

PROFITEST | PVSUN

Test Instrument for Testing PV Modules and Strings per DIN EN 62446 (VDE 0126-23)

3-349-672-03
1/2.12



These operating instructions are available
in this, as well as other languages, in PDF
format on the Internet at
www.gossenmetrawatt.com.





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1 Scope of Delivery

- 1 PROFITEST PVsUN
- 4 Batteries, 1.5 V IEC LR6 (AA)
- 3 Safety measurement cables, 1.5 m, red, blue and yellow
- 1 Safety test probe
- 1 Safety alligator clip
- 2 Solar plug adapter, red
- 2 Solar plug adapter, blue
- 1 Carrying case with foam insert
- 1 Set of operating instructions

2 Significance of Symbols

Meanings of Symbols on the Instrument

-  Warning concerning a point of danger (attention: observe documentation!)
-  Protection class II device (continuous, doubled or reinforced insulation)
-  This device may not be disposed of with the trash. Further information regarding the WEEE mark can be accessed on the Internet at www.gossen-metrawatt.com by entering the search term "WEEE".
-  EC mark of conformity

Meanings of Symbols in the Operating Instructions



Caution! Dangerous Voltage



Warning!
Warning concerning a source of danger



Attention!
Non-observance may result in distorted measurement results.



Note
Please observe!

Measuring Categories and their Significance per IEC 61010-1

CAT	Definition
0	Measurements in other electrical circuits which are not directly connected to the mains: <i>e.g. electrical systems in motor vehicles and aircraft, batteries etc.</i>
II	Measurements in electrical circuits which are electrically connected to the low-voltage mains: <i>via plug, e.g. in household, office and laboratory applications</i>
III	Measurements in building installations: <i>Stationary consumers, distributor terminals, devices connected permanently to the distributor</i>
IV	Measurements at power sources for low-voltage installations: <i>meters, mains terminals, primary overvoltage protection devices</i>

3 Introduction

These operating instructions contain information and directions which are necessary for safe operation and use of the instrument. Before using the instrument, the operating instructions must be carefully read and all points contained therein must be followed correctly. Non-observance of the operating instructions, as well as warnings and directions included therein, may result in severe injury to the user or damage to the instrument.

The PROFITEST PVsUN is used for simple testing of solar cells and modules. The terms used in these operating instructions to designate systems for generating electrical power from sunlight include: solar system, photovoltaic system, PV system and the like.

Scope of Functions

- Voltage measurement to 1000 V DC
- Short circuit current measurement to 20 A DC
- Selection of insulation test voltage: 250, 500 or 1000 V DC
- Insulation measurement to 20 MΩ with display of limit value
- Testing of protective conductor continuity
- Earth fault measurement
- Polarity check
- Backlit LCD panel
- Optional temperature measurement

4 Transport and Storage

Please retain the original packaging for subsequent shipment of the instrument. Transport damages due to inadequate packaging are excluded from the guarantee.

The instrument may only be stored in dry, closed rooms.

If the instrument is subjected to extreme temperature during transport, it requires at least 2 hours for acclimatization before it is switched on.

5 Safety Precautions

The instrument has been manufactured and tested in accordance with IEC/EN 61010-1, "Safety requirements for electrical equipment for measurement, control and laboratory use", and has been shipped from the factory in flawless technical safety condition. In order to assure that this condition is retained, the user must observe the safety precautions included in these operating instructions.



Caution! Dangerous Voltage

In order to prevent electrical shock, corresponding safety precautions must be implemented when working with voltages of greater than 120 V (60 V) DC or 50 V (25 V) AC TRMS. In accordance with DIN VDE, these values specify the limit for exposed (touchable) voltages (the values in parentheses apply to, for example, the fields of medicine and agriculture).

Before each measurement, make sure that the measurement cables and the measuring instrument are in flawless condition. The measuring instrument may only be used within the specified measuring ranges.

If the safety of the user is no longer assured, the instrument must be removed from service and secured against unintentional use.

Safety of the user is no longer assured if the instrument:

- Demonstrates apparent damage
- No longer performs the desired measurements
- Has been stored for too long under unfavorable conditions
- Has been subjected to mechanical stressing during transport

The instrument may not be opened, dismantled or modified in any way. The instrument may only be used with recommended accessories. The use of unsuitable accessories is impermissible. Trade association accident prevention regulations for electrical systems and operating equipment must be adhered to during all work with the instrument.

