Multi-function meter of electrical system parameters

MPI-540 / 540-PV

index: WMGBMPI540 / WMGBMPI540PV
WMGBMPI540NC (MPI-540 without 3xF-3A clamps)

CAT IV 300 V

CAT III 500 V

CAT II 1000 V DC

MPI-540-PV

Li-Ion BATTERY

WORK IN IT MAINS

IP51

BLUETOOTH

WiFi

7”
touch screen

MPI-540-PV

measurement of PV installations

3-phase power quality recorder

ρ R_E Z_S R_{ISO} E R_{CONT}
complex measurements of installations

Much more than a multifunctional meter

- **The largest touch screen on the market (7”) – remarkable ergonomics and ease of use**
- Removable microSD memory card – easy increase of memory capacity
- Li-Ion battery – longer operation of the meter

- **MPI-540-PV: measurement of photovoltaic installations according to EN 62446 standard**
- MPI-540-PV: photovoltaic installation test report with **Sonel Reports PLUS** software

- **Three-phase power recorder – advanced power quality diagnostics**
- Real time display of network parameters – immediate evaluation of the test site conditions
- Parameters measured in accordance to class S of EN 61000-4-30 standard – high accuracy of measurements
- Energy cost calculator – quick evaluation of potential savings

- **Measurement of all parameters related to earthing and protection against electric shock – one device instead of several**
- Quick measurement of the fault loop impedance in networks secured with RCD without triggering (up to several seconds) – time saver
- Auto measurements – the ability to perform automatic measurements in sequence – simplified measurements
- Fast path from measurements to report – time saver

Features

The meter has **above-average functionality**. It combines the measuring capabilities of several devices, while ensuring equally good accuracy.

- The **MPI-540-PV** instrument can measure photovoltaic installations in accordance with the EN 62446 standard:
  - » continuity of protective and equipotential bondings,
  - » earth resistance,
  - » insulation resistance on the DC side,
  - » open circuit voltage U_{OC},
  - » short circuit current I_{SC},
  - » work currents and powers on both DC and AC side,
  - » inverter efficiency.
- **MPI-540 / MPI-540-PV** can record 50/60 Hz power quality parameters in accordance to S class of EN 61000-4-30:
  - » voltage L1, L2, L3, – average values in the range up to 500 V,
  - » L1, L2, L3 currents, – average values, current measurement in the range up to 3 kA (depending on the current probes used),
  - » frequency in the range of 40 Hz – 70 Hz,
  - » active (P), reactive (Q) and apparent (S) power,
  - » power factor (PF), cosφ,
  - » harmonics (up to 40th for voltage and current),
  - » total harmonic distortion (THD) for current and voltage.
- **MPI-540 / MPI-540-PV** can be used for all measurements for commissioning of electrical installations in accordance with applicable regulations:
  - » short circuit loop impedance (also in circuits secured with RCDs),
  - » RCD parameters,
  - » insulation resistance,
  - » earth resistance (4 measurement methods + soil resistivity measurement),
  - » continuity of protective and equipotential bondings,
  - » light intensity measurement,
  - » phase sequence test,
  - » motor rotation direction test.

Automatic installation safety test

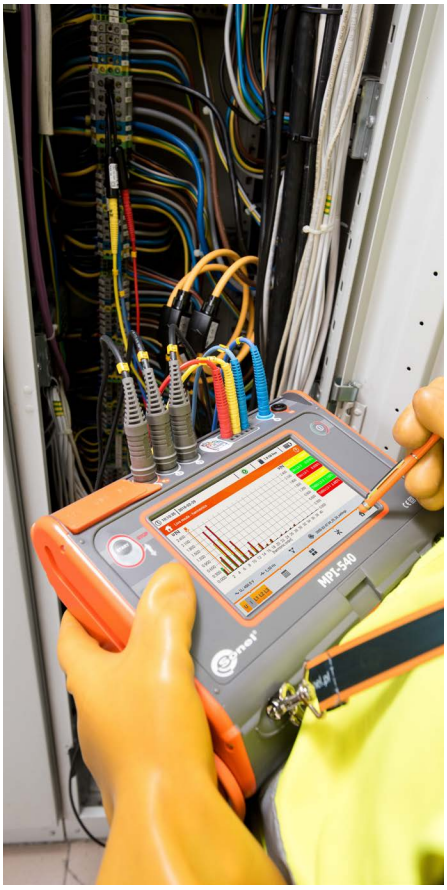
MPI-540 / MPI-540-PV allow safety control of **residential, commercial and industrial electrical installations**. Measurements can be easily automated with:

- auto mode of residual current devices (RCD) tests,
- auto measurements – freely configurable measuring sequences,
- AutoISO-1000C adapter for automatic insulation resistance test of 3-, 4- and 5-conductor cables, without switching.

