), 4 pcs
- Crocodile clip, (brown, black, grey, blue), 4 pcs
- Voltage measurement lead, (brown, black, grey, blue), 4 pcs
- Labels for color coding
- microSD memory card 8.0GB
- microSD card reader
- PC SW PowerView3
- USB cable
- Power supply adapter
- 1.2 V NiMH rechargeable battery, 6 pcs
- Soft carrying bag
- Instruction manual
- Calibration certificate

MI 2883 Euro set (EU)
- MI 2883 ST
- With 1-phase flexible current clamps 3000 / 300 / 30 A (A 1227), 3 pcs

MI 2883 Advanced set (AD)
- MI 2883 ST
- With 1-phase flexible current clamps 3000 / 300 / 30 A (A 1502), 4 pcs

Picture of MI 2883 AD set

Power Quality Analysers
A 1685 / A 1565 / A 1577 Professional protective waterproof case

Extreme atmospheric conditions can wreak havoc on even the sturdiest of instruments, especially if left unprotected for some time. Still, many testing and measuring situations take place in outdoor environments, where there could be few appropriate shelters or the measured application itself is exposed to the weather. Power quality analysis or more specifically long-term recording of power parameters is one such example as it is performed over a longer period of time and often in more demanding environments. For such situations and for our line power quality analysers, we have developed the A 1565 Waterproof case for outdoor application and recordings (pylons, switchyards).

A 1685 - PROFESSIONAL WATERPROOF TRANSPORT CASE

A 1685 Professional protective waterproof case is used for storing and suitable for easy transfer of PQA instrument and all accessories needed on the testing field, like:

- A 1479 wide range power supply
- A 1355 GPS receiver

- Optional flexible or iron current clamps
- Additional batteries, test voltage leads, crocodiles, test probes, storage devices, card reader, SD memory card
- All optional accessories including optional current clamps

A 1685 Professional protective waterproof carrying case, rated as an IP67, made from high-impact polypropylene. It has an automatic pressure equalization valve to ensure easy opening after altitude or temperature changes as well as a lock to discourage potential theft. The inside is

covered in soft, pliant foam with cut-out compartments for the PQA instrument and all necessary accessories. Tough, yet lightweight, and entirely waterproof, this hard protective carrying case offer premium protection of Power Quality instruments.

Dimensions: 464 x 366 x 176 mm
Net weight: 3.0 kg
Temp. resistant: -30 ... 90 °C

Note: by default, A 1685 case does not include any equipment. The contents of the suitcase should be agreed with the sales representative.

A 1565 - PROFESSIONAL WATERPROOF TRANSPORT CASE FOR OUTDOOR INSTALLATION

A 1565 Waterproof case for outdoor application and recordings (pylons, switchyards), enabling installation of:

- PQA instrument
- A 1479 Wide range power supply
- A 1622 3G/Wi-Fi router
- A 1355 GPS receiver
- A 1227 Flexible current clamps

The inside is covered in soft, pliant foam with cut-out compartments for the PQA instrument and with wide range power supply A 1479, 3G/WiFi-Router A 1622 and a GPS receiver A 1355. The case includes standard voltage measurement cables for all voltage connections and 4 current probe adapter current clamps.

Dimensions: 420x 325x 250 mm
Net weight: 4.0 kg

Overvoltage category:
CAT IV / 600 V or
CAT III / 1000 V

Temp. resistant: -30 ... 80 °C

A 1565 Waterproof, portable case, rated as an IP 65, made from high-impact polypropylene intended for outdoor pylon installation of PQ instruments. This portable lockable case is intended to be used in combination with PQA instruments. It has an automatic pressure equalization valve to insure easy opening after altitude or temperature changes as well as a lock to discourage potential theft.

To facilitate even greater level of protection on the A 1565 model, the connection leads, including current clamps, for the instrument are integrated into the case itself and extend to the lid mounted bag with enough additional room for current clamps and other miscellaneous accessories. For installation of pylons, the case has two suspension rings on the back, through which lanyards can be threaded.

Note: A 1565 case includes voltage test leads and requested current clamps. Other optional equipment (accessories) should be agreed with the sales representative.

A 1577 - PROFESSIONAL WATERPROOF TRANSPORT CASE WITH TELESCOPIC HANDLE AND WHEELS

A 1577 Professional protective waterproof case is designed for storing and suitable for easy transfer of PQA instrument and all accessories needed on the testing field, like:

- A 1479 wide range power supply
- A 1799 4G/Wi-Fi router
- A 1355 GPS receiver
- Optional flexible or iron current clamps

from high-impact polypropylene. It has an automatic pressure equalization valve to insure easy opening after altitude or temperature changes as well as a lock to discourage potential theft. The inside is covered in soft, pliant foam with cut-out compartments for the PQA instrument and much more available and organized space for additional accessories.

