

PROFITEST H+E EXPERT CHECK

Test Instrument and Function Tester for AC Charging Stations per IEC 61851-1, VDE 0122-1

3-447-180-03

1/9.23



Table of Contents

1	Safety Instructions	1
1.1	General	1
1.2	Personnel Qualifications	1
1.3	Handling the Tester	1
1.4	Damaged Tester	2
2	Applications.....	3
2.1	Intended Use / Use for Intended Purpose.....	3
2.2	Use for Other than Intended Purpose	3
2.3	Liability and Guarantee.....	3
2.4	Opening the Tester / Repairs.....	3
3	Documentation	4
4	Getting Started	5
5	Background Knowledge Concerning Electromobility	6
5.1	Charging Point / Wallbox.....	6
5.2	Charging Cables	6
5.3	Plugs.....	6
6	The Tester.....	8
6.1	Functions Description.....	8
6.2	Device Characteristics.....	8
6.3	Scope of Delivery	8
6.4	Device Overview.....	9
6.5	Relevant Standards.....	10
6.6	Technical Data	11
7	User Interface	13
8	Initial Startup	14
8.1	Unpacking the Tester	14
8.2	Power Supply.....	15
9	Operation	16
9.1	Switching the Tester On	16
9.2	Language Selection.....	16

- 9.3 Performing Tests and Inspections 16
- 9.4 Switching the Tester Off..... 19
- 10 Registering the Tester.....20**
- 11 Maintenance20**
 - 11.1 Cleaning..... 20
 - 11.2 Fuse..... 20
- 12 Contact, Support and Service22**
- 13 CE Declaration.....23**
- 14 Returns and Environmentally Sound Disposal24**

1 Safety Instructions

1.1 General

- Carefully and completely read and adhere to these operating instructions. The documents can be found at <http://www.gossenmetrawatt.com>. Retain these documents for future reference.
- Carefully and completely read and adhere to the product documentation for the tested/inspected AC charging point.
- Use only the specified accessories (included in the scope of delivery or listed as options) with the tester.
- Use the tester and the accessories only for their intended purpose in accordance with this documentation and the documentation for the associated test/measuring instrument. Safety of the operator, as well as that of the tester, is only assured when it's used for its intended purpose.
- Carefully and completely read and adhere to the product documentation for the associated test/measuring instrument.

1.2 Personnel Qualifications

- The tester is designed exclusively for use by qualified electricians.

1.3 Handling the Tester

- Observe and comply with all safety regulations which are applicable for your work environment.
- Only use the tester and its accessories within the limits of the specified technical data and conditions (ambient conditions, IP protection code, measuring category etc.).
Pay particular attention to maximum permissible loads for all connections.
- Do not use the tester in humid environments where condensation occurs, or in environments with explosive gases.
- Never plug in wet connector plugs.
- Connect the test setups correctly in order to prevent injury to persons and damage to the equipment.
- The USB socket must be covered when executing tests. Use the cover attached to the tester for this purpose.
- No electrical loads may be connected to or operated via the measuring sockets or the earthing contact socket.
- Do not use the tester and its accessories after long periods of storage under unfavorable conditions (e.g. humidity, dust or extreme temperature).

- Do not use the tester and its accessories after extraordinary stressing due to transport.
- Do not expose the tester to direct sunlight.
- The tester may only be used as long as the fuses are in flawless condition. Defective fuses must be replaced.
- Never bypass the fuses. Never disable the fuses.

1.4 Damaged Tester

- The tester may not be used:
 - If external damage is apparent
 - If the test plug is damaged
 - If it no longer functions flawlessly
 - After long periods of storage under unfavorable conditions (e.g. humidity, dust or extreme temperature)
 - If any changes have been made to the tester itself or to the accessories
 - If internal damage to the tester or accessories can be detected (e.g. loose parts in the housing)
- If the tester or its accessories don't function flawlessly, permanently remove the tester/accessories from operation and secure them against inadvertent use.
- If the tester or accessories are damaged during use, for example if they're dropped, permanently remove the tester/accessories from operation and secure them against inadvertent use.

