GOSSEN METRAWATT

METRACABLE TDR PRO

Time Domain Reflectometer

3-447-089-03
1/12.20

Read the complete operating instructions
which are available in PDF format at
www.gossenmetrawatt.com.
The condensed operating instructions do not replace
the complete operating instructions!

Table of Contents

1 Safety Instructions

Observe this documentation, in particular all included safety information, in order to protect yourself and others from injury, and to prevent damage to the instrument.

- Carefully and completely read and adhere to these condensed operating instructions, as well as the instrument's operating instructions.
  The respective documents can be found at http://www.gossenmetrawatt.com. Retain these documents for future reference.

- Use only the recommended accessories with the instrument!

- Tests may only be performed by a qualified electrician, or under the supervision and direction of a qualified electrician. The user must be instructed by a qualified electrician concerning performance and evaluation of the tests.

- Wear suitable and appropriate personal protective equipment (PPE) whenever working with the instrument.

- Always comply with all safety rules and other regulations which are applicable at the place of use.

- Comply with applicable safety regulations, for example in accordance with DIN VDE 0100, DIN VDE 0800 and DIN VDE 0805.

- If the instrument doesn't function flawlessly, remove it from operation and secure it against inadvertent use.

- The instrument may only be used as long as it's in good working order.
  Inspect the housing before use. Pay particular attention to any possible cracks and the insulation around the sockets.

- Accessories and cables may only be used as long as they're fully intact.
  Inspect all cables and accessories before use. Pay particular attention to damaged housings, interrupted insulation or kinked cables.
- Do not use the instrument after long periods of storage under unfavorable conditions (e.g. humidity, dust or extreme temperature).
- Do not use the instrument after extraordinary stressing due to transport.
- Use the instrument only within the specified ambient conditions.
- Use the instrument only in accordance with the specified protection class (IP code).
- The instrument must not be exposed to direct sunlight.
- The instrument and the included accessories may only be used for the measurements described here and in the operating instructions for the instrument.
- Do not apply any external voltage to the instrument.
- Do not use the instrument if the battery compartment cover has been removed. Touch contact with dangerous voltage is otherwise possible.
- Hands must be kept behind the probe/terminal guards during testing.
- The operator must check the safety of the circuit before starting the test, and appropriate precautions must be implemented.
- Circuits must be de-energized and isolated before making any test connections.
- The instrument may only be used with voltage-free cables.

- The instrument is equipped with a Bluetooth® module. Determine whether or not use of the implemented frequency range of 2.402 to 2.480 GHz is permissible in your country.
- Always create a backup copy of your measurement data.

2   Applications

2.1   Intended Use / Use for Intended Purpose

The METRACABLE TDR PRO is a time domain reflectometer for localizing faults in electrical cables (e.g. two-core, coaxial and power cables), and for measuring their lengths. The instrument is connected to the voltage-free cable to this end, to which it transmits a pulse. The pulse's reflection, i.e. its TDR trace, appears at the instrument's display panel. The shape of the trace indicates the length of the cable, any included components, type of wiring and even any cable faults.

The METRACABLE TDR PRO can be used in indoor environments, in laboratories, in industrial settings and on construction sites. It's a portable instrument which can be held in the hand during measurement, or hung around the neck using the carrying strap. Alternatively, the METRACABLE TDR PRO can be set up on a suitable surface with the help of the tilt stand. It can be stored and transported in the included pouch.

The instrument and the cable database can be managed and measurements can be transferred to a PC and viewed with the help of included METRACABLE MANAGER software.

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

⚠ Attention!

Read and comply with the complete operating instructions (available at http://wwww.gossenmetrawatt.com).

2.2   Use for Other than Intended Purpose

Using the instrument for any purposes other than those
described in these condensed operating instructions, or in the
instrument's operating instructions, is contrary to use for
intended purpose.

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 Instrument / Repairs

The instrument 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.

Unauthorized modifications to the instrument are prohibited.

If it can be ascertained that the instrument has been opened
by unauthorized personnel, no guarantee claims can be hon-
ored by the manufacturer with regard to personal safety, mea-
suring accuracy, compliance with applicable safety measures
or any consequential damages.

3   The Instrument

3.1   Scope of Delivery

Please check for completeness.

