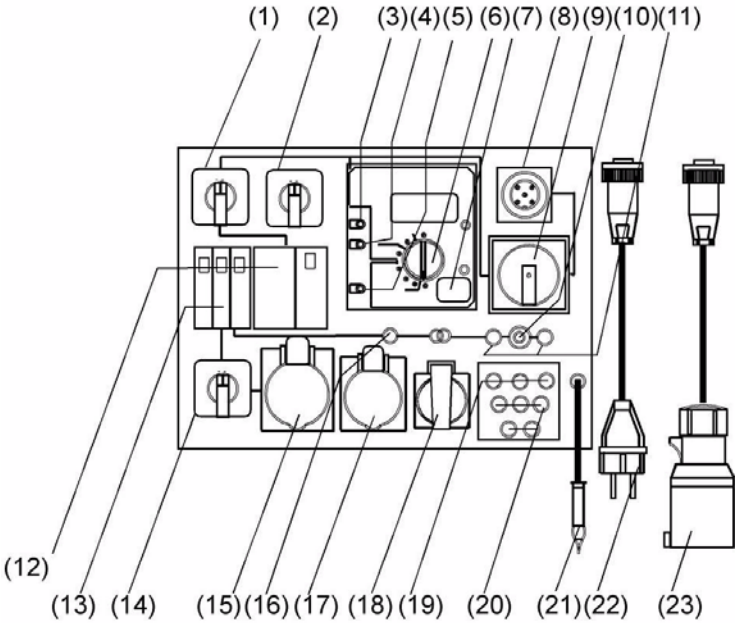
Operating Instructions

GOSSEN METRAWATT

METRA**TESTER 5+** | 3P

Workshop Test Panel for Testing Devices per DIN VDE 0701-0702 and DIN VDE 0104

3-349-414-03
6/2.11



1 NETZ-VDE switch (mains-VDE)
2 Measuring selector switch: L1-L2-L3
3 Connector socket/terminal for DUT phase conductor (parallel to test sockets)
4 Connector socket/terminal for DUT protective conductor (parallel to test sockets)
5 Connector socket/terminal for conductive parts of the DUT for testing for the absence of voltage in accordance with DIN VDE 0701–0702, and for contact current measurement for protection class II devices
6 Measuring function selector switch for METRATESTER 5+
7 Contact surface for finger contact
8 Plug connector for mains cables
9 Mains / emergency stop switch, undervoltage trigger can be connected at zero setting
10 “Durchgang” (continuity) indicator lamp
11 Connector sockets for continuity test with max. 33 V AC
12 RCD (residual current circuit beaker) 4*25 A, 0.03 A
13 Three circuit breakers, B16 A
14 Polarity reversing switch
15 CEE socket, 3P+N+PE, 32 A, 230/400 V **max. 16 A !**
16 Fuse, T 0.1/250G
17 CEE socket, 3P+N+PE, 16 A, 230/400 V
18 Earthing contact outlet
19 Mains indicator lamps, L1-L2-L3
20 Test sockets, L1-L2-L3-N-PE
21 Probe cable with clip / test probe
22 Mains cable with earthing contact plug and coupling socket
23 Mains cable with CEE 16 A, 5-pole mains plug and coupling socket

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1 Applications

The portable test case, manufactured in accordance with “guidelines for equipment required for electrical installation operations”, is intended for use by qualified electricians for measuring and testing electrical devices after repair or modifications, as well as for periodic testing, in accordance with DIN VDE 0701-0702.

According to these regulations, protective conductor resistance, insulation resistance, differential current, contact current and equivalent leakage current must be measured, and testing for the absence of voltage must be executed at user accessible conductive parts at data processing equipment and office machines.

Further applications for the substantiation of correct functioning of electrical equipment include the measurement of operating voltage and current consumption at devices under test. Beyond this, the protective conductor at the mains connection can be tested for the absence of voltage and line voltage can be measured. Extension cables can be tested after connecting the VL2 E accessory.

2 Safety Precautions

The test case is equipped with a METRATESTER 5+ test instrument, and has been manufactured and tested in accordance with the following regulations:

IEC 61010-1,
DIN EN 61010-1,

VDE 0411-1	“Regulations for electronic testers and controllers, Part 1: safety measures for electronic measuring instruments”
and DIN VDE 0404	“Devices for technical safety testing of electrical equipment, part 1: General requirements, and part 2: Devices for periodic testing”

If used for its intended purpose, safety of the test case and of the user is assured. Their safety is however not guaranteed, if the test case is used improperly or handled carelessly.

In order to maintain flawless technical safety conditions, and to assure safe use, it is imperative that you read these operating instructions thoroughly and carefully before placing the test case into service, and that you follow all instructions contained herein.

Observe the following safety precautions:

- Measurements within electrical systems are prohibited!
- The test case may only be connected to 230/400 V mains system with 50 Hz and a 16 A fuse via the 5-pole (23) or 3-pole (22) mains cable.
- In order to avoid undesired shutdown in the event of a defective device under test, the mains outlets should be separately fused if at all possible!
  A defect in the DUT may trip the mains power RCD (residual current circuit breaker), and thus cause a service interruption. If DUTs are being tested which cannot be disconnected from the mains intermittently, an RCD (residual current circuit breaker) can also trip the power supply circuit (test per section 6.4.1).
  The manufacturer of the test case assumes no liability for loss of data or other damage which results from its use.
- Be prepared for the occurrence of unexpected voltages at devices under test. For example, capacitors may be dangerously charged.
- If the test case is connected via the earthing contact mains adapter, phase conductor L1 may be connected to the N safety socket if poled accordingly! If this is the case, reverse polarity of the plug at the mains adapter (see section 4.1).
- Before connecting the device under test to the test case, subject it to a thorough visual inspection first. Devices under test with visibly damaged insulation must be repaired before metrological testing is performed.
- If the test case and/or its connector cables demonstrate visible damage, no longer function, have been stored for a lengthy period of time under unfavorable conditions or have been subjected to excessive stress during transport, it must be assumed that hazard-free operation is no longer possible. If this is the case, remove the test case from service and secure it against inadvertent use, for example by locking it up.

Attention!
The NETZ-VDE switch (2) may only be set to the “NETZ” (mains) position after devices under test with a protective conductor have passed the protective conductor test.

For reasons of safety, the device under test must be turned off before switching to “Netz” (mains), so that dangerous devices under test (e.g. a circular saw) can only be switched on intentionally.