2 Applications

Please read this important information!

2.1 Intended Use / Use for Intended Purpose

The PROFITEST H+E EXPERT CHECK is a tester for checking AC charging points in accordance with DIN EN/IEC 61851-1 (VDE 0122-1). The tester can be used to check the performance of AC charging points. In combination with measuring/test instruments from the PROFITEST MF or PROFITEST MASTER IQ series, the effectiveness of protective measures can be tested at AC charging points.

The tester is intended exclusively for function tests conducted on AC charging points in charging mode 3. The tester can be connected to AC charging points with type 2 inlet or permanently attached type 2 cable (extended CP test pin for permanently attached cables).

Safety of the operator, as well as that of the tester, is only assured when it's used for its intended purpose.

2.2 Use for Other than Intended Purpose

Use of the tester for any purposes other than those described in these operating instructions is contrary to use for intended purpose.

In particular, the tester is not suitable for use as an adapter for vehicle simulation in accordance with VDE 0122-1 (DIN EN 61851-1) for the performance of required, standards-compliant testing of charging infrastructures for electric road vehicles and the associated part of the electrical system.

2.3 Liability and Guarantee

Gossen Metrawatt GmbH assumes no liability for property damage, personal injury or consequential damage resulting from improper or incorrect use of the product, in particular due to failure to observe the product documentation. Furthermore, all guarantee claims are rendered null and void in such cases.

Nor does Gossen Metrawatt GmbH accept any liability for data loss.

2.4 Opening the Tester / Repairs

The tester may only be opened by authorized, trained personnel in order to ensure flawless, safe operation and to assure that the guarantee isn't rendered null and void. Even original replacement parts may only be installed by authorized, trained personnel.

Unauthorized modification of the tester is prohibited.

If it can be ascertained that the tester has been opened by unauthorized personnel, no guarantee claims can be honored by the manufacturer with regard to personal safety, measuring accuracy, compliance with applicable safety measures or any consequential damages.

3 Documentation

Identifiers

The following identifiers are used in this documentation:

Identifier	Meaning
 Attention! Warning	Safety information that must be complied with
 Note! Important	Important information which must be taken into consideration and complied with
✓ Prerequisite	A condition etc. which must be fulfilled before a given action can be taken
1. Procedural step	Steps of a procedure which must be completed in the specified order
↳ Result	Result of a procedural step
• Enumeration	Bullet lists
– Enumeration	
Figure 1: Caption	Description of the content of a figure
Table 1:	Description of the content of a table
Footnote	Comment

4 Getting Started

1. Read and adhere to the product documentation. In particular, observe all safety information in the documentation, on the tester and on the packaging.
 - ⇒ “Safety Instructions” 1
 - ⇒ “Applications” 3
 - ⇒ “Documentation” 4
2. Familiarize yourself with the tester.
 - ⇒ “Background Knowledge Concerning Electromobility” 6
 - ⇒ “The Tester” 8
 - ⇒ “User Interface” 13
3. Start up the tester ⇒ “Initial Startup” 14.
4. Execute measurements and tests ⇒ “Operation” 16.

5 Background Knowledge Concerning Electromobility

5.1 Charging Point / Wallbox

Electric vehicles are charged with alternating current (AC) at AC charging points in charging mode 3 with type 2 plug. Since electric vehicle batteries can only store direct current (DC), the alternating current is converted to direct current by the electric vehicle's on-board charger.

AC charging points are available for single-phase or three-phase connection. In the case of single-phase connection, currents of up to 20 A are permissible. Three-phase connections are designed for currents of up to 32 A.

Electric vehicles are charged with direct current at so-called fast charging points.

5.2 Charging Cables

The mode 3 charging cable establishes a connection between the electric vehicle and the AC charging point. There are 3 different ways to establish a connection between the electric vehicle and the AC charging point:

- The charging cable is permanently attached to the vehicle. The charging cable is plugged into the type 2 charging socket at the AC charging point.
- The charging cable is portable. The type 2 plug is plugged into the vehicle's charging socket, and the type 2 coupler is plugged into the charging socket at the AC charging point.
- The charging cable is permanently attached to the AC charging point. The type 2 plug of the AC charging point is plugged into the charging socket of the electric vehicle.

