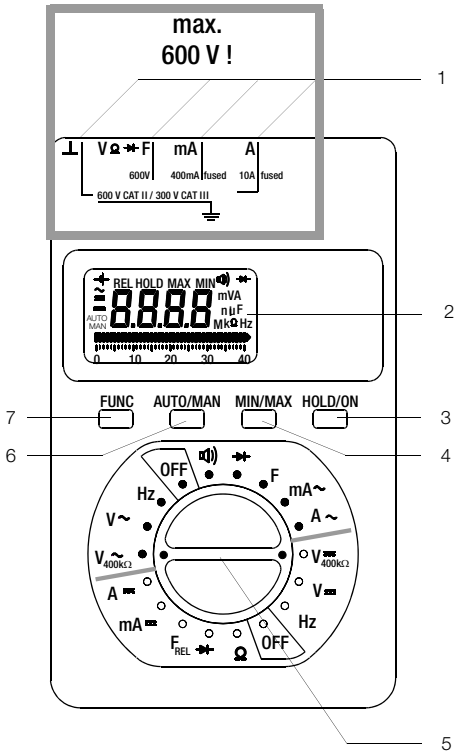
GOSSEN METRAWATT

Operating Instructions

METRA MAX | 12

Analog-Digital Multimeter

3-348-820-02
13/11.11


max.
600 V !
1
V Ω F
600V
mA
400mA fused
A
10A fused
600 V CAT II / 300 V CAT III
REL HOLD MAX MIN
mVA
n µ F
M k Ω Hz
AUTO
MAN
0 10 20 30 40
2
FUNC
AUTO/MAN
MIN/MAX
HOLD/ON
7
6
3
4
OFF
Hz
V~
V 400kΩ
A
mA
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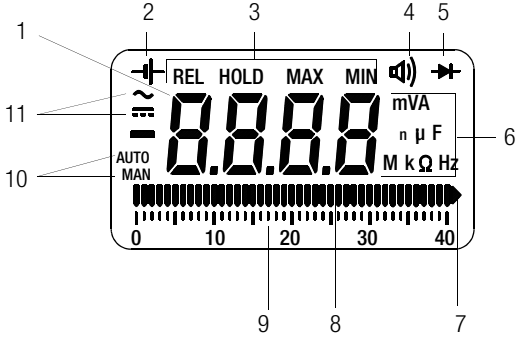
V 400kΩ
V
Hz
OFF
Ω
5


2
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10
REL HOLD MAX MIN
mVA
n µ F
M k Ω Hz
AUTO
MAN
6
0 10 20 30 40
9
8
7

Operating and Connector Elements

1 Connector Jacks
2 LCD Display
3 **HOLD/ON**: Measurement Value Storage Key / On Switch
4 **MIN/MAX**: Key for Storage of Minimum or Maximum Value
5 Selector Switch for OFF and Measurement Function Selection
6 **AUTO/MAN:** Key for Manual Measurement
7 Multifunction Key

Display

1 Digital Display with Decimal Point and Polarity Indicator
2 Low Battery Display
3 REL, HOLD, and MIN and MAX Display
4 Continuity Test Display:
Loudspeaker symbol appears when acoustic signal is activated
5 Diode Measurement Display
6 Unit of Measure Display
7 Exceeded Measuring Range Display
8 Pointer for Analog Display
9 Analog Display Scale
10 Display for Manual or Automatic Measuring Range Selection
11 Display of Selected Current Type

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1 Safety Features and Precautions

You have selected an instrument which provides you with a high level of safety.

This instrument fulfills the requirements of the applicable European and national EC guidelines. We confirm this with the CE marking. The relevant declaration of conformity can be obtained from GMC-I Messtechnik GmbH.
The instrument is manufactured and tested in accordance with safety regulations IEC 61010–1:200/EN 61010–1:2001/VDE 0411–1:2002. When properly used, safety of the operator, as well as that of the instrument, is assured. Their safety is however not guaranteed, if the instrument 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 the operating instructions thoroughly and carefully before placing your instrument into service, and that you follow all instructions contained therein.

Observe the following safety precautions:

- The instrument may only be operated by persons who are capable of recognizing contact hazards and taking the appropriate safety precautions. Contact hazards exist anywhere, where voltages of greater than 33 V may occur (effective value).
- Avoid working alone when taking measurements which involve contact hazards. Be certain that a second person is present.
- **The maximum allowable voltage between any given connector jack (1) and earth is equal to 600 V CAT II.**
- Be prepared for the occurrence of unexpected voltages at devices under test (e.g. defective devices). For example, capacitors can be dangerously charged.
- Make certain that the measurement cables are in flawless condition, e.g. no damage to insulation, no interruptions in cables or plugs etc.
- No measurements may be made with this instrument in electrical circuits with corona discharge (high-voltage).
- Special care is required when measurements are made in HF electrical circuits. Dangerous pulsating voltages may be present.
- Measurements under moist ambient conditions are not allowable.