- Due to the fact that the test case is laid out in accordance with DIN VDE 0404, the “PE” safety socket and the “PE” contacts in the outlet may only be connected to the mains protective conductor after the NETZ-VDE switch has been set to the “Netz” (mains) position.
- In order to assure compliance with technical safety requirements, the test case may only be repaired by a qualified electrician, who is preferably employed by the manufacturer.
- Before opening the test case in order to carry out repairs, it must be disconnected from the mains by pulling the plug from the electrical outlet.
- Disconnect the test case from the mains whenever work is interrupted and secure it against unauthorized use, for example by locking the cover.
- Use recommended accessories only!

Meaning of Symbols on the Instrument

Warning concerning a source of danger
(attention: observe documentation!)

EC label of conformity

This device may not be disposed of with the trash. Further information regarding the WEEE mark can be accessed on the Internet at www.gossenmetrawatt.com by entering the search term WEEE.

3 Standard Equipment and Accessories

Scope of Delivery

1 test case
2 mains cables (Schuko and CEE16A)
1 measurement cable with test probe, 1 alligator clip
1 set of operating instructions

Accessories

SECU-cal 10 calibration adapter (M662A)
VL2 E test adapter for testing cables (Z745W)

4 Connecting the Test Case to the Mains and Testing the Mains Connection

4.1 Connecting the Test Case

Set the switches as follows before connecting to the mains:
Set the NETZ–VDE switch (1) to “NETZ”, set the METRATESTER 5+ measuring function selector switch (6) to “250 V”, set the polarity reversing switch (14) to “1”, set the L1-L2-L3 measuring selector switch (2) to “L1” and then connect the test case to the mains. Set the mains switch (9) and the RCD (residual current circuit breaker) (12) to “EIN” (on). According to the manufacturer, the emergency stop switch may generate minor humming noises with the U coil in certain armature positions. If this is the case, quickly turn the emergency stop switch on and off several times.
When connected via the 5-pole CEE mains adapter (23), indicator lamps L1, L2 and L3 (19) must light up, and when connected via the earthing contact mains adapter (22), only indicator lamp L1 should light up. Mains polarity is tested for this type of connection, i.e. if lamp L1 does not light up, the polarity of the earthing contact plug must be reversed in the mains outlet.
If this is not the case, immediately disconnect the test case from the mains.
The fault at the mains connection or the test case must be eliminated before executing any tests.

4.2 Testing Protective Conductor Potential

Touch the contact surface (7) with your finger, and touch a grounded object at the same time (e.g. a water pipe). The PE indicator lamp may not light up! If this is the case, potential between the protective conductor at the mains plug (22/23) and the contact surface (7) is ≤ 100 V.

When connected via the 5-pole CEE mains plug (23), indicator lamps L1, L2 and L3 (19) must light up. When connected via the earthing contact mains adapter (22), only indicator lamp L1 should light up. Mains polarity is tested for this type of connection, **i.e. if lamp L1 does not light up, the polarity of the earthing contact plug must be reversed in the mains outlet. If this is not the case, immediately disconnect the test case from the mains.** The fault at the mains connection or the test case must be eliminated before executing any further tests.
If the PE signal lamp lights up when you touch the contact surface (7), potential between the protective conductor at the mains plug (22/23) and the contact surface (7) is ≥ 25 V, i.e. the protective conductor is conducting voltage.

☞ **Note!**
Depending upon handling, potential transfer may occur which causes the PE signal lamp to light up. For example, this could be the case if you touch a device under test with the NETZ-VDE switch (1) in the "VDE" position, thus creating a capacitive voltage divider.

⚠ **Attention!**
If, while testing protective conductor potential, you determine that the mains protective conductor is conducting voltage, no measurements may be performed with the test case. If this is the case, potentially dangerous voltage is also present at the user accessible earthing contacts at the outlets, the "PE" socket (20) and the jack (4). Immediately disconnect the test case from the mains and arrange to have the fault eliminated at the mains connection. Voltage in the mains protective conductor also results in incorrect measured values when testing for the absence of voltage in accordance with DIN VDE 0701-0702 (see section 6.4.1).

4.3 Measuring Line Voltage

- Set the measuring function selector switch (6) to "250 V~".
- If connected via the 5-pole CEE mains adapter, set the measuring selector switch (2) to the L1, L2 and L3 settings, one after the other, and if connected via the earthing contact mains adapter set the switch to L1 and read the measured value from the LCD panel for each switch setting.
  Line voltage must always lie within the permissible range of 207 to 253 V.

☞ **Note!**
If line voltage is present, values are displayed at the with the measuring function selector switch (6) in each of its respective positions, even if no device under test has been connected.
The display of such numbers indicates that line voltage is present, regardless of the position to which the measuring function selector switch (6) has been set. If the selector switch has been set to "250 V~", these numbers represent the actual line voltage value. In all other detented switch positions – if no device under test has been connected – these numbers do not represent actual measured values.
If the test case has been connected via the earthing contact mains adapter, all tests and measurements can be performed except tests at 3-phase current devices under mains operating conditions.

5 Connecting the DUT to the Test Case

It is absolutely mandatory to execute the tests in the order in which they are specified here!

1 Visual inspection

2 Measurement of protective conductor resistance for protection class I devices

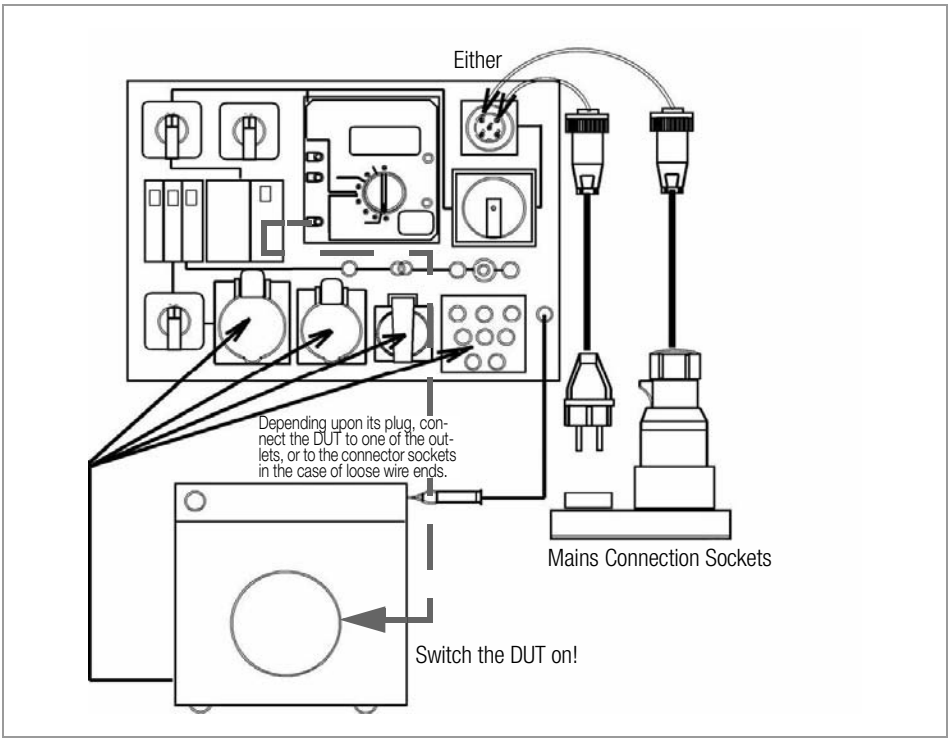
3 Measurement of insulation characteristics if technically feasible, i.e. if the DUT does not include any electrically actuated, all-pole switches:
   – Insulation resistance followed by protective conductor or equivalent leakage current
   – Otherwise: leakage current during operation, differential current, protection class I devices
      Contact current for protection class II devices
      Safety extra-low voltage (only at point of connection of safety extra-low voltage generated in the DUT)