Photovoltaics under supervision

MPI-540-PV is an extremely universal meter, designed in particular for testing photovoltaic installations. The device allows a complete set of tests on the DC and AC side – in accordance with the guidelines of EN 62446 standard.

Measuring parameters related to the photovoltaic installation, the instrument will automatically convert them to the STC (Standard Test Conditions) reference conditions. Measurements of voltage, current and power on the AC and DC side of the inverter allow to verify its efficiency. **Sonel Reports PLUS** software enables creating PV installation test report with measurement results saved meter's in memory.



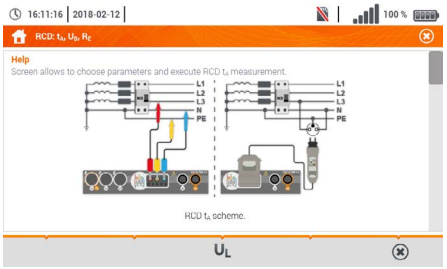
Three-phase power quality recorder

The device has a three-phase power quality recorder with the LIVE mode view and the possibility to register electrical network parameters such as voltage, current, power, harmonics and THD. The meter enables reading of selected parameters and their graphic presentation on the screen in real time. These parameters are measured and displayed concurrently with the recording on the memory card. In the LIVE mode, the user can see:

- voltage and current waveforms (oscilloscope),
- voltage and current timeplots,
- a phasor graph,
- display of multiple parameters in tabular form,
- spectrum graph of current and voltage harmonics.

Ease of reading

The device is equipped with a color TFT LCD touch screen with a resolution of 800x480 pixels and a diagonal of 7”, which allows for convenient operation and easy reading of parameters and plotted waveforms. This screen size enables displaying more information, available at any time of use. The interface is visible in all conditions – also thanks to the appropriate size of displayed symbols. **Included stylus allows to work also with dielectric gloves.**



Built-in help system

The device has built-in help screens with measurement diagrams. Thanks to this you can easily and quickly check and make sure how to connect to a given system depending on the type of performed measurement.

Increased resistance to environmental conditions

The MPI-540 / MPI-540-PV meter will cope well in difficult environmental conditions. Protection against penetration of dust and water is ensured by a unique housing with a level of protection IP51. It is resistant to mechanical damage, and a special design allows you to easily protect the touch screen by shielding using the cover of the meter. In addition to the fact that it protects against damage, it also allows you to conveniently carry and use the device in different positions.

Communication and software

A very strong feature of the device is the multitude of communication interfaces and cooperation with external software. You can easily transfer measurement data to your computer via USB port, removable SD memory card, or wireless communication (Bluetooth*, Wi-Fi).

In order to generate a report on measurements for electric shock protection, use **Sonel Reports PLUS** software. Saving the downloaded data to the simplest formats and printing is provided by free **Sonel Reader** software. The specialized, free **Sonel Analysis** software is used to read and analyze data from the power quality recorder.

* The function will be available after the software update (no additional fees).