5.3 Plugs

Type 2 plugs are used to transmit power to, and communicate with the electric vehicle.

The plug controls the following functions:

- Verification that an electric vehicle is connected
- Monitoring of protective conductor continuity
- Switching the system on
- Switching the system off
- Charging current selection
- Charging current settings
- Locking/unlocking the connectors
- Enabling power

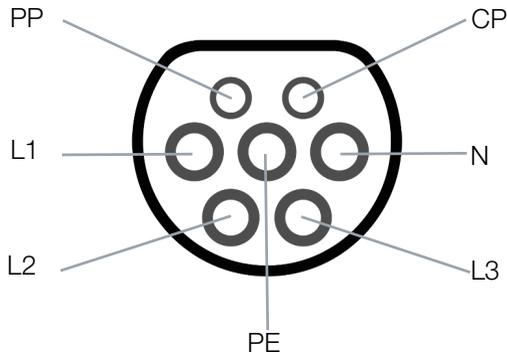


Figure 2: Type 2 Plug Layout

Function	Function
L1	Phase conductors
L2	
L3	
N	Neutral conductor
PE	Protective conductor
PP	Proximity plug Signal line for detecting the current carrying capacity of the cable
CP	Control pilot Pilot line for safety testing and communication

6 The Tester

6.1 Functions Description

Qualified electricians can use the device to test AC charging points for correct functioning. In addition to cable and vehicle simulation, faults can also be simulated and communication can be evaluated to this end.

Beyond this, AC charging points can be electrically tested by combining the tester with a measuring/test instrument from the PROFITEST MF or PROFITEST MASTER IQ series for the purpose of initial testing in accordance with DIN VDE 0100-600 and for periodic testing during operation in accordance with DIN VDE 0105-100.

6.2 Device Characteristics

- The tester can only be used to test AC charging points in charging mode 3.
- Vehicle simulation (CP): the tester simulates the charging socket of the electric vehicle. It can be connected to the charging socket or the type 2 plug of an AC charging point.
- Cable simulation (PP): the tester uses an automatic program sequence to check values for a 13, 20, 32 or 63 A cable. Testing for the absence of a connected cable is also possible (N.C.).
- Communication (PWM signal) can be evaluated.
- Fault simulation: the tester can be used to perform diode testing, as well as to check for CP-PE short-circuits (fault E) and PE faults (ground faults).
- In combination with instruments from the PROFITEST MF or PROFITEST MASTER IQ series, protective devices at AC charging points can be tested:
 - Continuity of the conductors (low-resistance measurement)
 - Insulation resistance
 - Testing of residual current circuit breakers (RCD/R)
 - Sensor testing, 6 mA RDC-DD/RCMB
 - Fault loop impedance (loop resistance), internal system resistance

6.3 Scope of Delivery

Please check for completeness.

- 1 PROFITEST H+E EXPERT CHECK (M525R)
- 1 Charging cable (micro USB plug)
- 1 Operating instructions (this document)

6.4 Device Overview

6.4.1 Front



Figure 3: Front Panel

6.4.2 Symbols on the Tester and the Included Accessories



Warning concerning a point of danger (attention, observe documentation!)



Double insulation (protection category II)



European conformity marking



The tester may not be disposed of with household trash → “Returns and Environmentally Sound Disposal” 24.