- Be absolutely certain that the *measuring ranges are not overloaded beyond their allowable capacities*. Limit values can be found in the table “Measuring Ranges” in chapter 14 "Characteristic Values".
- All current ranges are equipped with fuses. The maximum allowable voltage for the measuring current circuit (= nominal voltage of the fuse) is equal to 600 V ∼.
- **The instrument may only be used in power installations when the electrical circuit is protected with a 20 A fuse or circuit breaker, and the nominal voltage of the installation does not exceed 600 V.**
- We recommend the *KS30 measuring adapter* for hazard-free *voltage measurements in power installations of up to 1000 V*, which is available as an accessory. The internal resistance of the KS30 limits measuring current in case of excessive voltage or operator error, and assures for the reliable quenching of ignited spark paths. For additional information see chapter 8.1 "Voltage Measurements in Power Installations of up to 1000 V with the KS30 Measuring Adapter".

Measuring Categories and their Meaning per IEC 61010-1

CAT	Definition
I	Measurements in electrical circuits not directly connected to the mains system: *e. g. power systems in motor vehicles or aeroplanes, batteries ...*
II	Measurements in electrical circuits directly connected to the low-voltage system: *via plug, e.g. in households, offices, laboratories ...*
III	Measurements in facility installations: *stationary consumers, distributor connections, devices attached to a distributor*
IV	Measurements at the source of low-voltage installations: *Meters, main terminal, primary overcurrent protection devices*

The measurement category and the relevant maximum rated voltage (e. g. 300 V CAT III) which are shown on the instrument casing apply to your measuring instrument.

Application of cable set KS17-2

Attention!
Please observe the maximum values of the electrical safety of the device.
In conformity with standard DIN EN 61010-031, measurements in an environment according to measuring category III and IV may only be performed with the **safety cap** applied to the test probe of the measurement cable.

For establishing contact in 4 mm jacks you have to remove the safety cap by levering out the snap lock of the **safety cap** with another sharp object (e.g. the second test probe).

Electrical Safety of cable set KS17-2

Maximum Rated Voltage	**600 V**	**1000 V**	**1000 V**
Measuring Category	**CAT IV**	**CAT III**	**CAT II**
Maximum Rated Current	**1 A**	**1 A**	**16 A**
with safety cap applied	•	•	—
without safety cap applied	—	—	•

Meaning of symbols on the instrument

Warning concerning a point of danger
(Attention: observe documentation)

Earth

Continuous, doubled or reinforced insulation

Indicates EU 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'.

Repair, Parts Replacement and Balancing

When the instrument is opened, voltage conducting parts may be exposed. The instrument must be disconnected from the measuring circuit for repair, replacement of parts or balancing. If repair or balancing of a live, open instrument is required, this may only be carried out by trained personnel who are familiar with the dangers involved.

Errors and Extraordinary Strains

If it may be assumed that the instrument can no longer be operated safely, it must be removed from service and secured against unintentional use.

Safe operation can no longer be relied upon,

- if the instrument demonstrates visible damage,
- if the instrument no longer functions,
- after a long period of storage under unfavorable conditions.

2 Initial Start-Up

Battery

The instrument is delivered in operational condition with batteries installed.

Please see chapter 15.1, page 24, before initial start-up of your instrument, or after a lengthy period of storage.

Switching the Instrument On

➪ Turn the selector switch from the OFF position to the desired measuring range.
An acoustic signal acknowledges that the instrument has been switched on. All of the LCD elements are activated briefly. A drawing of the LCD can be found on page 2.

Note!
Electrical discharge and high frequency interference can cause incorrect displays, and may block the measuring sequence. To reset, switch the instrument off, and then back on. If this procedure is unsuccessful, briefly disconnect the battery from the contact terminals.

Attention!
Before opening, disconnect the instrument from the measuring circuit and observe chapter 15, page 24!

Automatic Shut-Down

Your instrument switches itself off automatically after 30 minutes, if no keys or the selector switch have been activated during this time.

Switching the Instrument back On

➪ Activate the HOLD/ON key. Press briefly twice.

Switching the Instrument Off

➪ Turn the selector switch to the OFF position.

3 Selecting Measuring Functions and Ranges

3.1 Measuring Function Selection

The desired measuring function is selected with the selector switch (white or colored printing). In order to select the function printed in color, the multifunction key must also be pressed. If the multifunction key is pressed again, the function printed in white is reactivated.

3.2 Automatic Measuring Range Selection

These multimeters are equipped with automatic measuring range selection for all measuring ranges except for the ranges 400 mV ∼ and 10 A. Automatic selection is functional as soon as the instrument has been switched on. The instrument automatically selects the measuring range in accordance with the applied measuring magnitude, which provides for optimum resolution.