4 Function Test

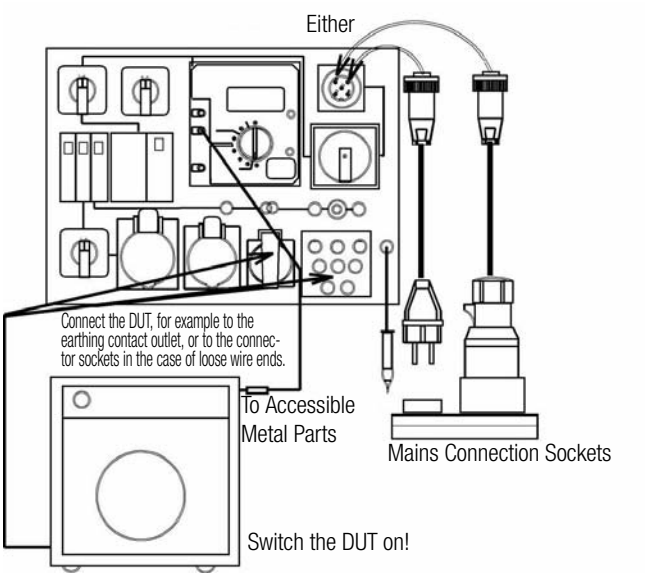
5 Labeling inspection

6 Documentation

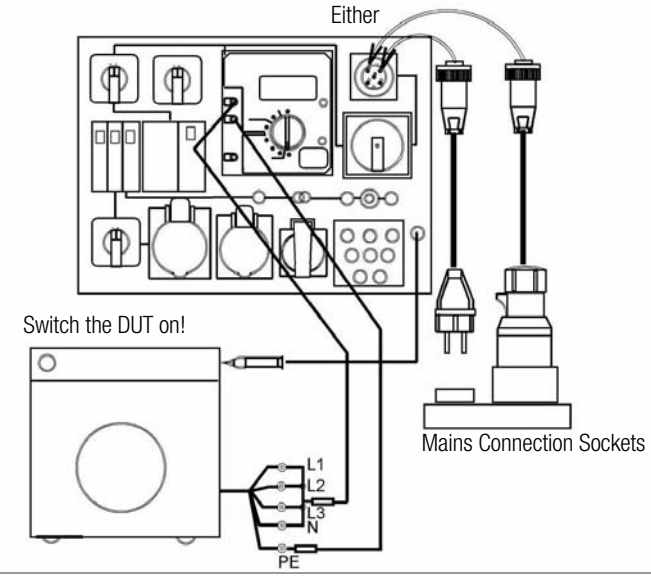
5.1 Protection Class I Devices



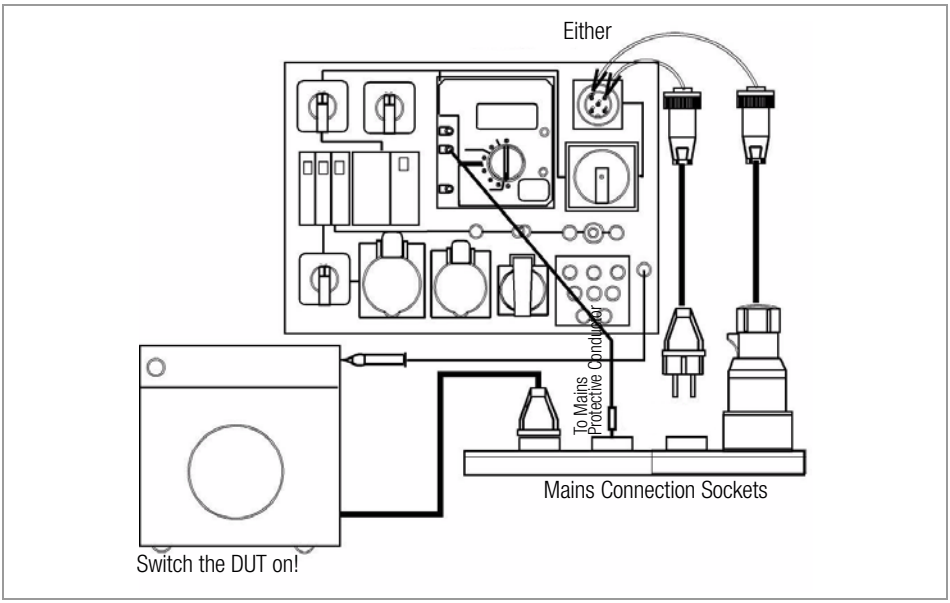
5.2 Protection Class II and III Devices



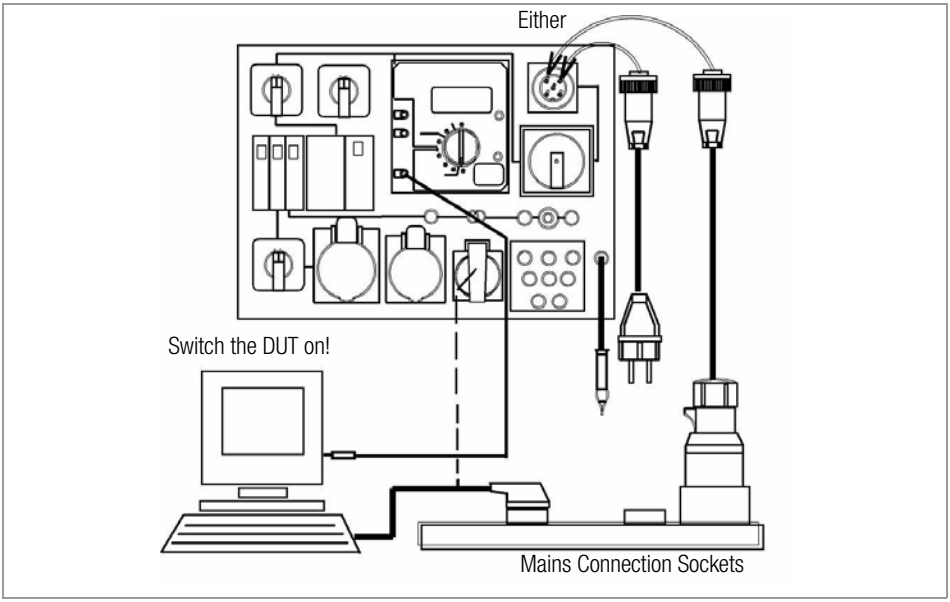
5.3 Devices with Single or Multi-Phase Connection without Plug



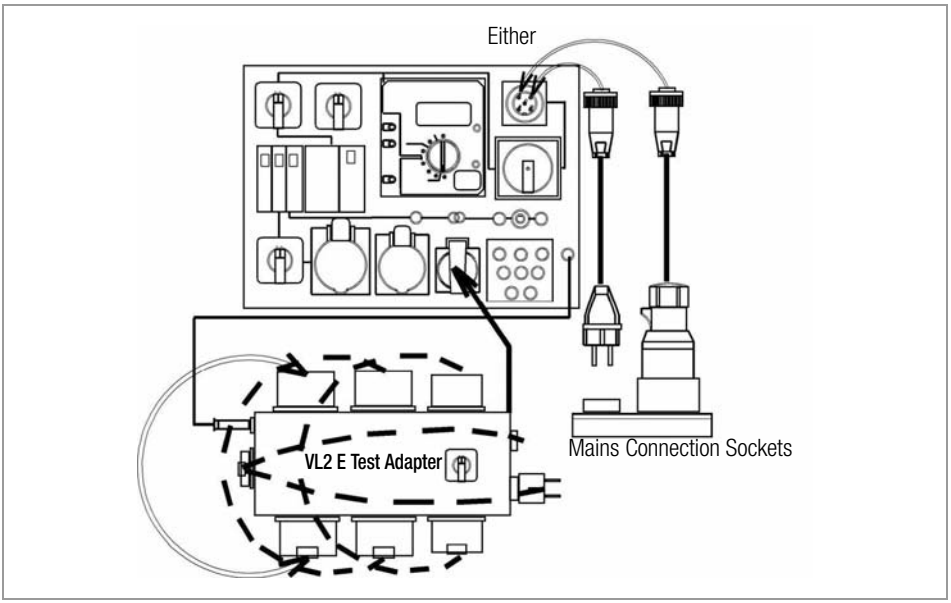
5.4 Stationary Devices for Protective Conductor Testing via the Supply Mains



5.5 Data Processing Equipment



5.6 Extension Cables with the VL2 E Accessory



5.7 Setting the Switches at the Test Case

The following settings must be made after visual inspection has been passed, and before the DUT is connected to the corresponding plug connectors at the test case, as well as before each new test:

NETZ–VDE switch (1)	Set to “VDE”
METRATESTER 5+ function selector switch (6)	Set to “I_{EA} 20 mA”
Polarity reversing switch (14)	Set to “1”
Measuring selector switch L1-L2-L3 (2)	Set to “L1”

5.8 Setting the Switches at the Device Under Test

Connect the device under test to the test case and switch all of its functions on, making sure that, for example, thermostat contacts are closed etc.

6 Testing Devices in Accordance with DIN VDE 0701-0702

Always measure protective conductor resistance first for safety class I devices under test. Measurement of insulation resistance, equivalent leakage current and protective conductor current is not possible without a properly functioning protective conductor. This measurement is of special importance because a defective or reversed protective conductor may represent a hazard for the user!

☞ **Note!**
Please note that the display indicates overloading when measuring protective conductor resistance and insulation resistance, if the terminals are open or if the upper range limit is exceeded. Only “O.L” appears at the display in this case.

☞ **Note!**
The limit values specified in the following sections correspond to the current status at the time or printing. Please note that normative legislation is continuously updated to meet the safety requirements necessitated by changing market situations, and that the listed limit values are thus subject to change.