MPI-540 • MPI-540-PV | Specifications – electrical installation parameters

Measurement functions	Measurement range	Display range	Resolution	Accuracy ±(% m.v. + digits)
Fault loop impedance				
Fault loop Z_{L-PE}, Z_{L-N}, Z_{L-L}	0.13 Ω…1999.9 Ω acc. to IEC 61557	0.000 Ω…1999.9 Ω	from 0.001 Ω	±(5% m.v. + 30 digits)
Fault loop Z_{L-PE} in RCD mode	from 0.50 Ω…1999 Ω acc. to IEC 61557	0.00 Ω…1999 Ω	from 0.01 Ω	from ±(6% m.v. + 5 digits)
Measurements of RCD parameters				
RCD tripping test and measurement of tripping time t_A measuring current 0.5 $I_{\Delta n}$, 1 $I_{\Delta n}$, 2 $I_{\Delta n}$, 5 $I_{\Delta n}$				
general and short-time delay RCD	0 ms…300 ms	0 ms…300 ms	1 ms	from ±(2% m.v. + 2 digits)
selective RCD	0 ms…500 ms	0 ms…500 ms	1 ms	from ±(2% m.v. + 2 digits)
Measurement of RCD tripping current I_A measuring current 0.2 $I_{\Delta n}$…2.0 $I_{\Delta n}$				
for sinusoidal residual current (AC type)	3.3 mA…1000 mA	3.3 mA…1000 mA	from 0.1 mA	±5% $I_{\Delta n}$
for unidirectional residual current and unidirectional with the 6 mA DC bias (type A)	3.5 mA…700 mA	3.5 mA…700 mA	from 0.1 mA	±10% $I_{\Delta n}$
for direct residual current (type B)	2.0 mA…1000 mA	2.0 mA…1000 mA	from 0.1 mA	±10% $I_{\Delta n}$
Earth resistance				
3- and 4-pole method	from 0.50 Ω…1.99 kΩ acc. to IEC 61557-5	0.00 Ω…1.99 kΩ	from 0.01 Ω	from ±(2% m.v. + 3 digits)
3-pole + clamp method	0.00 Ω…1.99 kΩ	0.00 Ω…1.99 kΩ	from 0.01 Ω	from ±(2% m.v. + 4 digits)
2-clamp method	0.00 Ω…99.9 kΩ	0.00 Ω…99.9 kΩ	from 0.01 Ω	from ±(10% m.v. + 4 digits)
Resistance-to-earth	0.0 Ωm…99.9 kΩm	0.0 Ωm…99.9 kΩm	from 0.1 Ωm	Depending on accuracy of R_E measurement
Insulation resistance				
Measuring voltage 50 V	50 kΩ…250 MΩ acc. to IEC 61557-2	0 kΩ…250 MΩ	from 1 kΩ	from ±(3% m.v. + 8 digits)
Measuring voltage 100 V	100 kΩ…500 MΩ acc. to IEC 61557-2	0 kΩ…500 MΩ	from 1 kΩ	from ±(3% m.v. + 8 digits)
Measuring voltage 250 V	250 kΩ…999 MΩ acc. to IEC 61557-2	0 kΩ…999 MΩ	from 1 kΩ	from ±(3% m.v. + 8 digits)
Measuring voltage 500 V	500 kΩ…2.00 GΩ acc. to IEC 61557-2	0 kΩ…2.00 GΩ	from 1 kΩ	from ±(3% m.v. + 8 digits)
Measuring voltage 1000 V	1000 kΩ…9.99 GΩ acc. to IEC 61557-2	0 kΩ…9.99 GΩ	from 1 kΩ	from ±(3% m.v. + 8 digits)
Resistance of protective conductors and equipotential bondings				
Measurement of resistance of protective conductors and equipotential bondings with ±200 mA current	0.12 Ω…400 Ω acc. to IEC 61557-4	0.00 Ω…400 Ω	from 0.01 Ω	±(2% m.v. + 3 digits)
Measurement of resistance with low current	0.0 Ω…1999 Ω	0.0 Ω…1999 Ω	from 0.1 Ω	±(3% m.v. + 3 digits)
Light intensity				
Measurement in luxes (lx)	0 lx…399.9 klx	0 lx…399.9 klx	from 0.01 lx	from ±(2% m.v. + 5 digits)
Measurement in feet-candles (fc)	0 fc…39.99 kfc	0 fc…39.99 kfc	from 0.01 fc	from ±(2% m.v. + 5 digits)
Phase sequence indication	in the same direction (correct), opposite direction (incorrect), U_{L-L} voltage: 95 V…500 V (45 Hz…65 Hz)			

MPI-540 • MPI-540-PV | Specifications – 3-phase power quality recorder

The device is designed to work with mains:

- » with nominal frequency 50/60 Hz
- » with nominal voltage: 64/110 V, 110/190 V, 115/200 V, 127/220 V, 220/380 V, 230/400 V, 240/415 V, 254/440 V, 290/500 V
- » DC networks

Supported systems:

- » single-phase
- » split-phase with common N
- » three-phase – WYE with and without N conductor
- » three-phase – Delta

