





<p><b>7"</b></p> <p>touch screen</p>	<p>MPI-540-PV</p>  <p>measurement of PV installations</p>	 <p>3-phase power quality recorder</p>	<p><math>\rho</math> <math>R_E</math> <math>R_{ISO}</math> <math>Z_S</math> <math>R_{CONT}</math> <math>E</math></p> <p>complex measurements of installations</p>
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## 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 | Cooperation with solar radiation and temperature meter**
- **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

Choose the best set for your needs

F-3A flexible coils

IRM-1 MPI solar radiation measurement set



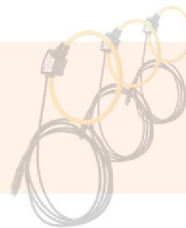
**MPI-540-PV Solar**  
includes flexible coils and solar radiation measurement set



**MPI-540-PV**  
includes flexible coils



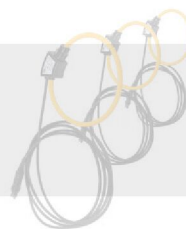
**MPI-540-PV Start**  
does not include flexible coils



**MPI-540**  
includes flexible coils



**MPI-540 Start**  
does not include flexible coils





## 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),  $\cos\phi$ ,  $\tan\phi$ ,
  - » harmonics (up to 40th for voltage and current),
  - » total harmonic distortion (THD) for current and voltage,
  - » recording of events for current and voltage,
  - » energy flow – 4 quadrants.
- **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.



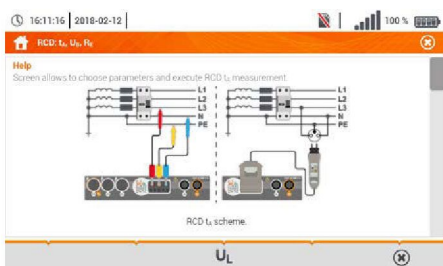
## Three-phase power quality recorder

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.

## IRM-1 MPI: solar radiation measurement set

### Features

- Measurement of solar radiation and temperature.
- The LoRa interface for communication with a master meter – offers a larger range than the Bluetooth technology!
- Built-in recorder that can be used to record solar radiation before constructing PV systems, as well as to measure the shading of existing systems.
- Large measurement memory: 999 cache memory cells and 5000 recorder records available (one-time recording) with the option of overwriting them (continuous recording).

### Measured parameters

- Solar radiation intensity (irradiance) in  $\text{W}/\text{m}^2$  or  $\text{BTU}/\text{ft}^2\text{h}$ .
- PV panel temperature in  $^{\circ}\text{C}$  or  $^{\circ}\text{F}$ .
- Ambient temperature in  $^{\circ}\text{C}$  or  $^{\circ}\text{F}$ .
- Inclination angle of panels
- Orientation of the panels with the built-in compass.



# Specifications – electrical installation parameters

Measurement functions	Measurement range	Display range	Resolution	Accuracy ±(% m.v. + digits)
<b>Fault loop impedance</b>				
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)
<b>Measurements of RCD parameters</b>				
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% $I_{\Delta n}$
<b>Earth resistance</b>				
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-pole method	0.00 Ω...99.9 kΩ	0.00 Ω...99.9 kΩ	from 0.01 Ω	from ±(10% m.v. + 4 digits)
<b>Resistance-to-earth</b>	0.0 Ωm...99.9 kΩm	0.0 Ωm...99.9 kΩm	from 0.1 Ωm	Depending on accuracy of $R_E$ measurement
<b>Insulation resistance</b>				
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...4.99 GΩ acc. to IEC 61557-2	0 kΩ...9.99 GΩ	from 1 kΩ	from ±(3% m.v. + 8 digits)
<b>Resistance of protective conductors and equipotential bondings</b>				
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)
<b>Light intensity</b>				
Measurement in luxes (lx)	0 lx...399.9 klx	0 lx...399.9 klx	from 0.001 lx	from ±(2% m.v. + 5 digits)
Measurement in feet-candles (fc)	0 fc...39.99 kfc	0 fc...39.99 kfc	from 0.001 fc	from ±(2% m.v. + 5 digits)
<b>Phase sequence indication</b>	in the same direction (correct), opposite direction (incorrect), $U_{L-L}$ voltage: 95 V...500 V (45 Hz...65 Hz)			