6.5 Relevant Standards

The tester has been manufactured in accordance with the following safety regulations:

IEC 61010-1 EN 61010-1 VDE 0411-1	Safety requirements for electrical equipment for measurement, control and laboratory use – general requirements
EN 60529 VDE 0470, part 1	Test instruments and test procedures Degrees of protection provided by enclosures (IP code)
DIN EN 61326-1 VDE 0843-20-1	Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements
DIN EN IEC 61851-1 VDE 0122-1	Electric vehicle conductive charging system – Part 1: General requirements
DIN EN 62196-1 VDE 0623-5-1	Plugs, socket-outlets, vehicle connectors and vehicle inlets – Conductive charging of electric vehicles – Part 1: General requirements

6.6 Technical Data

Measuring Connections	Earthing contact socket	Max. 10 A, 230 V _{AC} Fuse: T 10 A, 250 V, 20 × 5 mm
	Measuring inputs	4 mm L1, L2, L3, N, PE
	CP signal output	± 12 V, PWM signal
Power Supply	Internal rechargeable battery (charging via USB port)	
	Type	18650H-2600
	Nominal voltage	3.7 V
	mAh	2600 mAh
	Energy	9,62 Wh
	Protective function	PCB/IC protection
	Charging current	Max. 1 C
	Discharge current	Max. 5.2 A (2 C)
	Internal resistance	180 mΩ
	Weight	48 g
Dimensions (dia. × L)	18 × 69 mm	
Ambient Conditions	Operating temperature	-5 ... +45 °C
	Storage temperature	-5 ... +60 °C
	Relative atmospheric humidity	Max. 75%, non-condensing, no condensation allowed
	Elevation	Max. 2000 m
Electrical Safety	Measuring category	CAT III, 300 V
	Pollution degree	2
	Protection category	II
Mechanical Design	Protection	Tester: IP 21 Earthing contact socket: IPX4
	Housing (W × H × D)	240 × 115 × 60 mm
	Weight:	1180 g
	Display	Monochrome
Interfaces	Micro USB port (for charging the battery)	
Internal Memory	Last measurement is saved automatically	

6.6.1 Test/Analysis Standards

AC	DIN EN IEC 61851-1 VDE 0122-1 Electric vehicle conductive charging system – Part 1: General requirements
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Measurement of voltage values in all three phases and N

6.6.2 Test Parameters

Cable Simulation	N.C no cable connected ($\infty \Omega$) 13 A 13 A cable (1.5 k Ω) 20 A 20 A cable (680 Ω) 32 A 32 A cable (220 Ω) 63 A 63 A cable (100 Ω)
Vehicle Simulation	State A State B State C Phase tAUS Rotary field Duty cycle Frequency
Fault Simulation	Diode test CP-PE short-circuit (fault E) PE fault (ground fault) with display of tripping time

7 User Interface

The tester is equipped with a membrane keypad including function keys and a rotary switches. The screen is used to display measurement results.

The rotary switches can be used to select the test and adjust the test parameters. The operating keys are used for general operation and fault simulation.

Control Panel and Navigation



Figure 4: Membrane Keypad with Control Panel, Rotary Switches and Screen

Control Element	Description	
	▼▲	Scroll down/up
	ON/OFF	Press: the tester is switched on. Press and hold: the tester is switched off.
	CP STATE	Vehicle simulation: A No vehicle connected B Vehicle connected, but not ready for charging C Vehicle connected and ready for charging D Vehicle connected and ready for charging, venting required

Control Element	Description	
	PP STATE	Cable simulation: N.C. no cable connected ($\infty \Omega$) 13 A 13 A cable (1.5 k Ω) 20 A 20 A cable (680 Ω) 32 A 32 A cable (220 Ω) 63 A 63 A cable (100 Ω)
	Diode test	Simulation of a short-circuited diode
	Short-circuit CP-PE	Simulation of a CP fault in accordance with DIN EN 62196-1 / VDE 0623-5-1 (state E) (charging aborted)
	PE fault (ground fault)	Simulation of a PE fault (ground fault) (charging aborted)

Momentary measurement results appear at the display. Activate the respective control element in order to trigger the desired action.

- Press and hold **▼▲ ONIOFF** in order to switch the tester on or off.
- Briefly press **▼▲ ONIOFF** in order to scroll in the corresponding direction.
- Set the **CP STATE** rotary switch to a parameter in order to simulate the respective vehicle state.
- Set the **PP STATE** rotary switch to a parameter in order to simulate the respective vehicle state.
- Press one of the fault keys in order to simulate the respective fault.