The instrument switches automatically to:

the next highest range	at	± (3999 D + 1 D)
the next lowest range	at	± (380 D – 1 D)

3.3 Manual Measuring Range Selection

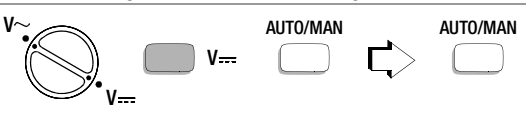
You can deactivate automatic measuring range selection and select and define the ranges manually in accordance with the following table.

➪ First select the desired measuring function with the selector switch and, if appropriate, the multifunction key.

➪ Briefly activate the AUTO/MAN key.

Manual operation is **de**activated if you press and hold the AUTO/MAN key until you hear a second acoustic signal, and the display switches from MAN to AUTO.

When switching back to automatic operation in the 400 mV ∼ range occurs, the 4 V ∼ range is activated.



Example: manual meas. range selection for volts DC

⇓ AUTO/ MAN	Function	Acknowledgement Display	Acoust. Signal
Brief	Manual Operation ON: Measuring Range is defined	MAN	1 x
Brief	Switching Sequence at: V ⎓ : 400 mV →4 V → 40 V → 400 V → 600 V → 400 mV → 4 V → ... V ∼/: 4 V → 40 V → 400 V → 600 V → 400 mV → ... mA ⎓ : 40 mA → 400 mA → 40 mA ... mA ∼/: 40 mA → 400 mA → 40 mA ... Ω : 40 MΩ → 400 Ω → 4 kΩ → 40 kΩ → 400kΩ → 4000 kΩ → 40 MΩ ... F : 4 nF → 40 nF → 400 nF → 4 µF → 40 µF...	MAN	1 x
Long	Return to Automatic Range Selection	AUTO	2 x

3.4 Quick Measurements

If you wish to perform quicker measurements than those possible with the automatic measuring range selection function, the appropriate measuring range must be fixed by the function “Manual Meas. Range Selection”, see above.

4 LCD Display

4.1 Digital Display

The digital display shows the measurement value, decimal point and sign. The selected unit of measure and type of current are displayed. A minus sign appears in front of the digits for the measurement of direct magnitudes, if the positive pole of the measurement magnitude is applied to the "⊥" input. A blinking "4000" appears if the measuring range upper limit of 3999 is exceeded.

The digital display is updated twice per second for V, A and Ω measurements.

4.2 Analog Display

The analog bar display, which demonstrates the dynamic performance of a moving coil mechanism, is updated 20 times per second for V, A and Ω measurements. This is especially advantageous for the observation of measurement value fluctuations and for balancing.

5 Acoustic Signal

The following sequence steps are acknowledged by an acoustic signal:

- New measurement function selection
- Activation or deactivation of the following functions: AUTO/MAN, MIN/MAX or HOLD

A repetitive acoustic signal indicates that a function cannot be selected, or an operator error.

6 Measurement Value Storage "HOLD"

By pressing the HOLD/ON key, the currently displayed measurement value can be "held", and "Hold" is simultaneously displayed.

The Hold display is deactivated if:

- the Hold key is reactivated
- the selector switch is activated
- the multifunction key is activated for a change of function, e.g. AC → DC.

7 Storing Minimum or Maximum Values “MIN/MAX” Hold

With the MIN/MAX function, you can “hold” either the minimum or the maximum measurement value which was present at the measuring instrument input immediately after activation of MIN or MAX. The most important application is the determination of the minimum or the maximum measurement value in the long-term observation of measurement magnitudes.

MIN/MAX has no influence on the analog display; it continues to display the current measurement value.

- ➪ Select the measurement function with the selector switch and, if appropriate, with the multifunction key.
- ➪ Select the measuring range manually. Automatic measuring range selection is not active in this mode.
- ➪ Connect the device under test as described in the following measurement instructions.
- ➪ Press the MIN/MAX key.
  HOLD MIN is displayed. The measuring instrument continually updates and digitally displays the smallest occurring measurement value. This function remains active, and the respective minimum remains in storage, until the MIN/MAX key is once again activated.
- ➪ Press the MIN/MAX key.
  HOLD MAX is displayed. The measuring instrument continually updates and digitally displays the largest occurring measurement value. If the MIN/MAX key is activated again, this function is deactivated and the maximum value is deleted.

8 Voltage Measurement

➲ Turn the selector switch, depending upon the desired input resistance, to V ~ (R_E > 10 MΩ) or V $\sim_{400k\Omega}$ (R_E = 400 kΩ).

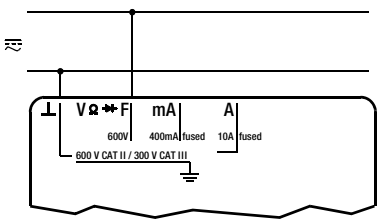
Note!
The measuring instrument is provided with the switch position $V_{400k\Omega}$ for electricians, which has an input resistance of approx. 400 kΩ. This reduces incorrect message displays due to capacitive interference during voltage measurements in power supply networks to a minimum.