Do not allow the instrument to warm up due to exposure to direct sunlight. Flawless functioning and a long service life cannot otherwise be assured.

6 Use for Intended Purpose

The instrument may only be used under the conditions and for the purposes for which it has been designed. In this respect, special attention must be given to safety precautions, technical data regarding ambient conditions and use in a dry environment.



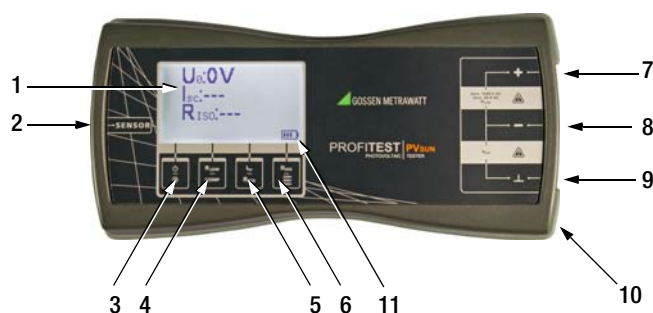
Warning!

The instrument may not be operated at measuring category II, III and IV mains power circuits. In accordance with EN 61010-1:2010, the instrument has been designed without a rated measuring category, and may only be used at direct voltage circuits with up to 1000 V without transient overvoltages.

Operating safety is no longer assured in the event of modification or alteration. The instrument may only be opened by authorized service technicians.

Never operate the instrument at a higher voltage than specified in the technical data! The instrument may otherwise be destroyed or permanently damaged.

7 Operating and Display Elements



- 1 LCD panel with background illumination
- 2 Sensor socket for temperature measurement (optional)
- 3 On/Off switch / background illumination
- 4 Low-resistance measurement R_{LOW} / measurement cable compensation **COMP**
- 5 Short-circuit measurement I_{SC} / insulation resistance measurement R_{ISO} per EN 62446
- 6 General insulation resistance measurement **RISO** / selection of insulation test voltage
- 7 Measurement input + / continuity test
- 8 Measurement input - / insulation measurement / continuity test
- 9 Measurement input ground terminal / insulation measurement
- 10 Back: battery compartment
- 11 Battery level indicator



Battery full



Battery weak

8 Initial Start-Up

The **PROFITEST PVSUN** is supplied with power from four AA batteries (1.5 V IEC LR6). The batteries must be inserted before the instrument can be used.

- Remove the battery compartment lid on the back of the instrument by loosening the two Phillips head screws.
- Insert the batteries. Be sure to observe the polarity symbols which are embossed into the floor of the battery compartment.
- Replace the battery compartment lid and retighten the screws.



Attention!

The test instrument may only be operated with installed battery compartment lid.

9 Measurements



Warning!

The photovoltaic system's plug connectors may not be disconnected under load. Please observe warnings and instructions provided by the plug manufacturer.



Caution! Dangerous Voltage

Solar modules continuously generate current, even when shaded. Regulations for working with live voltage must be adhered to during all work.

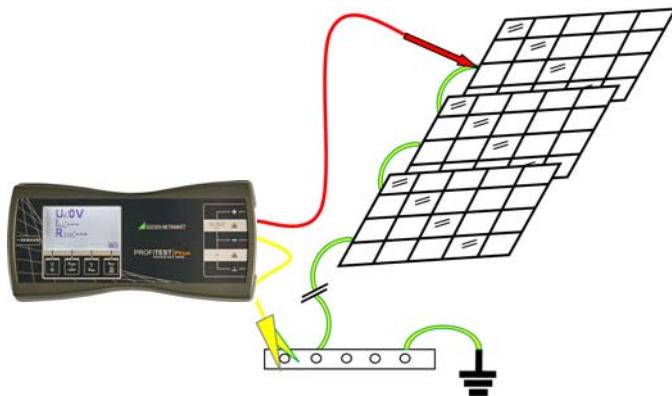
Switching the PROFITEST PVsUN On

- ⇨ The test instrument is switched on by pressing the key.
- ⇨ After the test instrument has been switched on, background illumination can be switched on by briefly pressing the same key once again.
- ⇨ Briefly pressing the key a third time switches background illumination back off.
- ⇨ The test instrument can be switched off by pressing and holding the key for longer than 2 seconds.