# 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
<b>Alternating voltage (TRMS)</b>	0.0...500 V	0.01% $U_{nom}$	$\pm 0.5\% U_{nom}$
<b>Alternating current (TRMS)</b>	depending on clamp*	0.01% $I_{nom}$	$\pm 2\%$ m.v. if m.v. $\geq 10\% I_{nom}$ $\pm 2\% I_{nom}$ if m.v. $< 10\% I_{nom}$ (error does not account for clamp error)
<b>Frequency</b>	40.00...70.00 Hz	0.01 Hz	$\pm 0.05$ Hz
<b>Active, reactive, apparent and distortion power</b>	depending on configuration (transducers, clamps)	4 significant digits	depending on configuration (transducers, clamps)
<b>Active, reactive and apparent energy</b>	depending on configuration (transducers, clamps)	4 significant digits	as power error
<b>cos<math>\phi</math> and power factor (PF)</b>	0.00...1.00	0.01	$\pm 0.03$
<b>Harmonics</b>			
Voltage	as for alternating voltage True RMS	as for alternating voltage True RMS	$\pm 5\%$ m.v. if m.v. $\geq 3\% U_{nom}$ $\pm 0.15\% U_{nom}$ if m.v. $< 3\% U_{nom}$
Current	as for alternating current True RMS	as for alternating current True RMS	$\pm 5\%$ m.v. if m.v. $\geq 10\% I_{nom}$ $\pm 0.5\% I_{nom}$ if m.v. $< 10\% I_{nom}$
<b>THD</b>			
Voltage	0.0...100.0% (relative to RMS value)	0.1%	$\pm 5\%$
Current			
<b>Unbalance factor</b>	0.0...10.0%	0.1%	$\pm 0.15\%$ (absolute error)

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



**C-4A**

WACEGC4AOKR



**C-5A**

WACEGC5AOKR



**C-6A**

WACEGC6AOKR



**C-7A**

WACEGC7AOKR



**F-1A**

WACEGF1AOKR



**F-2A**

WACEGF2AOKR



**F-3A**

WACEGF3AOKR

<b>Rated current</b>	1000 A AC	1000 A AC 1400 A DC	10 A AC	100 A AC		3000 A AC	
<b>Frequency</b>	30 Hz...10 kHz	DC...5 kHz	40 Hz...10 kHz	40 Hz...1 kHz		40 Hz...10 kHz	
<b>Max. diameter of measured conductor</b>	52 mm	39 mm	20 mm	24 mm	380 mm	250 mm	140 mm
<b>Minimum accuracy</b>	$\leq 0.5\%$	$\leq 1.5\%$	$\leq 1\%$	0.5%		1%	
<b>Battery power</b>	–	✓	–	–		–	
<b>Lead length</b>	2.2 m	2.2 m	2.2 m	3 m		2.5 m	
<b>Measurement category</b>	IV 300 V	IV 300 V	IV 300 V	III 300 V		IV 600 V	
<b>Ingress protection</b>			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 MPI-540-PV   II 1000 V DC
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%

### Memory and communication

Memory of measurement results	unlimited
Data transmission	USB 2.0










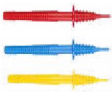

### Other information

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

		MPI-540-PV Solar	MPI-540-PV	MPI-540-PV Start	MPI-540	MPI-540 Start
		WMGBMPI540PVIRM1	WMGBMPI540PV	WMGBMPI540PVNC	WMGBMPI540	WMGBMPI540NC
	<b>IRM-1 MPI solar radiation measurement set</b> (IRM-1 solar radiation and temperature meter + IRM-1 mounting & measuring set + Z24 power supply + LORA-S1 adapter for data transmission + M14 carrying case) WMGBIRM1MPI	1				
	<b>PVM-1 adapter</b> WAADAPVM1	1	1	1		
	<b>MC4-banana sockets adapter (set)</b> WAADAMC4	1	1	1		
	<b>WS-03 adapter with START button with UNI-Schuko plug (CAT III 300 V)</b> WAADAWS03	1	1	1	1	1
	<b>C-PV clamp</b> WACEGCPVOKR	1	1	1		
	<b>Adapter for C-PV clamp</b> WAADACPV	1	1	1		
	<b>F-3A flexible clamp (Ø 120 mm)</b> WACEGF3AOKR	3	3		3	
	<b>Test lead 1.2 m (banana plugs) black / red / blue / yellow</b> WAPRZ1X2BLBNN / WAPRZ1X2REBB / WAPRZ1X2BUBB / WAPRZ1X2YEBB	1/1/1/1	1/1/1/1	1/1/1/1	1/1/1/1	1/1/1/1
	<b>Crocodile clip 1 kV 20 A black / red / blue / yellow</b> WAKROBL20K01 / WAKRORE20K02 / WAKROBU20K02 / WAKROYE20K02	1/1/1/1	1/1/1/1	1/1/1/1	1/1/1/1	1/1/1/1
	<b>Pin probe 1 kV (banana socket) red / blue / yellow</b> WASONREOGB1 / WASONBUOGB1 / WASONYEGB1	1/1/1	1/1/1	1/1/1	1/1/1	1/1/1
	<b>Test lead 15 m, blue (on a reel)</b> WAPRZ015BUBBSZ	1	1	1	1	1