➲ Connect the measurement cable as shown. Connector jack "⊥" should be grounded, and the second measuring cable with a higher potential connected to jack "V".

Note!
The measuring rage 400 mV ~ can only be selected manually with the "AUTO/MAN" key!

Attention!
Make certain that the *current ranges* ("mA" or "A") *are deactivated and that the measurement cables are connected to the correct jacks, "V and ⊥"*, before connecting your multimeter for the measurement of voltage! If the fuse tripping limit values are exceeded due to operator error, both the operator and the instrument are in danger! Observe the voltage limit values as printed on the instrument!

➲ Select the respective voltage type which corresponds to the measuring magnitude by briefly pressing the multifunction key. Each activation of the key causes alternate switching between DC and AC, as well as aknowledgement by means of an acoustic signal. The symbols ⎓ DC and ~ AC indicate the selected voltage type in the LCD display.
After selection of this function with the selector switch, the voltage type AC is always activated



8.1 Voltage Measurements in Power Installations of up to 1000 V with the KS30 Measuring Adapter

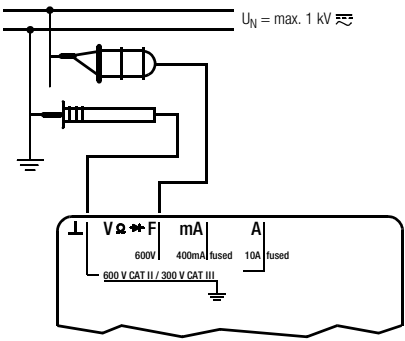
Transient overvoltages of several kilovolts or lightning discharge can occur in low voltage systems due to switching functions. Direct connection of the multimeter to a network of this type for the purpose of voltage measurement can thus be dangerous for the operator and the instrument.

Use the KS30 meas. adapter for voltage measurement in power installations with nominal voltages of up to 1000 V. This is an adapter for the multimeter, which eliminates dangers caused by overvoltages and operator errors with the following protective functions:

- Input circuit protection for multimeter voltage measuring ranges. The internal resistance of the KS30 limits current when excessive voltage occurs.
- Overload capacity: continuous 1200 V_{eff} transient (rise: 10 µs/fall: 1000 µs) max. 6 kV.
- Reliable quenching of ignited spark paths after the occurrence of excessive voltage, even if a substantial voltage source is applied.
- Current limiting for operator error (e.g. application of measuring voltage to a current input).

Voltages of over 1000 V can be measured with a high-voltage probe. The required safety precautions must be observed!

Note!
For correct voltage measurement, the measurement function V $\sim_{400k\Omega}$ may not be used.



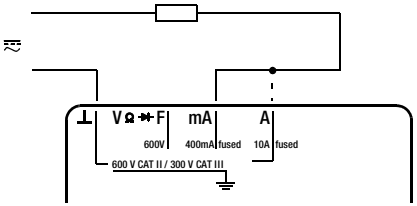
9 Current Measurement

Attention!
First switch off the power supply to the measuring circuit or the load component and discharge any capacitors which might be present.

- ➲ Select function A with the selector switch for currents > 400 mA, or function mA for currents < 400 mA. *Switch to the next highest measuring range, or activate automatic measuring range selection first* for the measurement of currents of an unknown magnitude.
- ➲ Select the respective voltage type which corresponds to the measuring magnitude by briefly pressing the multifunction key. Each activation of the key causes alternate switching between DC and AC, as well as aknowledgement by means of an acoustic signal. The symbols ⎓ DC and ∼ AC indicate the selected voltage type in the LCD display.
  After selection of this function with the selector switch, the voltage type AC is always activated.
- ➲ Securely connect the measuring instrument in series to the load component as shown (without transition resistance).

Current Measurement Tips:

- The instrument may only be used in power installations when the nominal voltage of the installation does not exceed 600 V.
- The measuring circuit must be mechanically stable and protected against unintentional opening. Conductor cross sections and connection points must be substantial enough to avoid excessive overheating.
- In the 400 mA measuring range an intermittent acoustic signal warns you, if the measurement value has exceeded the measuring range upper limit value.
- Current ranges up to 400 mA are protected with a FF1.6 A/600 V fuse in combination with power diodes up to a short-circuit current of 25 A. The breaking capacity of the fuse is equal to 50 kA at a nominal voltage of 600 V ∼ with resistive load.
- The 10 A current measuring range is protected with a 16 A/600 V fuse. The breaking capacity of the fuse is equal to 50 kA at a nominal voltage of 600 V∼ with resistive load.
- If a fuse blows, eliminate the cause of the overload before placing the instrument back into operation!
- Fuse replacement is described in chapter 15.2, page 25.



