

# Multifunctional Power Quality Analysers

From Simple One Phase to Ultimate Three Phase Portable Instruments

**Power Quality Analyser-Plus**  
**Power Quality Analyser**  
**Power Harmonics Analyser**  
**VoltScanner**



*Measuring  
Recording  
Analysing*

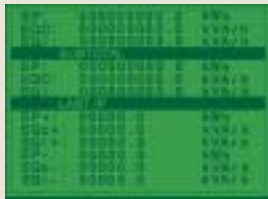
Testing according to:  
EN 61000-4  
EN 61000-7  
EN 61000-11  
EN 50160

Instrument designed  
according to:  
EN 61010-1  
(Safety)

EN 50081-1  
EN 61000-6-1  
(Electromagnetic  
compatibility)



# Main Features



## Accurate Energy Measurement

Active & Reactive  
Import & Export  
Inductive & Capacitive  
Separate registers for Total,  
Sub-total & Last Integration  
Period



## Voltage and Current Harmonic Analysis

up to 63<sup>th</sup> component



**True real-time operation** for capturing anomalies, voltage interruptions and power breaks.

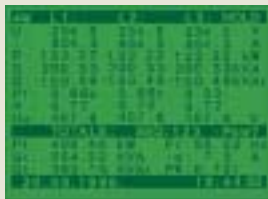
**2 Mb of memory** allows data logging up to several months.



**AC powered and Battery Powered**  
Battery Pack provides full operation for up to 5 hours.



**Modem Remote Control** by using GSM or standard type of communication.  
- Remote programming of instrument via PC.  
- Downloading recorded data via PC from a remote location.  
- Receiving SMS alarms (task completed full memory etc.)



**Meter Menu** for display of all measured parameters



**Scope function** allows viewing of current and voltage waveforms.



**Configuration menu** for setting measuring method, integration period, current scaling factor, and selection of signals.

## TECHNICAL SPECIFICATION

### AC VOLTAGES

#### Three-phase AC voltage input (3 differential inputs, L<sub>1</sub> - N<sub>1</sub>, L<sub>2</sub> - N<sub>2</sub>, L<sub>3</sub> - N<sub>3</sub>)

Input voltage range: 10–550 V<sub>rms</sub> L-N, 900 V<sub>rms</sub> L-L  
600 V<sub>rms</sub> L-N (over load 10 s)  
Optional on request: 10–750 V<sub>rms</sub> L-N, 1000 V<sub>rms</sub> L-L  
800 V<sub>rms</sub> L-N (overload 10 s)

Resolution: 0.1 V  
Accuracy: ± 0.5 % of reading ± 2 digits  
Crest factor max. 1.4  
Frequency range: 43–68 Hz fundamental

### AC CURRENTS

#### Three-phase AC input for connection to current transducers with voltage output

Input current (voltage range): 0.02–1 V<sub>rms</sub> (from 0.02 x I<sub>n</sub> to I<sub>n</sub>) input  
Resolution: 0.3 mV (0.3 A with 1000 A / 1 V)  
Accuracy: ± 0.5 % of reading ± 6 digits plus current transformer accuracy  
Crest factor: 2.5  
Maximum permissible overload: 150 % I<sub>n</sub> (sinusoidal current)  
Maximum input voltage: 1 V<sub>rms</sub>

### PHASE ANGLE

Consider phase angle data of used current transformer.

### SCOPE

Display options: Waveform of pairs (L<sub>1</sub>: U<sub>1</sub> and I<sub>1</sub>, L<sub>2</sub>: U<sub>2</sub> and I<sub>2</sub>,  
L<sub>3</sub>: U<sub>3</sub> and I<sub>3</sub>), U<sub>1,2,3</sub>, and I<sub>1,2,3</sub>  
Ranging: Auto / manual

### METER – Power measurement

#### Quantities related to selected measuring connections per phase, i.e.:

Measured: voltage (U), current (I), cosφ between U and I  
Calculated: active power (P), apparent power (S), reactive power (Q),  
power factor (P<sub>f</sub>) with its characteristic (c, I, none)  
Line – Line voltage;

#### Quantities for complete three-phase system, i.e.:

Calculated: active power (P<sub>t</sub>), apparent power (S<sub>t</sub>), reactive power (Q<sub>t</sub>), power factor (P<sub>f</sub>), neutral current (I<sub>n</sub>);

Basic accuracy for P, Q, S,: ± 1 % of reading  
Resolution for P, Q, S,: 0.01 of displayed value

### SPECTRUM – Harmonics measurement

The instrument computes harmonics on signals sampled with an A/D converter.