1   METRACABLE TDR PRO (with carrying strap)
     (M281A)

4   LR6 batteries, 1.5 V, type AA

1   Set of test probes
     (1.3 m, banana plugs; 300 V, Cat II)

2   Alligator clips (plug-on)

1   BNC adapter (banana plug to coaxial cable)

1   Pouch (with carrying strap)

1   Operating instructions (this document)

Included "METRACABLE MANAGER" software is available from our website at http://www.gossenmetrawatt.com. For further information please refer to the following section: "METRACABLE MANAGER Software ⇨📄25".

3.2   Symbols on the Instrument

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

CE   European conformity marking

🗑️   The instrument may not be disposed of with
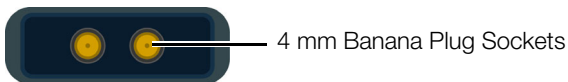   household trash.
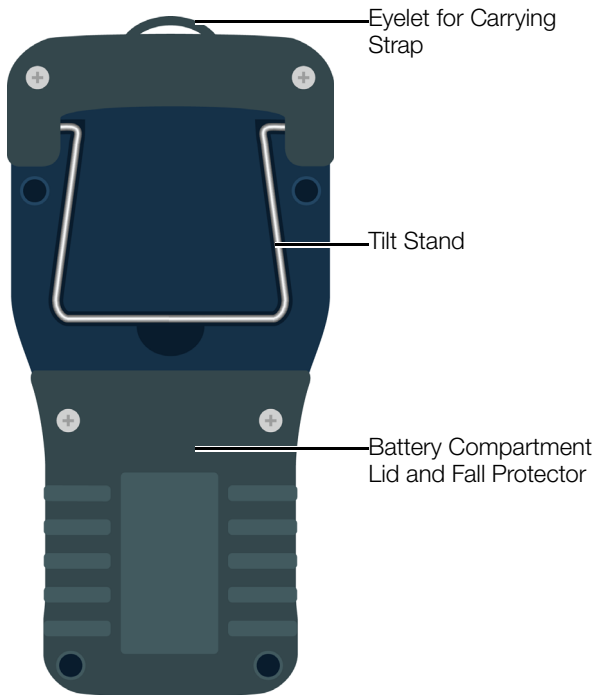
3.3 Instrument Overview

Front

Eyelet for Carrying Strap

Fall Protector

Battery Display

LCD Panel

METRACABLE TDR PRO
TIME DOMAIN REFLECTOMETER

ESC Key

SEL Key

Scroll Keys
(for control)

GOSSEN METRAWATT

On/Off Key

Fall Protector and Battery
Compartment Lid

Top

4 mm Banana Plug Sockets

Back

Eyelet for Carrying Strap

Tilt Stand

Battery Compartment Lid and Fall Protector

## 3.4   Technical Data

Power supply	4 ea. LR6 battery, 1.5 V, type AA or 4 ea. rechargeable NiMH battery,1.2 V, type AA	
Operating time	Up to 30 hours (depending on battery type and quality), automatic shutdown can be selected	
Connections	2 ea. 4mm banana plug safety sockets	
Place of use	Indoor environments, laboratories, industrial settings, construction sites	
Ambient conditions	Operating temperatures:	-10 ... +50 °C
	Storage temperatures:	-25 ... +75 °C
	Relative humidity:	No condensation allowed
	Elevation:	Max. 2000 m
Electrical safety	Pollution degree:	1
	Protection category:	II per DIN EN 61140/ VDE 0140-1
	Overvoltage protection:	DC: 100 V AC: 230 V / 50 Hz
Electro-magnetic compatibility (EMC)	Interference emission:	EN 55011: 2015
	Interference immunity:	EN 61000-4-2: 2009 EN 61000-4-3: 2006

Mechanical design	Housing (W × H × D):	Approx. 19.5 × 10.0 × 4.5 cm
	Mechanical protection:	Impact-resistant ABS housing with fall protector and display protection (2 mm Plexiglas with hardened safety glass)
	Protection:	IP 52 per DIN VDE 0470, part 1/ EN 60 529 (protection against ingress of solid foreign objects: ≥ 1.0 mm diameter, protection against ingress of water: protection against falling dripping water, when the housing is inclined up to 15°)
	Weight:	Approx. 390 g (without batteries)
	Display:	LCD, monochrome, luminous, 240 x 128 pixels, adjustable on-time and contrast for background illumination
Internal memory	Up to 32 entries in the cable database Up to 510 measurements in the instrument	
Languages	German, English, French	
Interface	Bluetooth®	