9.1 AC Measurement with (Clip-On) Current Transformers

9.1.1 Transformer Output mA/A

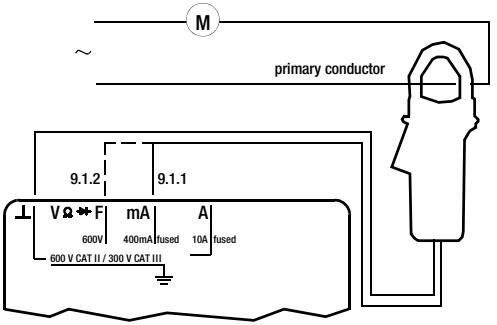
Attention!
If current transformers are used at the secondary side in an open condition, e.g. due to defective or non-connected power cables, a blown device fuse or incorrect connection, dangerously high voltages can occur at the connections. For this reason, check to see if the measuring instrument's current path and transformer's secondary winding, which is connected to the instrument, complete a closed current circuit, and connect the transformer to the ⊥ and mA or A jacks.

Some current transformers (e.g. Z3511 ... 3514) include safety devices, which prevent dangerous voltage increases at open electrical circuits.

The maximum allowable operating voltage at the primary conductor is equal to the nominal voltage of the current transformer. When reading the measurement value, consider the transformation ration of the transformer, as well as additional display error.

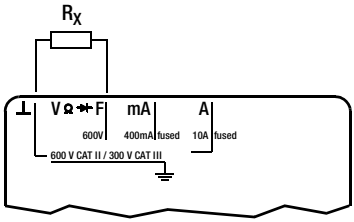
9.1.2 Transformer Output mV/A (e. g. Z201A ... 203A)

Some transformers have a voltage output (designation: mV/A). Consequently, the secondary connection must be connected to ⊥ and V.



Attention!
Be absolutely certain that the device under test is voltage-free. Extraneous voltages distort the measurement results!

➪ Set the selector switch to "🔊".
➪ Connect the DUT as shown.



Continuity Testing
The instrument generates a continuous acoustic signal at a measured resistance of 0 ... approx. < 40 Ω.

Resistance Measurement
➪ Press the multifunction key to switch to the resistance measuring range. Display of the 🔊 symbol is deactivated.

11 Diode Testing

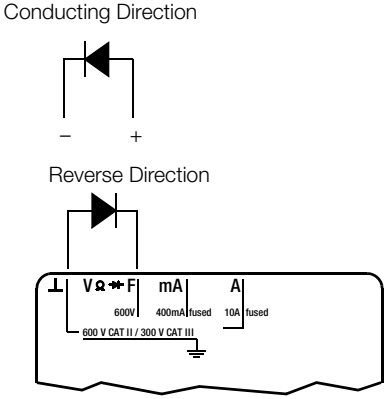
Attention!
Be absolutely certain that the device under test is voltage-free. Extraneous voltages distort the measurement results!

➪ Set the selector switch to " ⊣◁ ".
➪ Connect the device under test as shown.

Conducting Direction and Short-Circuit
The measuring instrument displays the forward voltage in volts. As long as the voltage drop does not exceed the maximum display value of 3.000 V, you can test several elements connected in series, or reference diodes with small reference voltages.

Reverse Direction or Interruption
The measuring instrument displays a voltage of approx. 3 V (battery voltage test).

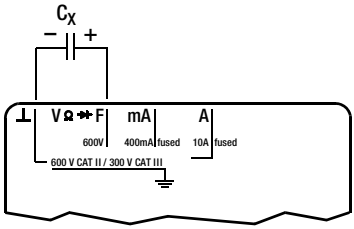
Note!
Resistors and semiconductor paths in parallel to the diode distort the measurement results!



12 Capacitance Measurement

Attention!
Be absolutely certain that the device under test is voltage-free. Extraneous voltages distort the measurement results!

- Set the selector switch to “F”.
- Connect the (discharged!) device under test to jacks “⊥” and “F” with measurement cables. Polarized capacitors must be connected to the “⊥” jack at the “–” pole.



Note!
Resistors and semiconductor paths in parallel to the capacitor distort the measurement results! To measure small capacities please use short measurement cables!

Only digital display is available in this mode.

Zero Adjustment (relative mode)
For the measurement of small capacitive values in the 4 nF and 40 nF ranges, the inherent capacity of the measuring instrument and the cables can be eliminated with zero balancing:

- Connect the measurement cables to the measuring instrument without a DUT.
- Press the multifunction key briefly.
  The instrument acknowledges zero balancing with an acoustic signal, and a value close to “00.00” and REL are displayed at the LCD. The capacitance measured at the moment the key is activated serves as a reference value. This value is then automatically subtracted from all measured values.

Delete Zero Balancing

➪ Press and hold the multifunction key and a two-fold acoustic signal acknowledges deletion,

or

➪ Activate the selector switch

or

➪ Switch the multimeter off.