8 Initial Startup

8.1 Unpacking the Tester

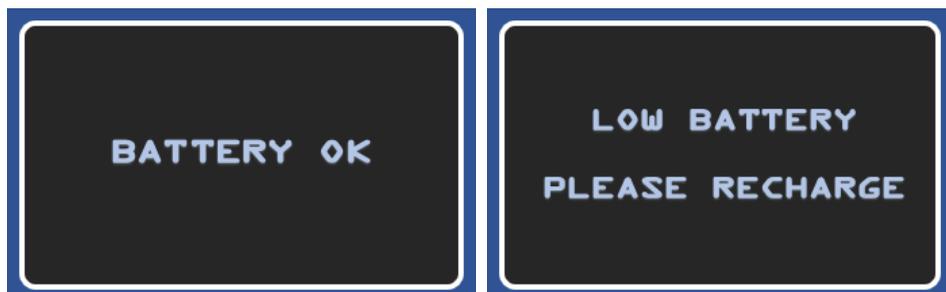
1. Carefully remove the tester and its accessories from the packaging.
2. Check for completeness and possible damage.
3. If any damage, hidden defects or missing items are detected, contact the manufacturer or you dealer without delay.
4. Retain the packaging materials for future use.

8.2 Power Supply

The tester is powered by an internal rechargeable battery. The internal battery is charged via the tester's USB port.

Battery Charge Level

The battery charge level is displayed briefly after switching the tester on. If the battery charge level drops to below a certain value during operation, a message is displayed at the screen.



Display	Battery Level
BATTERY CHARGE LEVEL OK	The battery charge level is sufficient.
LOW BATTERY – PLEASE RECHARGE	The battery charge level is low. The battery must be charged.

Charging the Tester's Internal Battery

✓ USB power pack with connector for charging cable and mains plug suitable for your mains power outlet (not included)

1. Connect the micro USB plug to the micro USB socket on the side of the tester.
2. Connect the USB plug to a mains power pack.
3. Connect the power pack's plug to a mains outlet.

↳ The internal battery is charged.



Note!

The USB socket is equipped with a cover. The cover must be removed before charging.

After charging, reseal the USB socket with the cover!

This is the only way to protect the USB socket from contamination and damage.

Furthermore, measurements may only be performed with the cover on the USB socket ⇔ "Safety Instructions" 1.

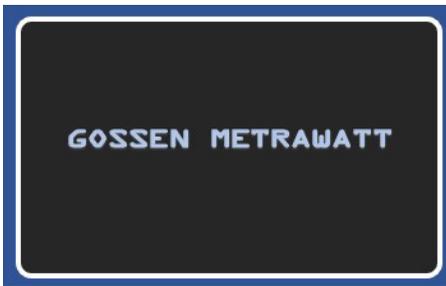
9 Operation

The tester performs functional testing of AC charging points. AC charging points in charging mode 3 with a type 2 socket or a permanently attached type 2 cable can be tested.

The results appear at the display in plain text.

9.1 Switching the Tester On

1. Briefly press the **ON/OFF** function key.
The tester is switched on.
The battery charge level is displayed briefly.



After a few seconds, the display changes and the measuring menu appears.

9.2 Language Selection

- ✓ The tester is switched off.
1. Press and hold the **▼▲ ON/OFF** key.
The tester is switched on. The initial window appears. The language menu is then displayed.
 2. Press **▼▲ ON/OFF** in order to scroll through the menu and select another language, e.g. **ENGLISH**.
 3. Press and hold the **▼▲ ON/OFF** key in order to save your selection.
An acknowledgement appears.
- ↳ The selected display language is activated.
The startup procedure is resumed: the battery charge level is displayed briefly.
The initial screen is then displayed.

9.3 Performing Tests and Inspections

According to DIN VDE 0100-600, AC charging points must be tested before initial startup. Subsequently, periodic testing must be carried out in accordance with DIN VDE 0105-100 and DGUV regulation 3.

Testing includes visual inspection, measurement, and testing. Documentation of testing is also required.

The tester facilitates the measuring and testing steps to this end. The respective tests must be performed and their parameters must be set independently by the operator.