Recording interval: 160 ms (8 cycles)  
Spectrum calculation range: DC – 63<sup>rd</sup>  
Spectrum display range: DC – 25<sup>th</sup>

Displayed items for selected harmonic: Order, relative and absolute value

Range	Limits of error		Resolution
I <sub>range</sub> U <sub>range</sub>	THD Total Harmonic	HD Harmonic	on LCD and PC
	Distortion	Distortion	
2 ... 100 %	0.2 % x U <sub>r</sub> /U (I <sub>r</sub> /I)	0.2 % x U <sub>r</sub> /U (I <sub>r</sub> /I)	0.1 %

### ENERGY

**Displayed quantities** from integration of calculated power as:

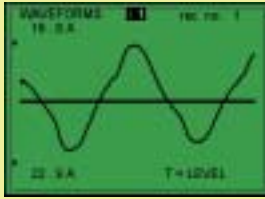
- cumulative values (TOTAL);
- partly cumulative (resettable by user request) (SUBTOTAL);
- values related to last integration period (LAST IP).

**Quantities.** Active energy (EP), capacitive energy (EQC), inductive energy (EQI)

Basic accuracy: ± 1 % of reading  
Resolution: 0.1 of displayed value

## Special SW Tools

Special tools enable a detailed, time domain based signal analysis. They represent a powerful, modern troubleshooting tool for solving of all kinds of problems which are appearing in power distribution systems. The user can choose between three modes, differing in terms of sampling speed, trigger possibilities and recording time:



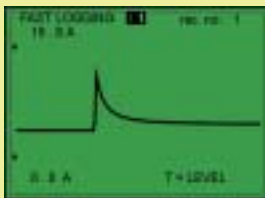
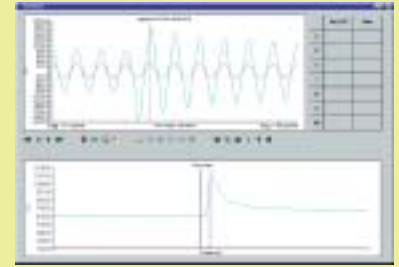
### ● WAVEFORMS

Recording of voltages and currents with 128 samples/period. Half period RMS values of recorded quantities are also calculated and shown in this mode. Best suited for:

- monitoring of switching phenomena,
- locating of noise and disturbance sources,
- defining disturbance type,
- locating excessive harmonics sources.

Typical problems that can be solved by WAVEFORM analysis:

- capacitor banks switch over,
- transformer overheating,
- UPS problems,
- SMPS failures etc.



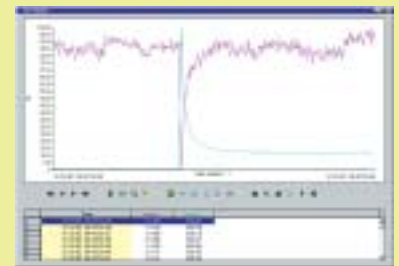
### ● FAST LOGGING OF SIGNALS

Recording of half period RMS voltage and currents values. Recommended when record length is critical and signal's details are not of importance. Best suited for:

- observing start up and inrush events,
- locating impedance problems,
- long term analysing of unstable mains.

Typical problems that can be solved with FAST LOGGING analysis:

- too high inrush currents of large motors,
- undersized fuses and installation wiring,
- too weak voltage source etc.



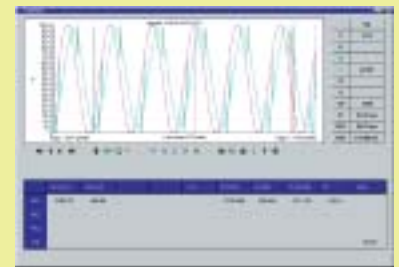
### ● TRANSIENTS

The recording mode with fastest sampling rate that the instrument can provide. Up to 50 kHz transient detect ability in this mode. Best suited for:

- monitoring atmospheric discharging,
- analysing switching problems,
- detailed analysis of high frequency noise and notching.

Typical problems that can be solved with TRANSIENT analysis:

- frequency noise,
- voltage spikes caused by switching of capacitor banks etc.