Dimensions: 610 x 430 x 265 mm
Net weight: 6.8 kg
Temp. resistant: -30 ... 80 °C

- Additional batteries, test voltage leads, crocodiles, test probes, storage devices, card reader, SD memory card
- All optional accessories including optional current clamps

A 1577 Professional protective waterproof carrying case, rated as an IP67, made

Case is equipped with a telescopic handle and smooth-running wheels for easiest transport and offers excellent mobile protection for all of your equipment. Tough, yet lightweight, and entirely waterproof, this hard protective carrying case offer premium protection of Power Quality instruments.

Note: by default, A 1577 case does not include any equipment. The contents of the suitcase should be agreed with the sales representative.

Other instruments / adapters / accessories
CS 2890 Power Calibrator / Simulator

The CS 2890 Power Calibrator/ Simulator is handheld multifunction four-phase instrument intended for calibrating and adjusting Metrel Power Quality Class A and Class S instruments as well as simulation of typical voltages and current power quality phenomena's and situations on electrical network.

GENERAL

- Simple and powerful waveform generator with various settings.
- 4 voltage channels with wide simulation range: up to 350 Vrms.
- 4 current channels with current clamps simulation up to 2000 A.
- Simultaneous voltage and current (8 channels) simulation, 16-bit Digital to Analogue conversion for accurate signal generation.
- Saving current system settings on power off.
- 4.3'' TFT colour display.
- Calibration of METREL Class A and Class S Power Quality devices.
- Adjustment of METREL Class A and Class S Power Quality devices.
- Training purposes.
- Demonstration of PQA testing equipment by sales personnel.
- Education of power quality phenomena.

POWER SIMULATOR

- Dip, swell, interrupt, signalling, transient and inrush events simulation.
- Voltage and current harmonics waveform simulation.
- Unbalanced voltage and current waveform simulation.
- Square flicker simulation.
- Various character load/character type (inductive/capacitive) combination simulation.
- Thorough signal parameters settings.
- Programming event occurrence (key, manual, periodically, random).
- Voltage, Current, Frequency;
- Harmonics, Phase angle, Phase sequence, Unbalance (U,I);

CALIBRATOR

- Calibration of METREL power quality devices Class A (MI 2893, MI 2892) and Class S (MI 2885, MI 2883) - predefined calibration points, related to the tested instruments.

ADJUSTMENT

- Adjustment of METREL power quality devices Class A (MI 2893, MI 2892) and Class S (MI 2885, MI 2883).

KEY FEATURES CALIBRATOR/ ADJUSTMENT

- Voltage/current stability in the predefined calibration/adjustment points better than ±0.06% under prescribed environmental conditions.
- Fine adjustment of calibration points with substandard volt-meter control measurements.

STANDARDS

Safety:
- EN 61010-1: 2010

Electromagnetic compatibility (EMC):
- EN 61326-2-2: 2013

TECHNICAL SPECIFICATION - CALIBRATOR

Warmup time	Minimum 30 minutes, connection to external power supply is obligatory
Settling time	Less than 10 seconds
Reference temperature	23 °C ± 2 °C
Voltage/current stability	±0.1% referred to Unom = 230 V
Calibration currents	0.05 – 0.1 – 0.2 – 1 – 2 V
Calibration voltages	5-11-14-23-50-75-110-150-165-206-230-250-345-400-500 V
Frequency	50 Hz / 60 Hz
Uncertainty / 90 days	± 0.06%
Setup resolution (under Adjustment menu)	0.0001 V