The corresponding specifications can be found in the respectively valid, applicable standards.

Documentation must be completed independently by the operator (measurement and test results are shown in real time at the display and cannot be stored at the tester).

9.3.1 Performing the Function Test

✓ The USB socket is sealed with the cover.

1. Connect the tester's plug to the AC charging point under test.
 2. Authorize yourself at the AC charging point.
 3. Select the desired test parameters:
 - Cable simulation: set the **PP STATE** rotary switch to the "cable" to be simulated (**N.C.** – no cable connected / **13 A** cable / **20 A** cable / **32 A** cable / **63 A** cable).
 - Vehicle simulation: set the **CP STATE** rotary switch to the vehicle state to be simulated. You can also select either vehicle with ventilation (**A, B, D** or turn counter-clockwise) or without ventilation (**A, B, C** or turn clockwise).
- ↳ The result appears at the display in real time.
4. Repeat step 3 in order to perform all specified tests.
- ↳ The function test has been completed.

9.3.2 Fault Simulation

The following faults can be simulated:

- Diode test
- CP-PE short-circuit (state E)
- PE fault (ground fault) with display of tripping time

✓ The USB socket is sealed with the cover.

1. Connect the tester's plug to the AC charging point under test.
2. Authorize yourself at the AC charging point.
3. Press the desired fault key ⇔ "User Interface" 13.

↳ The fault is simulated.

Expected result: no fault.

In the event of a fault, the charging process must be aborted and further charging processes may not be initiated.

**Attention!**

PE fault: external voltage is present at the protective conductor. Do not perform any further measurements/tests until the fault has been eliminated.

9.3.3 Visualizing the PWM Signal (communication)

Communication between the charging point and the vehicle takes place via the PWM signal. PWM stands for pulse width modulation – voltage alternates as a square wave signal between two values (+12 V / -12 V) at a frequency of 1 kHz. Communication via the PWM signal, i.e. how vehicle state and permissible charging current are communicated, is defined in DIN EN IEC 61851-1 / VDE 0122-1.

Pulse width, duty cycle and frequency are checked during the function test (⇒ 17). The PWM signal can be visualized as well.

- ✓ The USB socket is sealed with the cover.
 - ✓ You'll need an oscilloscope and connector cables.
1. Connect the oscilloscope to the PROFITEST H+E EXPERT CHECK: connect the CP socket to the oscilloscope's measuring terminal and the PE socket to the oscilloscope's ground terminal.
 2. Connect the plug from the PROFITEST H+E EXPERT CHECK to the charging point.
 3. Authorize yourself at the AC charging point.
 4. Switch the PROFITEST H+E EXPERT CHECK on.
 5. Turn the **CP STATE** rotary switch to state **C** or **D**.
 6. Read the documentation provided with your oscilloscope and make the necessary settings in order to display the signal.
- ↳ The signal is displayed. Expected result: the PWM signal is displayed in accordance with IEC/EN 62851-1.

9.3.4 Testing Protective Measures (electrical test)

- ✓ The USB socket is sealed with the cover.
 - ✓ The PROFITEST MF or PROFITEST MASTER IQ series measuring/test instrument is ready for use.
1. Connect the tester's plug to the AC charging point under test.
 2. Authorize yourself at the AC charging point.
 3. Connect the PROFITEST MF or PROFITEST MASTER IQ measuring/test instrument to the PROFITEST H+E EXPERT CHECK.
Refer to the measuring/test instrument's operating instructions for further information.

4. Perform electrical testing in accordance with the operating instructions of the measuring/test instrument.
 - ↳ The protective measure is tested.
Expected result: in accordance with the specification stipulated in the standard.

9.4 Switching the Tester Off

1. Press and hold the **ON/OFF** function key.
 - ↳ The tester is switched off.



10 Registering the Tester

You can register your tester in your personal myGMC account.

1. Access the website at <https://www.gmc-instruments.de/services/mygmc/>.
2. Create a personal myGMC account.
3. Register your tester in your personal myGMC account.

11 Maintenance

The tester is maintenance-free.