6.1 Measuring Protective Conductor Resistance for Protection Class I Devices

Connect the single-pole probe cable with test probe and clip (21) to the housing of the DUT in accordance with section 5.1. Assure good contact. In the case of stationary DUTs, measurement can be performed without interrupting the mains connection. To this end, connection must first be established from the protective conductor socket (4) at the METRA-TESTER 5+ to a protective conductor which has been previously tested for the absence of voltage – for example at an outlet within the electrical system – which is connected with the protective conductor of the DUT. When testing in accordance with DIN VDE 0701-0702, DUTs with external connections such as data cables etc. can be tested within their entire configuration at the installation site (see section 5.4 regarding connection).
However, due to the fact that this test does not provide any indication as to the safety of the device under test, complete testing via the connector sockets at the test case must be performed as soon as disconnection from the mains and the connector cables is possible – insofar as permitted by the device.

- ➪ Set the measuring function selector switch (6) to the “20 Ohm” range.
- ➪ Read the measured value in Ohms at from the LCD panel, and compare it to permissible values in accordance with DIN VDE 0701-0702.

Protective conductor resistance may not exceed the following resistance values:

Maximum Permissible Values for Protective Conductor Resistance Relative to Cable Length (per DIN VDE 0701-0702:2008)

Lengths up to [m]	5	12.5	20	27.5	35	42.5	50	More than 50
Max. resistance [Ω]	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0

A value of 1 Ω may not be exceeded on any case. The table applies to cable reels and extension cables as well.

In the case of longer cables, 0.1 Ohms is added per additional 7.5 m cable length regardless of conductor cross-section.

Attention!
The connector cable must be shaken back and forth, section by section over its entire length, during measurement (for permanently installed devices only insofar as the connector cable is accessible during repair, modification or testing).