Parameter	Measuring range	Max. resolution	Accuracy
Alternating voltage (TRMS)	0.0…500 V	0.01% U_{nom}	±0.5% U_{nom}
Alternating current (TRMS)	depending on clamp*	0.01% I_{nom}	±2% m.v. if m.v. ≥ 10% I_{nom} ±2% I_{nom} if m.v. < 10% I_{nom} (error does not account for clamp error)
Frequency	40.00…70.00 Hz	0.01 Hz	±0.05 Hz
Active, reactive, apparent and distortion power	depending on configuration (transducers, clamps)	4 significant digits	depending on configuration (transducers, clamps)
Active, reactive and apparent energy	depending on configuration (transducers, clamps)	4 significant digits	as power error
cosφ and power factor (PF)	0.00…1.00	0.01	±0.03
Harmonics			
Voltage	as for alternating voltage True RMS	as for alternating voltage True RMS	±5% m.v. if m.v. ≥ 3% U_{nom} ±0.15% U_{nom} if m.v. < 3% U_{nom}
Current	as for alternating current True RMS	as for alternating current True RMS	±5% m.v. if m.v. ≥ 10% I_{nom} ±0.5% I_{nom} if m.v. < 10% I_{nom}
THD			
Voltage	0.0…100.0% (relative to RMS value)	0.1%	±5%
Current			
Unbalance factor	0.0…10.0%	0.1%	±0.15% (absolute error)

* **F-1A**, **F-2A**, **F-3A** clamp: 0…3000 A AC (10 000 A_{p-p}) • **C-4A** clamp: 0…1000 A AC (3600 A_{p-p}) • **C-5A** clamp: 0…1000 A AC/DC (3600 A_{p-p}) • **C-6A** clamp: 0..10 A AC (36 A_{p-p}) • **C-7A** clamp: 0…100 A AC (360 A_{p-p})

							
	C-4A WACEGC4AOKR	**C-5A** WACEGC5AOKR	**C-6A** WACEGC6AOKR	**C-7A** WACEGC7AOKR	**F-1A** WACEGF1AOKR	**F-2A** WACEGF2AOKR	**F-3A** WACEGF3AOKR
Rated current	1000 A AC	1000 A AC 1400 A DC	10 A AC	100 A AC		3000 A AC	
Frequency	30 Hz…10 kHz	DC…5 kHz	40 Hz…10 kHz	40 Hz…1 kHz		40 Hz…10 kHz	
Output signal level	1 mV / 1 A	1 mV / 1 A	100 mV / 1 A	5 mV / 1 A	77.6 µV / 1 A	38.8 µV / 1 A	19.4 µV / 1 A
Max. diameter of measured conductor	52 mm	39 mm	20 mm	24 mm	360 mm	235 mm	120 mm
Minimum accuracy	≤0.5%	≤1.5%	≤1%	0.5%		1%	
Battery power	–	√	–	–		–	
Lead length	2.2 m	2.2 m	2.2 m	3 m		2.2 m	
Measurement category	IV 300 V	IV 300 V	IV 300 V	III 300 V		IV 600 V	
Ingress protection	IP40					IP67	

MPI-540-PV | Specifications – photovoltaic installation parameters

Measurement functions	Display range	Resolution	Accuracy ±(% m.v. + digits)
Open circuit voltage U_{oc}	0.0 V...1000 V	from 0.1 V	from ±(3% m.v. + 2 digits)
Short circuit current I_{sc}	0.00 A...20.00 A	0.1 A	±(3% m.v. + 0.10 A)

Other technical data

Safety and work conditions	
Measuring category according to EN 61010	IV 300 V, III 500 V II 1000 V DC (only MPI-540-PV)
Ingress protection	IP51
Type of insulation according to EN 61010-1 and IEC 61557	double
Dimensions	288 x 223 x 75 mm
Weight	ca. 2.5 kg
Operating temperature	0...+45°C
Storage temperature	-20...+60°C
Humidity	20...90%
Nominal temperature	23 ± 2°C
Reference humidity	40%...60%
Altitude a.s.l.	≤2000 m

Memory and communication	
Memory of measurement results	unlimited
Data transmission	USB 2.0

Other information	
Quality standard – development, design and production	ISO 9001
The product meets the EMC (emission for industrial environment) requirements according to standards	EN 61326-1 EN 61326-2-2

Standard accessories

PVM-1 adapter (only MPI-540-PV)

WAADAPVM1

MC4-banana sockets adapter (set) (only MPI-540-PV)

WAADAMC4

WS-03 adapter with START button with UNI-Schuko plug (CAT III 300 V)

WAADAWS03

C-PV clamp (only MPI-540-PV)

WACEGCPVOKR

Adapter for C-PV clamp (only MPI-540-PV)

WAADACPV

3x F-3A flexible clamp (Ø 120 mm)

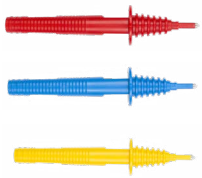
WACEGF3AOKR

Test lead 1,2 m (banana plugs) black / red / blue / yellow

WAPRZ1X2BLBB
WAPRZ1X2REBB
WAPRZ1X2BUBB
WAPRZ1X2YEBB

Crocodile clip 1 kV 20 A black / red / blue / yellow

WAKROBL20K01
WAKRORE20K02
WAKROBU20K02
WAKROYE20K02



Pin probe 1 kV (banana socket) red / blue / yellow

WASONREOGB1
WASONBUOGB1
WASONYEOGB1

Test lead 15 m, blue (on a reel)