### RECORDER

Periodics integration period: 1 s – 900 s  
 Selected signals: max. 64  
 Statistics values: each period divided in 200 parts (0.1 ms)  
 Voltage anomalies: based on half period, start, duration and extrens of voltage

### EN 50160 ANALYSIS MODE

Voltage dips, swells, sags and breaks, resolution 10 ms, no gaps  
 Voltage unsimetry, Voltage RMS values, Frequency  
 Hamonics: up to 43<sup>th</sup> component  
 Flickers Plt Pst: no gap

### FLICKER MEASUREMENT

The instrument computes flickers according to IEC 61000-4-15

### WAVEFORMS

Sampling rate: 128 scans / period  
 Trigger: level, manual, timer  
 Buffer: min. 10 periods of pre / post size, up to 7812 periods can be recorded  
 Channels: 3 x U, 3 X I, U lines, Min / Max rms values: Avg  
 Pf, cosp, Crest factor, THD U, I Frequency  
 Hamonics / direction: magnitudes / positive / negative

### FAST LOGGING

Sampling rate: 128 scans / period, min, max, Avg recorded each halfperiod  
 Trigger: level, manual, timer  
 Buffer: pre / post size, up to 166 minutes of recording  
 Channels: 3 x U, 3 X I, Single or multichannel mode

### TRANSIENTS

Capturing: >20 µs transient detect ability  
 Trigger: Level, slope, manual  
 Buffer: min. 10 periods of pre / post size, up to 1000 periods can be recorded  
 Channels: 3 x U, 3 X I, Single or multichannel mode

## GENERAL SPECIFICATION

**Display:** Graphic Liquid Crystal Display with LED backlight, 160 x 116 dots resolution

### NON - VOLATILE MEMORY

2048 Kbytes SRAM, battery backed.

### DIGITAL HARDWARE SPECIFICATION

A/D conversion, 14 bit with 128 samples per channel per period (43–68 Hz).

### OUTPUTS

Communication type: RS 232 serial interface, fully opto isolated  
 Baud rate: 2400–57600 baud.  
 Connector: 9 pin D-type.  
 Communication cable: Standard type

### POWER SUPPLY

Operating range: 230 V A.C. + 10% – 20%, 45–65 Hz, 8 VA  
 Optional: 115 V A.C. + 10% – 20%, 45–65 Hz, 8 VA  
 DC power supply: Internal 4 x 1.2 V NiCd or NiMh rechargeable IEC LR14 batteries provide full operation for up to 5 hours.  
 Charger: Internal built-in battery charger, charging time approx. 10 hours.

### GENERAL

Working temperature range: – 20 °C ... + 60 °C  
 Max. humidity: 85 % RH (0 + 40 °C)  
 Pollution degree: 2  
 Protection classification: II - double insulation  
 Overvoltage category: Voltage inputs: CAT III 600 V; optional CAT IV 600 V  
 AC power supply CAT III 300 V  
 Protection degree: IP 44 (IP 54 on request)  
 Dimensions: 265 x 110 x 185 mm  
 Weight (without accessories): 2 kg

## Recorder mode

### Simple set-up

- Selection of signals and type of analysis (periodics, anomalies, statistics, EN 50160).
  - Selection of recording time and averaging cycles integration period.
- Recording can be set also from instrument directly.



## Analysis

### PERIODICS AND STATISTICS ANALYSIS

Over 300 quantities (64 at the same time) can be recorded and stored in this mode. All important quantities and events can be selected:

- average, minimum and maximum voltage and current RMS values,
- harmonics and THD of voltage and current
- particular and total power (classified sign and character)
- voltage events and anomalies (interruptions, dips, sags), type and duration
- flicker Pst and Plt values
- other EN50160 parameters: signaling, interharmonics, unbalances.



## Direct mode

On-line monitoring of three-phase currents and voltages

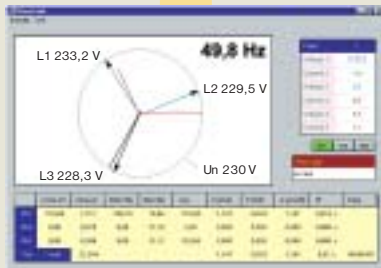
### 6-CHANNEL OSCILLOSCOPE



### HARMONICS UP TO 63th



### PHASE DIAGRAM



### ENERGY counter, P, S, Q, PF and other calculations



## EN 50160 AUTO-MODE with statistics and results based on the standard

### HARMONICS REPORT



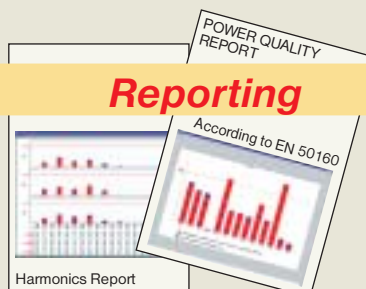
### STATISTICS REPORT in EN 50160 graphic and tabelaric form



### FLICKER DIAGRAMS



## Reporting



### Test Reports

- Saving of results, graphs and reports for further analysis
- Exporting of data and graphs in xls files for making custom reports.
- Print-out of results and graphs.