Measure- ments	Signal type:	Symmetrical search signal
	Range:	$\leq$ 14 km
	Accuracy:	+1% $\pm$ pixels at 0.66 VF
	Resolution:	3.125 ns or 0.3 m depending on cable
	Output pulse:	Max. 20 V pp
	Pulse lengths:	12, 25, 50, 100, 200, 500, 1000 and 2500 ns
	Velocity factor:	Variable from 0.2 to 0.99 in steps of 0.01
	Impedance:	50, 75, 100, 125 Ω
	Signal type:	Symmetrical
	Zoom (magnification factor):	In steps of 6 dB

3.5 Supported Cable Types

Symmetrical cables with maximum attenuation of 80 dB can
be measured using the TDR method. Examples:

Coaxial   Shielded   Twisted   Multi-wire
Cable   Cable   Pair   Line
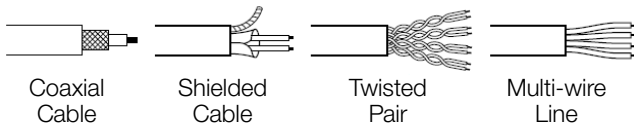
3.6   Menu

The instrument has two menus: the main menu with basic settings and the TDR menu with specific settings for measurements.

Main Menu Overview

Press and hold the **ESC** key in order to open the main menu. Use the scroll keys to navigate within the menu, and to make selections and entries. Press the **SEL** key in order to acknowledge a selection. Select the **TDR Measurement** item in order to return to the TDR trace.

TDR measurement	Exit menu / return to measurement
Velocity factor	VF value The material-dependent velocity of propagation of the signal within the cable is taken into consideration by means of the VF value. It must be selected individually for each respective cable so that distance can be calculated correctly.
Cable type	Access to the cable database and selection of the cable type (including VF value) (max. 32 entries)
Data transmission	Activate Bluetooth for data transmission to the PC.

Settings	→	Language	German, English, French
	→	Unit of measure	Meters (m) or feet (ft) in combination with velocity factor VF or half of velocity factor VF/2
	→	Battery type	Battery, rechargeable battery (depending on which is used)
	→	Illumination	Display illumination time after last entry 0 … x sec. (0 = continuously on)
	→	Shutdown	Auto-shutdown of the instrument after last entry 0 … x min. (0 = continuously on)
	→	Contrast	-20 … +50 (default: 20)
	→	Program update	Start the update process
	→	Time	Time of day in 24-hour format
	→	Date	Date in format DD/MM/YY

TDR Menu Overview

The TDR menu is opened by pressing and holding the SEL key. Use the scroll keys to navigate within the menu, and to make selections and entries. Press the **SEL** key in order to acknowledge a selection. Press the **ESC** key in order to return to the TDR trace.

Reference	Sets the momentary measurement as a reference curve in the background for comparing two measurements.
	☞ **Note!** The reference curve is not changed during Y zooming.
Save	Saves the momentary measurement with timestamp. (Data can be transferred subsequently to the PC via Bluetooth.)
Freeze	Freezes the momentary trace at the display.
Input	Selection of either AC or DC. • AC = capacitive coupling to the cable. Increased protection against interference voltage. • DC = direct connection to the cable. Less protection against interference voltage. Use DC for long cables (long pulse times influence the graphic representation of the TDR trace when using AC).

Pulse length	Selection of the desired pulse length. Pulse transmission duration changes when the TDR range is adjusted. Pulse length must be increased in order for the instrument to overcome signal attenuation and still be able to determine cable length. However, shorter pulse lengths result in better resolution.
Z	Impedance of the cable to be measured. These values are available from the respective cable manufacturers (determined automatically when the AUTO Test function is used).

4   Initial Startup

Proceed as follows:

1. Supply the instrument with electrical power ⇨📄16.
2. Switch the instrument on and familiarize yourself with the display ⇨📄17.
3. Enter the basic settings ⇨📄18.

4.1   Power Supply

The instrument is battery-operated. Charged batteries are shipped loose. These must be inserted before initial use.

⚠ Attention!

Risk of injury due to contact with dangerous voltages. Only use the instrument when the battery compartment lid is inserted and firmly screwed into place.

Required tools: Philips screwdriver

✓ The instrument has been switched off.
✓ All measurement cables and accessories have been removed from the instrument.