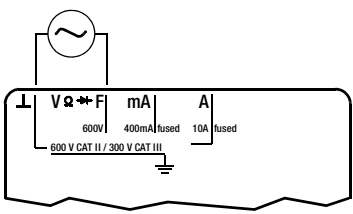
13 Frequency Measurement

➪ Set the selector switch to Hz.
The frequency measurement mode is activated. Frequency is displayed at the LCD. Display occurs digitally only, and is expanded to 9999 digits. Only the autorange mode of operation is possible, because the AUTO/MAN key is required for sensitivity selection.

➪ Apply the measurement magnitude in the same fashion as for voltage measurement.

➪ Select sensitivity with the AUTO/MAN key. You can switch between sensitivity levels of 0.1 V, 1 V and 10 mV. After each activation of the AUTO/MAN key, the corresponding sensitivity level is displayed.
After selection of this function with the selector switch, the triggering threshold is always set to the highest level of sensitivity (10 mV).

➪ The lowest measurable frequencies and the maximum allowable voltages can be found in the chapter “Characteristic Values”.



14 Characteristic Values

Measuring Function	Measuring Range	Resolution	Input Impedance 100 pF // X Ω	
			$V_{\overline{\sim}}$	$V_{400k\Omega}$
$V_{\overline{\sim}}$ $V_{\overline{\sim}400k\Omega}$	400.0 mV	100 µV	> 20 MΩ	400 kΩ
	4.000 V	1 mV	11 MΩ	400 kΩ
	40.00 V	10 mV	10 MΩ	400 kΩ
	400.0 V	100 mV	10 MΩ	400 kΩ
	600 V	1 V	10 MΩ	400 kΩ
$V_{\sim}$ $V_{\sim 400k\Omega}$	400.0 mV	100 µV	> 20 MΩ	400 kΩ
	4.000 V	1 mV	11 MΩ	400 kΩ
	40.00 V	10 mV	10 MΩ	400 kΩ
	400,0 V	100 mV	10 MΩ	400 kΩ
	600 V	1 V	10 MΩ	400 kΩ
			Voltage Drop at Maximum Measuring Current, approx.	
$A_{\overline{\sim}}$	40.00 mA	10 µA	450 mV	
	400.0 mA	100 µA	1.5 V	
	10.00 A	10 mA	750 mV	
$A_{\sim}$	40.00 mA	10 µA	450 mV	
	400.0 mA	100 µA	1.5 V	
	10.00 A	10 mA	750 mV	
			Open-Circuit Voltage	
Ω	400.0 Ω	100 mΩ	approx. 0.5 V	
	4.000 kΩ	1 Ω		
	40.00 kΩ	10 Ω		
	400.0 kΩ	100 Ω		
	4000 kΩ	1 kΩ		
	40.00 MΩ	10 kΩ		
Ω	400.0 Ω	100 mΩ		
	3.000 V	1 mV	approx. 3 V [2]	
F	4.000 nF	1 pF		
	40.00 nF	10 pF		
	400.0 nF	100 pF		
	4.000 µF	1 nF		
	40.00 µF	10 nF		
			f_{min}	
Hz [1]	100.00 Hz	0,01 Hz	10 Hz	
	1.0000kHz	0,1 Hz		
	10.000kHz	1 Hz		
	100.00kHz	10 Hz		
	400.0 kHz	100 Hz		

1) Indication for frequency measurement expanded to 9999 D

2) Battery voltage 2.2 V ... 3.2 V

Measuring Function	Measuring Range	Digital Display **Intrinsic Uncertainty** at Reference Conditions ±(...% of rdg. +... D)		**Overload Capacity** [1] Value	Duration
V ⎓	400.0 mV	0.75 + 2		600 V effective	continuous
	4.000 V	0.5 + 2			
V ⎓400kΩ	40.00 V				
	400.0 V				
	600 V				
V ∼	400.0 mV	1.5 + 5		600 V effective	continuous
	4.000 V	1 + 5			
V ∼400kΩ	40.00 V				
	400.0 V				
	600 V	1 + 10			
A ⎓	40.00 mA	0.8 + 2		480 mA	continuous
	400.0 mA				
	10.00 A [4]	1.5 + 5		[3]	[3]
A ∼	40.00 mA	1 + 5		480 mA	continuous
	400.0 mA				
	10.00 A [4]	2 + 5		[3]	[3]
Ω	400.0 Ω	0.8 + 5		600 V effective	5 min
	4.000 kΩ	0.8 + 2			
	40.00 kΩ				
	400.0 kΩ				
	4000 kΩ	1 + 5			
	40.00 MΩ	2 + 5			
Ω 🔊	400.0 Ω	Acoustic signal for 0 … < 40 Ω			
→|←	3.000 V	2 + 10			
F	4.000 nF	3 + 40 [2]		600 V effective	5 min
	40.00 nF	3 + 10 [2]			
	400.0 nF	3 + 10			
	4.000 µF				
	40.00 µF	5 + 10			
Hz	100.00 Hz	≤ 600 V	0.2 + 2	600 V effective	continuous
	1.000 0kHz				
	10.000kHz	≤ 100 V			
	100.00kHz	≤ 40			
	400.0 kHz				