Unrealistic, continuously changing measured values indicate poor contact, a damaged protective conductor or a broken core in the probe cable (21) in the event that it has been excessively stressed! If brief or continuous interruption of the protective conductor occurs during the manual step of the continuity test, the limit value indicator at the METRATESTER 5+ test instrument lights up and an acoustic warning signal is generated. In such cases, the interruption must be repaired in a professional manner and measurement must be repeated.
Measurement of protective conductor resistance is of course impossible for devices which are not equipped with a protective conductor (e.g. protection class II and III devices).

6.2 Measuring Insulation Resistance

This test must be performed on all DUTs for which all insulation is checked during testing without applying mains voltage (practically all DUTs without electrically actuated switches and relays). If this is only possible after applying mains voltage, testing in accordance with section 6.3.2/section 6.4.1 must be performed. If there is any doubt about performing measurement with insulation voltage, for example at electronic devices, measurement must also be performed in accordance with section 6.3.2/section 6.4.1.
It must be assured that all switches, thermostats etc. are closed!

Attention!
Do not touch the instrument's terminal contacts during insulation resistance measurements!

If nothing has been connected to the terminal contacts, or if a resistive load component has been connected for measurement, your body would be exposed to a current of approx. 1 mA at a voltage of 500 V. The resulting electrical shock is not life endangering. However, the noticeable shock may lead to injury (e.g. resulting from a startled reaction etc.).

Attention!
If measurement is performed at a capacitive object such as a long cable, it becomes charged with up to approx. 500 V! **Touching such objects is life endangering!**

In accordance with DIN VDE 0701-0702, L1, L2, L3 and N (short-circuited) are measured against PE during this test (connection per section 5.2).

- Switch the DUT on in all functions.
- Set the NETZ-VDE switch to "VDE".
- Set the measuring function selector switch (6) to the "20 MOhm" range.
- Read the measured value in MOhms at from the LCD panel, and compare it to permissible values in accordance with DIN VDE 0701-0702.

Limit Values per DIN VDE 0701-0702, Part 1: 2008

Device Type	Limit Values	Min. Display Value
Protection class I devices	1MΩ	1.15 MΩ
Protection class I devices with heating elements	0.3 MΩ [1)]	0.38 MΩ
Protection class II devices	2.0 MΩ	2.25 MΩ
Protection class III and battery powered devices	1000 Ω/V and 250 kΩ	

[1)] If the limit value is fallen short of, an equivalent leakage current measurement must be performed and passed.

Note: "OL" at the display means measured value > 20 MΩ.

Evaluation of Measured Values

Device measuring error must be taken into consideration in order to make absolutely sure that the limit values for insulation resistance have not been fallen short of. The following table allows for calculation of the required minimum value for insulation resistance which must be displayed at the device in consideration of maximum measuring error (under nominal conditions of use), in order to assure that the required limit values are not fallen short of (DIN VDE 0413, part 1). Intermediate values can be interpolated.

Limit Value, MΩ	Min. Display Value
0.25	0.33
0.3	0.38
0.5	0.60
1.0	1.15
2.0	2.25
7.0	7.75
10.0	11.05

Attention!
Insulation resistance must be measured with a test probe connected to the appropriate socket (4) in accordance with figure 5.2 at all exposed, conductive parts for protection class II and III devices, as well as for battery powered devices.

This test is omitted for protection class III and battery powered devices which fulfill the following conditions:
Nominal power ≤ 20 VA
Nominal voltage ≤ 42 V
Batteries must be disconnected during testing of battery powered devices.

Note!
In the event of long-term short-circuiting in the 20 MOhm range, measuring current is reduced after approximately 10 minutes. This is indicated by a triangle which appears at the top left-hand portion of the display panel. A nominal current of 1 mA, as specified by DIN VDE 0413 and DIN VDE 0701-0702, is no longer assured when the triangle appears. After the short-circuit has been eliminated and a brief cool-down period has elapsed, the triangle disappears and measurements once again comply with VDE conditions.

6.3 Measuring Protective Conductor Resistance

6.3.1 Equivalent Leakage Current

In accordance with DIN VDE 0701-0702:2008, protective conductor resistance must be measured after the performance of the insulation resistance measurement. We recommend equivalent leakage current measurement.

The limit value is:

- 3.5 mA for protection class I devices whose exposed conductive parts are connected to the protective conductor.
- 1 mA per kW of heating power for protection class I devices with heating elements with a total connected load of greater than 3.5 kW , whose exposed conductive parts are connected to the protective conductor.

Attention!
Do not touch the instrument's terminal contacts during equivalent leakage current measurement!

- ⇨ Connection is the same as for insulation resistance measurement.
- ⇨ Set the NETZ-VDE switch to "VDE".
- ⇨ Set the measuring function selector switch to "I_{EA} 20 mA".
- ⇨ Switch all DUT functions on and make sure, for example, that all thermostat contacts and the like are closed.
- ⇨ Read the measured value in "mA" from the LCD panel.
  In accordance with DIN VDE 0701-0702, the displayed current value between parts to which voltage is applied during operation and exposed metal parts may not exceed 3.5 mA, or 1 mA per kW for devices with > 3.5 kW heating power.

Note!
Leakage current measurement in accordance with the respective device regulations is usually not possible, because the device would have to be set up in an electrically isolated fashion, or connected to an earth isolated power supply to this end. Equivalent leakage current is measured for this reason. Resultant measured values are not directly comparable with the leakage current values set forth in the device regulations.

6.3.2 Differential Current Measurement for Protection Class I Devices

This test must be executed for all devices for which it is not possible to measure insulation resistance at all safety relevant parts (practically all DUTs with electrically actuated switches and relays), or where there is any doubt regarding measurement with insulation voltage, for example at electronic devices. If the DUT is equipped with a non-polarized mains plug, the test must be performed with the mains plug poled in both directions. The measurement of residual current includes the sum of instantaneous current values in L1, L2, L3 and N.

Attention!
The DUT is placed into operation, and this test may not be performed until the protective conductor test has been passed.

- Turn off the device under test.
- Plug the DUT into the appropriate surface mount socket (15, 17, 18) at the test case.
- Set the L1/L2/L3 switch (2) to “L1”.
- Set the NETZ-VDE switch (1) to “NETZ”.
- Signal lamps L1, L2 and L3 (19) indicate the presence of line voltage.
- Place the device under test into service by switching it on.
- Set the measuring function selector switch (6) at the METRATESTER 5+ test instrument to the “I_{Diff} 20 mA” position and read the differential current value in mA from the display at the test instrument.