9.1 Testing Protective Conductor Continuity per EN 62446 (VDE 0126-23) (> 200 mA)

If a protective conductor or an equipotential bonding conductor is included at the DC side of the photovoltaic system, its electrical connection must be tested for continuity.

The connection to the main grounding terminal must also be tested.



Warning!

Disconnect all solar modules from the system before performing the measurement.

Compensation for Measurement Cable Resistance

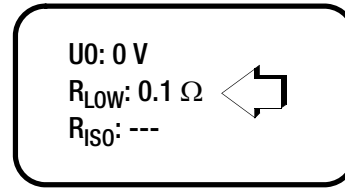
Ohmic measurement cable resistance can be subtracted from the measurement results automatically. Proceed as follows in order to determine the resistance offset value:

- ⇨ Switch the **PROFITEST PVsUN** test instrument on.
- ⇨ Connect the measurement cables to the (+) and (-) sockets and short-circuit the plug-on test probes.
- ⇨ Press and hold the **COMP** key for at least 2 seconds in order to trigger offset resistance measurement. The following display appears after completion of the measurement: $R_{LOW}: 0.0 \Omega$.

The measured **ROFFSET** value is not displayed, but is permanently stored internally and is subtracted from the actual result of all subsequent R_{LOW} measurements, until a new offset resistance value is acquired.

Protective Conductor Resistance Measurement

- ⇨ Connect the (+) socket to a protective conductor terminal at the solar module and the (-) socket to the equipotential bonding busbar.
- ⇨ Briefly press the R_{LOW} key. Measurement is started. The R_{LOW} resistance value measured for the protective conductor system appears at the display:



Attention!

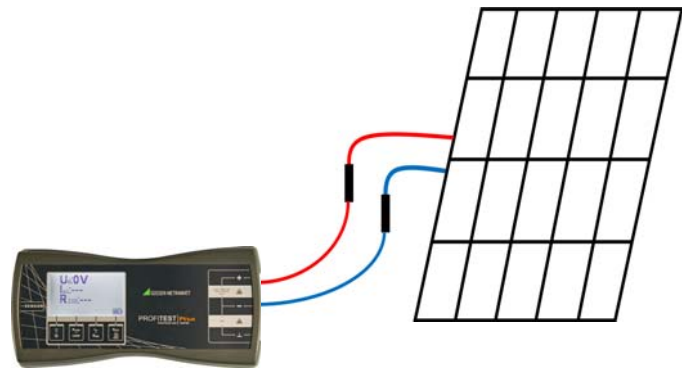
Measurement results may be distorted due parallel connected impedances at load current circuits, as well as equalizing current.

9.2 Polarity Test / Measuring Open Circuit Voltage U_0 per EN 62446 (VDE 0126-23)

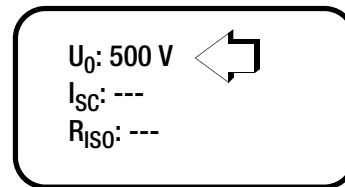


Warning!

Disconnect the solar module under test from the system before performing measurement.

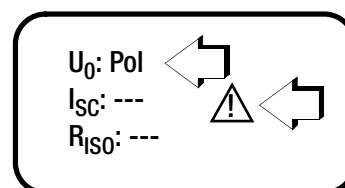


- ⇨ Connect the **PROFITEST PVsUN** test instrument to the module with the help of suitable solar plugs.
- ⇨ Switch the **PROFITEST PVsUN** test instrument on. The module's open circuit voltage U_0 appears at the display.



Note

In the case of incorrect polarity, a warning symbol appears to the right of the voltage display.



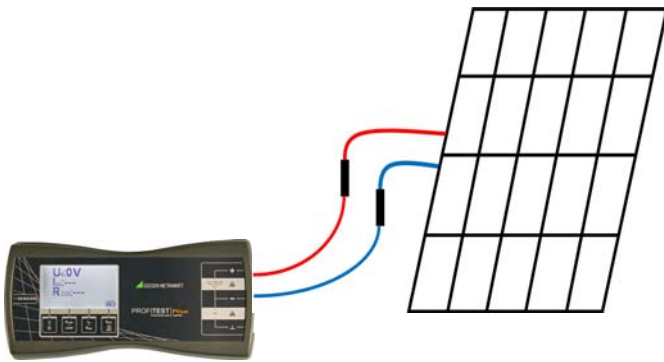
- ⇨ Reverse polarity at the solar module and start testing over again.