1. Place the instrument face down on a stable surface.
2. Loosen and remove the 2 screws from the battery compartment lid.
3. Remove the battery compartment lid by pulling it down.
4. Insert the 4 included batteries into the battery compartment, making sure that the plus and minus poles match up with the provided polarity symbols.
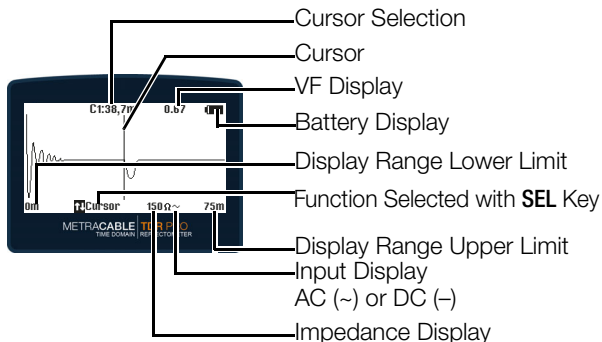
⚠️ ## Attention!

Insert only the included batteries during initial startup. Information concerning use of other batteries or recharge-able batteries can be found in the operating instructions (available at http://wwww.gossenmetrawatt.com).

5. Slide the battery compartment lid onto the battery com-partment.
6. Secure the battery compartment lid with the screws.
↳ The batteries have now been inserted. The instrument can now be used.

4.2 Switching the Instrument On/Off and Displays

Press the **ON/OFF** key in order to switch the instrument on and off. The TDR trace is displayed immediately after pressing the **ON/OFF** key.

Cursor Selection
Cursor
VF Display
Battery Display
Display Range Lower Limit
Function Selected with **SEL** Key
Display Range Upper Limit
Input Display
AC (~) or DC (–)
Impedance Display

The cursor can be moved to the right or the left with the help of the scroll keys. Pressing and holding the scroll key causes the cursor to move more quickly.

By pressing the **SEL** key, a function is selected which can then be controlled with the help of the two scroll keys, namely Cursor, Length, Y-Zoom or X-Zoom. For example if length is selected, length can be reduced or increased with the help of the scroll keys.

4.3   Basic Settings

1. Press the **ON/OFF** key at the instrument.
   The instrument is switched on and the TDR trace is displayed.
2. Open the main menu by pressing and holding the **ESC** key.
   The main menu appears.
3. Navigate to the **Settings** submenu with the help of the ∧ and ∨ keys.
4. Acknowledge by pressing the **SEL** key.
   The **Settings** menu is displayed.
5. Set time and date, select a language, select a unit of measure in combination with velocity factor and enter settings for illumination, shutdown and contrast in accordance with your preferences ⇨"Menu" 🖹12.
↳ The instrument is ready to perform measurements ⇨"Measurements" 🖹19.

5 Measurements

This section describes basic performance of measurements with the METRACABLE TDR PRO. Detailed information, as well as information concerning additional functions and other measurements (e.g. for coaxial cables), can be found in the operating instructions (available at http://www.gossenmetrawatt.com).

The METRACABLE TDR PRO is connected to the voltage-free cable to be measured. It performs a TDR measurement (time domain reflectometry) whose results appear at the display as a TDR trace.

The instrument transmits an electrical pulse during measurement. Cable length can be calculated based on the amount of time it takes for the pulse signal to be returned to the instrument (reflection). The shape of the reflection provides information concerning:

- Any included components (e.g. a splitter)
- The wiring itself (e.g. splices, branches etc.)
- Cable faults (short-circuits, broken cable, pinching etc.)

The locations of these items are also calculated – accurate to approximately 0.3 m – based on the time it takes for the signal to return to the instrument.

Cables with lengths of up to 14 km can be examined with the METRACABLE TDR PRO.

Proceed as follows:

1. Perform measurement ⇨📄20.
2. Evaluate the reflection ⇨"Typical Reflection Curves and Their Meanings" 📄24.
3. View the information at a PC for detailed observation and evaluation ⇨"METRACABLE MANAGER Software" 📄25.

Performing the Measurement

The momentary TDR trace is always shown at the display. If you change a setting, the TDR trace is adjusted automatically.

✓ The electrical cable to be measured is not in use.
✓ The velocity factor (VF value) of the cable to be measured is known, or there's a corresponding entry in the cable database.
  (Detailed information concerning the VF value can be found in the operating instructions which are available at http://wwww.gossenmetrawatt.com.)