11.1 Cleaning

Keep outside surfaces clean.



Attention!

Switch the tester off before cleaning.

During cleaning, the tester must not be connected to an AC charging point. The type 2 plug and the USB socket must be sealed with their respective covers during cleaning.



Attention!

Avoid the use of cleansers, abrasives or solvents.

Unsuitable cleaning agents such as aggressive or abrasive cleansers result in damage to the tester.

Clean the tester by gently wiping it with a slightly damp, lint-free cloth.

11.2 Fuse

The tester is equipped with an fuse. If the fuse is missing or defective, the earthing contact socket will not function and the tester's functionality will be limited.



Attention!

The tester may only be used as long as this fuse is in flawless condition.

- ✓ A slotted screwdriver for opening the fuse compartment is available.
 - ✓ A replacement fuse in accordance with the technical data is available ⇨ "Technical Data" 11.
-

1. Open the tester's fuse compartment. Use the slotted screwdriver to this end and turn the fuse holder counterclockwise until it's unlocked and can be removed.
 2. Remove the defective fuse.
 3. Insert the new fuse.
 4. Push the fuse holder with the new fuse back into the opening and turn it clockwise with the slotted screwdriver until it's closed.
 5. Dispose of the blown fuse properly ⇨ "Returns and Environmentally Sound Disposal" 24.
- ↳ The fuse has been changed and the tester is ready for use.

12 Contact, Support and Service

Gossen Metrawatt GmbH can be reached directly and simply – we have a single number for everything! Whether you require support or training, or have an individual inquiry, we can answer all of your questions here:

+49-911-8602-0	Monday to Thursday:	8 a.m. to 4 p.m.
	Friday:	8 a.m. to 2 p.m.

Or contact us by e-mail at: info@gossenmetrawatt.com

Do you prefer support by e-mail?

Measuring and Test Technology:	support@gossenmetrawatt.com
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Industrial Measuring Technology:	support.industrie@gossenmetrawatt.com
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Enquiries concerning training and seminars can also be submitted by e-mail and online:

training@gossenmetrawatt.com

<https://www.gossenmetrawatt.com/training>



Please contact GMC-I Service GmbH for repairs, replacement parts and calibration¹:

+49-911-817718-0
service@gossenmetrawatt.com
www.gmci-service.com

Beuthener Str. 41
 90471 Nürnberg
 Germany



¹. DAKkS calibration laboratory per DIN EN ISO/IEC 17025 – accredited by the Deutsche Akkreditierungsstelle GmbH under reference number D-K-15080-01-01.

13 CE Declaration

The tester fulfills all requirements of applicable EU directives and national regulations. We confirm this with the CE mark. The CE declaration is available upon request.

14 Returns and Environmentally Sound Disposal

This tester is subject to directive 2012/19/EC on Waste Electrical and Electronic Equipment (WEEE) and its German national equivalent implemented as the Waste Electrical and Electronic Equipment Act (ElektroG) on the marketing, return and environmentally sound disposal of electrical and electronic equipment. The device is a category 9 product (monitoring and control instrument) in accordance with ElektroG (German Waste Electrical and Electronic Equipment Act).



The symbol at the left indicates that this device and its electronic accessories must be disposed of in accordance with applicable legal regulations, and not together with household trash. In order to dispose of the tester, bring it to a designated collection point or contact our product support department (→ 23).

This device is also subject to directive 2006/66/EC on batteries and accumulators, as well as waste batteries and accumulators, and its German national equivalent implemented as the Battery Act (BattG) on the marketing, return and environmentally sound disposal of batteries and accumulators.



The symbol at the left indicates that batteries and rechargeable batteries must be disposed of in accordance with applicable legal regulations. Batteries and rechargeable batteries may not be disposed of with household trash. In order to dispose of the batteries or rechargeable batteries, remove them from the tester and bring them to a designated collection point.

Segregated disposal and recycling conserves resources and protects our health and the environment.

Current and further information is available on our website at <http://www.gossen-metrawatt.com> under the search terms “WEEE” and “environmental protection”.

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