9.3 Measuring Short-Circuit Current I_{SC} per EN 62446

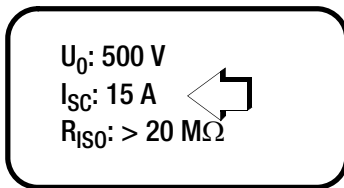


Warning!

Disconnect the solar module under test from the system before performing the measurement.



- Connect the **PROFITEST PVSUN** test instrument to the module with the help of suitable solar plugs.
- Switch the **PROFITEST PVSUN** test instrument on. The module's open circuit voltage U_0 appears at the display.
- Press the I_{SC} key. Open circuit voltage U_0 and short-circuit current I_{SC} appear at the display:



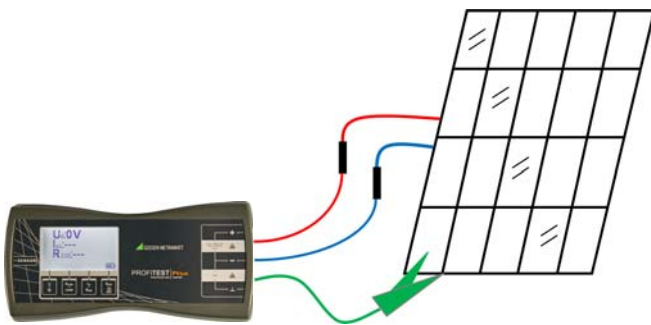
The (+) and (-) terminals at the solar module are short circuited during the measurement, and momentary short-circuit current is measured. Insulation resistance is measured at the same time (see section 9.4).

9.4 Testing Insulation Resistance per EN 62446



Warning!

Disconnect the solar module under test from the system before performing measurement.



Attention!

Insulation measurement per EN 62446 is executed between short circuited (+) / (-) and (L) terminals.

- Connect the **PROFITEST PVSUN** test instrument to the module with the help of suitable solar plugs.
- Connect the ground terminal at the **PROFITEST PVSUN** to the module frame.
- Switch the **PROFITEST PVSUN** test instrument on. The module's open circuit voltage U_0 appears at the display.

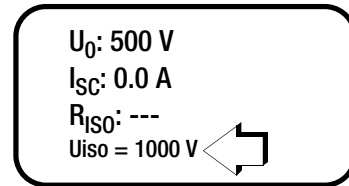
Selecting the Test Voltage

- Press and hold the **RISO/250V/500V/1000V** key for at least 2 seconds.

The currently selected test voltage appears the display.

- Select the required insulation test voltage by briefly and repeatedly pressing the **RISO/250V/500V/1000V** key.

The last selected value is saved after a short period of time, and is then cleared from the display.



Executing the Insulation Resistance Measurement

- Press the I_{SC}/R_{ISO} key and read the measured value from the display.

The (+) and (-) terminals at the solar module are short circuited during the measurement, and momentary short-circuit current is measured. Insulation resistance is measured at the same time.

Minimum Permissible Limit Values for Insulation Resistance Relative to Insulation Test Voltage per EN 62446

System Voltage ($U_0 \times 1.25$)	Test Voltage	Limit Value
< 120 V	250 V	0.5 M Ω
120 to 500 V	500 V	1 M Ω
> 500 V	1000 V	1 M Ω



Note

If the limit value is fallen short of, < 1 M Ω or < 0.5 M Ω appears for R_{ISO} .



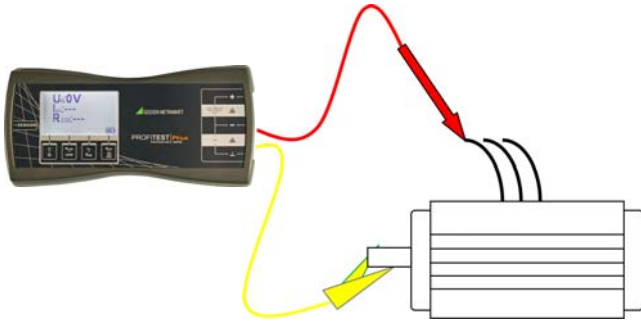
9.5 General Insulation Resistance Measurement

The PROFITEST PVsUN test instrument is additionally equipped with system-independent insulation testing. This is helpful, for example, when testing systems or supply lines when no modules have yet been installed. All insulation tests known to date can be performed.