1. Connect the test probes to the METRACABLE TDR PRO.
2. Optional (recommended): Plug the alligator clips on to the test probe.
3. Hold the probes against the cable to be measured or connect the alligator clips to the cable to be measured. One test probe or alligator clip must directly contact each of the two conductors (without insulation).
4. Press the **ON/OFF** key at the instrument.
   The instrument is switched on and the TDR trace is displayed.
5. Adjust the velocity factor (VF value) to match the cable under test.
   – The instrument includes a cable database with entries for various cable types. Select an appropriate cable type:
     Open the main menu by pressing and holding the **ESC** key. Navigate to the **Cable Type** submenu with the help of the scroll keys and acknowledge your selection by pressing the **SEL** key. Select the appropriate entry from the database which then appears with the help of the scroll keys, and acknowledge your selection by pressing the **SEL** key. In order to return to the TDR trace, navigate to the **TDR Measurement** submenu and acknowl-

edge your selection by pressing the **SEL** key.
(Enter the value manually if you don't find an appropriate entry. See instructions below.)

– Enter the value manually.
Open the main menu by pressing and holding the **ESC** key. Navigate to the **Velocity Factor** submenu and acknowledge your selection by pressing the **SEL** key. Enter the value with the help of the scroll keys and acknowledge by pressing the **SEL** key. In order to return to the TDR trace, navigate to the **TDR Measurement** submenu and acknowledge your selection by pressing the **SEL** key.

6. Enter the basic settings for the momentary measurement: input (AC or DC) and pulse length (⇨🖹14).
Press and hold the **SEL** key to this end, in order to open the TDR menu. Use the scroll keys to navigate through the options, and to make selections and entries. Press the **SEL** to acknowledge your selection and entries. Then return to the TDR trace by pressing the **ESC** key.

7. Activate the AUTO Test function by briefly pressing the **ESC** key.
Impedance (Z) is determined automatically.
The TDR trace is generated automatically.

8. Adjust length (display range) in the TDR trace:
Briefly press the **SEL** key repeatedly until the **Length** function is selected. Adjust length with the help of the ∧ and ∨ keys. (Maximum length depends on the cable.)
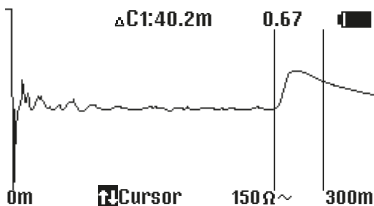

☞ Note!

Use the AUTO Test function!
Instead of adjusting impedance (Z) manually, it can be determined automatically by the instrument.
Briefly press the **ESC** key in order to activate the AUTO Test function.

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9. Adjust the display range of the TDR trace as required:
   Briefly press the **SEL** key repeatedly until the **X Zoom** or **Y Zoom** function is selected. Zoom in with the ∧ scroll key and zoom out with the ∨ scroll key.
   – Y Zoom: Magnifies/reduces the measuring range display in steps of 6 dB.
   – X Zoom: Magnifies/reduces the display of the measurement segment. A cursor which has been positioned within the display can be used as a zoom reference.

10. Navigate to the desired position within the TDR trace with the help of the cursor:
    Briefly press the **SEL** key repeatedly until the **Cursor** function is selected. Move the cursor with the help of the < and > scroll keys (press and hold a scroll key for rapid motion). You can display a second cursor to measure two reflection points (e.g. measurement of distance between distributor and fault or distributor and distributor). Use the ∧ scroll key to switch back and forth between the two cursors and absolute position and difference:
    – C1: absolute position of cursor 1, cursor 1 is active
    – C2: absolute position of cursor 2, cursor 2 is active
    – ΔC1: difference between cursors 1 and 2, cursor 1 is active
    – ΔC2: difference between cursors 1 and 2, cursor 2 is active

☞ **Note!**
Distance is calculated on the basis of the velocity factor (VF value ⇨📄12). If this has not been entered correctly for the respective cable, distance is displayed incorrectly.

11. Optional: determine cable length. Move the cursor to the end of the trace where either the reflection curve for "open end" or "short-circuit" is displayed (⇨📄24). The displayed cursor position corresponds to the length of the cable.
12. Optional: ascertain and analyze any detected reflection curve(s) ⇨📄24.
13. Optional: save your measurement.
Open the TDR menu to this end by pressing and holding the **SEL** key. Navigate with the ∧ and ∨ scroll keys until the **Save** function is selected. Acknowledge by pressing the **SEL** key. Enter a name with the help of the ∧ and ∨ scroll keys. Acknowledge by pressing the **SEL** key. The measurement is saved to memory.
14. Switch the METRACABLE TDR PRO off by pressing the **ON/OFF** key.
The instrument is switched off.
15. Remove all measurement cables from the cable under test and from the instrument.
↳ Measurement has now been completed.