The limit value is 3.5 mA, or 1 mA per kW of heating power for DUTs with heating elements with a with a total connected load of greater than 3.5 kW.

Note!
For devices with permissible protective conductor current of greater than 3.5 mA in accordance with the device standards, special protective conductor connection must be observed and the following warning sign must be present: “High leakage current! – connect protective conductor before connecting to the mains” (DIN 4844). Measurements must be performed with the mains plug poled in both positions (if the plug is reversible). The larger of the two measured values is deemed valid. The possibility of a symmetrical error must be taken into consideration with multi-phase devices. Data cables, as well as gas and water supply lines with potential to ground, for example, do not have to be disconnected from the DUT for this measurement.

If no device under test has been connected, numbers appear at the digital display which do not represent any actual measured value.

6.4 Measuring Contact Current

6.4.1 Contact Current Measurement – Differential Current

This test must be executed for all protection class II devices, as well as protection class I devices with exposed conductive parts which are not connected to the protective conductor (practically all DUTs with electrically actuated switches and relays). If the DUT is equipped with a non-polarized mains plug, the test must be performed with the mains plug poled in both directions. Connection per section 5.1.
The larger of the two measured values is deemed valid. Testing in accordance with the differential current measuring method.

Attention!
The DUT is placed into operation.

- Turn off the device under test.
- Plug the DUT in to the appropriate surface mount socket at the test case.
- Connect a measurement cable with test probe to the socket/terminal (5), and contact all exposed conductive parts at the DUT, or all conductive parts which are not connected to the protective conductor at protection class I devices.
- Set the L1/L2/L3 switch (2) to “L1”.
- Set the NETZ-VDE switch (1) to “NETZ”.
- Signal lamps L1, L2 and L3 (19) indicate the presence of line voltage.
- Place the device under test into service by switching it on.
- Set the measuring function selector switch (6) at the METRATESTER 5+ test instrument to the “I_{Diff} 20 mA” position and read the differential current value in mA from the display at the test instrument.

The limit value is 0.5 mA.

6.4.2 Testing in Accordance with the Direct Method

The DUT can remain connected to the mains for this test. When testing in accordance with DIN VDE 0701-0702, DUTs with external connections such as data cables etc. can be tested within their entire configuration at the installation site. However, due to the fact that this test does not provide any indication as to the safety of the device under test, complete testing via the connector sockets at the test case must be performed as soon as disconnection from the mains and the connector cables is possible – insofar as permitted by the device.

Note!
If the DUT is defective, the electrical system’s RCD (residual current circuit breaker) may be tripped during this test which would result in interruption of supply power.

- Connect the test case to an electrical outlet within the same power supply circuit to which the device under test is also connected to this end.

- Connect a measurement cable with test probe to the socket/terminal (5), and contact all exposed conductive parts at the DUT, or all conductive parts which are not connected to the protective conductor at protection class I devices.
- Set the measuring function selector switch (6) at the METRATESTER 5+ test instrument to the "I_A 2 m" position and read the contact current value in mA from the display at the test instrument.

The limit value is 0.5 mA.
If no device under test has been connected, numbers appear at the digital display which do not represent any actual measured value.

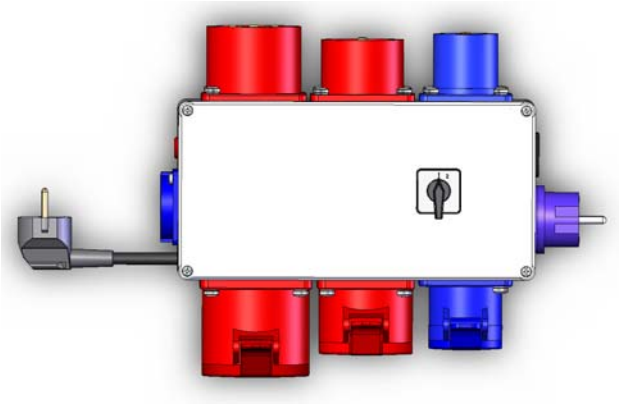
6.5 Measuring Load Current and Voltage at the Consumer

- Turn off the device under test.
- Plug the DUT into the appropriate surface mount socket (15, 17, 18) at the test case.
- Set the L1/L2/L3 switch (2) to "L1".
- Set the NETZ-VDE switch (1) to "NETZ".
- Signal lamps L1, L2 and L3 (19) indicate the presence of line voltage.
- Place the device under test into service by switching it on.
- Set the measuring function selector switch (6) to "16 A~" for the measurement of current consumption, and to "250 V~" for the measurement of voltage against the neutral conductor.
- The phase (L1, L2 or L3) at which current consumption and voltage is to be measured can be selected for three-phase consumers with the measuring selector switch (2).

☞ **Note!**
During measurement of current consumption by switching to the various phases, the DUT may be switched off if it's equipped with, for example, an undervoltage trigger. The DUT must be switched back on again in this case.

7 Testing Extension Cables with the VL2 E Accessory

Testing in accordance with the wiring diagram in section 5.6



7.1 DIN VDE Tests for Extension Cables

Always set the NETZ-VDE switch (1) to “VDE” for these tests.

Protective Conductor Resistance Measurement

Perform test as described in section 6.1. The probe cable (21) is connected to the SI socket in the VL2 E test adapter.

Insulation Resistance Measurement

The rotary selector switch remains in position 1.
Perform test as described in section 6.2. A value of 2 MOhm should not be significantly exceeded.

7.2 Function Test for Extension Cables

Execute this test in accordance with the operating instructions for the 0701-0702 test instrument, using the test described under “Measuring Insulation Resistance”.
The following characteristics can be tested with this procedure:

- Testing of AC cables for short-circuiting and continuity and
- Additional testing of 3-phase cables and caravan cables for reversed wiring of L1, L2, L3 and N (clockwise rotation).

⇨ Set the rotary selector switch to position 2.

⇨ Read the measured value.

The display can settle in within a range of 0 Ohm (if all cores are short-circuited) up to, for example, infinity (in the event of overload) if one core is interrupted. Due to good insulation assured by undamaged cables, a test value of 10 MOhm with a tolerance of 20% has been established for this rational test procedure.

All values within a range of 8 to 12 MOhm thus indicate that the test has been passed.

In the event of an error, the actual defect, i.e. core short-circuiting, core interruption, core reversal or too little insulation, must be determined. Do not touch the connector plugs of long extension cables after testing, because they may be electrically charged.

8 Continuity Test with Extra-Low Voltage

Objects can be tested for continuity with the help of the “Durchgang” (continuity) indicator lamp (10). Connect the DUT to the two connector sockets (11) to this end. Testing is conducted with safety extra-low voltage of no greater than 33 V AC.