Warning!

The test object must be potential-free. Assure absence of voltage with the help of a suitable measuring instrument, for example the METRAVOLT 12D+L voltage tester.



Note

General insulation measurement is executed between short circuited (-) and (L) terminals.

- ⇨ Connect the (-) and (L) terminals at the PROFITEST PVsUN to the device under test.
- ⇨ Switch the PROFITEST PVsUN test instrument on.

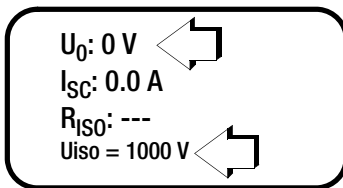
Selecting the Test Voltage

- ⇨ Press and hold the R_{ISO}/250V/500V/1000V key for at least 2 seconds.

The currently selected test voltage appears at the display.

- ⇨ Select the required insulation test voltage by briefly and repeatedly pressing the R_{ISO}/250V/500V/1000V key.

The last selected value is saved after a short period of time, and is then cleared from the display.



Executing the Insulation Resistance Measurement

- ⇨ Press the R_{ISO}/250V/500V/1000V key and read the measured value from the display.



Note

If the minimum permissible limit value is fallen short of, < 1 MΩ or < 0.5 MΩ appears for R_{ISO}.

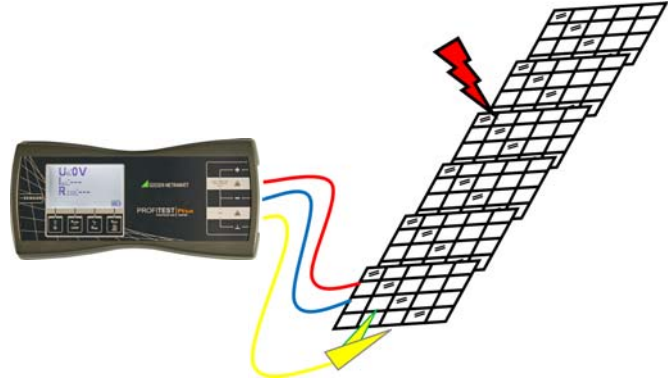
9.6 Ground Fault Test

If a ground fault occurs within the system, the error can be narrowed down on the basis of the voltage ratio.



Warning!

Disconnect all solar modules from the system before performing the measurement.



- ⇨ Connect the PROFITEST PVsUN to the module with the help of suitable solar plugs.
- ⇨ Connect the ground terminal at the PROFITEST PVsUN to the module frame.
- ⇨ Switch the PROFITEST PVsUN test instrument on.

Momentary open circuit voltage is displayed.

At the same time, a second voltage (U_e) appears in the event of a ground fault.



9.7 Temperature Measurement (optional)

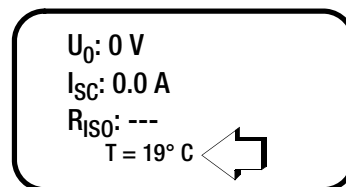


Warning!

Hot surfaces may cause burns.

- ⇨ Connect the temperature sensor to the sensor socket.
- ⇨ Switch the PROFITEST PVsUN on.

Current temperature appears at the display.



10 Characteristic Values

Voltage Measurement U0

Measuring range	0 to 1000 V DC (no transient voltages)
Resolution	1 V
Accuracy	±(1% rdg. + 1 d)

Current (direct)

Measuring range	0 to 20 A DC
Voltage range	2 to 1000 V DC
Resolution	0.1 A
Accuracy	±(1% rdg. + 1 d)
Overcurrent protection	Max. 24 A (shutdown of internal circuit)

Insulation Resistance Measurement RISO

Test voltage	250 V DC	500 V DC	1000 V DC
Measuring range	0 to 1 MΩ	1 MΩ to 20 MΩ	1 MΩ to 20 MΩ
Resolution	0.1 MΩ	1 MΩ	1 MΩ
Accuracy	±(1% rdg. + 1 d)	±(1% rdg. + 2 d)	±(1% rdg. + 2 d)
Limit value	> 0.5 MΩ	> 1 MΩ	> 1 MΩ
No. of measurements	Approx. 1000 (with battery set per IEC LR6)		