TECHNICAL SPECIFICATION - SIMULATOR

Fundamental RMS voltage output			
Output voltage AC	Resolution	Accuracy	
50 ... 350 V	10 V	± 0.1 %	
Event RMS voltage output			
Output voltage AC	Resolution	Accuracy	
0 ... 350 V	0.01 V	± 2%	
Fundamental RMS current			
Range	Output voltage	Overall current accuracy	
A 1033 (1 A ... 2000 A)	1 mV ... 1 V	±0.1 %	
Inrush RMS current output			
Inrush current	Accuracy	Crest factor	
Range 1: 2.0 mVRMS ... 200.0 mVRMS	± 0.5 % · URMS	1.5	
Range 2: 20.0 mVRMS ... 2.0000 VRMS	± 0.5 % · URMS	1.5	
Frequency			
Output range	Resolution	Accuracy	
45 Hz ... 70 Hz	1 Hz	± 10 mHz	
Flickers			
Flicker type	Measuring range	Resolution	Accuracy*
Pst	0.5 ... 5.0	0.1	± 1 %
Voltage harmonics			
Measuring range	Resolution	Accuracy	
Uhn 1 % ... 100 % of fundamental output voltage	1 %	± 5 % of Uhn	
Uhn:	generated harmonic voltage		
n:	harmonic component 2nd ... 50th		
Current harmonics and THD			
Measuring range	Resolution	Accuracy	
Ihn 1 % ... 100 % of fundamental current	1 %	± 5 % of Ihn	
Ihn:	measured harmonic current		
n:	harmonic component 2th ... 50th		
Unbalance			
Unbalance range	Resolution	Accuracy	
u-	0.5 % ... 5.0 %	0.1 %	± 0.15 %
u0			
i-	0.0 % ... 20 %	0.1 %	± 1 %
i0			
Overdeviation and Underdeviation			
Measuring range	Resolution	Accuracy	
UOver	0 ... 50 % UNom	0.001 %	± 0.15 %
UUnder	0 ... 90 % UNom	0.001 %	± 0.15 %
Event duration and recorder time-stamp and uncertainty			
Measuring Range	Resolution	Error	
Event Duration	10 ms ... 7 days	1 ms	± 1 cycle
Event Duration (Signaling)	1 s ... 100 s	100 ms	
Record and Event Time stamp	N/A	1 ms	± 1 cycle
General			
Measuring category	CAT I / 300 V		
Dimensions	230 x 140 x 80 mm		
Weight (with batteries)	1,36 kg		
Display	Colour 4.3 TFT liquid crystal display (LCD) with backlight, 480 x 272 dots.		
Batteries	6 x 1.2 V NiMH rechargeable batteries type HR 6 (AA)		
Working temperature range	0 °C ... +40 °C		

STANDARD SET

CS 2890

- Instrument Power Calibrator/Simulator
- Voltage measurement lead, (brown, black, grey, green, blue), 5 pcs
- Special power supply cable for voltage offset measurement
- Current measurement leads, 4pcs
- Labels for colour coding
- Power supply adapter
- 1.2 V NiMH rechargeable battery, 6 pcs
- Soft carrying bag
- USB cable
- Instruction manual
- Calibration certificate

Picture of CS 2890 set

Selection Guide for PQA Accessories

Photo	Part number	Description	Target application	MI 2893	MI 2892	MI 2885	MI 2883/84
	A 1501	1-phase mini flexible current clamp 3000/300/30 A / 1V	Single phase smart flexible current clamp with three selectable measuring ranges (Sensor length: 25 cm; max. conductor size: 70 mm). Does not require external power supply as it is powered by the measuring instrument.	•	•	•	•
	A 1502	1-phase mini flexible current clamp 3000/300/30 A / 1V	Single phase smart flexible current clamp with three selectable measuring ranges (Sensor length: 48 cm; max. conductor size: 140 mm). Does not require external power supply as it is powered by the measuring instrument.	•	•	•	•
	A 1609	1-phase mini flexible current clamp 3000/300/30 A / 1V	Single phase smart flexible current clamp with three selectable measuring ranges (Sensor length: 175 cm; max. conductor size: 540 mm). Does not require external power supply as it is powered by the measuring instrument.	•	•	•	•
	A 1503	1-phase mini flexible current clamp 6000/600/60 A / 1V	Single phase smart flexible current clamp with three selectable measuring ranges (Sensor length: 90 cm; max. conductor size: 270 mm). Does not require external power supply as it is powered by the measuring instrument.	•	•	•	•
	A 1227	1-phase flexible current clamp 3000/300/30 A / 1 V	Single phase smart flexible current clamp with three selectable measuring ranges Sensor length: 48 cm; max. conductor size: 140 mm. Current clamp is automatically recognized by the instrument. Clamp does not require external power supply as it is powered by the measuring instrument.	•	•	•	•
	A 1445	1-phase flexible current clamp 3000/300/30 A / 1 V	Single phase smart flexible current clamp with three selectable measuring ranges Sensor length: 61 cm; max. conductor size: 190 mm. Current clamp is automatically recognized by the instrument. Clamp does not require external power supply as it is powered by the measuring instrument.	•	•	•	•
	A 1446	1-phase flexible current clamp 6000/600/60 A / 1 V	Single phase smart flexible current clamp with three selectable measuring ranges Sensor length: 90 cm; max. conductor size: 270 mm. Current clamp is automatically recognized by the instrument. Clamp does not require external power supply as it is powered by the measuring instrument.	•	•	•	•
	A 1582	1-phase flexible current clamp 3000/300/30 A / 1 V; High temperature	Single phase, high temperature (sensor: -20 to 200 °C, module: -20 to 70 °C) smart flexible current clamp with three selectable measuring ranges. Sensor length: 61 cm; max. conductor size: 190 mm. Current clamp is automatically recognized by the instrument. Clamp does not require external power supply as it is powered by the measuring instrument.	•	•	•	•
	A 1281	Current clamp 0,5/5/100/1000 A / 1 V	Four smart ranges current clamp 0,5/5/100/1000 A/ 1 V, with jaw opening: 5.2 cm; Max. conductor size < 50 mm for measuring alternating currents in low and medium power installations. Current clamp is automatically recognized by the instrument. Clamp does not require external power supply as it is powered by the instrument.	•	•	•	•
	A 1588	Current clamp 0.5/5/50 A	High smart accuracy current clamp 0.5/5/50 A, Jaw opening: 40 mm; Max. conductor size < 50 mm for precise current and power measurements including leakage current measurement	•	•	•	•