9 Display and Indicators at the Test Instruments

METRATESTER 5+ Display and Indicating Devices

PE Indicator Lamp

Indicates whether or not voltage is present.

Error Lamp

The red error lamp indicates exceeded limit values when measuring protective conductor current, insulation resistance, equivalent leakage current, contact current, leakage current and differential current.

Piezo Buzzer

In the event that the error lamp lights up in order to indicate that the respective, critical limit value has been exceeded, the buzzer also generates an acoustic signal.

9.1 Indication of Errors and Limit Values

Error Message	Condition	PE Indicator Lamp
Mains protective conductor potential	$U_B \geq 25$ V	When the contact surface is touched

The following limit values are indicated:

Measurement	Fault Condition per Standard	Indication of Exceeded Limit Value at the Test Instrument		
		Continuously Lit Red Error Lamp	Display of Limit Values	Continuous Buzzing (beeper)
Protective conductor resistance	R_{SL} > 0.3 Ω [1]	•	> 0.3 Ω	—
	R_{SL} > 1 Ω [2]	•	> 1 Ω	•
Insulation resistance	Heater [3]: R_{ISO} < 0.3 MΩ	•	< 0.5 MΩ	•
	PCI: R_{ISO} < 1.0 MΩ	•	< 2.0 MΩ	—
	PCII: R_{ISO} < 2.0 MΩ	—	< 2.0 MΩ	—
Equivalent leakage current	I_{EA} > 3.5 mA	•	—	—
		•	> 7.0 mA [4]	•
Leakage/contact current (verification of absence of voltage)	I_A > 0.25 mA	•	> 0.25 mA	—
	I_A > 0.5 mA	•	> 0.5 mA	•
Differential current	I_{Diff} ≥ 3.5 mA	•	—	•

1) Resistance between housing and mains plug for connector cables up to 5 meters long
2) 0.1 Ω is added for each additional 7.5 meters of cable length, up to a maximum of 1 Ω
3) For protection class I devices with activated heating elements
(if heating power > 3 kW and R_{ISO} < 0.3 MΩ: leakage current measurement is required)
4) This limit value refers to all-pole switches (corresponds to doubling the limit value or cutting actual measuring current in half)

10 Technical Data

10.1 Test case

Power Supply

Nominal line voltage	230/400 V 50 Hz
Mains connection	230 V 1P+N+PE 16 A earthing contact plug with coupling socket or 230/400 V 3P+N+PE 16 A CEE plug with coupling socket or 230/400 V 3P+N+PE 32 A CEE plug with coupling socket, **max. 16 A !**
Throughput rating:	
Rated input per phase	16/20 A, 10 min., protection class I
Measuring category	300 V CAT II
Pollution degree	2
RCD (RCCB)	4-pole, I_N 25 A, I_A 0.03 A
Protection, case:	IP 40 per DIN VDE 0470, part 1, connections: IP 20
Dimensions (WxHxD)	Approx. 380 x 300 x 220 mm with cover
Weight	Approx. 7.5 kg

10.2 METRATESTER 5+ Test Instrument

Measuring Qty.	Measuring Range	Resolution	$U_{no\text{-}load}$	R_i	I_K	I_N
Protective conductor resistance	0 … 19.99 Ω	10 mΩ	< 20 V –	—		> 200 mA
Insulation resistance	0.05 … 19.99 MΩ	10 KΩ	600 V –	Approx. 100 kΩ	< 10 mA	> 1 mA
Equivalent leakage current,	0 … 19.99 mA ~	10 µA	28 V ~	2 kΩ	< 20 mA	—
Contact current (verification of absence of voltage by means of current measurement)	0 … 1.999 mA ~	1 µA		2 kΩ		
Differential current	0,01 … 19.99 mA ~	10 µA				

Measurements During Operation

Measuring Quantity	Measuring Range	Resolution
Line voltage	207 … 253 V ~	1 V
Load current via mains outlet	0 … 16.00 A ~	10 mA

Overload Capacity

Load current via mains outlet, differential current	19 A, 5 min.
All other measured quantities	250 V continuous

Intrinsic Uncertainty and Measuring Uncertainty

Measured Quantity	Intrinsic Uncertainty	Measuring Uncertainty
Protective conductor resistance	± (2.5% rdg. + 2 d)	± (10% rdg. + 5 d)
Insulation resistance, 0 … 19.99 MΩ	± (2.5% rdg. + 2 d)	± (10% rdg. + 5 d)
Equivalent leakage current	± (2.5% rdg. + 2 d)	± (10% rdg. + 5 d)
Verification of absence of voltage by means of current measurement (contact current)	± (2.5% rdg. + 2 d)	± (10% rdg. + 5 d)
Differential current	± (4% rdg. + 5 d)	± (10% rdg. + 5 d)
Line Voltage	± (2.5% rdg. + 2 d)	± (10% rdg. + 5 d)
Load current via mains outlet	± (2.5% rdg. + 2 d)	± (10% rdg. + 5 d)

Reference Conditions

Ambient temp.	+23 °C ±2 K
Relative humidity	40 … 60%
Line voltage	230 V ±1%
Measured quantity frequency	50 Hz ±0.2%
Measured quantity waveshape	Sine (deviation between effective and rectified value: ±0.5%)

Influencing Quantities and Influence Error

Influencing Quantity / Sphere of Influence	Designation per DIN VDE 0404	Influence Error ± … % of the measured values
Change of position	E1	—
Change to test equipment supply voltage	E2	2.5
Temperature fluctuation 0 … 21 ° C and 25 … 40° C	E3	Specified influence error valid starting with temperature changes as of 10 K: 1 for protective conductor resistance 0.5 for all other measuring ranges
Amount of current at DUT	E4	2.5
Low frequency magnetic fields	E5	2.5
DUT impedance	I6	2.5
Capacitance during insulation measurement	E7	2.5
Waveshape of measured current	E8	
49 … 51 Hz		2 with capacitive load (for equiv. leakage current)
45 … 100 Hz		1 (for contact current)
		2.5 for all other measuring ranges

Display and Indicating Devices

LCD

Display range	0 ... 1999 digits, 3½ places
Character height	17 mm and special characters
Overflow	Indicated by displaying “OL”
Overtemp. R_{ISO}	In case of long-term short-circuit: “R_{ISO}” and “MΩ” segments blink

PE Indicator Lamp

Indicates whether or not voltage is present.