Earth Fault Measurement

Measuring range	0 to 1000 V DC
Resolution	1 V
Accuracy	±(1% rdg. + 1 d)

Low-Resistance Measurement

Measuring range	0 to 10 Ω
Test current	> 200 mA
Resolution	0.1 Ω
Accuracy	±(1% rdg. + 1 d)
No. of measurements	Approx. 500 low-resistance measurements (batteries: 1.5 V per IEC LR6)

Display

LCD	Backlit multiple display Dot matrix: 128 x 64 pixels
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Reference Conditions

Ambient temperature	+23° C ±2 K
Relative humidity	40 to 75%
Battery voltage	6 V ± 1 V

Ambient Conditions

Operating temperature	0 to +40° C
Storage temperature	-10° C to 60° C
Relative humidity	< 80%, no condensation allowed
Elevation	Max. 2000 m above sea level

Power Supply

Batteries	4 ea. 1.5 V IEC LR6, AA, AM3, MN1500
Consumption	Approx. 20 µA when switched off Approx. < 30 mA during normal operation Approx. 190 mA with backgr. illumination

Electrical Safety

Measuring category	CAT 0 / 1000 V Instrument without rated measuring category per EN 61010-2-30:2010
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Electromagnetic Compatibility (EMC)

EMC directive	EMC 2004/108/EC
Basic standard	EN 61326-1:2006

Mechanical Design

Protection	Housing: IP 42 per DIN VDE 0470 part 1/EN 60529
Dimensions	209 x 98 x 35 mm
Weight	Approx. 500 g with batteries

11 Maintenance

11.1 Battery Replacement

If the battery level indicator displays only minimal remaining battery capacity (only one segment appears, see figure at right), the batteries must be replaced.



- ⇨ Switch the instrument off and disconnect it from all measuring circuits.
- ⇨ Remove the battery compartment lid on the back of the instrument by loosening the two Phillips head screws.
- ⇨ Remove the depleted batteries.
- ⇨ Insert new batteries. Be sure to observe the polarity symbols which are embossed into the floor of the battery compartment.
- ⇨ Replace the battery compartment lid and retighten the screws.

After inserting new batteries, all four segments should appear at the display.



11.2 Housing

No special maintenance is required for the housing. Keep outside surfaces clean. Use a slightly dampened cloth for cleaning. Avoid the use of cleansers, abrasives or solvents.

Return and Environmentally Sound Disposal

The instrument is a category 9 product (monitoring and control instrument) in accordance with ElektroG (German electrical and electronic device law). This device is not subject to the RoHS directive.

In accordance with WEEE 2002/96/EG and ElektroG, we identify our electrical and electronic devices (as of Aug. 2005) with the symbol in accordance with DIN EN 50419 which is shown at the right. Devices identified with this symbol may not be disposed of with the trash. Please contact our service department regarding the return of old devices (see address in section 12).



If the batteries used in your instrument are depleted, they must be disposed of properly in accordance with valid national regulations. Batteries may contain pollutants and heavy metals such as lead (Pb), cadmium (Cd) and mercury (Hg).

The symbol at the right indicates that batteries must not be disposed of with the trash, and must be brought to a designated collection point.



12 Repair and Replacement Parts Service

If required please contact:

GMC-I Service GmbH
Service Center
Thomas-Mann-Strasse 16-20
90471 Nürnberg • Germany
Phone: +49 911 817718-0
Fax: +49 911 817718-253
e-mail service@gossenmetrawatt.com
www.gmci-service.com

13 Product Support

If required please contact:

GMC-I Messtechnik GmbH
Product Support Hotline
Phone: +49-911-8602-0
Fax: +49 911 8602-709
e-mail: support@gossenmetrawatt.com

Diese Bedienungsanleitung ist in der nächsten Auflage in den folgenden Sprachen verfügbar: Deutsch, Englisch, Französisch, Spanisch, Italienisch und Portugiesisch.
In the next edition, these operating instructions will be available in the following languages: German, English, French, Spanish, Italian and Portuguese.

Edited in Germany • Subject to change without notice • PDF version available on the Internet

 **GOSSEN METRAWATT**

GMC-I Messtechnik GmbH
Südwestpark 15
90449 Nürnberg • Germany

Phone: +49 911 8602-111
Fax: +49 911 8602-777
e-mail: info@gossenmetrawatt.com
www.gossenmetrawatt.com