Typical Reflection Curves and Their Meanings

Typical reflection curves and associated components, wiring and cable faults:
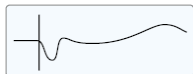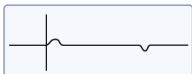

Open End

Short-Circuit

Poor Contact

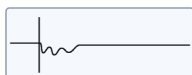Tap

Split/Resplit

Water in Cable

Tap, Short

Splice

Water Ingress

Splitter

Comprehensive, helpful instructions for troubleshooting and fault identification can be found in the operating instructions (available at http://www.gossenmetrawatt.com).

METRACABLE MANAGER Software

With the help of included METRACABLE MANAGER software, measurement results saved to the instrument can be transferred to a PC for more precise observation and evaluation. The software can also be used to manage the cable database and update the instrument.

Complete information can be found in the operating instructions (available at http://www.gossenmetrawatt.com).

6   Product Support

If required please contact:

Gossen Metrawatt GmbH

Product Support Hotline

Phone: +49-911-8602-0

Fax: +49-911-8602-709

e-mail: support@gossenmetrawatt.com

7   Repair and Replacement Parts Service / Calibration Center and Rental Instrument Service

If required please contact:

GMC-I Service GmbH

Service Center

Beuthener Str. 41

90471 Nürnberg, Germany

Phone: +49-911-817718-0

Fax: +49-911-817718-253

e-mail: service@gossenmetrawatt.com

Web: www.gmci-service.com

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

8   CE Declaration

The instrument fulfills all requirements of applicable EU directives and national regulations. We confirm this with the CE mark.

CE

EU-KONFORMITÄTSERKLÄRUNG
DECLARATION OF CONFORMITY

GOSSEN METRAWATT

Dokument-Nr./ *Document-no:*	20-3-003
Hersteller/ *Manufacturer:*	Gossen Metrawatt GmbH
Anschrift / *Address:*	Südwestpark 15 D - 90449 Nürnberg
Produktbezeichnung/ *Product name:*	TDR Prüfgerät *TDR Tester*
Typ / *Type:*	METRACABLE TDR PRO
Artikel-Nr / *Article no:*	M281A

Das bezeichnete Produkt stimmt mit den Vorschriften folgender Europäischer Richtlinien überein, nachgewiesen durch die vollständige Einhaltung folgender Normen:

The above mentioned product has been manufactured according to the regulations of the following European directives proven through complete compliance with the following standards:

Nr. / No.	Richtlinie	*Directive*
2014/53/EU	Bereitstellung von Funkanlagen - RED Richtlinie – Anbringung der CE-Kennzeichnung : 2020	*Making available of radio equipment - RED Directive - Attachment of CE mark : 2020*

Anforderungen an die Sicherheit gemäß 2014/35/EU

Safety requirements according to 2014/35/EU

EN/Norm/*Standard*
EN 61010-1 : 2010

Anforderungen an die elektromagnetische Verträglichkeit gemäß 2014/30/EU

Requirements for electromagnetic compatibility according to 2014/30/EU

Grundnorm / *Generic Standard*
EN 55011 : 2016
EN 61000-4-2 : 2009
EN 61000-4-3 : 2006

Nürnberg, den 02.12.2020

Ort, Datum / Place, **Date:**

Geschäftsführung / Managing Director

Diese Erklärung bescheinigt die Übereinstimmung mit den genannten Richtlinien, beinhaltet jedoch keine Zusicherung von Eigenschaften. Die Sicherheitshinweise der mitgelieferten Produktdokumentationen sind zu beachten.

This declaration certifies compliance with the above mentioned directives but does not include a property assurance. The safety notes given in the product documentations, which are part of the supply, must be observed.

9   Return and Disposal

This instrument 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 instrument 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 instrument 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 instrument, bring it to a designated collection point or contact our product support department (⇨🕮26).

This instrument is also subject to directive 2006/66/EC on batteries and accumulators and 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 instrument 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.gossenmetrawatt.com under the search terms "WEEE" and "environmental protection".