Error Lamp

The red error lamp indicates exceeded limit values when measuring protective conductor current, insulation resistance, equivalent leakage current, contact current, leakage current and differential current.

Piezo Buzzer

In the event that the error lamp lights up in order to indicate that the respective critical limit value has been exceeded, the buzzer also generates an acoustic signal.

Power Supply

Line voltage	230 V / 50 Hz
Throughput rating	Max. 3700 VA, depending upon load at the mains outlet

Electrical Safety

Protection class	II
Nominal line voltage	230 V
Test Voltage	Mains + PE (mains) + 2 mA socket for testing for absence of voltage at test socket, connector sockets for phase and protective conductors, as well as clip: 3 kV~ mains to PE (mains) + 2 mA socket 1.5 kV~
Measuring category	II
Pollution degree	2
Safety shutdown	If test instrument overheats

Electromagnetic Compatibility (EMC)

Product standard EN 61326-1: 2006

Interference Emission		Class
EN 55022		A
Interference Immunity	Test Value	Feature
EN 61000-4-2	Contact/atmos. – 4 kV / 8 kV	B
EN 61000-4-3	10 V/m	B
EN 61000-4-4	Mains connection – 2 kV	B
EN 61000-4-5	Mains connection – 1 kV	A
EN 61000-4-6	Mains connection – 3 V	B
EN 61000-4-11	0.5 period / 100 %	A

Ambient Conditions

Operation	– 10 ... + 55° C
Storage	– 25 ... + 70° C
Humidity	Max. 75 %, no condensation allowed
Elevation	To 2000 m

Mechanical Design

Dimensions	W x H x D: 190 x 140 x 95 mm
Weight	1.3 kg
Protection	Housing: IP 40, connections: IP 20

Table Excerpt Regarding Significance of IP Codes

IP XY (1^{st} char. X)	Protection against foreign object entry	IP XY (2^{nd} char. Y)	Protection against the penetration of water
0	not protected	0	not protected
1	≥ 50.0 mm diameter	1	vertically falling drops
2	≥ 12.5 mm diameter	2	vertically falling drops with enclosure tilted 15°
3	≥ 2.5 mm diameter	3	spraying water
4	≥ 1.0 mm diameter	4	splashing water

11 Maintenance – Recalibration

11.1 Housing Maintenance

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

☞ **Note!**
If the test case has not been used for a long period of time, the switches may demonstrate increased contact resistance depending upon storage conditions. If this is the case, actuate the switches several times.

11.2 Recalibration

The respective measuring task and the stress to which your measuring instrument is subjected affect the ageing of the components and may result in deviations from the guaranteed accuracy.

If high measuring accuracy is required and the instrument is frequently used in field applications, combined with transport stress and great temperature fluctuations, we recommend a relatively short calibration interval of 1 year. If your measuring instrument is mainly used in the laboratory and indoors without being exposed to any major climatic or mechanical stress, a calibration interval of 2-3 years is usually sufficient.

During recalibration* in an accredited calibration laboratory
(DIN EN ISO/IEC 17025) the deviations of your instrument in relation to traceable standards are measured and documented. The deviations determined in the process are used for correction of the readings during subsequent application.

We are pleased to perform DKD or factory calibrations for you in our calibration laboratory. Please visit our website at www.gossenmetrawatt.com (→ Services → DKD Calibration Center or → FAQs → Calibration questions and answers).

By having your measuring instrument calibrated regularly, you fulfill the requirements of a quality management system per DIN EN ISO 9001.

☞ **Note!**
These tests can be performed on-site with the SECU-cal 10 calibration adapter accessory.

* Verification of specifications or adjustment services are not part of the calibration. For products from our factory, however, any necessary adjustment is frequently performed and the observance of the relevant specification is confirmed.

11.3 Periodic Self-Test of the Connector Cable for Protective Conductor Continuity

Connect the probe cable (21) to a grounding contact which has been previously tested for absence of voltage (e.g. at an electrical outlet), and which is connected to the protective conductor in the connector cable, and set the NETZ-VDE switch (1) to “NETZ”. Then measure protective conductor resistance as described in section 5.4. If an excessively high protective conductor resistance value is displayed at the LCD panel or if overloading is indicated (only “O.L” appears), protective conductor resistance is too high or the protective conductor is interrupted. Eliminate the interruption (in the cable or at the NETZ-VDE switch).

11.4 Testing the Integrated RCD (residual current circuit breaker)

Test on a regular basis. The integrated RCD (residual current circuit breaker) can be tested by pressing the test key. Breaking current value and time can be measured with test instruments for DIN VDE 0413, part 6.

11.5 Fuse Replacement

All fuses can be accessed from outside. Only fuses with the breaking characteristics and rated current values specified on the front panel may be used.

11.6 Return and Environmentally Sound Disposal

The **METRATESTER 5+** | **3P** 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 below).

12 Repair and Replacement Parts Service Calibration Center * and Rental Instrument Service

If required please contact:

GMC-I Service GmbH
Service Center
Thomas-Mann-Str. 20
90471 Nürnberg, Germany
Phone +49 911 817718-0
Fax +49 911 817718-253
E-mail service@gossenmetrawatt.com
www.gmci-service.com

This address is only valid in Germany. Please contact our representatives or subsidiaries for service in other countries.

* **DKD Calibration Laboratory for Measured Electrical Quantities**
DKD–K–19701 accredited per DIN EN ISO/IEC 17025:2005

Accredited measured quantities: direct voltage, direct current values, DC resistance, alternating voltage, alternating current values, AC active power, AC apparent power, DC power, capacitance, frequency and temperature

Competent Partner

GMC-I Messtechnik GmbH is certified in accordance with DIN EN ISO 9001:2008.
Our DKD calibration laboratory is accredited by the Deutscher Kalibrierdienst (German Calibration Service) in accordance with DIN EN ISO/IEC 17025:2005 under registration number DKD–K–19701.
We offer a complete range of expertise in the field of metrology: from **test reports** and **factory calibration certificates**, right on up to **DKD calibration certificates**.
Our spectrum of offerings is rounded out with free test equipment management.
An on-site **DKD calibration station** is an integral part of our service department. If errors are discovered during calibration, our specialized personnel are capable of completing repairs using original replacement parts.
As a full service calibration laboratory, we can calibrate instruments from other manufacturers as well.

13 Product Support

If required please contact:

GMC-I Messtechnik GmbH
Product Support Hotline
Phone +49 911 8602-112
Fax +49 911 8602-709
E-mail support@gossenmetrawatt.com

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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