WAPRZ015BUBBSZ

Test lead 30 m, red (on a reel)

WAPRZ030REBBSZ

2x earth contact test probe (rod), 30 cm

WASONG30

4x voltage adapter with M4/M6 thread

WAADAM4M6

USB cable

WAPRZUSB

4 GB microSD card

Charging

Mains cable with IEC C7 plug
WAPRZLAD230

Z7 power supply
WAZASZ7

Cable for battery charging from car cigarette lighter socket (12 V)
WAPRZLAD12SAM

Li-Ion battery 11.1 V 3.4 Ah

WAAKU15

L2 hanging straps (set)

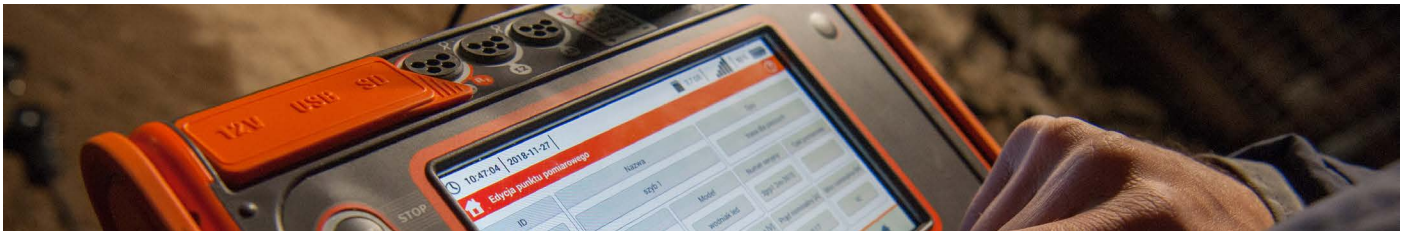
WAPOZSZEKPL

Carrying case M13 (only MPI-540-PV)

WAFUTM13

L2 carrying case

WAFUTL2



Optional accessories

EVSE-01 adapter for testing vehicle charging stations

WAADAEVSE01

AutoISO-1000C adapter

WAADAAISO10C

WS-04 adapter with UNI-SCHUKO angular plug

WAADAWS04

F-1A flexible clamp (Ø 360 mm)

WACEGF1AOKR

F-2A flexible clamp (Ø 235 mm)

WACEGF2AOKR

C-3 clamp (Ø 52 mm)

WACEGC3OKR

C-4A clamp (Ø 52 mm) 1000 A AC

WACEGC4AOKR

C-5A clamp (Ø 39 mm) 1000 A AC/DC

WACEGC5AOKR

C-6A clamp (Ø 20 mm) 10 A AC

WACEGC6AOKR

C-7A clamp (Ø 24 mm) 100 A AC

WACEGC7AOKR

N-1 transmitting clamp (Ø 52 mm)

WACEGN1BB

Hard carrying case for clamps

WAWALL2

Test lead for fault loop measurement (banana plugs) 5 m / 10 m / 20 m

WAPRZ005REBB
WAPRZ010REBB
WAPRZ020REBB

Test lead for earth resistance measurement 25 m / 50 m

WAPRZ025BUBBSZ
WAPRZ050YEBBSZ

Industrial socket adapter 16 A / 32 A

WAADAAGT16T
WAADAAGT32T

Three-phase socket adapter 16 A / 32 A

WAADAAGT16C
WAADAAGT32C

Three-phase socket adapter 16 A / 32 A

WAADAAGT16P
WAADAAGT32P

Three-phase socket adapter 63 A

WAADAAGT63P

LP-10A light meter probe with WS-06 plug

set
WAADALP10AKPL

only probe with miniDIN-4P plug
WAADALP10A

only WS-06 adapter with miniDIN-4P socket
WAADAWS06

LP-10B light meter probe with WS-06 plug

set
WAADALP10BKPL

only probe with miniDIN-4P plug
WAADALP10B

only WS-06 adapter with miniDIN-4P socket
WAADAWS06

LP-1 light meter probe with WS-06 plug

set
WAADALP1KPL

only probe with miniDIN-4P plug
WAADALP1

only WS-06 adapter with miniDIN-4P socket
WAADAWS06