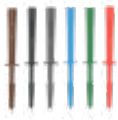
• Option

Photo	Part number	Description	Target application	MI 2893	MI 2892	MI 2885	MI 2883/84
	A 1398 PQA	Current clamp 10A / 1V	Highly accurate iron current clamp for current (including leakage current) and power measurements with smart clamp technology (automatic recognition by the analyser), powered by the connected PQA, and designed for measuring alternating currents in low-power installations (up to 20 A).	•	•	•	•
	A 1391 PQA	Current clamp AC/DC 40/300 A / 1 V	AC current clamp 40/300 A / 1 V with jaw opening: 2.5 cm cm; Max. conductor size < 50 mm for power measurements. Battery Life, 66 hours typical (Alkaline).	•	•	•	•
	A 1636	Current clamp AC/DC 1500 A	AC/DC current clamp 1500 A, with Jaw opening: 7,3 cm; Max. conductor size < 68 mm for power measurements (photo voltaic) Battery operated (9V)	•	•	•	•
	A 1717	Current clamp AC/DC 100/1000 A / 1 V	AC/DC current clamp 100/1000A / 1V with jaw opening 51mm, max. conductor size 52 mm for power measurements (photo voltaic). Battery operated 9V, battery life with 500 mAh approx. 75 hours, 1200mAh approx. 6 1/2 days. Requires A 1561 connection cable.	•	•	•	•
	A 1037	Current transformer 5 A / 1 V	3-phase transformer for power measurements on distribution panels with 5 A nominal output current.	•	•	•	•
	A 1783	Mini current clamps 20/200A	Highly accurate iron current clamp for current (including leakage current) and power measurements with two manually selected ranges and designed for measuring alternating currents in low-power installations (up to 20 A / 200 A).	•	•	•	•
	S 2141	Measuring lead with safety fuse 2 m	Measuring cable with fuse to protect voltage inputs	•	•	•	•
	A 1940	Marking rings 5 - 6 mm	Marking rings for marking current clamps with cable diameter between 5 – 6 mm	•	•	•	•
	A 1941	Marking rings 4 - 5 mm	Marking rings for marking current clamps with cable diameter between 4 – 5 mm	•	•	•	•
	S 2124	DC current clamp with cable adapter	100A / 1000A DC current clamp with adapter A 1561	•	•	•	•
	A 1561	Connection cable for current clamp	Connection cable for connecting current clamps A 1717, on Metrel power quality analysers.	•	•	•	•

• Option

Photo	Part number	Description	Target application	MI 2893	MI 2892	MI 2885	MI 2883/84
	A 1354	Temperature probe	Temperature probe can be used for monitoring and recording of temperature trend at measuring objects, such as capacitors, motors, transformers, etc.	•	•	•	•
	A 1648	Current clamp extension cable, 5 m	Extension cable for current clamps	•	•	•	•
	A 1479	Wide range power supply	Wide range power supply (Unom: 85V ÷ 650 Vac / 920 Vdc) provide power supply for PQ device and modem directly from voltage measuring terminals. Applicable when standard electrical sockets are not available on measurement site.	•	•	•	•
	A 1778	Magnetic contact probe	The A 1778 magnetic probe (with a Ø6.6 mm right-angle magnetic adapter and a Ø4 mm socket) is designed for semi-temporary measurement of voltage on steel screw terminal blocks.	•	•	•	•
	A 1355	GPS receiver	GPS Synchronization unit for ensuring exact date & time, which guaranties that the time clock uncertainty of the Metrel power quality analyzers does not exceed ±10 ms for 50 Hz signals, according to IEC 61000-4-30.	•	•	•	
	A 1750	GPS Cable extension	Cable extension for A 1355 GPS receiver, 10 m.	•	•	•	
	A 1799	4G modem	4G modem for remote instrument access.	•	•	•	
	A 1756	Photo-scanning head	Optically sensitive device, which reads the blinking of a LED on electronic electricity meters as well as color marks on the disc of induction electricity meters. It is intended for accuracy measurement (active/reactive energy) of electronic and mechanical electricity meters.		•	•	
	A 1631	EV monitoring cable	A special accessory designed for current, voltage and CP signal, monitoring during Electric Vehicle (EV) charging process.	•	•	•	•