Key: of rdg. = of reading (measured value), D = digit

1) At 0 °C ... + 40 °C

2) With zero adjustment "REL"; without zero adjustment +300 D in 4 nF range
+30 D in 40 nF range

3) Maximum 10 A/30 minutes
12 A/5 minutes
16 A/30 seconds

Reference Conditions

Ambient Temperature	+ 23 °C ± 2 K
Relative Humidity	40% ... 60%
Measuring Magnitude Frequency	Sine, 50 Hz
Measuring Magnitude Waveform	Sine
Battery Voltage	3 V ± 0.1 V

Ambient Conditions

Working Temperature Range	–10 °C ... + 50 °C
Storage Temperature Range	– 25 °C ... + 70 °C (without batteries)
Relative Humidity	45 ... 75%, no condensation allowed
Elevation	to 2000 m

Display

LCD display field (50 mm x 30 mm) with analog and digital display and display of unit of measure, current type and various special functions.

Analog

Display	LCD scale with bar graph pointer
Scale Length	40 mm
Scaling	0 ... 40 with 40 graduations
Polarity Display	with automatic switching
Overflow Display	Bar with triangle
Measuring Rate	20 measurements/s

Digital

Display/Char. Height	7 segment digits / 10 mm
Number of Places	3¾ place ≙ 3999 steps
Overflow Display	“4000” with blinking “4”
Polarity Display	“–” sign is displayed when plus pole is at “⊥”
Measuring Rate	2 measurements/s for U, I, and Ω 1 measurement/s for capacitance and frequency

Influence Variables and Effects

Influence Variable	Influence Range	Meas. Magnitude/ Measuring Range	Influence Effect
Temperature	0 °C ... +21 °C and +25 °C ... +40 °C	V ⎓	0.1 x intrinsic uncertainty/K
		V ∼	
		A ⎓	
		A ∼	
		Ω	
		F	
		Hz	

Influence Variable	Influence Range (max. resolution)	Frequency	Inherent Uncertainty at Ref. ±(... % of rdg. +... D)
Frequency V_{AC}	4, 40, 400 V	20 Hz ... < 50 Hz > 50 Hz ... 500 kHz	2 + 3
	400 mV, 600 V	20 Hz ... < 50 Hz > 50 Hz ... 100 Hz	2 + 3

Influence Variable	Influence Range	Meas. Magnitude/ Measuring Range	Influence Effect
Relative Humidity	55 ... 75%	V ≃ A ≃ Ω F, Hz	1x intrinsic uncertainty

Influence Variable	Interference Magnitude	Measuring Range	Attenuation
Common Mode Interference Voltage	600 V DC/AC 50 Hz sinus	all V DC	> 100 dB
	600 V DC	all V AC	> 100 dB
	600 V AC 50 Hz sinus	400 mV / 4 V AC	> 80 dB
		40 V AC	> 63 dB
		400 V AC	> 43 dB
		600 V AC	> 23 dB
Series-Mode Interference Voltage	max. 600 V AC 50/60 Hz sinus	V DC	> 43 dB
	max. 600 V DC	V AC	> 55 dB

Aux. Voltage Influence
(without ⊣⊢ display) all ranges except AC: ±5 D
AC range: ±20 D

Power Supply

Battery
2 x 1.5 V mignon cell
zinc-carbon cell per IEC R6
alkaline manganese cell per IEC LR 6

Service Life
with zinc-carbon cell: approx. 300 hr.
with alkaline manganese cell: approx. 600 hr.

Battery Test
Automatic display of the symbol " ⊣⊢ " when battery voltage falls below the following values: approx. 2.3 V

Fusing

Fuse for ranges up to 400 mA	FF(UR) 1.6 A / 700 V; 6.3 mm x 32 mm; breaking capacity 50 kA at 700 V ~ with resistive load, cos φ < 0.2; protects all current measuring ranges up to 400 mA in combination with power diodes
Fuse for 10 A Range	FF(UR) 16 A/600 V; 6.3 mm x 32 mm breaking capacity 50 kA at 600 V ~ with resistive load, cos φ < 0.2

Electrical Safety

Protection Class	II per IEC 61010-1:2001/ EN 61010-1:2001/ VDE 0411-1:2002	
Measurement Category	II	III
Nominal Voltage	600 V	300 V
Pollution degree	2	2
Operating Voltage	600 V	
Test Voltage	3.5 kV~ per IEC 61010-1:2001/ EN 61010-1:2001/ VDE 0411-1:2002	

Electromagnetic Compatibility EMC

Interference Emission	EN 61326-1:2006 Class B
Interference Immunity	EN 61326-1:2006 EN 61326-2-1:2006

Mechanical Design

Protection	Housing: IP 50 Connector Jacks: IP 20
Dimensions	W x H x D: 92 mm x 154 mm x 25 mm
Weight	approx. 0.2 kg with battery

15 Maintenance

Attention:

Disconnect the instrument from the measuring circuit before opening the instrument to replace the battery or the fuse !