## Standard accessories

		MPI-540-PV Solar	MPI-540-PV	MPI-540-PV Start	MPI-540	MPI-540 Start
		WMGBMPI540PVIRM1	WMGBMPI540PV	WMGBMPI540PVNC	WMGBMPI540	WMGBMPI540NC
	<b>Test lead 30 m, red (on a reel)</b> WAPRZ030REBBSZ	1	1	1	1	1
	<b>Earth contact test probe (rod), 30 cm</b> WASONG30	2	2	2	2	2
	<b>Voltage adapter with M4/ M6 thread (set of 4 pcs.)</b> WAADAM4M64	1	1	1	1	1
	<b>USB cable</b> WAPRZUSB	1	1	1	1	1
	<b>4 GB microSD card</b> WAPZMSD4	1	1	1	1	1
	<b>Mains cable with IEC C7 plug</b> WAPRZLAD230	1	1	1	1	1
	<b>Z-7 power supply</b> WAZASZ7	1	1	1	1	1
	<b>Cable for battery charging from car cigarette lighter socket (12 V)</b> WAPRZLAD12SAM	1	1	1	1	1
	<b>Li-Ion battery 11.1 V 3.4 Ah</b> WAAKU15	1	1	1	1	1
	<b>L-2 hanging straps (set)</b> WAPZSZEKPL	1	1	1	1	1
	<b>Carrying case M-13</b> WAFUTM13	1	1	1		
	<b>L-2 carrying case</b> WAFUTL2	1	1	1	1	1
	<b>Factory calibration certificate</b>	1	1	1	1	1

## Optional accessories



**IRM-1 MPI solar radiation measurement set**  
only for  
MPI-540-PV / MPI-540-PV Start  
WMGBIRM1MPI



**LORA-S1 adapter for data transmission**  
only for  
MPI-540-PV / MPI-540-PV Start  
WAADAUSBLORA



**EVSE-01 adapter for testing vehicle charging stations**  
WAADAEVSE01



**F-1A flexible clamp (Ø 360 mm)**  
WACEGF1AOKR



**F-2A flexible clamp (Ø 235 mm)**  
WACEGF2AOKR



**F-3A flexible clamp (Ø 120 mm)**  
only for  
MPI-540 Start / MPI-540-PV Start  
WACEGF3AOKR



**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



**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



**Industrial socket adapter 16 A / 32 A**  
WAADAAGT16T  
WAADAAGT32T



**WS-04 adapter with UNI-SCHUKO angular plug**  
WAADAWS04



**AutoISO-1000C adapter**  
WAADAISO10C



**Cramp with banana socket**  
WAZACIMA1



**Earth contact test probe 80 cm**  
WASONG80V2



**L-3 carrying case (for 80 cm test probes)**  
WAFUTL3



**LP-10A light meter probe with WS-06 plug**  
set  
WAADALP10AKPL



**LP-10B light meter probe with WS-06 plug**  
set  
WAADALP10BKPL



**LP-1 light meter probe with WS-06 plug**  
set  
WAADALP1KPL

only probe with miniDIN-4P plug  
WAADALP10A

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

only probe with miniDIN-4P plug  
WAADALP10B

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

only probe with miniDIN-4P plug  
WAADALP1

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



**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



**Calibration certificate with accreditation**