## VoltScanner

### Easy and smart solution to measuring the quality of the line voltage in accordance with EN 50160 – event or periodics mode

Maintaining a high-quality electric power supply is essential for your daily work and life. For a proper operation of computers and other electrical and electronic equipment you want to know whether the contracted level is being met and when and how often the limit values are exceeded.

LED and BUZZER indicate a wrong polarity connection on the outlet.

A flashing LED indicate that events have been captured

LED lamp indicate when the memory capacity is over.

Low-battery indication LED



RS 232 communication port

- A flashing LED indicate that events have been captured
- Memory capacity of up to 3500 events

### OPERATING PROCEDURE

- **Set-up limit values**
  - Custom or
  - EN 50160 auto-mode
- **Plug-in**
- **Measuring & Recording**
  - **Events mode**
    - Dips/Sags, Swells
    - Voltage interruptions
    - Frequency fluctuations
    - Transients overvoltage
  - **Periodics mode**
    - Power frequency
    - Supply voltage
    - EN 50160 auto-mode
- **Downloading**
- **Analysis**

- Periodics (max., min., or average values) – table or graph
- Statistics of
  - All the events by character, apparent and duration time,
  - Events selected by period of time (divided in day by day periods or divided period within a day).

### TECHNICAL SPECIFICATION

#### Measurement

##### Phase to Neutral

Range	Accuracy	Resolution
90 to 265 V	± 2 V of reading + 2 %	1 V

##### Neutral to Ground

Range	Accuracy	Resolution
0 to 155 V	± 2 V of reading + 2 %	1 V

##### Frequency

Range	Accuracy	Resolution
47-52 Hz,	± 0.1 Hz	0.1 Hz
57-62 Hz	± 0.1 Hz	0.1 Hz

##### Transients

Range	Accuracy	Resolution
50 to 2600 V	± 10 %	5 V

Minimum width: 1 µs

#### General

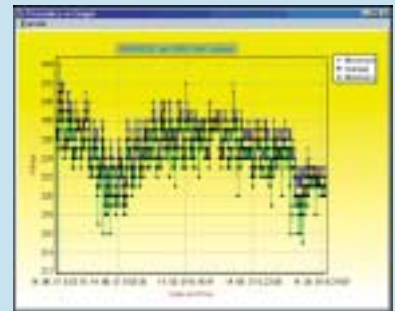
- Nominal Supply Voltage: 230 V or 120 V
- Nominal Frequency: 50/60 Hz
- Communication: RS 232 serial interface, fully opto isolated, 9 pin D-type connector
- Memory: 32 kB, 3500 events
- Battery: 6 V DC (4 x 1.5 V AA) Rechargeable
- Overvoltage category: CAT III 300 V



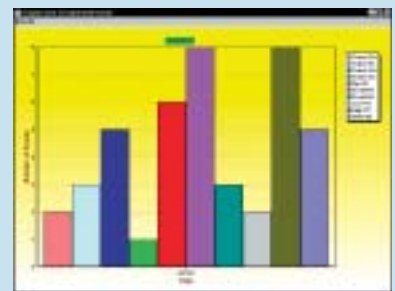
Set-up of event recording or periodics recording mode



Simple plug-in and automatic start of monitoring







Periodics analysis of voltage variation for the past 3 weeks



Statistics of the captured events

**ScanLink** Windows 95/98/2000/NT software for analysing and print-outs with a complete history of captured events in a table or graphic form (statistics). By analysing periodics it enables review of voltage quality against the set limits (Custom or EN 50160 auto-mode).