• Option

Photo	Part number	Description	Target application	MI 2893	MI 2892	MI 2885	MI 2883/84
	A 1298	Test probe, brown	Test probe with fi 4 mm connection is suitable for performing measurements both in mains outlets and in situations when no schuko outlet is not present.	•	•	•	•
	A 1014	Test probe, black		•	•	•	•
	A 1453	Test probe, grey		•	•	•	•
	A 1015	Test probe, blue		•	•	•	•
	A 1062	Test probe, green		•	•	•	•
	A 1016	Test probe, red		•	•	•	•
	A 1297	Crocodile clip, brown	Crocodile clip assures secure and permanent contact during the measurement on bus bars, fixing screws, etc.	•	•	•	•
	A 1013	Crocodile clip, black		•	•	•	•
	A 1547	Crocodile clip, grey		•	•	•	•
	A 1310	Crocodile clip, blue		•	•	•	•
	A 1309	Crocodile clip, green		•	•	•	•
	A 1064	Crocodile clip, red		•	•	•	•
	S 2015	Safety flat clamp, 4 pcs	Safety flat clamps assure good contact when connecting the test leads on busbars and other larger flat surfaces.	•	•	•	•
	A 1458	microSD card reader	Move data between your computer and memory card with memory card reader.	•	•	•	•
	A 1673	Micro SD card 32GB	32GB memory card to store large amount of data	•	•	•	•
	S 2072	USB storage device (for backup of data)	USB stick enables you to backup your data to a USB drive. This is a practical backup solution as it allows you to store recorded data files to external device, offering increased portability.	•	•	•	•
	A 1459	Set of measuring leads, 5 x 2m	High quality measuring leads for use up to CAT III / 1000 V.	•	•	•	
	A 1459 5M	Set of measuring leads, 5 x 5m		•	•	•	
	A 1512	Set of measuring leads, 4 x 2m	High quality measuring leads for use up to CAT III / 1000 V.				•
	A 1577	Professional protective waterproof case with a telescopic handle and smooth-running wheels	Professional protective waterproof carrying case with telescopic handle and smooth-running wheels, made from high-impact plastic intended for easiest transportation to testing place. Huge volume enables storage of all needed accessories. It also has an automatic pressure equalization valve to insure easy opening after altitude or temperature changes.	•	•	•	•

• Option

Photo	Part number	Description	Target application	MI 2893	MI 2892	MI 2885	MI 2883/84
	A 1685	Professional protective waterproof case	Professional protective waterproof carrying case, made from high-impact plastic. It also has an automatic pressure equalization valve to insure easy opening after altitude or temperature changes. Tough, yet lightweight, and entirely waterproof, this hard protective carrying case offer premium protection of Power Quality instruments.	•	•	•	•
	A 1565	Waterproof case for outdoor application and recordings (pylons, switchyards)	Waterproof, portable case, rated as an IP 65, for outdoor application of PQ instruments. This portable lockable case is intended to be used in combination with PQA instruments. It is designed to be used with wide range power supply A 1479, 3G/WiFi-Router A 1622 and a GPS receiver A 1355. The case includes standard voltage measurement cables for all voltage connections and 4 current clamps, A 1227.	•	•	•	•
	A 1006	Soft carrying bag	Large soft carrying bag for transport and storage of test instrument and belonging accessories.	•	•	•	•
	A 1020	Small soft carrying bag	Small soft carrying bag for transport and storage of test instrument or accessories.	•	•	•	•
	S 2125	1,2 V, 2400 mAh AA rechargeable NiMH batteries type AA, 6 pcs	A set of 6 pieces of rechargeable batteries type AA.	•	•	•	•
	A 1160	Fast charger for 8 AA batteries with a set of 6 NiMH bat., type AA	Fast battery charger for up to 8 pieces of AA rechargeable batteries, and a set of 6 pcs NiMH rechargeable batteries, type AA.	•	•	•	•

• Option