15.1 Battery

Before initial start-up, or after storage of your instrument, make sure that no leakage has occurred at the instrument battery. Repeat this inspection at regular intervals.

If battery leakage has occurred, electrolyte from the battery must be carefully and completely removed and a new battery must be installed, before the instrument can be placed back into operation.

If the " ⊣⊢ " symbol appears in the LCD display, you should change the battery as soon as possible. You can continue to take measurements, but reduced measuring accuracy may result.

Replacing the Batteries

The housing base must be removed from the instrument in order to replace the batteries.

- ➪ Press the tab located beneath connector jacks with a test prod, a banana plug or a similar object in the direction indicated by the arrow as shown on the housing base, and remove the base.
- ➪ Remove the battery from the battery compartment.
- ➪ Insert two new 1.5 V mignon cells in accordance with the polarity symbols in the battery compartment. Place both battery cables between the cells before closing the housing in order to prevent pinching of the cables.
- ➪ Replace the housing base and press until it snaps audibly into place.
- ➪ Dispose of the dead battery in an environmentally sound fashion.

15.2 Fuses

The 16 A fuse interrupts the 10 A current measuring range, and the 1.6 A fuse the mA current measuring ranges. All other measuring ranges continue to function.

If a fuse blows, eliminate the cause of the overload before placing the instrument back into operation!

Replacement of Fuses

- ➪ Open the instrument as described under battery replacement.
- ➪ Remove the defective fuse with the help of, for example, a test prod, and replace it with a new fuse.
- ➪ **Make certain that the new fuse makes good contact.**

The following fuses may be used:

- for current measuring ranges up to 400 mA: type Siba FF(UR) 1.6 A/700 V~ ; 6.3 mm x 32 mm
- for the 10 A measuring range: type Siba FF(UR) 16 A/600 V~ ; 6.3 mm x 32 mm
- Both fuses have a breaking capacity of 50 kA.

Attention!
Be absolutely certain that only the specified fuses are used! The use of a fuse with different triggering characteristics, a different nominal current or a different breaking capacity places the operator, the system and the measuring instrument in danger.
The use of repaired fuses or short-circuiting of the fuse holder is prohibited.

Fuse Testing

- ⇨ Set the selector switch to „))".
- ⇨ Plug the measurement cable into the "V, Ω, →|–, F" socket.
- ⇨ Contact the mA socket with the other end of the measurement cable. A continuous audible signal and the display of approx. 10.2 Ω, indicate that the fuse for the mA current range is OK.
- ⇨ Contact the A socket with the other end of the measurement cable. A continuous audible signal and the display of approx. 0.5 Ω, indicate that the fuse for the A current range is OK.

If a value other than those indicated above, or if overflow ("400.0"; 4 blinks) is displayed, the corresponding fuse must be replaced.

15.3 Housing

No special maintenance is required for the housing. Excessive contamination has an adverse effect on isolation and reduces input resistance. The surface must be kept clean for this reason. Use a slightly dampened cloth for cleaning. Avoid the use of cleansers, abrasives or solvents.

Device Return and Environmentally Compatible Disposal

The **instrument** is a category 9 product (monitoring and control instrument) in accordance with ElektroG (German Electrical and Electronic Device Law). This device is not subject to the RoHS directive.

We identify our electrical and electronic devices (as of August 2005) in accordance with WEEE 2002/96/EG and ElektroG with the symbol shown to the right per DIN EN 50419 . These devices may not be disposed with the trash. Please contact our service department regarding the return of old devices.

If you use **batteries** or **rechargeable batteries** in your instrument or accessories which no longer function properly, they must be duly disposed of in compliance with the applicable national regulations.
Batteries or rechargeable batteries may contain harmful substances or heavy metal such as lead (PB), cadmium

(CD) or mercury (Hg).

They symbol shown to the right indicates that batteries or rechargeable batteries may not be disposed of with the trash, but must be delivered to collection points specially provided for this purpose.

15.4 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.

* 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.

16 Product Support

If required please contact:

GMC-I Messtechnik GmbH
Hotline Produktsupport
Phone +49 911 8602-0
Fax +49 911 8602-709
E-Mail support@gossenmetrawatt.com

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

If required please contact:

GMC-I Service GmbH
Service-Center
Thomas-Mann-Straße 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 for Germany. In other countries our representatives or subsidiaries may be contacted.

* **DKD** Calibration Laboratory for Electrical Quantities DKD–K–19701

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 **proprietary 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.

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