	<b>Power Quality Analyser-Plus</b> 	<b>Power Quality Analyser</b> 	<b>Power Harmonics Analyser</b> 	<b>VoltScanner</b> 
<b>Main features:</b>	Order No.: MI 2292	MI 2192	MI 2092	MI 2130
<b>Power Quality Testing</b>				
RMS Voltages, Currents (average, min., max.)	✓	✓	✓	
THD & Harmonics Analysis	✓	✓	✓	
Power – Active, Reactive, Apparent Cos Φ, Character, sign	✓	✓	✓	
Voltage Events (dips, sags, interruptions)	✓	✓	✓	✓
Periodics & Statistics Analysis	✓	✓	✓	✓
Anomalies (Events) Analysis	✓	✓	✓	✓
Neutral current (calculated)	✓	✓	✓	✓
<b>On Line monitoring</b>				
Meter mode – tabelaric results	✓	✓	✓	
Scope mode – oscilloscope	✓	✓	✓	
Spectrum Analysis mode	✓	✓	✓	
<b>EN 50160 compliant testing</b>				
Fast Set Up – Auto mode	✓	✓		✓
Voltage	✓	✓	✓	✓
THD & Harmonics	✓	✓	✓	
Dips, Sags, Interruptions	✓	✓	✓	✓
Flicker	✓			
Frequency	✓	✓	✓	✓
Interharmonics / Signalling	✓			
Unbalance	✓	✓		
EN 50160 Test Report	✓	✓		
<b>Special tools</b>				
FAST LOGGING mode	✓ (166 minutes)	✓ (8.4 minutes)		
WAVEFORM mode	✓ (7812 periods)	✓ (390 periods)		
TRANSIENT mode	✓ (1000 periods)	✓ (50 periods)		✓
<b>Energy</b>				
Total & Subtotal counters	✓	✓	✓	
PC SW	✓	✓	✓	✓
Modem entrance key	✓	optional	optional	


#### Optional accessories for


MI 2092, MI 2192 and MI 2292


Order No.:


 **3-Phase Flex Kit** **A 1120**  
30 A / 300 A / 3000 A / 1 V  
Selectable ranges and length of 45 cm will accommodate conductors of various shapes and dimensions.

 **1-Phase Flex Kit** **A 1099**  
30 A / 300 A / 3000 A / 1 V  
Selectable ranges and length of 45 cm will accommodate conductors of various shapes and dimensions.

 **Mini clamp 5 A / 1 V** **A 1122**  
**Mini clamp 100 A / 1 V** **A 1069**  
Jaw dimensions make them suitable for measurements on round conductors with a diameter up to 15 mm.


 **Clamp Adapter** **A 1039**  
Clamp Adapter has to be purchased for connecting different type of clamps to the instrument's input (for A1122, A1069)

 **3-Phase Current Transformer** **A 1037**  
**5 A / 1 V**  
For standard 5 A AC current output in power substations.

 **Flat Contact Clamps** **S 2015**  
Particularly useful for making connections on bus bars and other large sized conductors.

 **Fuse Adapters** **S 2014**  
For additional protection measure in high energy LV systems.

 **Modem ST** (standard telephone lines) **A 1100**  
**Modem GSM** (gsm) **A 1101**  
- Remote programming of the instrument via PC  
- Downloading recorded data via PC from a remote location  
- Receiving SMS alarms (task completed, full memory...).

 **Modem Entrance Key** **A 1124**  
A 1124 is supplied in the standard set for MI 2292, or optionally for MI 2192 and MI 2092.

#### Standard set

Order No. MI 2092, MI 2192, MI 2292



- Instrument
- Current clamp 1000 A/1 V, 3 pcs
- Small soft carrying bag
- Test tips, 3 pcs
- Alligator clips, 4 pcs
- Voltage measurements cables, 6 pcs
- Mains cable
- RS 232 cable
- 4 x 1.2 V NiCd batteries
- Soft carrying bag
- Instruction manual
- Declaration of conformity
- Product verification data
- Declaration of warranty
- Power Link PC analysis and control software package (for Windows 95/98 and 2000)

\* Safety flat clamps, 4 pcs (at MI 2292 only)

#### Standard set

Order No. MI 2130



- Instrument
- Mains measuring cable
- Battery-rechargeable 4 x 1.2 V
- Windows Software "ScanLink" with RS 232 interface cable
- Instruction Manual
- Declaration of conformity
- Product verification data
- Declaration of warranty

#### Optional accessories



- Small soft carrying bag **A 1020**
- Universal test cable, 3 x 1.5 m with test tips **S 1112**
- Alligator clip (black), 3 pcs **S 2010**

 **METREL**® Measurement and Regulation Equipment Manufacturers

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Subject to technical change without notice!

Distributor: