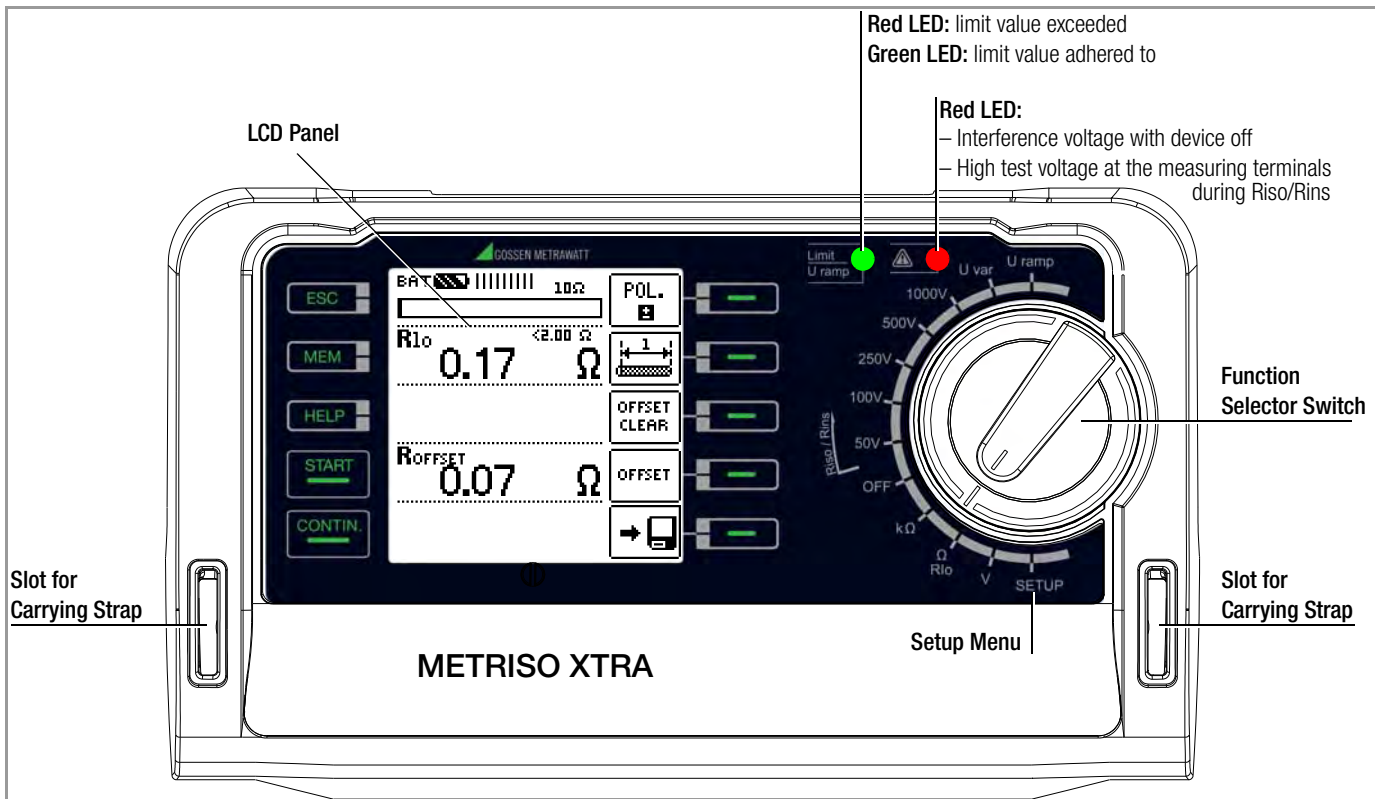


METRISO XTRA

High-Precision Insulation, Low Resistance and Voltage Measurement Instrument

3-349-818-03
3/8.19





Control panel

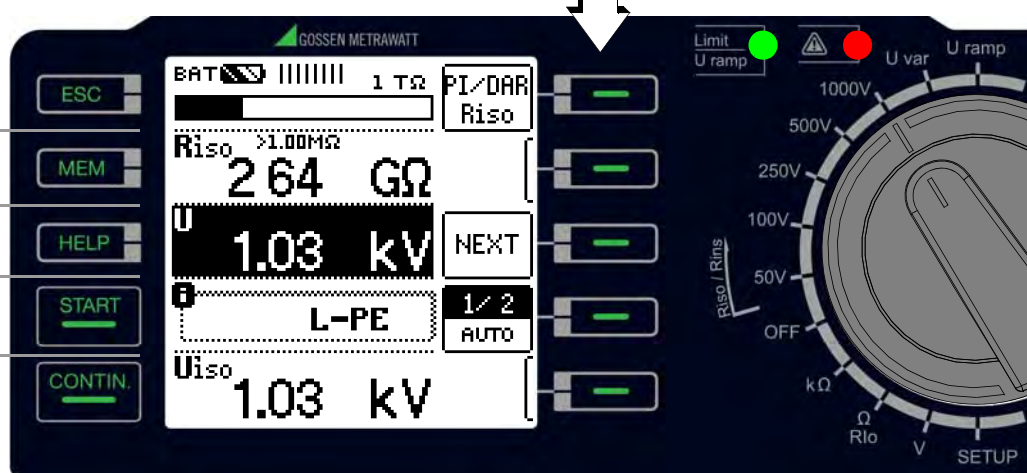
Fixed Function Keys

- ESC:** Exit submenu / activate instrument standby state
- MEM:** Key for memory functions
- HELP:** Access context sensitive help
- START:** Start measurement
- CONTIN:** Continuous measurement of Rins and R (k Ω)

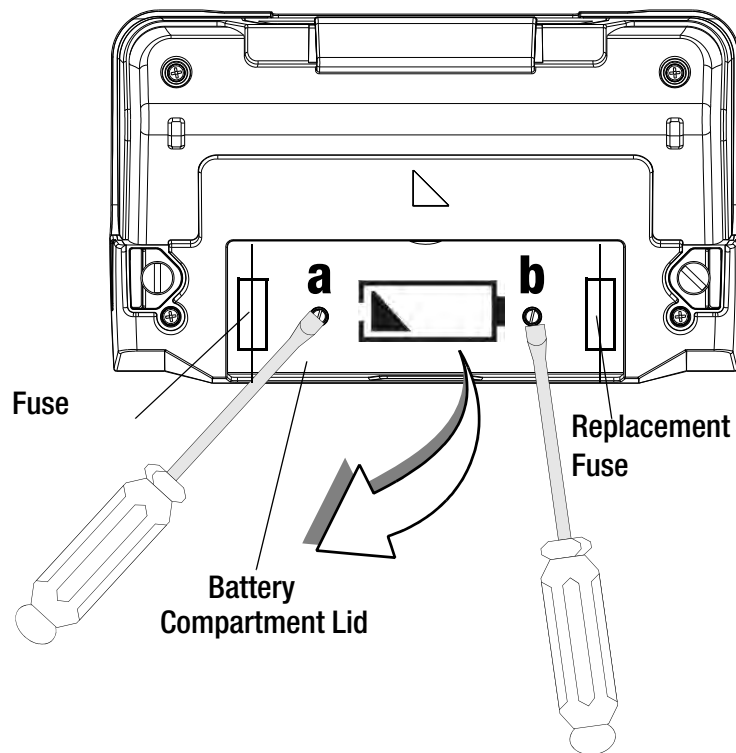
Softkeys

- Parameter selection
- Limit value specification
- Entry functions
- Memory functions

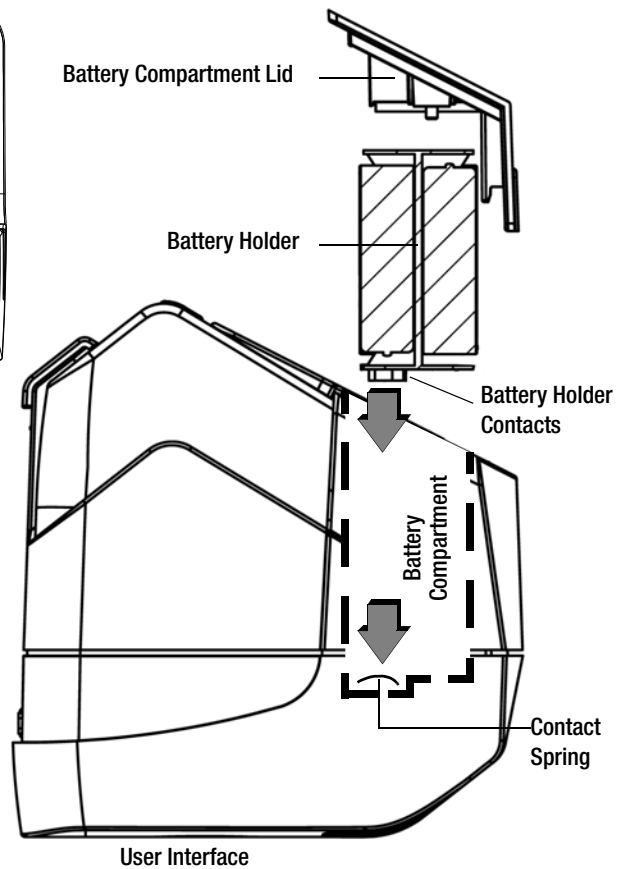
LEDs → section 4.3



Batteries, Fuses

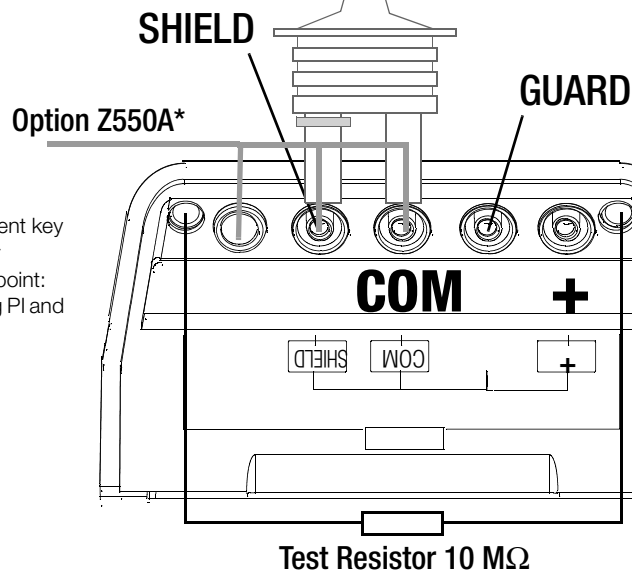


Inserting the Battery Holder (side view)



Measuring Connections

Option KS-C (Z541F)



* Regarding Z550A:
Test Probe with measurement key
remote control and LED for
illuminating the measuring point:
Do not use when measuring PI and
DAR.

Charger Socket, Interfaces

These connections are located under a protective rubber flap.

Socket for Z502R charger

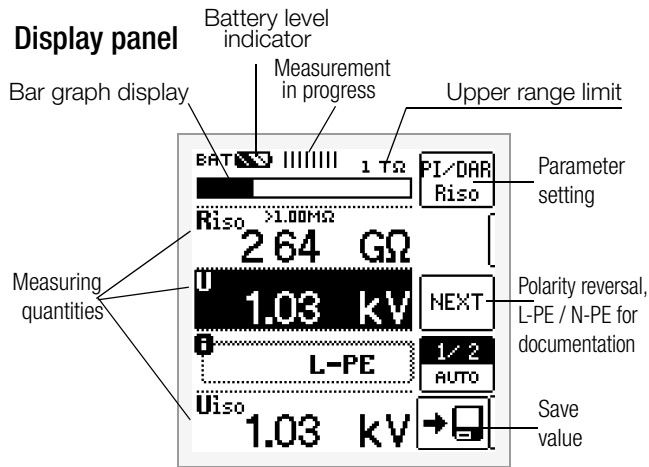
Caution!

Make sure that no batteries are inserted
before connecting the charger.
The test instrument must remain off
during the charging process.

Port for connecting Barcode/Rfid reader



Overview of Device Settings and Measuring Functions Relative to Rotary Switch Setting



Measuring Status

|||||||))) Measurement in progress: Bars moves from left to right.

||||||| Measurement on pause: Bars are static.

Battery Level Indicator

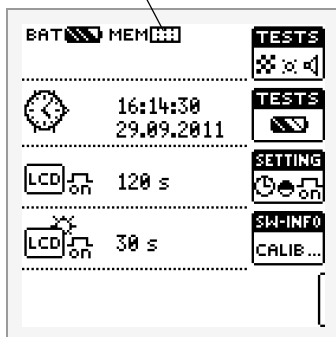
BAT Battery full **BAT** Battery weak

BAT Battery OK **BAT** Battery (nearly) depleted U < 8.5 V

Memory Occupancy Display

MEM Memory full > transfer data to PC!

MEM Memory half full



These operating instructions describe a tester with software as of version SW-VERSION (SW1) 01.02.00.

Switch setting, see as of	Picto-graph	Device settings, measuring functions	
RISO RINS page 15		RINS	Insulation resistance
		U	Voltage at the test probes
		U _N fix	Fixed test voltage, limit values per VDE 0100
		Uvariable	Variable test voltage, limit value: 1 MOhm (for go/no-go display while saving the measured value)
		Uramp	Variable test voltage, ramp: triggering/breakdown voltage
kΩ page 20		PI	Polarization index
		DAR	Absorption index
RLO page 21		R	Resistance measurement
		RLO	Low-resistance with polarity reversal
		RLO+, RLO-	Low-resistance, single-pole
V page 14		ROFFSET	Offset resistance
		U	Voltage measurement
SETUP page 8		Tests:	LCD pixel display LCD pixel display All pixels off All pixels on Acoustic signal
		Green limit LED Red limit LED	
		Battery test	Ubat
			Date/time
		CULT	Language (D, GB)
		Brightness	
		SET on:	On-time for LCD and tester
		Contrast	Default settings
			Device type
			Serial number
			Software version
			Hardware version
			Calibration date
			Adjustment date

Scope of delivery:

- 1 Insulation and resistance measuring instrument
- 1 DAkkS calibration certificate
- 1 Set batteries (8 pieces in battery holder)
- 1 Carrying strap
- 1 Alligator clip
- 1 KS17-4 cable set
- 1 USB cable
- 1 Condensed operating instructions
- 1 Supplement Safety Information
- Detailed operating instructions for download from our website at www.gossenmetrawatt.com

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1 Applications

This instrument fulfills all requirements of applicable European and national EC directives. We confirm this with the CE mark. The relevant declaration of conformity can be obtained from GMC-I Messtechnik GmbH.

The METRISO XTRA insulation and resistance measuring instrument allows for quick and efficient testing of protective measures in accordance with DIN VDE 0100, ÖVE-EN 1 (Austria), SEV 1000 (Switzerland), and regulations specific to other countries as well.

The device is equipped with a microprocessor and complies with IEC/EN 61557 / VDE 0413 regulations:

Part 1: General requirements

Part 2: Insulation resistance

Part 4: Resistance of earth connection, protective conductors and equipotential bonding

Part 10: Electrical safety in low-voltage systems up to 1000 V AC and 1500 V DC – Equipment for testing, measuring or monitoring of protective measures

As well as requirements per VDE 0701-0702:

Repair, modification and testing of electrical devices

The test instrument is especially well suited for:

- Systems setup
- Initial start-up
- Periodic testing
- Troubleshooting in electrical systems

The following measurements and tests can be performed with the insulation measuring instrument:

- Insulation resistance
- Low-resistance
- Voltage

The following can also be tested by using a shielded measurement cable:

- Floor covering electrostatic discharge capability

1.1 Optional Z550A Remote Control

The optional remote control with triggering key on the test probe and a key for illuminating the measuring point makes it possible to use the measuring instrument at difficult to access places.

For safety reasons, a predefined voltage is only applied to the test probes for as long as the triggering key is held depressed.

The start key on the test instrument should be used instead of remote control for triggering polarization and absorption index measurements, because these two measurements involve complete measuring cycles.

1.2 Overview of Measuring Instrument Performance Features

METRISO		XTRA
Article No.		M550S
Measurement		
R _{INS}	U = 50, 100, 250, 500, 1000 V	✓
R _{INS}	Uvar = 50 ... 1000 V	✓
R _{INS}	Uramp (U) = 100 ... 1000 V	✓
PI		✓
DAR		✓
R	10 ... 10 kΩ	✓
R _{LO}	0.01 ... 10 Ω	✓
U	0 ... 1000 V	✓
Display Functions		
Backlit display		✓
Limit value LED (green/red) for: limit values per VDE 0100 in addition to acoustic signal		R _{INS} R _{LO}
URamp limit value LED for: indicating ramp characteristics		R _{INS}
LED for dangerous contact voltage (when switched off)		✓
Battery level display		✓
Special Functions		
Discharge capacitive devices under test		✓
Safety shutdown (UBatt < 8 V)		✓
Data storage at the instrument		✓
ETC software for data acquisition, data management and reporting		✓
Features		
Measuring categories: CAT II 1000 V / CAT III 600 V / CAT IV 300 V		✓
Test resistance: 10 MΩ		✓
Connections: charging socket, USB port (slave), RS 232 port		✓
DAkkS calibration certificate		✓

2 Safety Features and Precautions

The electronic measuring and test instrument is manufactured and tested in accordance with safety regulations IEC/EN 61010-1/VDE 0411-1 and EN 61557. When used for its intended purpose, safety of the operator, as well as that of the instrument, is assured.

Read the operating instructions thoroughly and carefully before using your instrument. Follow all instructions contained therein. Make sure that the operating instructions are available to all users of the instrument.

Tests may only be executed by a qualified electrician.

The measuring and test instrument may not be placed into service:

- If the battery compartment lid has been removed
- If external damage is apparent
- If connector cable or measuring adapters are damaged
- If the instrument no longer functions flawlessly
- After extraordinary damage due to transport
- After a long period of storage under unfavorable conditions (e.g. humidity, dust or extreme temperature).

Opening of Equipment / Repair

The equipment may be opened only by authorized service personnel to ensure the safe and correct operation of the equipment and to keep the warranty valid.

Even original spare parts may be installed only by authorized service personnel.

In case the equipment was opened by unauthorized personnel, no warranty regarding personal safety, measurement accuracy, conformity with applicable safety measures or any consequential damage is granted by the manufacturer.

Data Backup

We advise you to regularly transfer your stored data to a PC in order to prevent potential loss of data in the test instrument.

We assume no responsibility for any data loss.

We recommend ETC software (Electric Testing Center) for backing up, processing and managing data.

Meaning of Symbols on the Instrument



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



Protection class II device



Charging socket for extra-low direct voltage (Z502R charger)
Attention!

Only rechargeable batteries may be inserted when the charger is connected.

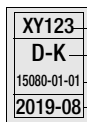


Indicates European Conformity



The device and included batteries 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".

Calibration Seal (blue seal):



XY123 — Consecutive number

D-K — Deutsche Akkreditierungsstelle GmbH – calibration lab

15080-01-01 — Registration number

2019-08 — Date of calibration (year – month)

See also "Recalibration" on page 38.

3 Initial Start-Up

3.1 Battery test

Four different battery symbols, ranging from fully depleted to fully charged, continuously indicate the momentary charge level in the

If battery voltage has fallen below the allowable lower limit, the pictograph shown at the right appears. The instrument does not function if the batteries have been depleted excessively, and no display appears.

3.2 Installing or Replacing Batteries

New batteries must be inserted for initial start-up, or if **only one filled segment remains in the battery symbol**.



Attention!

Before opening the battery compartment (see page 5 for location), disconnect the instrument from the measuring circuit (mains) at all poles.

Eight 1.5 V size AA batteries in accordance with IEC LR 6 are required for operation of the insulation measuring instrument. Use new alkaline manganese batteries only.

Rechargeable NiCd or NiMH batteries may also be used. These can be charged externally or by connecting the Z502R charger to the test instrument. We recommend rechargeable NiMH batteries.

Always replace batteries in complete sets.

Dispose of batteries in an environmentally sound fashion.

- Loosen both slotted screws for the battery compartment lid on the back, and remove the lid.
- Remove the battery holder and insert eight 1.5 V size AA batteries with correct polarity in accordance with the symbols.



Attention!

Make sure that **all of the batteries are inserted with correct polarity**. If just one battery is inserted with reversed polarity, it will not be recognized by the instrument and may result in leakage from the batteries.

- Push the battery holder into the battery compartment such that the battery holder's contacts touch the contact springs at the bottom of the battery compartment (see drawing on page 3).
If the battery holder is not inserted as specified, the instrument cannot be supplied with power.
- Replace the battery compartment lid and retighten the screws.



Attention!

The instrument may only be placed into service if the battery compartment lid is securely fastened!

3.3 Charging the Batteries in the Tester



Attention!

Use only the Z502R charger (available as an accessory) to charge batteries which have already been inserted into the test instrument.

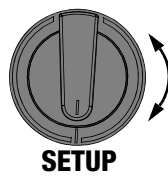
Make sure that the following conditions have been fulfilled before connecting the charger to the charging socket:

- Rechargeable batteries have been installed with correct polarity (not standard batteries)
- The test instrument has been disconnected from the measuring circuit at all poles
- The instrument must remain off during charging.

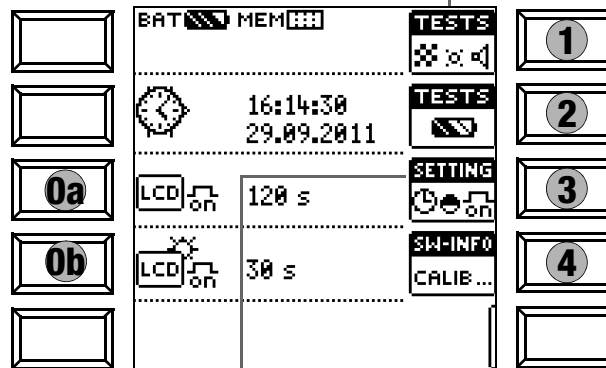
Refer to section 12.2.1 with regard to charging batteries which have been inserted into the tester.

If the batteries or the battery pack have not been used or recharged for a lengthy period of time (> 1 month), thus resulting in excessive depletion:

Observe the charging sequence (indicated by the LED at the charger) and initiate a second charging sequence if necessary (disconnect the charger from the mains and from the test instru-

**0**

Display: date / time

Display: automatic shutdown
of the tester after 120 s.Display: automatic shutdown
of display illumination after 30 s.**Menu Selections for Operating Parameters**

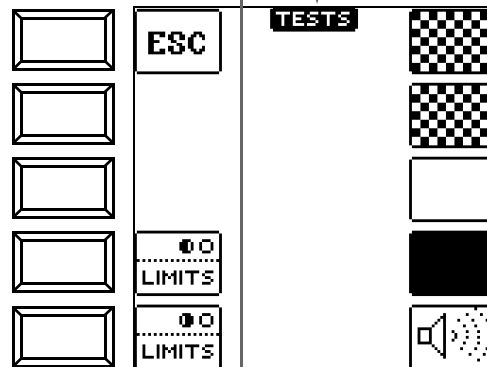
- 1** LED and LCD test menu
- 2** Battery test menu
- 3** Brightness/contrast menu
Time, language, profiles
- 4** Software revision level
Calibration date

1

Return to main menu

Limit LED: test red

Limit LED: test green

LED Tests**LCD and Acoustic Signal Tests**

- Cell test
- Inverse cell test
- Hide all pixels
- Show all pixels
- Acoustic signal test

3**Brightness and Contrast Settings**

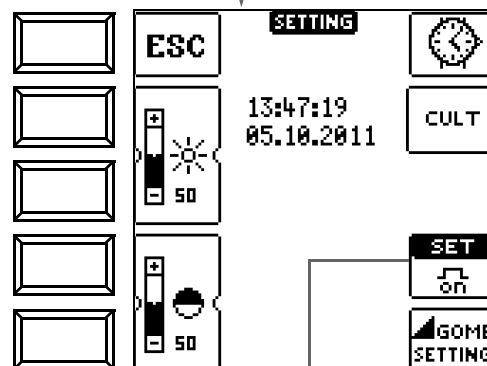
Return to main menu

Increase brightness

Decrease brightness

Increase contrast

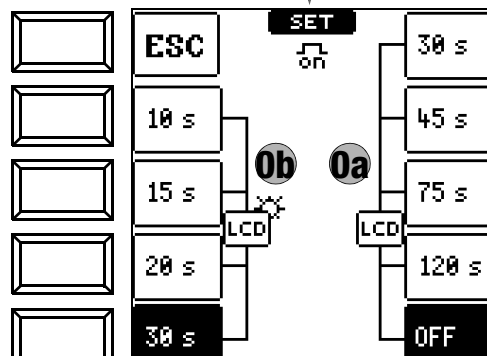
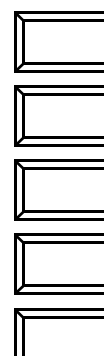
Decrease contrast

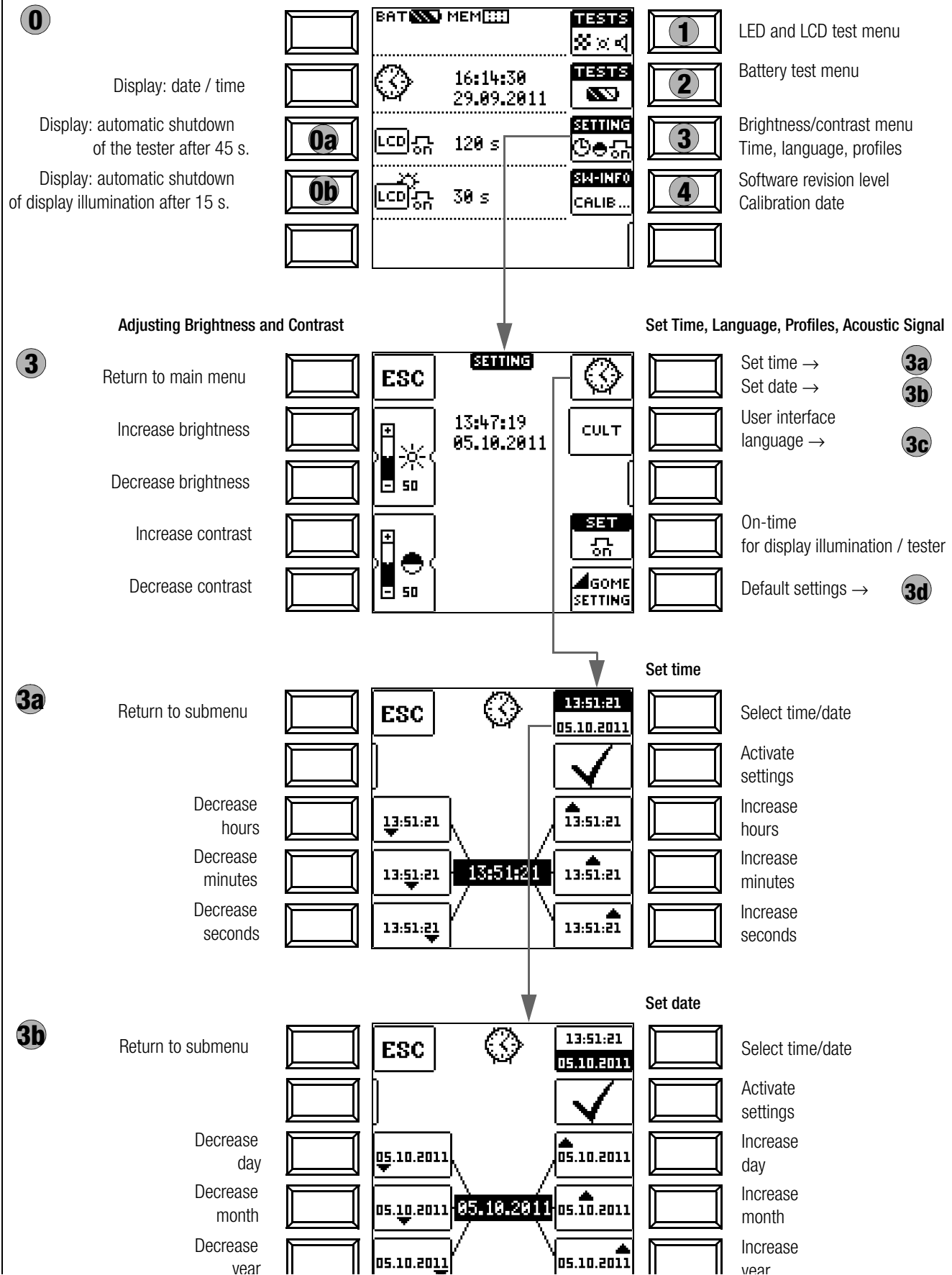
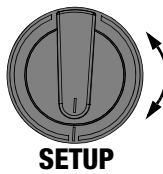
**Time, On-Time and Default Settings**

- Set time → **3a**
- Set date → **3b**
- User interface language → **3c**
- On-time for display illumination / tester
- Default settings → **3d**

Display Illumination On-time

Return to submenu

**Test Instrument On-Time**Automatic shutdown,
deactivated = OFF



0a Test Instrument On-Time

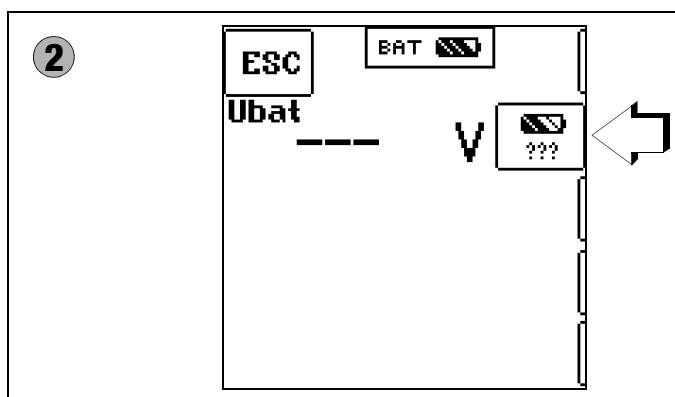
The period of time after which the test instrument is automatically shut off can be selected here. This selection has a considerable influence on the service life and the charging status of the batteries.

0b On-Time for LCD Illumination

The period of time after which LCD illumination is automatically shut off can be selected here. This selection has a considerable influence on the service life and the charging status of the batteries.

Submenu: Battery Level Query

Battery voltage U_{BAT} (U_0) can be queried here without subjecting the battery to a load.

**Note****Measuring Sequence**

If battery voltage drops to below 8.0 V during the course of a measuring sequence, this is only indicated by means of a pop-up window. Measured values are invalid. Measurement results cannot be saved to memory.

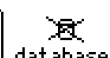


⇒ Press **ESC** in order to return to the main menu.

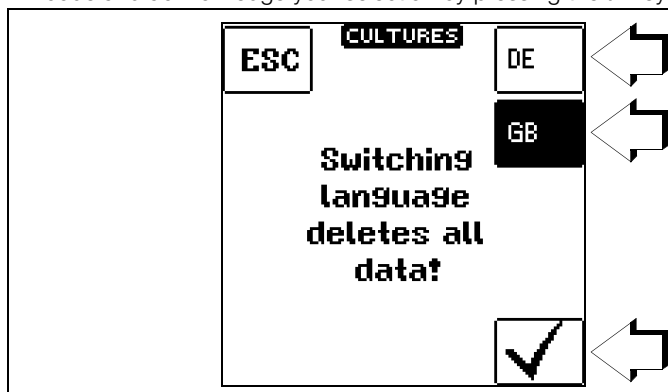
**Attention!**

Data are lost when the **language is changed**, or if the instrument is **reset to its default settings!**

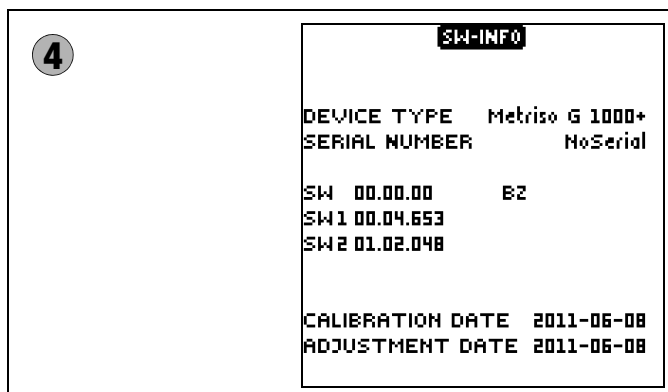
Back up your measurement data to a PC with the help of ETC software before pressing the respective key. The prompt window shown at the right asks you to confirm deletion.

**3c User Interface Language (CULTURE)**

⇒ Select the desired language with the appropriate country code and acknowledge your selection by pressing the **✓** key.

**3d Default Settings (GOME SETTING)**

The test instrument is returned to its original default settings when this key is activated.

Firmware Revision and Calibration Information (example)

⇒ Press any key in order to return to the main menu.

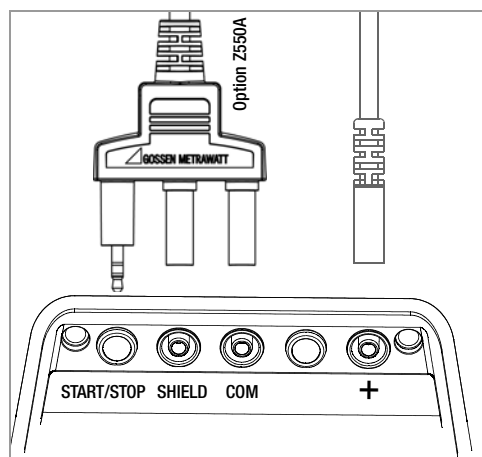
4 General Operation

4.1 Connecting the Instrument

The test leads are connected to the “+” and “COM” jacks.

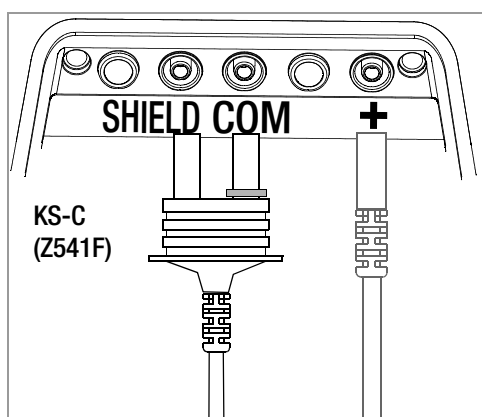
Special Case: Test Probe for Remote Triggering (Option Z550A)

When inserting the 3-pole plug, make sure that the jack plug is inserted in the START/STOP position. Press and align the 3-pole plug such that it is placed flush on the connection terminal. This is the only way to assure that the three contacts of the jack plug are properly connected with the command cables.



Special Case: Measuring High-Value Resistance with the KS-C Probe (Option)

When measuring electrostatic discharge capacity for floor coverings, the shielded cable should be connected to the **COM** and **SHIELD** jacks (KS-C accessory set, “cable set consisting of measurement cable and high-resistance measurement cable for measurements in the GΩ range”, see diagram). Be sure to observe color coding.



4.2 Switching On, Monitoring and Switching Off

After switching on the device, an acoustic message is generated which signals that the test instrument is ready for operation.

If supply voltage drops to a value of less than 8.5 V, the LOW BATT pop-up message appears: No more measurements can be started.

If battery voltage falls below the allowable limit value of 8.0 V, the instrument cannot be switched on, or it is switched off.

Measurements cannot be started in the resistance measuring ranges in the event of interference voltage.

The instrument only switches itself off automatically after completion of an (automatic) measuring sequence, and after the predetermined on-time has expired (see page 8). On-time is reset to its original value as defined in the setup menu, as soon as any key or the rotary function switch is activated.

If the instrument is switched off automatically with the rotary switch in any position other than **OFF**, it can be reactivated by pressing the **ESC** key. The instrument is also reactivated if the rotary switch is activated and turned through the **OFF** position.

The instrument can be switched off manually by turning the rotary switch to the **OFF** position.

4.3 Optical Indicators

LED	Status	Function – Cause
	Limit	Limit Value Indication <ul style="list-style-type: none">Measured insulation resistance does not violate the limit value.Measured low-resistance R_{LO} does not violate the limit value.
	Limit	Limit Value Indication <ul style="list-style-type: none">Measured insulation resistance has fallen short of the selected limit value.Measured low-resistance R_{LO} does not exceed the permissible limit value.
	U _{ramp}	Indication of ramp characteristics <ul style="list-style-type: none">Maximum ramp voltage (upper voltage limit) has been reached (without breakdown).
	U _{ramp}	Indication of ramp characteristics <ul style="list-style-type: none">Maximum ramp voltage (upper voltage limit) has not been reached (due to breakdown). Breakdown voltage is displayed.
		Interference voltage in switched-off condition¹ and signalings of test voltage during insulation measurement <p>Dangerous voltage of greater than 50 V is present at the measurement inputs:</p> <ul style="list-style-type: none">Initialization of insulation resistance and low-resistance measurement is disabled.High test voltage is applied to the measuring terminals (R_{ISO}/R_{INS}, PI and DAR) during insulation measurement
		Detection of interference voltage in the on-state <p>in the resistance measuring ranges after starting measurement</p> <p>The value of interference voltage is displayed in addition to signalling in the resistance measuring ranges for as long as it is present.</p>

¹ Function testing should be executed at regular intervals (see following section regarding testing the LEDs).

Testing the LED which Indicates Detection of Interference Voltage when Switched Off – OFF Switch Position

- Apply a voltage of greater than 50 V (+ and COM jacks).
- Turn the rotary switch to the V position.
- Read the voltage value at the LCD.
- Turn the rotary switch to the OFF position.

Test results: If applied voltage is unchanged and the LED which indicates the detection of interference voltage lights up red, the LED is OK. In this case, the LED reliably indicates interference voltage even when the instrument is switched off. We recommend executing this test at regular intervals.

METRISO XTRA Measuring Functions, Measuring Ranges and Limit Values

	Measuring Ranges
R _{ISO} / R _{INS}	U = 50, 100, 250, 500, 1000 V
R _{ISO} / R _{INS}	U _{var} = 50 ... 1000 V
R _{ISO} / R _{INS}	U _{ramp} (U _↘) = 100 ... 1000 V
R	10 ... 10 kΩ
R _{LO}	0.01 ... 10 Ω
U	0 ... 1000 V

Limit	Limit Values	
	Limit R _{ISO} / R _{INS}	Fixed setting
		50 kΩ @ U _{ISO} /U _{INS} = 50 V
		100 kΩ @ U _{ISO} /U _{INS} = 100 V
		500 kΩ @ U _{ISO} /U _{INS} = 250 V
		1 MΩ @ U _{ISO} /U _{INS} = 500 V
		1 MΩ @ U _{ISO} /U _{INS} = 1000 V
PI limit	Adjustable	1.0, 1.1, 1.5, 2.0, 3.0, 4.0
	Adjustable	1.25, 1.6

4.4 Measurement Value Display and Memory

The following appear at the **display panel**:

- Measurement values with abbreviations and units of measure
- Selected function
- Error messages

Measurement values for automatic measuring sequences are stored and displayed as digital values until the next measurement sequence is started, or until automatic shut-off occurs.

If the upper range limit is exceeded, the upper limit value is displayed and is preceded by the ">" symbol (greater than), which indicates measurement value overrun.



Note

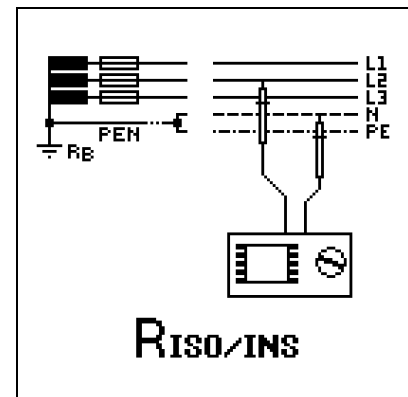
The depiction of LEDs in these operating instructions may vary from the LEDs on the actual instrument due to product improvements.

4.5 Help Function

A wiring diagram can be displayed for selected switch positions, as well as basic functions **after they have been selected with the rotary selector switch**:

- Press the **HELP** key in order to query online help.
- Press the **ESC** key in order to exit online help.

HELP



4.6 Setting Measuring Parameters using Insulation Resistance Measurement as an Example

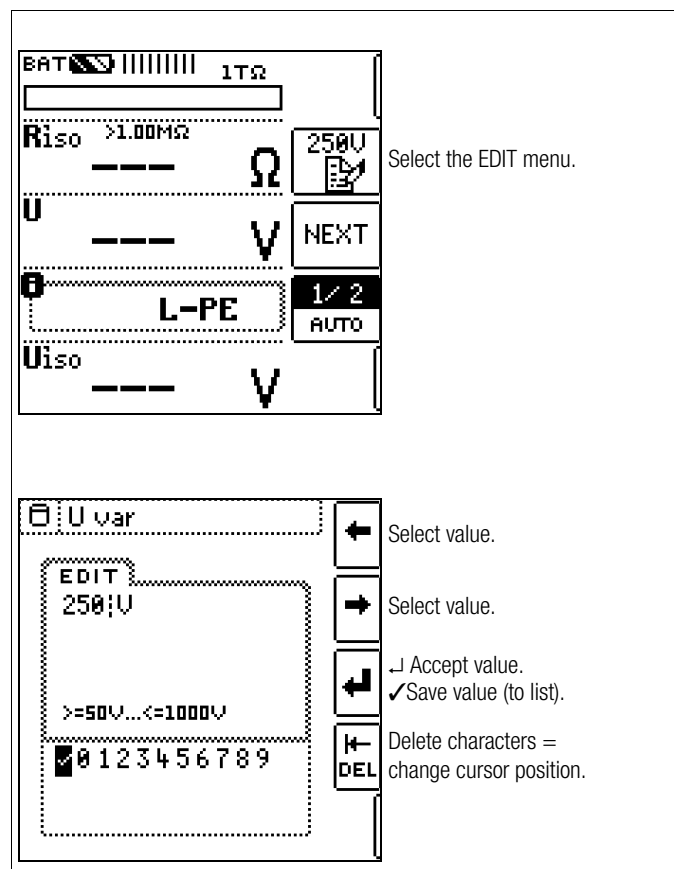
The sequence of screenshots illustrates the process of setting measuring parameters for Insulation Resistance (Riso) measurement:

- Access the submenu for setting the desired parameter.** The main menu shows 'Riso' selected under 'PI/DAR'.
- Select a parameter using the \uparrow or \downarrow scroll key.** The submenu for 'Riso' is displayed, showing 'Riso' selected.
- The setting value is not permanently accepted for the respective measurement until the \checkmark key is pressed, after which the display is returned to the main menu.** The submenu for 'Riso' is displayed, showing 'Riso' selected.
- You can return to the main menu by pressing ESC instead of \checkmark , without accepting the newly selected value.** The final menu shows 'Riso' and 'Limits'.


- 1 Access the submenu for setting the desired parameter.
- 2 Select a parameter using the \uparrow or \downarrow scroll key.
- 3 The setting value is not permanently accepted for the respective measurement until the \checkmark key is pressed, after which the display is returned to the main menu. You can return to the main menu by pressing ESC instead of \checkmark , without accepting the newly selected value.

4.7 Specifying Nominal Voltage for Uvar and Uramp

Nominal voltage can be freely selected within specified limits for the Uvar and Uramp measuring functions:



- 1 Access submenu for selecting the desired voltage:

Press the key with the  icon.

- 2 Select the desired value with the left or right scroll key. The value is accepted by pressing the ↓ key. The entire value is acknowledged by selecting ✓ and then pressing the ↓ key. The new nominal voltage appears at the main display.



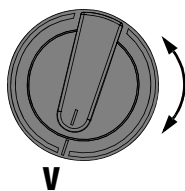
Note

Observe the predefined limits for the new setting value. New, freely selected limit values or nominal values included in the parameters list can be deleted/edited at the PC with the help of ETC software.

5 Measuring Direct Alternating Voltage

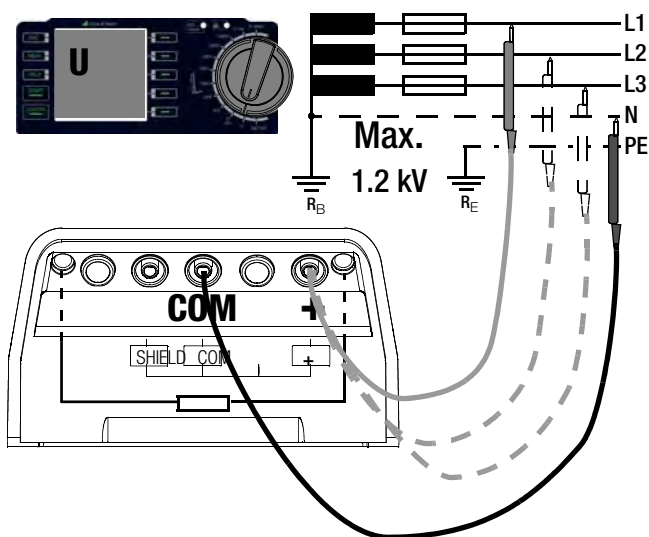
You can measure direct voltage, as well as sinusoidal alternating voltage with frequencies ranging from 45 to 65 Hz, with this test instrument.

Select Measuring Function



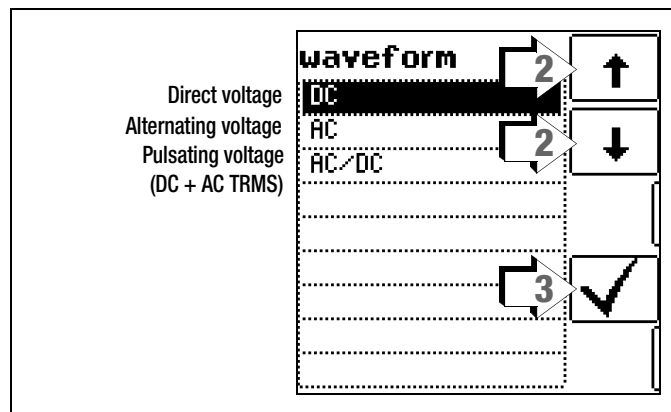
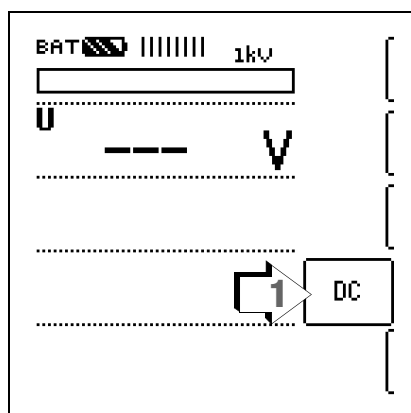
- Select the **V** measuring function with the rotary switch.

Connection

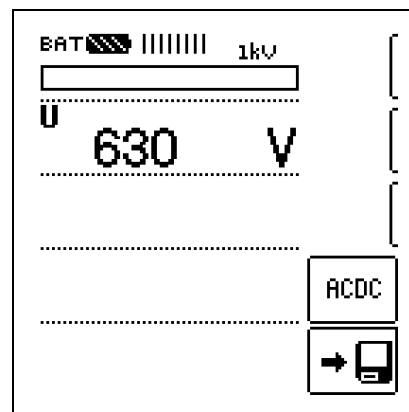


- Connect the measurement cables to the **+** and **COM** jacks.
- Contact the measuring point with both test probes.

Set the waveform parameter (voltage type).



Measurement



The measured value is displayed directly (without pressing the **START** key) – in analog format at the bar graph and in digital format at the matrix display.

- After completing the measurement, switch the instrument off by turning the rotary switch to the **OFF** position.

The **ESC**, **START** and **CONTIN.** keys have no function in this case.

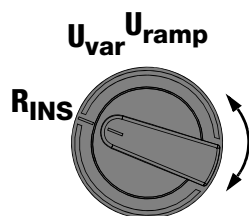


Note

Input impedance for the voltage measuring range is 10 MΩ.

6 Measuring Insulation Resistance

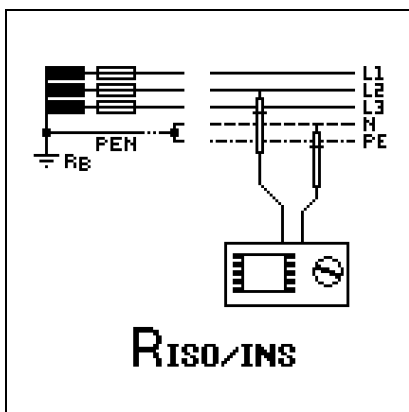
Select Measuring Function



- Select the R_{INS} measuring function with the rotary switch and, depending on the measuring task, constant or variable test voltage (U_{var}), or a ramp function (U_{ramp}).

Connection

HELP



Note

Checking Measurement Cables Before Measurements

Before performing insulation measurement, the test probes on the measurement cables should be short-circuited in order to assure that the instrument displays a value of less than 1 k Ω (see section 9). In this way, incorrect connection can be avoided and broken measurement cables can be detected.

- Connect the device under test to the + and COM jacks. Sample connection layouts for insulation resistance measurement are included in section 13.1.

Insulation resistance can only be measured at voltage-free objects. If mains voltage or interference voltage is applied to the measurement inputs, measurement cannot be started.

Semiautomatic Measurement in Multipole Systems

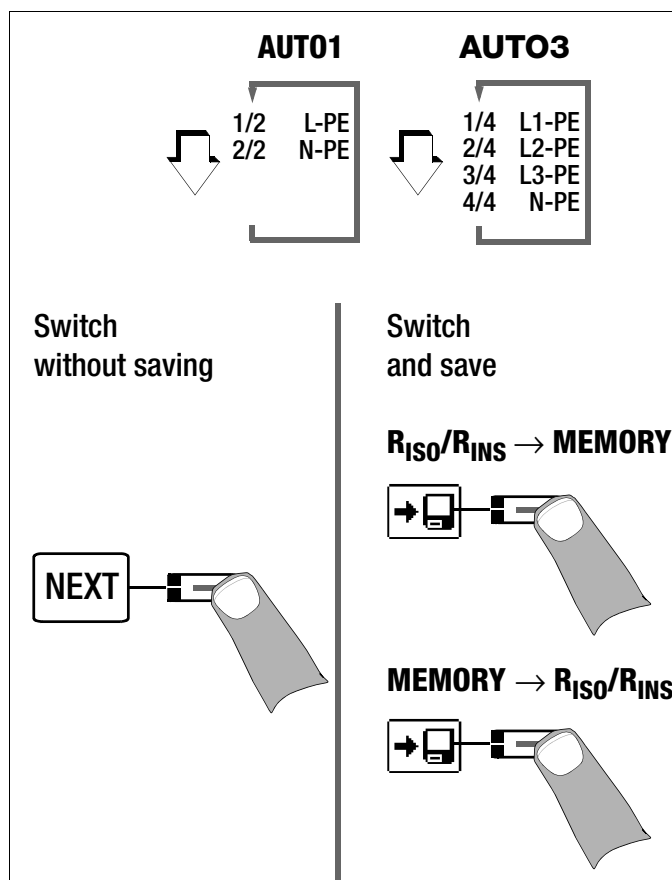
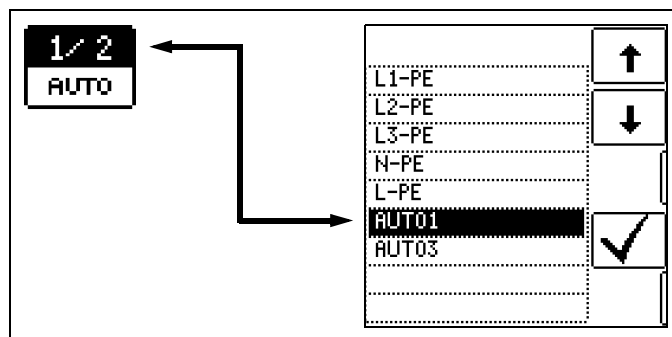
Fast, semiautomatic polarity reversal is possible in all rotary switch positions for insulation resistance measurement. However, polarity selection is only relevant for documentation.

Fast Polarity Reversal

The polarity parameter is set to **AUTO1** (single-phase mains voltage) or **AUTO3** (3-phase mains voltage).

There are two ways to quickly and conveniently switch amongst all polarity variants without switching to the parameter settings submenu:

- Press the NEXT key.
- Press the save key at the instrument twice after each measurement.



Continuous Measurement via the CONTIN. Key

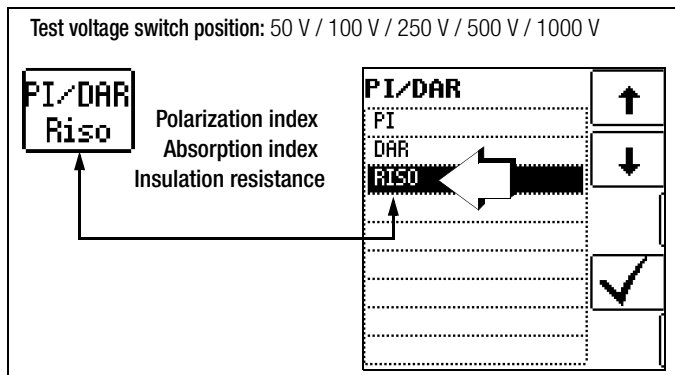


Note

The instrument's batteries are rapidly depleted during the insulation resistance measurement. Stop continuous measurement with "constant test voltage" as soon as the display has settled in.

6.1 Measuring with Constant Test Voltage and Nominal Value Selection via Rotary Switch Position

Set Parameters



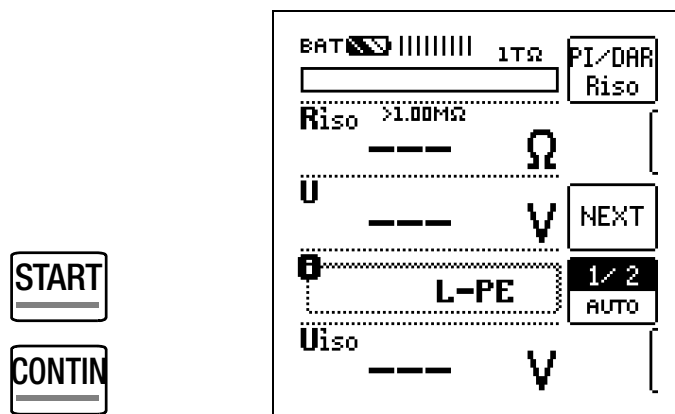
The constant test voltage function offers two options:

- **After briefly pressing the START key**, specified test voltage U_N is read out and insulation resistance RINS is measured. As soon as the measured value is stable (settling time may be several seconds in the case of high cable capacitance values), measurement is ended and the last measured values for RINS and UINS are displayed. **U** is the **voltage** which is measured **at the test probes** during and after testing. This voltage drops to a value of less than 10 V (see section entitled “Discharging the Device Under Test”).

or

- **As soon as you press the CONTIN key**, test voltage U_N is applied and insulation resistance RINS is measured. Do not press the key again in order to stop measurement until the measured value has settled in (settling time may be several seconds in the case of high cable capacitance values). Voltage **U**, which is measured during testing, corresponds to voltage UINS. After once again pressing the **CONTIN** key, measurement is ended and the last measured values for RINS and UINS are displayed. **U** drops to a value of less than 10 V after measurement (see the section entitled “Discharging the Device Under Test”).

Start Measurement



After pressing the **START** key, nominal voltage U_N (50 ... 1000 V) selected with the rotary switch is applied until the measured values settles in.

After pressing the **CONTIN** key, the previously selected test voltage or nominal voltage U_N (50 to 1000 V) is applied until the **CONTIN** key is pressed once again.

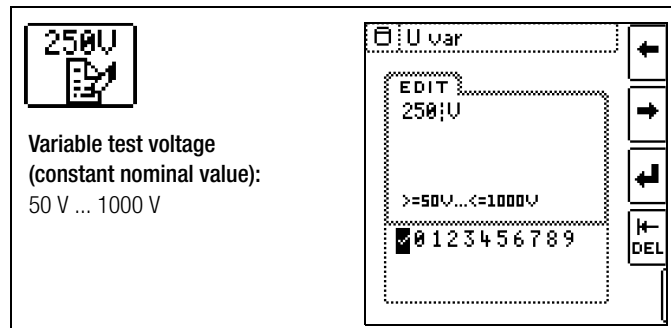
U is the **voltage** which is measured **at the test probes** during and after testing. This voltage drops to a value of less than 10 V after measurement (see section 6.5, “Discharging the Device Under Test”).

Test voltage **U** is displayed for U_{INS} .

6.2 Measurement with Constant Test Voltage and Variably Adjustable Nominal Value

A test voltage which deviates from nominal voltage, and is usually lower, can be selected for measurements at sensitive components, as well as systems with voltage limiting devices.

Set Parameters

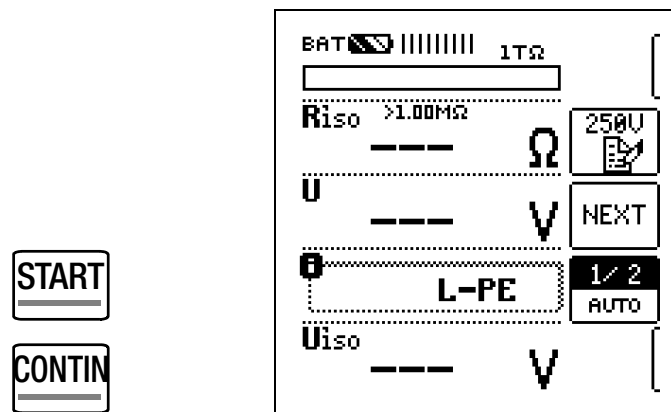


Refer to section 4.7 regarding how to enter the variable voltage. The selected nominal voltage is displayed in the main menu.

□ Pole Selection Report Entry

The poles between which testing takes place can only be entered here for reporting purposes. The entry itself has no influence on the actual polarity of the test probes or pole selection.

Start Measurement



After pressing the **START** key, nominal voltage U_N (50 to 1000 V) entered previously via the parameters menu is applied until the measured values settles in.

After pressing the **CONTIN** key, the previously selected test voltage or nominal voltage U_N (50 to 1000 V) is applied until the **CONTIN** key is pressed once again.

U is the **voltage** which is measured **at the test probes** during and after testing. This voltage drops to a value of less than 10 V after measurement (see section 6.5, “Discharging the Device Under Test”).

Test voltage **U** is displayed for U_{INS} .

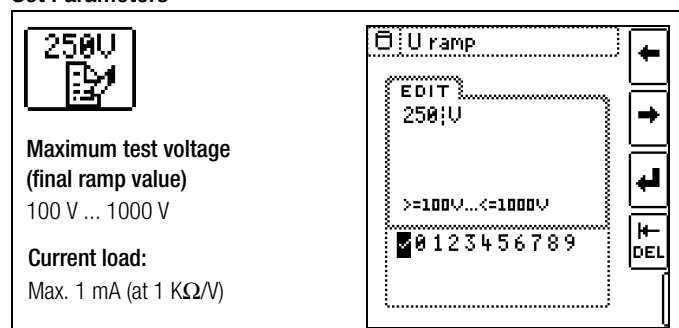
Note

The instrument's batteries are rapidly depleted during the insulation resistance measurement. Stop continuous measurement with “constant test voltage” as soon as the display has settled in.

6.3 Measurement with Rising Test Voltage (ramp function) and Variably Adjustable Final Value

The “U_{ramp}” rising test voltage function (ramp function) is used to detect weak points in the insulation, as well as to determine response voltage for voltage limiting components.

Set Parameters

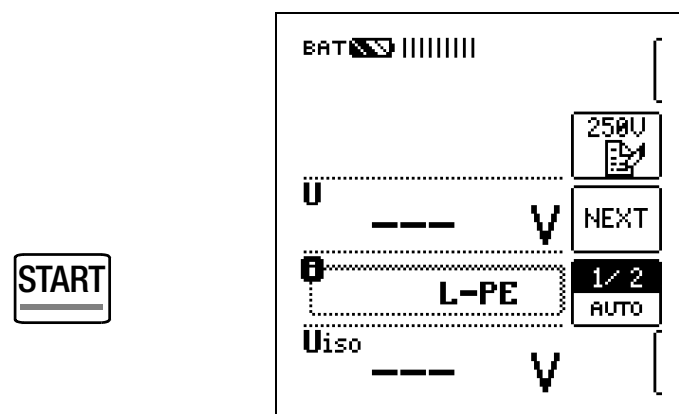


Refer to section 4.7 regarding how to set the final ramp value. The selected nominal voltage value is displayed in the main menu.

❑ Pole Selection Report Entry

The poles between which testing takes place can only be entered here for reporting purposes. The entry itself has no influence on the actual polarity of the test probes or pole selection.

Start Measurement



After briefly pressing the **START** key, test voltage is continuously increased until the specified nominal voltage U_N (100 ... 1000 V) is reached.

Insulation measurement with rising test voltage is ended:

- As soon as specified maximum test voltage U_N is reached and the measured value is stable
- or
- After sparkover occurs at breakdown voltage

As soon as the final ramp value is reached, the **U_{ramp}** LED lights up green. If the final ramp value is not reached due to sparkover, the **U_{ramp}** LED lights up red.

U is the **voltage** which is measured **at the test probes** during and after testing. This voltage drops to a value of less than 10 V after measurement (see section 6.5, “Discharging the Device Under Test”).

Highest achieved test voltage **U** or any **triggering or breakdown voltage** which occurs is displayed for **U_{INS}**.



Note

Measurement can be stopped at any time by pressing the **START** key or the **CONTIN.** key.

6.4 Insulation Resistance Measurement – Special Conditions



Attention!

Insulation resistance can only be measured at voltage-free objects.

If measured insulation resistance is less than the selected limit value, the limit LED lights up red.

If an interference voltage of roughly ≥ 15 V is present and “U_{EXT} – Interference Voltage” appears in a pop-up window, insulation resistance is not measured. In the case of interference voltage > 50 V, the “ > 50 V” LED lights up.

In 3-phase systems, all conductors (L1, L2, L3 and N) must be tested against PE!



Attention!

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

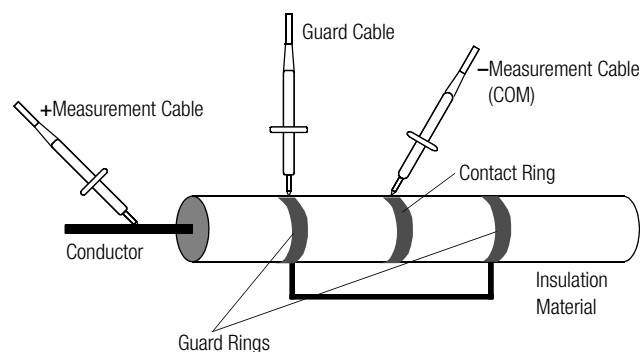
If nothing has been connected to the terminal contacts, or if a resistive load component has been connected for measurement, your body would be exposed to a current of approximately 1 mA at a voltage of 1000 V. The noticeable shock may lead to injury (e.g. resulting from a startled reaction etc.).

6.4.1 Measurements with the Guard Cable

The measurement of very high resistances necessitates extremely minimal measuring current and may be rendered problematic as a result of influences such as electromagnetic fields, humidity or surface pollution. An accurate test set-up is thus absolutely essential.

A guard cable must be used for measurements within a range of 100 GΩ (10 GΩ) ... 1 TΩ, in order to prevent surface current from distorting measurement results. The guard rings prevent current at the surface of the insulation material from flowing from the +measurement cable to the –measurement cable, instead of through the insulation material itself.

- Insert the plug from the guard cable into the appropriate jack in the test instrument.
- Plug the alligator clip onto the guard cable test probe.
- Connect the alligator clip to the guard ring between the two measuring points at the insulation material under test.
- Refer to section 6.1 to section 6.3 regarding the measuring sequence.



Note

The following materials can be used as guard rings: aluminum foil, copper foil or metallic hose clamps.

**Attention!**

If measurement is performed at a capacitive object such as a long cable, it becomes charged with up to approx. 1000 V!

Touching such objects is life endangering!

When an insulation resistance measurement has been performed on a capacitive object it is automatically discharged by the instrument after measurement has been completed. Contact with the device under test must be maintained to this end. The falling voltage value can be observed at the U display.

Do not disconnect the DUT until less than 10 V is displayed for U!

6.6 Evaluation of Measured Values

Instrument measuring error must be taken into consideration in order to assure that the limit values set forth in DIN VDE regulations are not fallen short of. The required minimum display values for insulation resistance can be determined with the help of the table, "Display Values in Consideration of Measuring Uncertainty", on page 30. These values take maximum device error into consideration (under nominal conditions of use). Intermediate values can be interpolated.

6.7 Polarization Index Measurement

In the case of electrical machines which include components with windings (generator and motor windings), it's advisable to conduct polarization index testing. This procedure involves expanded testing of insulation resistance. The accumulation of moisture and contamination on windings can be detected as reduced insulation resistance.

DC measuring voltage from the METRISO XTRA is applied to the insulation for a duration of 10 minutes to this end. Measured values are documented after one minute, and after ten minutes. If the insulation is good, the value measured after ten minutes is higher than the value measured after one minute. The relationship between the two measurement values is the polarization index.

The molecules within the insulation are aligned due to the application of measuring voltage over a long period of time, resulting in polarization. The polarization index indicates whether or not the molecules contained in the insulation can still be moved, thus allowing for polarization. This, in turn, is an indication of the condition of the insulation. The more freely the charge carriers can be moved, the better is the condition of the insulation.

The following rules apply in general:

$$PI = \frac{R_{10min}}{R_{1min}}$$

PI value < 1:	Troubleshooting is required.
PI value = 1 to 2:	Maintenance is advisable.
PI value = 2 to 3:	DUT is OK! No immediate action is required. Preventive maintenance can be planned according to workload.
PI values > 3:	Error-free device under test

Applications

Determination of moisture and contamination levels

**Attention!**

For PI measurement, test instrument on-time should be set to **OFF** (see section 3.4, "Device Settings – SETUP").

**Note****Z550A Option**

Use of the measurement cable with remote start/stop is not advisable for polarization index measurement PI or absorption index measurement DAR, because measurement is only conducted as long as the **START** key is pressed and held. In order to assure that the entire measuring sequence is nevertheless executed, start each measurement with the **START** key at the test instrument only.

Set Parameters

Test voltage switch position: 50 V / 100 V / 250 V / 500 V / 1000 V

PI/DAR
Riso

Polarization Index
Absorption index
Insulation resistance

PI/DAR
PI
DAR
RISO

↑
↓
✓

Limits

PI
> 4.0
> 3.0
> 2.0
> 1.5
> 1.1
> 1.0

↑
↓
✓

Start Measurement

BAT

PI/DAR
Rins

PI > 4.00

Limits

--- R1 min --- Ω
 --- R10 min --- Ω
 U --- U R --- Ω

BAT

PI/DAR
Riso

PI > 1.00

1.08

U 1.03 kV

Limits

01:00 R1 min 33.1 GΩ
 10:00 R10 min 35.7 GΩ
 U 1.03 kV R 35.7 GΩ

→

The selected polarization index menu is only displayed until the rotary switch is activated or the parameter is changed.

6.7.1 Absorption Index (DAR) – DC Charging Test

The absorption index test is part of the polarization index test. Insulation resistance measurements are placed in relationship to one another after 30 and 60 seconds.

Applications: Faster version of the polarization index test.

$$DAR = \frac{R_{60s}}{R_{30s}}$$

Set Parameters

Test voltage switch position: 50 V / 100 V / 250 V / 500 V / 1000 V

PI/DAR
Riso



Polarization Index
Absorption index
Insulation resistance

PI/DAR
PI
DAR
RISO

Limits

DAR
> 1.60
> 1.25

Start Measurement

BAT  



PI/DAR
Rins

DAR > 1.25

Limits

---:--- R30 sec --- Ω
---:--- R1 min --- Ω
U --- V R --- Ω

START

BAT  


PI/DAR
Riso

DAR > 1.25
1.02

U 1.03 kV

Limits

00:30 R30 sec 31.8 GΩ
01:00 R1 min 32.5 GΩ
U 1.03 kV R 32.5 GΩ

→ 

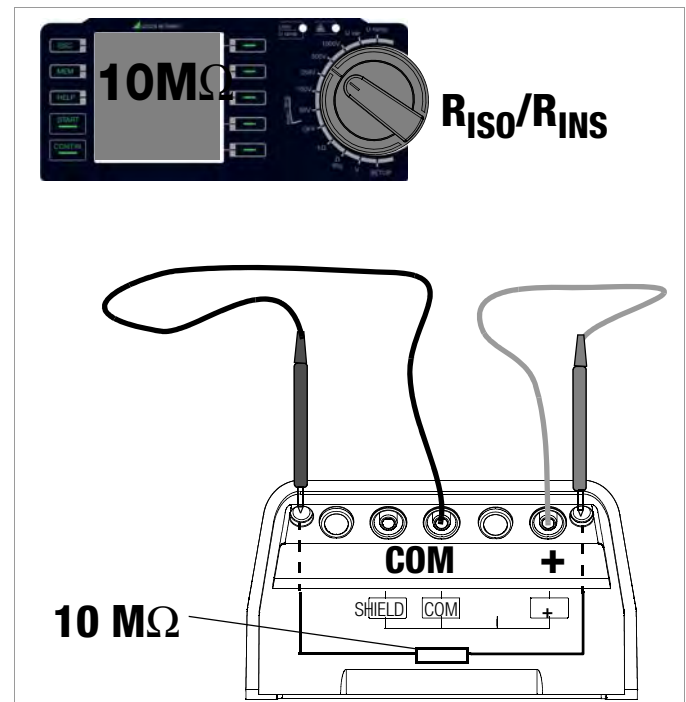
The selected polarization index menu is only displayed until the rotary switch is activated or the parameter is changed.

7 Test Resistor for Insulation Measurement for Checking the Insulation Measuring Instrument

According to section 5.3.1.2 of VDE 0105-100 (EN 50110-1), the following applies: "These measuring instruments must be tested before, and if applicable after use."

The two outermost jacks on the connection panel must be connected to each other internally via a 10 MΩ test resistor to this end.

The sum of test resistor and cable resistance (for both cables), including test probes, amounts to 10 MΩ ±5%. This value allows for quick self-testing.

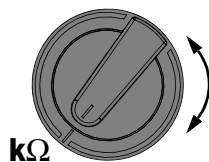


- Connect the measurement cables to the + and COM jacks.
- Insert the test probes into the above described jacks.
- Select the RiSO/INS measuring function with the rotary switch, as well as the desired test voltage, e.g. RiSO 100V.
- Press the start key and view the measurement results.

8 Measuring Resistance – kOhm Function

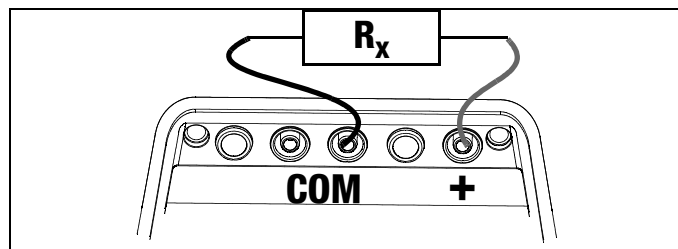
Resistances of greater than 10 Ω and less than 10 k Ω are measured in this switch position. Refer to section 9 regarding resistances of less than 10 Ω .

Select Measuring Function



- Select the **k Ω** measuring function with the rotary switch.

Connection



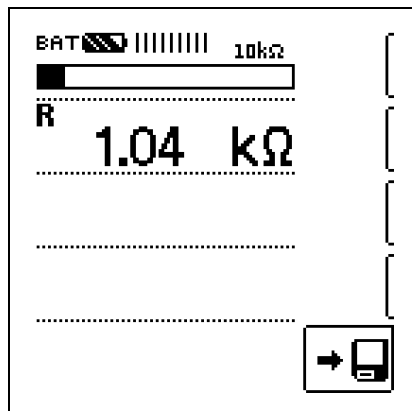
- Connect the device under test to the + and **COM** jacks.



Attention!

Resistance can only be measured at voltage-free objects. If mains voltage or interference voltage is applied to the measurement inputs, measurement cannot be started.

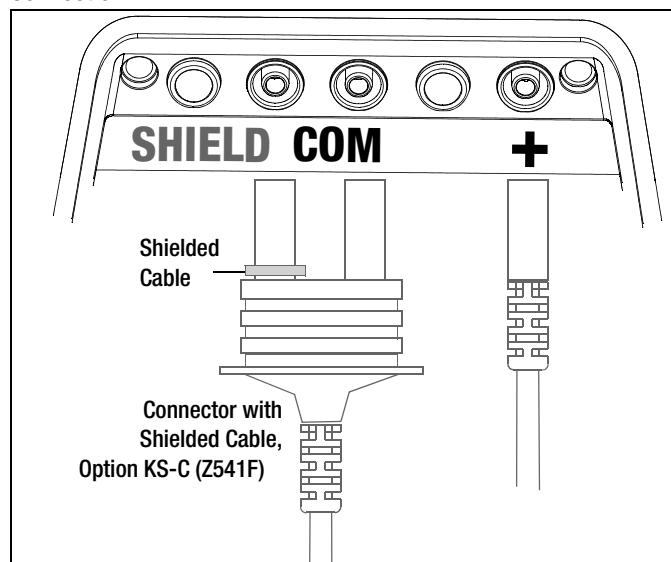
Start Measurement



- Start an individual measurement by briefly pressing the **START** key, or initiate continuous measurement by briefly pressing the **CONTIN** key.

Special Case: Measuring High-Value Resistance with the KS-C Probe

Connection



- Connect the device under test to the + and **COM** jacks with a shielded cable via the optional **KS-C** probe.

9 Measuring Low-Value Resistance of up to 10 Ohm (protective conductor and equipotential bonding conductor)

According to the regulations, the measurement of low-value resistance at protective conductors, earth conductors or bonding conductors must be performed with (automatic) polarity reversal of the test voltage, or with current flow in one direction (+ pole to PE) and then the other (– pole an PE).



Attention!

In the measuring function R_{LO} , measurements are performed with **currents about 200 mA**.

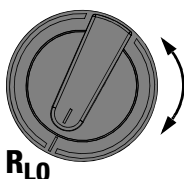
Please check before measuring whether your DUT or your circuit is designed for these high current values.



Attention!

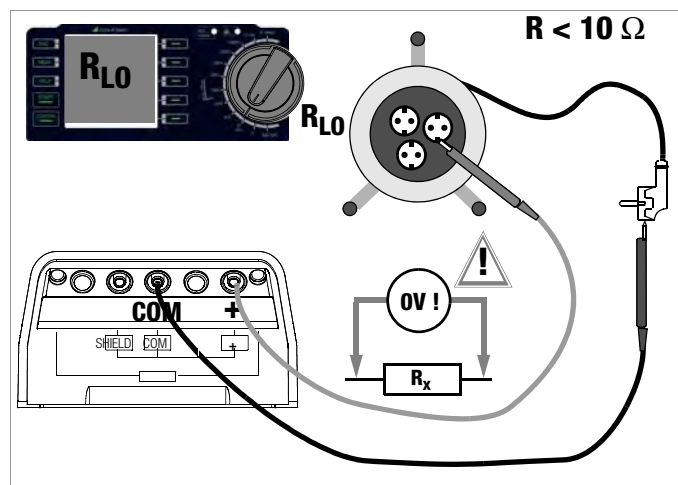
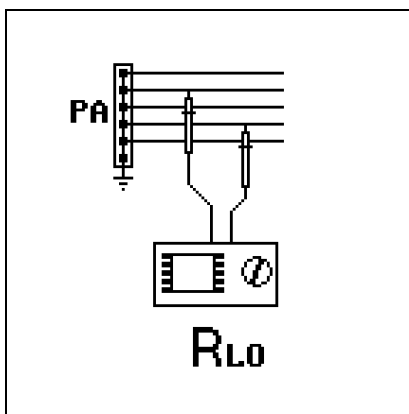
Low-value resistance can only be measured at voltage-free objects.

Select Measuring Function



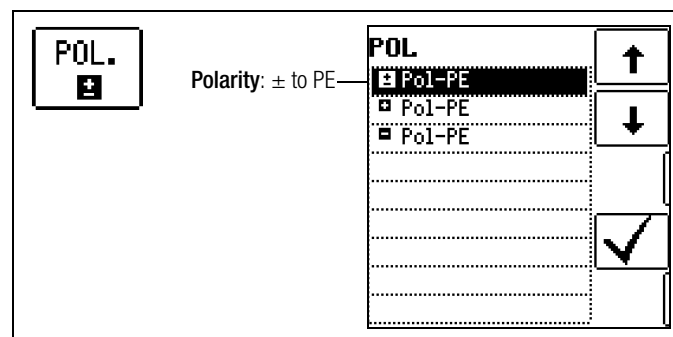
- Select the **Rlo** measuring function with the rotary switch.

Connection



- Connect the device under test to the + and **COM** jacks.

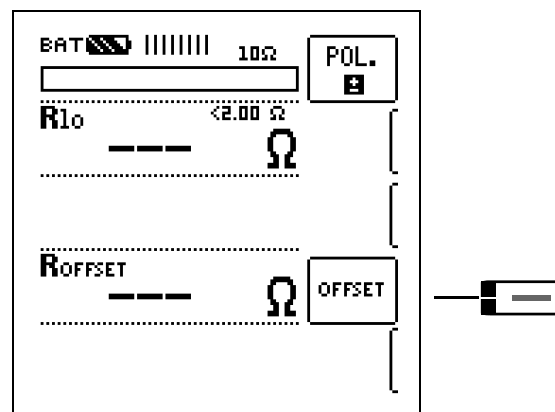
Set Polarity Parameter (direction of current flow)



- Select a polarity option or automatic polarity reversal.

Measuring ROFFSET

When using extension cables with resistance of up to 5.00 Ω , their resistance can be deducted automatically from the measurement results. Proceed as follows:



- Short-circuit the end of the measurement extension cable with the second test probe at the instrument.
- Start measurement of offset resistance with **ROFFSET**.



Note

If the difference between R_{LO+} and R_{LO-} is great than 10% with automatic polarity reversal, no offset is accepted. A pop-up window appears which must be acknowledged by any desired key. The respectively smaller value is otherwise stored to memory as an offset value.

The maximum offset value is 5.00 Ω . Negative resistances may result due to the offset value.

The permissible value for **ROFFSET** is between 0.00 and 5.00 Ω . In the case of values of greater than 5.00 Ω , a pop-up window appears and the value is not accepted. The error message must be acknowledged and/or cleared by any desired key. The measured **ROFFSET** value will now be deducted from the actual measurement value for all subsequent R_{LO} measurements.

ROFFSET can be deleted at any time by pressing the **OFFSET CLEAR** key.



Note

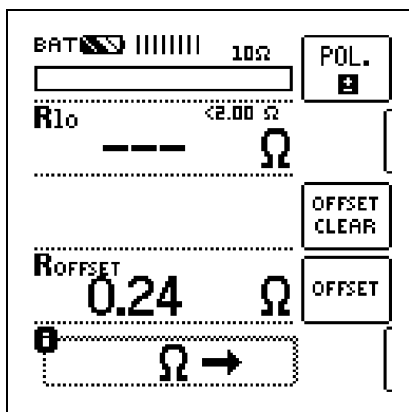
Only use this function when performing measurements with extension cables.

When different extension cables are used, the above described procedure must always be repeated.

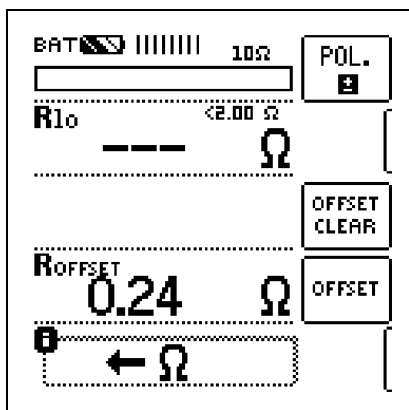
Start Measurement



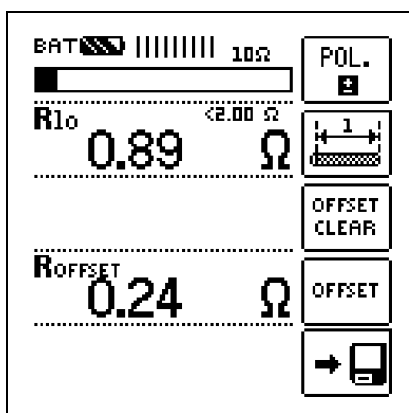
Measurement of + pole to PE



Measurement of – pole to PE



Final results



Attention!

The measurement cannot be started until the test probes are in contact with the device under test.

If a voltage of $U > \text{approx. } 3 \text{ V}$ is present at the device under test, a pop-up window appears which warns against interference voltage.

This error message must be acknowledged and/or cleared by any desired key. Eliminate the interference voltage.

If resistance is greater than 10Ω , OL appears at the display.

In the case of single-pole measurement, the respective value is saved to the database as RLO.

Polarity Selection	Display	Condition
+ pole to PE	RLO+	None
– pole to PE	RLO–	None
± pole to PE	RLO	If $\Delta RLO \leq 10\%$
	RLO+	If $\Delta RLO > 10\%$

Automatic Polarity Reversal

After the measuring sequence has been started, the instrument performs measurement with automatic polarity reversal, first with current flow in one direction, and then in the other.

If the difference between RLO+ and RLO– is greater than 10% with automatic polarity reversal, RLO+ and RLO– values are displayed instead of RLO. The respectively larger value, RLO+ or RLO–, appears at the top and is saved to the database as the RLO value.

Resistances which do not demonstrate a stable value until after a “settling in period” should not be measured with automatic polarity reversal. Measurement with automatic polarity reversal may lead to varying and/or inflated measurement values, and thus to an ambiguous reading.

Limit Value Indication

If the measured value is less than or equal to 2Ω , the **limit LED** lights up green. If the measured value is greater than 2Ω , the LED lights up red.

Evaluating Measurement Results

Differing results for measurements in both directions indicate voltage at the DUT (e.g. thermovoltages or unit voltages).

Measurement results can be distorted by parallel connected impedances at load current circuits and by equalizing current, especially in systems which make use of “overcurrent protection devices” (previous neutralization) without an isolated protective conductor. Resistances which change during measurement (e.g. inductance), or a defective contact, can also cause distorted measurements (double display).

In order to assure unambiguous measurement results, causes of error must be located and eliminated.

In order to find the cause of measuring error, measure resistance in both current flow directions.



Note

Measuring Low-Value Resistance

If an extension cable is used its resistance must be measured and deducted from the measurement results.

Resistances which do not demonstrate a stable value until after a “settling in period” should not be measured with automatic polarity reversal, but rather one after the other with positive and negative polarity.

Examples of resistances whose values may change during measurement include:


- Incandescent lamp resistance, whose values change due to warming caused by test current
- Resistances with a large conductive component
- Contact resistance

Evaluating of Measured Values

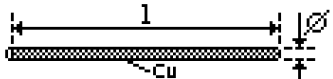
See table, "Display Values in Consideration of Measuring Uncertainty", on page 30.

Calculation of Cable Lengths for Common Copper Conductors



If the  key is activated after performance of resistance measurement, the cable lengths corresponding to common conductor cross sections are displayed.



RLo:			
			
\varnothing	l	\varnothing	l
[mm ²]	[m]	[mm ²]	[m]
0.14:	1.42	2.5:	25.3
0.25:	2.53	4.0:	40.5
0.50:	5.07	6.0:	60.8
0.75:	7.60	10.0:	101
1.00:	10.1	16.0:	162
1.50:	15.2	25.0:	253

If results vary for the two different directions of current flow, cable length is not displayed. In this case, capacitive or inductive components are apparently present which would distort the calculation.

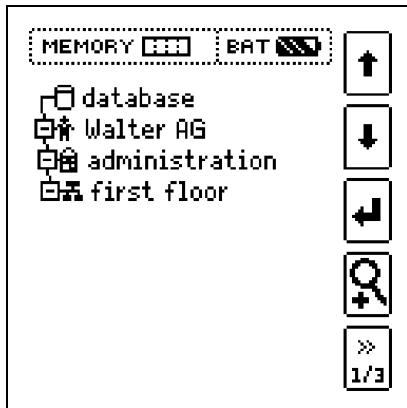
This table only applies to cables made with commercially available copper conductors and cannot be used for other materials (e.g. aluminum)!

10.1 Creating Distributor Structures, General

A complete distributor structure with customer, building and distributor data can be created in the METRISO XTRA test instrument. This structure makes it possible to assign measurements to distributors in various buildings and customer facilities.

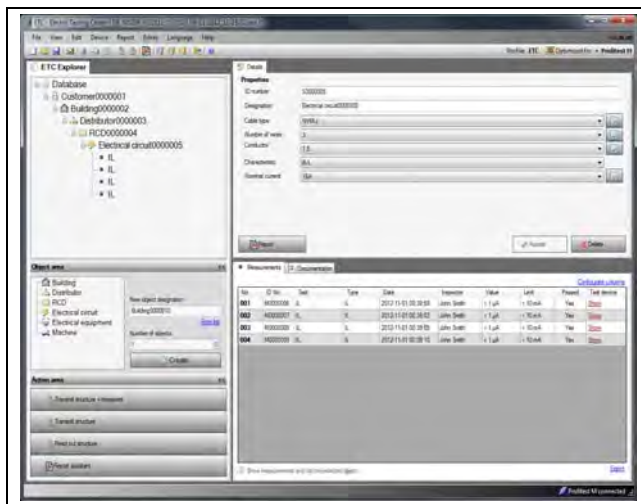
There are two possible procedures:

- On location or at the construction site:
Create the distributor structure in the test instrument. A distributor structure with up to 50,000 structural elements can be created in the test instrument, which is saved to the instrument's flash memory.



or

- Create and save a distributor structure at a PC with the help of **ETC report generating software** (Electric Testing Center) (see condensed operating instructions for ETC report generating software). The distributor structure is then transferred to the test instrument.



Note regarding ETC Report Generating Software

The following steps must be completed before using the software:

- Install USB device drivers:**
(required for operation of the METRISO XTRA at a PC):
GMC-I Driver Control software can be downloaded from Gossen Metrawatt's website at:
www.gossenmetrawatt.com
- Install ETC report generating software:**
You can download the current ETC version free of charge from our homepage under section **myGMC** after registration or login:
www.gossenmetrawatt.com

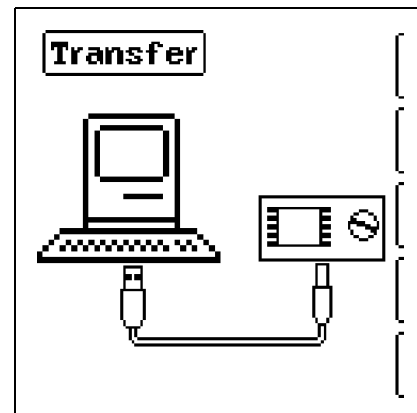
10.2 Transferring Distributor Structures

The following data transfer operations are possible:

- Transfer a distributor structure from the PC to the test instrument.
- Transfer a distributor structure including measured values from the test instrument to the PC.

The test instrument and the PC must be connected with a USB cable in order to transfer distributor structures and data.

The following image appears at the display during transfer of structures and data.



10.3 Creating a Distributor Structure in the Test Instrument

Overview of the Meanings of Icons used to Create Structures

Icon		Meaning
Main Level	Sub-Level	
		Memory menu, page 1 of 3
		Cursor UP: scroll up
		Cursor DOWN: scroll down
		ENTER: acknowledge selection + → - change to sub-level (open directory) or - → + change to main level (close directory)
		Display structure designation or ID number
		Switch back and forth between structure designation and ID number
		Hide structure designation or ID number
		Change display to menu selection
		Memory menu, page 2 of 3
		Add a structural element
		Meaning of icons from top to bottom: Customer, building, distributor, RCD and electrical circuit (display of the icons depends on the selected structural element). Selection: up/down scroll keys and ↵
		In order to add a designation to the selected structural element, refer to the edit menu below.
	EDIT	For additional icons see edit menu below.
		Delete the selected structural element.
		Show measurement data, if a measurement has been performed for this structural element.

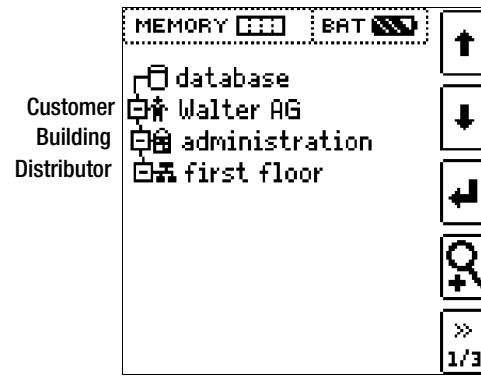
Icon	Meaning
	Edit the selected structural element.
	Memory menu, page 3 of 3
	Search for ID number. > Enter complete ID number.
	Search for text. > Enter full text (complete word).
	Search for ID number or text.
	Continue searching.
	Edit menu
	Cursor left: Select an alphanumeric character.
	Cursor right: Select an alphanumeric character.
	ENTER: Accept an individual character.
	Acknowledge entry
	Cursor left
	Cursor right
	Delete characters.
	Switching amongst different types of alphanumeric characters:
A	✓ABCDEFGHIJK Upper case letters LMNOPQRSTUVWXYZ XYZ↵↵
a	✓abcdefghijklmnopqrstuvwxyz Lower case letters lmnopqrstuvwxyz xyz↵↵
0	✓0123456789+ Numbers -*/=:;_(<> .!?↵↵
@	✓@äÅöÜß€\$% Special characters &#äåëïöóü À Á Â Ã ↵↵

Distributor Structure Symbology / Tree Structure

A **check mark** to the right of a structural element means that all measurements within the respective hierarchy have been passed.

x: At least one measurement has not been passed.

No symbol: Measurement has not yet been performed.



Same type of element as in the Windows Explorer:

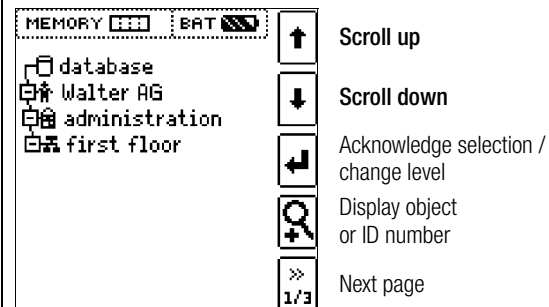
+: Sub-object available, display by pressing ↵.

–: Sub-objects are displayed, hide by pressing ↵.

10.3.1 Creating Structures (example for electrical circuit)

After selection with the **MEM** key, all setting options for the creation of a tree structure are made available on three menu pages (1/3, 2/3 and 3/3). The tree structure consists of structural elements, referred to below as objects.

Select the position at which a new object will be added.

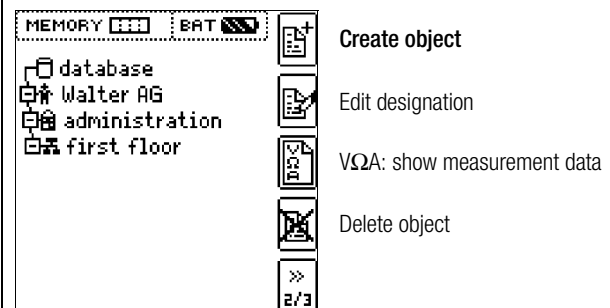


Use the ↑↓ keys in order to select structural elements.

Change to the sub-level with the ↵ key.

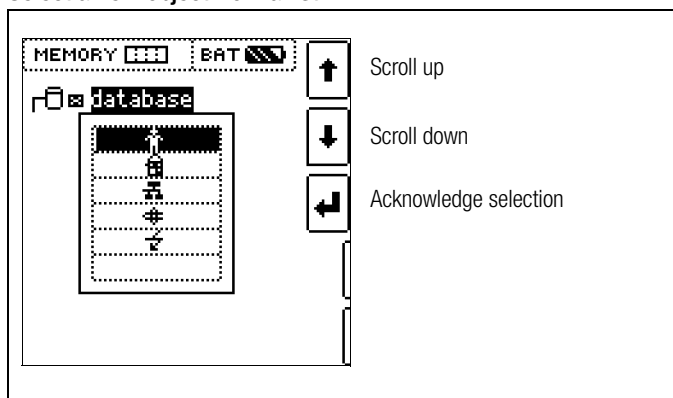
Go to the next page with the >> key.

Create a new object.



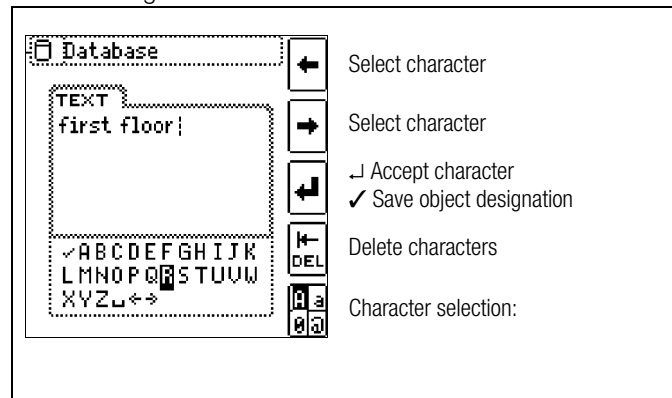
Press the key in order to create a new object.

Select a new object from a list.



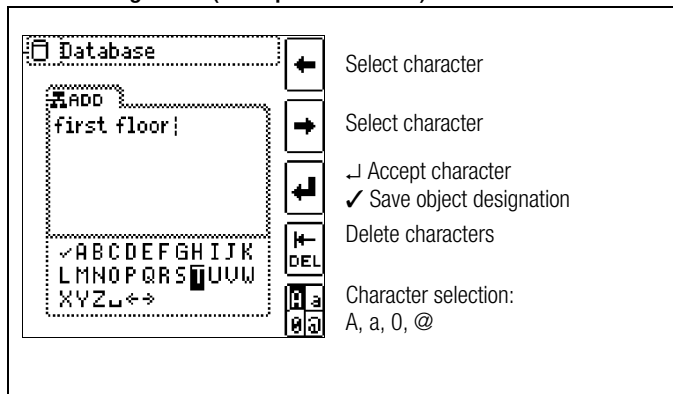
Select the desired object from the list with the ↑↓ keys and acknowledge with the ↵ key.

After selecting text search ...

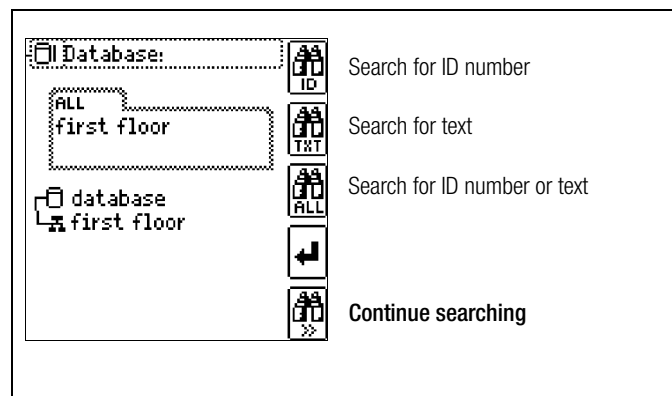


... and entering the desired text (only full matches are found – no wild cards, case sensitive) ...

Enter a designation (Example Distributor).



Enter a designation and then acknowledge it by entering a ✓.

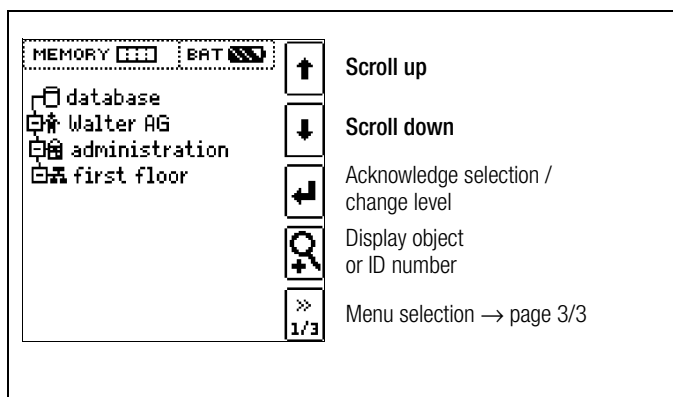


... the first match is displayed.

Further matches can be found by selecting the icon shown at the right.

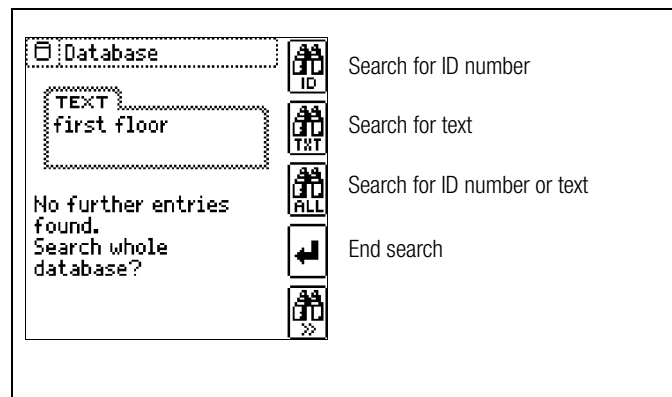
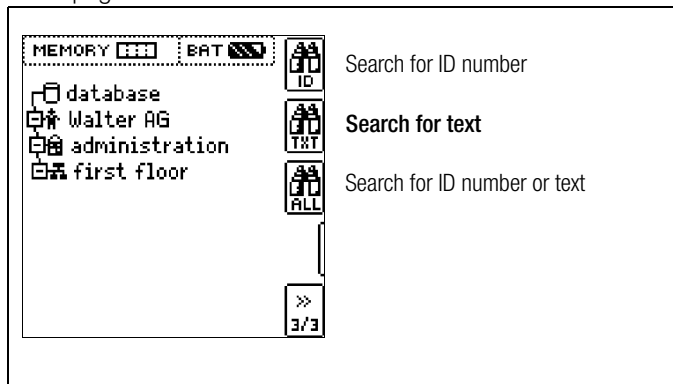


10.3.2 Searching for Structural Elements



Mark the structural element from which the search will be started. Objects located underneath or next to this object will be included in the search.

Go to page 3/3 in the database menu.



If no further matches are found, the message shown above is displayed.

10.4 Saving Data and Generating Reports

Preparing and Executing a Measurement

Measurements can be performed and stored to memory for each structural element. Proceed as follows, adhering to the prescribed sequence:

- Select the desired measurement with the function selector switch.
- Start the measurement by pressing the **START** key.

Upon completion of measurement, the "→ Floppy Disk" softkey is displayed.

- Briefly press the "Save Value" key.



The display is switched to the memory menu or the structural view.

- Navigate to the desired memory location, i.e. to the desired structural element / object, for which the measurement data will be saved.
- If you would like to save a comment along with the measurement, press the key shown at the right and enter a designation via the "EDIT" menu as described in section 10.3.1.
- Complete data storage by pressing the "STORE" key.



Alternative Storage Procedure

- The measured value can be saved to the last selected object in the structural diagram by **pressing and holding** the "Save Value" key, without switching the display to the memory menu.



Note

If you change the parameters in the measurement view, they are not saved for the structural element. A measurement with changed parameters can nevertheless be saved to the structural element, and any changed parameters are documented in the report for each measurement.

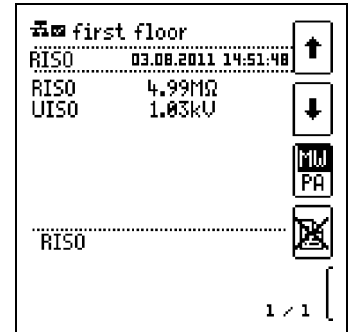
Retrieving Saved Measured Values

- Switch the display to the distributor structure by pressing the **MEM** key and select the desired electrical circuit with the scroll keys.
- Switch to page 2 by pressing the key shown here:
- Display the measurement data by pressing the key shown here:



One measurement with date and time, as well as any comment you might have entered, is displayed in each screen.

Example:
RCD Measurement



Note

An inverse displayed **check mark** in the header means that the respective measurement has been passed.
An inverse displayed **X** means that the measurement has not been passed.

- Scrolling amongst measurements is possible with the keys shown here:



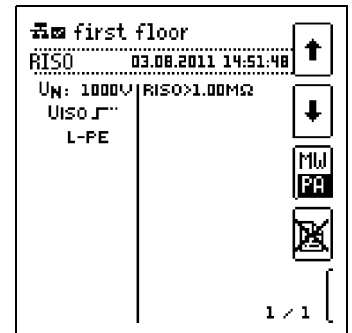
- The measurement can be deleted with the key shown here:



A prompt window asks you to confirm deletion.



With the help of the key shown at the right (MW: measured value / PA: parameter), the setting parameters can be displayed for this measurement.



- Scrolling amongst measurements is possible with the keys shown here:



Data Evaluation and Report Generation with ETC Software

All data, including the distributor structure, can be transferred to the PC and evaluated with the help of ETC software. Additional information can be entered here subsequently for the individual measurements. After pressing the appropriate key, a report including all measurements within a given distributor structure is generated, or the data are exported to an Excel spreadsheet.



Note

The database is exited when the rotary selector switch is turned. Previously selected parameters in the database are not used for the measurement.

10.4.1 Use of Barcode Scanners and RFID Readers

Search for an Already Scanned Barcode

The search can be started from any switch setting and menu.

⇒ Scan the object's barcode.

The search is started based on the currently selected structural element down through lower hierarchical levels. The found barcode is displayed inversely.

⇒ This value is accepted after pressing the ENTER key.



Note

An already selected object cannot be found.

Continued Searching in General



Regardless of whether or not an object has been found, searching can be continued by pressing this key:

- Object found: Searching is continued underneath the previously selected object.
- No further object found: The entire database is searched at all levels.

Reading In a Barcode for Editing

If the menu for alphanumeric entry is active, any value scanned by means of a barcode or RFID reader is accepted directly.

Using a Barcode Printer (accessory)

A barcode printer allows for the following applications:

- Read-out of ID numbers as encrypted barcodes; for quick and convenient acquisition for periodic testing
- Read-out of repeatedly occurring designations, such as test object types, encrypted as barcodes in a list, allowing them to be read in as required for comments.

11 Characteristic Values

METRISO XTRA

Meas. Qty.	U _{ISO}			Range	Measuring Range	Resolution	Open-Circuit Voltage U _{0max}	Test Current	Intrinsic Uncertainty	Measuring Uncertainty	Overload Capacity	
R _{ISO}	50 V	100 V	250 V / 500 V	1000 V	100 k	10 kΩ ... 99.9 kΩ	0.1 k	50 V/100 V: 1.25 U _{ISO} 250 V / 500 V / 1000 V: 1.1 U _{ISO}	I _N = 1 mA I _K ≤ 5 mA	±(5% rdg. + 3 d)	±(7% rdg. + 3 d)	1000 V AC/DC TRMS
					1 M	100 kΩ ... 999 kΩ	1 k					
					10 M	1.00 MΩ ... 9.99 MΩ	10 k					
					100 M	10.0 MΩ ... 99.9 MΩ	100 k					
					1 G	100 MΩ ... 999 MΩ	1 M					
					10 G	1.00 GΩ ... 9.99 GΩ	10 M					
					100 G	10.0 GΩ ... 99.9 GΩ	100 M					
					1 T	100 GΩ ... 999 GΩ	1 G					
U AC/DC				100 V	10.0 V ... 99.9 V	0.1 V	—	—	±(2.5% rdg. + 3 d)	±(5% rdg. + 3 d)	1000 V AC/DC TRMS ³⁾	
				1000 V	100 V ... 999 V	1 V						
R _{LO}				10 Ω	0.17 ... 9.99 Ω	0.01 Ω	4 V < U ₀ < 6 V	200 mA ≤ I ≤ 260 mA ⁴⁾	±(2.5% rdg. + 3 d)	±(5% rdg. + 3 d)	1000 V AC/DC TRMS	
R	Display range as of 01.0 Ω			100 Ω	10.0 ... 99.9 Ω	0.1 Ω	U ₀ max. 15 V	1 mA ≤ I ≤ 1.3 mA	±(2.5% rdg. + 3 d)	±(5% rdg. + 3 d)	1000 V AC/DC TRMS	
				1 kΩ	100 ... 999 Ω	1 Ω						
				10 kΩ	1.00 ... 9.99 kΩ	10 Ω						

- ¹⁾ the indicated accuracy is only achieved with the optional accessory „shielded high-resistance measuring cable KS-C (article number Z541F)“
⁴⁾ up to 5 Ω

- ²⁾ does not conform to DIN EN 61557-2
³⁾ Display range up to 1.2 kV

Breakdown Voltage (U_{ramp})

Parameter	Range	Intrinsic Uncertainty	Measuring Uncertainty
Voltage range	100 ... 1000 V	±(10% rdg. + 8 d)	±(15% rdg. + 10 d)
Rise time	5 ... 300 s	—	—
Measuring time	1 ... 120 s / auto / cont. measurement	—	—

Polarization Index (PI), Absorption Ratio (DAR)

	t1 [min.]	t2 [min.]	Limit [min.]
PI	01:00	10:00	> 4.0 / > 3.0 / > 2.0 / > 1.5 / > 1.1 / > 1.0
DAR	00:30	01:00	> 1.60 / > 1.25

PI and DAR are calculated values. Insulation measurement specifications apply.

Reference Conditions

Reference temperature	+ 23 °C ±3 K
Relative humidity	40 to 75%
Measured quantity frequency	45 to 65 Hz
Measured quantity waveshape	Sine, deviation between TRMS and rectified value < 1%
Battery voltage	9.5 V ±0.1 V
Test resistance	10 MΩ ±1%


Electrical Safety

Protection class	II per IEC/EN 61010-1/VDE 0411-1
Pollution degree	2
Measuring category	CAT II 1000 V / CAT III 600 V / CAT IV 300 V
Fuses	
Fuse link	FF315mA/1000V, effective in all resistance measuring ranges, 1 additional replacement fuse in the battery compartment
Electronic fuse	Protects low-resistance and resistance measurements R _{LO} and R

Electromagnetic Compatibility (EMC)

Interference emission	EN 61326-1:2013, class B
Interference immunity	EN 61326-1:2013

Power Supply

Batteries	8 ea. 1.5 V mignon cell (8 ea. size AA) (alkaline manganese per IEC LR14) or 8 rechargeable NiMH batteries (must be recharged externally)
Z502R charger	Broad-range charger with barrel connector, input: 100 to 240 V AC, output: 16.5 V DC, 1 A (Mascot)
Nominal range of use	8.5 to 12 V
Battery test	Battery capacity display with battery symbol in 4 segments:  . Querying of momentary battery voltage via menu function.
Battery saver circuit	Automatic shutdown of display illumination after 10 to 30 seconds (after the last time the rotary switch is actuated) can be selected in the setup menu (see page 8). The test instrument is automatically switched to the standby mode if the measured value remains unchanged for approximately 15 minutes, and if none of the controls are activated during this time. The instrument is switched off automatically if the measured value remains unchanged for a long period of time and if none of the keys or the rotary switch have been activated during on-time (specified in seconds).
Service life	For R _{INS} (1000 V / 1 MΩ) and R _{LO} with 25 s on-time and 1 subsequent measurement each for a duration of 5 s – With batteries (alkaline manganese): 700 measurements – With rechargeable batteries (2000 mAh): 650 measurements
Safety shutdown	If supply voltage is too low (U < 8 V), the instrument is switched off, or cannot be switched on.
Recharging socket	Installed rechargeable batteries can be recharged directly by connecting a charger to the recharging socket: charger Z502R
Charging time	Approx. 2 hours *

- * Maximum charging time with fully depleted rechargeable batteries.
 A timer in the charger limits charging time to no more than 4 hours.

Displays

Digital display

Multiple display with dot matrix
128 x 128 pixels, backlit (transflective),
dimensions: 65 x 65 mm

Limit LED

LED lights up red to indicate an exceeded
limit value.

LED lights up green to indicate adherence
to the limit value.

LED 

LED lights up red to indicate the presence
of an external voltage (with the instrument
switched off)

or high test voltage during insulation mea-
surement (Riso/Rins, PI and DAR) at the
measuring terminals

Uramp LED

LED lights up green to indicate ramp
sequence in progress.

LED lights up red to indicate interrupted
ramp sequence (e.g. in case of break-
down).

Ambient Conditions

Accuracy temperature
range

0 ... +40 °C

Operating temperature

-10 ... +50 °C

Storage temp. range

-25 ... +70 °C (without batteries)

Relative humidity

Up to 75% (max. 85% during storage/
transport), no condensation allowed

Elevation

Max. 2000 m

Calibration interval

1 year (recommended)

Mechanical Design

Dimensions

225 x 130 x 140 mm

Weight

Approx. 1.4 kg with batteries

Protection

Housing: IP 52, measurement cables and
connectors: IP 40 per DIN VDE 0470, part
1 / EN 60529, housing category 2

Excerpt from Table on the Meaning of IP Codes

IP XY (1 st digit X)	Protection Against Foreign Object Entry	IP XY (2 nd digit Y)	Protection Against Penetration by Water
2	≥ 12.5 mm dia.	2	Dripping (at 15° angle)
3	≥ 2.5 mm dia.	3	Spraying water
4	≥ 1.0 mm dia.	4	Splashing water
5	Dust protected	5	Jet-water
6	Dust-proof	6	Powerful water jets

Display Values in Consideration of Measuring Uncertainty

Table for determining minimum display values for insulation resistance in
consideration of the instrument's measuring uncertainty.

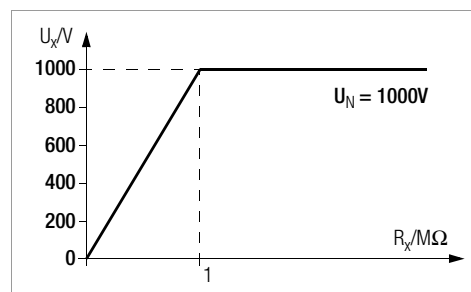
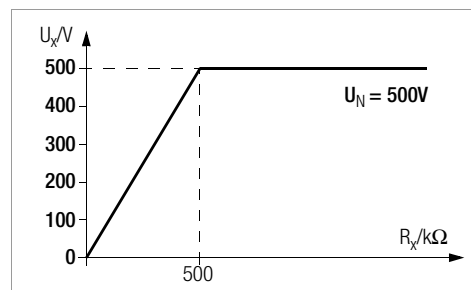
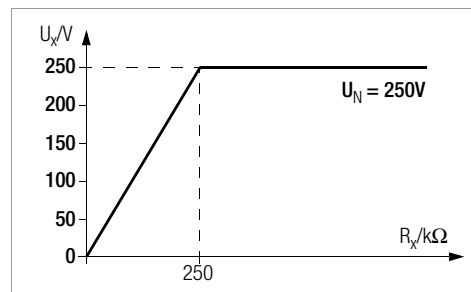
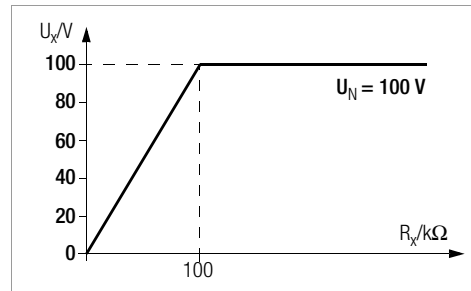
Limit Value	Minimum Display Value	Limit Value	Minimum Display Value
020 kΩ	025 kΩ		
100 kΩ	111 kΩ	100 MΩ	111 MΩ
200 kΩ	219 kΩ	200 MΩ	219 MΩ
500 kΩ	541 kΩ	500 MΩ	541 MΩ
0.20 MΩ	0.25 MΩ		
0.50 MΩ	0.57 MΩ		
1.00 MΩ	1.11 MΩ	1.00 GΩ	1.11 GΩ
2.00 MΩ	2.19 MΩ	2.00 GΩ	2.19 GΩ
5.00 MΩ	5.41 MΩ	5.00 GΩ	5.41 GΩ
10.0 MΩ	11.1 MΩ	10.0 GΩ	11.1 GΩ
20.0 MΩ	21.9 MΩ	20.0 GΩ	22.6 GΩ
50.0 MΩ	54.1 MΩ	50.0 GΩ	55.9 GΩ

Table for determining maximum display values for low-value resistance in
consideration of the instrument's measuring uncertainty.

Limit Value	Maximum Display Value	Limit Value	Maximum Display Value
0.15 Ω	0.11 Ω		
0.20 Ω	0.16 Ω	5.00 Ω	4.72 Ω
0.50 Ω	0.44 Ω	10.0 Ω	9.47 Ω
1.00 Ω	0.92 Ω	20.0 Ω	17.7 Ω
2.00 Ω	1.87 Ω	50.0 Ω	44.7 Ω

Voltage at Device Under Test During Insulation Resistance Measurement

Measuring voltage U_x at the device under test depending upon its
resistance R_x at nominal voltages of 100, 250, 500 and 1000 V:



12 Maintenance

12.1 Firmware Revision and Calibration Information

See section 3.4.

12.2 Rechargeable Battery Operation and Charging

Check to make sure that no leakage has occurred at the rechargeable batteries in the Z502H battery pack at short, regular intervals, or after the instrument has been in storage for a lengthy period of time.



Note

Prior to lengthy periods of rest (e. g. holiday), we recommend removing the (rechargeable) batteries. This helps to prevent excessive depletion or leakage of batteries, which, under unfavourable circumstances, may cause damage to the instrument.

If battery voltage has fallen below the allowable lower limit, the pictograph shown at the right appears. “Low Batt!!!” is also displayed along with a battery icon. The instrument does not function if the batteries have been depleted excessively, and no display appears.



Attention!

Use only the Z502H battery pack.



Attention!

Use only the Z502R charger (available as an accessory) to charge batteries which have already been inserted into the test instrument.

Make sure that the following conditions have been fulfilled before connecting the charger to the charging socket:

- Rechargeable batteries have been installed with correct polarity (not standard batteries).
- The test instrument has been disconnected from the measuring circuit at all poles.
- The instrument must remain off during charging.

If the batteries or the battery pack have not been used or recharged for a lengthy period of time, thus resulting in excessive depletion:

Observe the charging sequence (indicated by the LED at the charger) and initiate a second charging sequence if necessary (disconnect the charger from the mains and from the test instrument to this end, and then reconnect it).

12.2.1 Charging Procedure with the Z502R Charger (accessory)

- Insert the correct mains plug for your country into the charger.



Attention!

Make sure that rechargeable batteries have been inserted (not normal batteries). We recommend the use of rechargeable NiMH batteries (eneloop type).

- Connect the charger to the test instrument with the barrel connector, and then to the 230 V mains with the interchangeable plug.



Attention!

Do not switch the test instrument on during charging. Monitoring of the charging process by the microprocessor might otherwise be disturbed, in which case the charging times specified in the technical data can no longer be assured.

- Please refer to the operating instructions included with the charger regarding the meanings of LED displays during the charging process.
- Do not disconnect the charger from the test instrument until

12.3 Fuses

If a fuse has blown due to overload, a corresponding error message appears at the display panel. The instrument's voltage measuring ranges are nevertheless still functional.

12.3.1 Melting Fuse

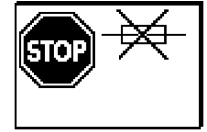
This fuse is active in all resistance measuring ranges except for voltage measurement. A replacement fuse is included in the battery compartment (FF315mA/1000V).

Checking the Fuse

If a resistance measuring range is selected with the rotary switch with a blown or defective fuse in the instrument, and if measurement is started with the **START** or **CONTIN.** key, a pop-up window with the “blown fuse” icon appears. Prerequisite: The **+** and **COM** measurement jacks are not short circuited.

This error message must be acknowledged and cleared by pressing the **ESC** key.

- Eliminate the cause of failure and replace the blown fuse.



Replacing the Fuse



Attention!

Disconnect the instrument from the measuring circuit before opening the battery compartment lid in order to replace the fuse (refer to page 3 for location)!

The rotary switch must be in the OFF position when the fuse is replaced.



Attention!

Incorrect fuses may cause severe damage to the instrument.

Only **original fuses** from GMC-I Messtechnik GmbH assure the required protection by means of suitable blowing characteristics.

Short-circuiting of fuse terminals or the repair of fuses is prohibited!

The instrument may be damaged if fuses with incorrect ampere ratings, breaking capacities or blowing characteristics are used!

- Open the battery compartment lid by loosening the two screws.
- Remove the defective fuse and replace it with a new one. A replacement fuse is included in the battery compartment.
- Insert the new fuse.
- Replace the battery compartment lid and retighten the screws.

12.3.2 Electronic Fuse

This fuse protects low-resistance (Rlo) and resistance measurements (kΩ) from overloading (electronic hardware circuit).

A pop-up window appears when the fuse blows.

This error message must be acknowledged and/or cleared by pressing any desired key.

- Eliminate the cause of overloading.



12.4 Housing

No special maintenance is required for the housing. Keep outside surfaces clean. Use a slightly dampened cloth for cleaning. In particular for the protective rubber surfaces, we recommend a moist, lint-free microfiber cloth. Avoid the use of cleansers, abrasives or solvents.

12.5 Return and Environmentally Sound Disposal

The instrument is a category 9 product (monitoring and control instrument) in accordance with ElektroG (German electrical and electronic device law). This device is subject to the RoHS directive. Furthermore, we make reference to the fact that the current status in this regard can be accessed on the Internet at www.gossenmetrawatt.com by entering the search term WEEE.

In accordance with WEEE 2012/19EU and ElektroG, we identify our electrical and electronic devices with the symbol in accordance with DIN EN 50419 which is shown at the right. Devices identified with this symbol may not be disposed of with the trash. Please contact our service department regarding the return of old devices (see address in section 14).



If the **batteries** used in your instrument or accessory product are depleted, they must be disposed of properly in accordance with valid national regulations.

Batteries may contain pollutants and heavy metals such as lead (Pb), cadmium (Cd) and mercury (Hg).

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

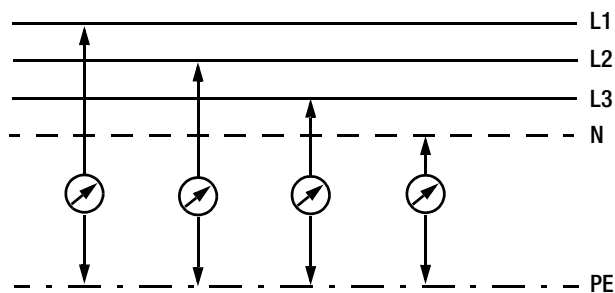


13 Appendix

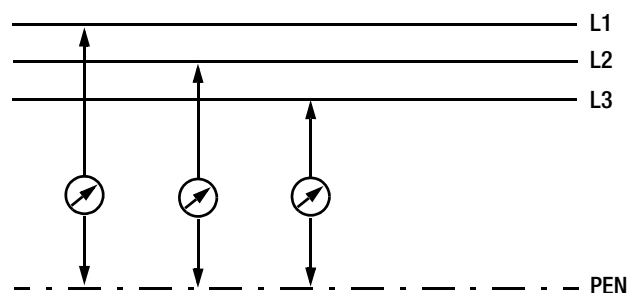
13.1 Sample Connection Layouts for Insulation Resistance Measurement

Insulation Resistance Measurement per DIN VDE 0100, Part 600

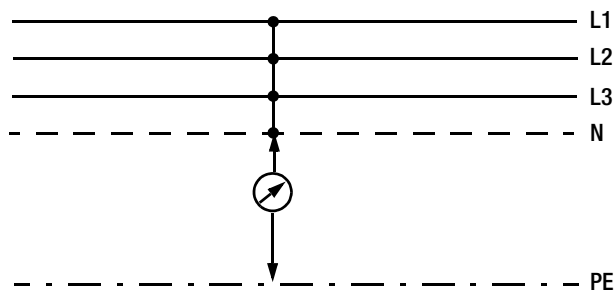
Between each active conductor and ground



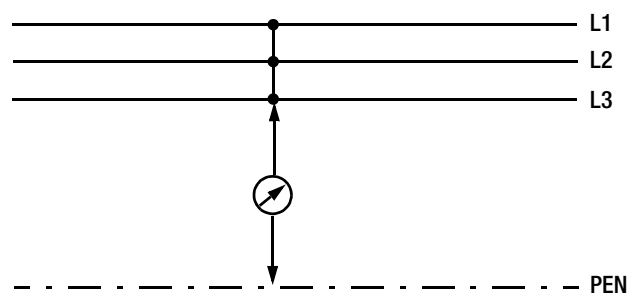
Between each active conductor and the PEN conductor



Between each active conductor (phase and neutral conductors) and ground

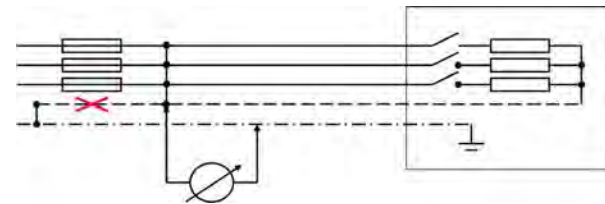
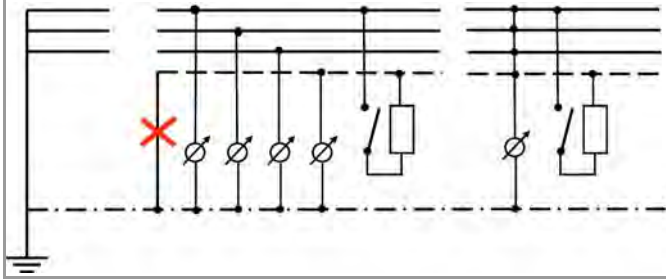


Between each active conductor and the PEN conductor



TN-S

- With or without consumer
- N – PE, separately

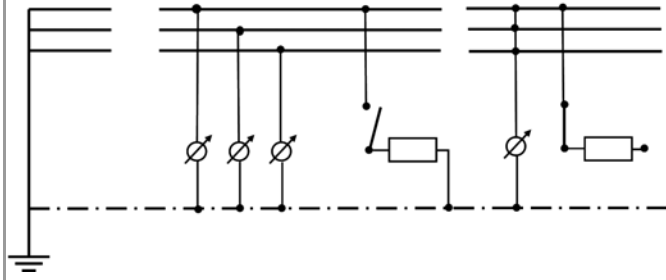


Attention:

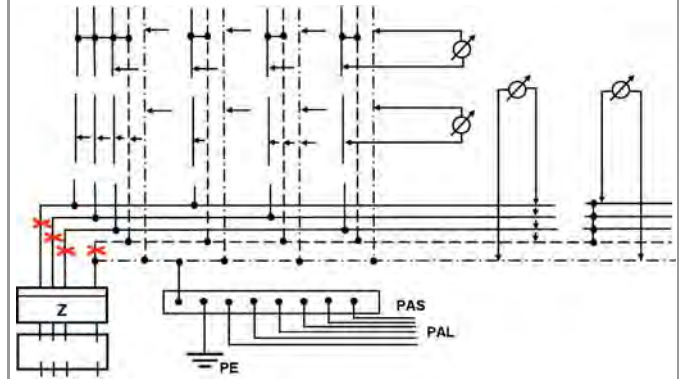
- Open the overcurrent protective device
- Disconnect the N conductor
- Jumper the L and N conductors
- Insulation measurement between L conductors and N to PE
- Device switch can be open – if single-pole

TN-C

- With or without consumer
- N – PE, together

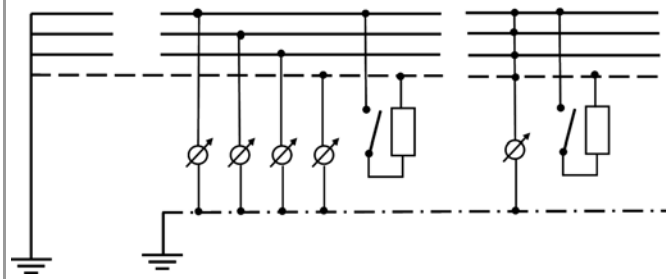


In the distributor: individual and combined measurements



TT

- With or without consumer









3-phase current (switched at all poles)



13.2 Error Messages

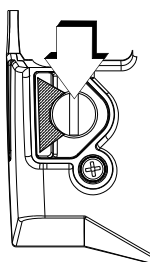
The following pop-up windows must be acknowledged and/or cleared by any desired key and the cause of the error must be eliminated.

Pop-Up	Function Switch Position	Function / Meaning
	All except U	Interference voltage Remedy: Device under test must be disconnected from all sources of voltage.
 Difference > 10% <any key to continue>	R _{LO}	OFFSET measurement does not make sense. Remedy: Check system. OFFSET measurement of R _{LO} + and R _{LO} - is still possible.
 Offset > 5.00 Ω! <any key to continue>	R _{LO}	R _{OFFSET} > 50 Ω: OFFSET measurement does not make sense. Remedy: Check system.
	R _{INS} / kΩ / R _{LO}	Externally accessible fuse is blown. The voltage ranges remain functional even if the fuse has blown. Special case, R_{LO}: Interference voltage during measurement may result in a blown fuse. Remedy: Replace fuse (replacement fuse in battery compartment). Observe notes regarding fuse replacement in section 12.3.1.
 →ELECTRONIC-FUSE	R _{LO} / kΩ	The electronic fuse protects low-resistance (R _{lo}) and resistance measurements (kΩ) from overloading (electronic hardware circuit). The voltage ranges remain functional even if the fuse has blown. Remedy: This error message must be acknowledged and cleared by pressing the ESC key.
	All	Battery voltage is less than or equal to 8 V. Reliable measurement is no longer possible. Storage of measured values to memory is disabled. Remedy: Rechargeable batteries must be recharged, or replaced towards the end of their service life.

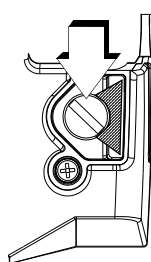
Pop-Up	Function Switch Position	Function / Meaning
Database and Entry Operations		
	All	The parameters you have selected do not make sense in combination with previously configured parameters. The selected parameter settings will not be saved. Remedy: Enter other parameter settings.
	All	Please enter a designation (alphanumeric).
	All	Operation with a Barcode Scanner Error message appears when the "EDIT" entry field is opened and battery voltage is less than 8 V. Output voltage is generally switched off during barcode scanner operation if U is less than 8 V in order to assure that remaining battery capacity is adequate for entering designations for devices under test and saving the measurement. Remedy: Rechargeable batteries must be recharged, or replaced towards the end of their service life.
	All	Operation with a Barcode Scanner Current flowing through the RS 232 port is too high. Remedy: The connected device is not suitable for this port.
	All	Operation with a Barcode Scanner Barcode not recognized, incorrect syntax
	All	Data cannot be entered at this location within the structure. Remedy: Observe profile for preselected PC software (see SETUP menu).
	All	Measured value cannot be saved at this location within the structure. Remedy: Make sure that you have selected the right profile for you PC evaluation program in the SETUP menu (see section 3.4).
	All	Memory is full. Remedy: Save your measurement data to a PC and then clear memory at the test instrument by deleting the database or by importing an empty database.
	All	Delete measurement or database. This prompt window asks you to confirm deletion.
	SETUP	Data loss after changing language or profile, or after restoring default settings. Back up your measurement data to a PC before pressing the respective key. This prompt window asks you to confirm deletion.

13.3 Attaching the Test Probe Holder to the Carrying Strap

- ① Detach the strap from the instrument:
Turn out the slotted screw (M3) at the bottom.

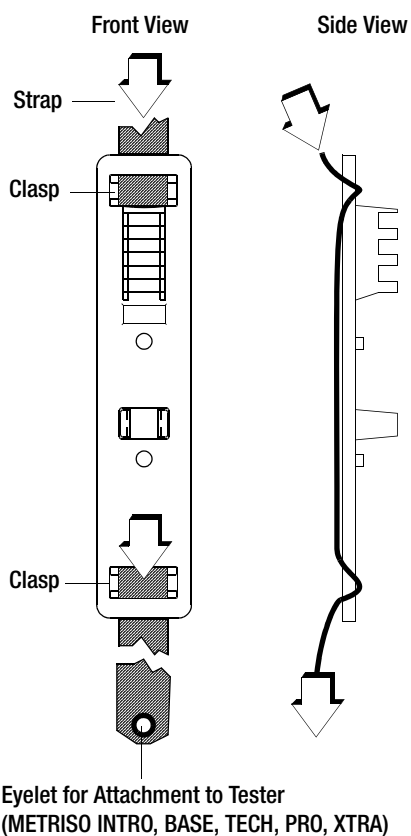


Bottom Left

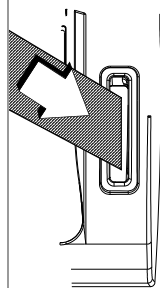


Bottom Right

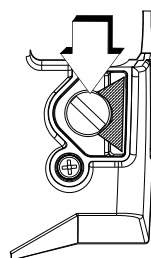
- ② Slide the strap through the test probe holder.



- ③ Feed the strap through from the front of the test instrument and secure it with the slotted screw (M3).



Front



Back

13.4 Technical Data for Measurement Cables (scope of delivery: KS17-4 safety cable set)

Electrical Safety

Maximum rated voltage	600 V	1000 V	1000 V
Measuring category	CAT IV	CAT III	CAT II
Max. rated current:	1 A	1 A	16 A
With safety cap attached	•	•	—
Without safety cap	—	—	•

Ambient Conditions (EN 61010-031)

Temperature –20 °C ... + 50 °C

Relative humidity Max. 80%

Pollution degree 2

Using the KS17-4



Attention!

Observe the instrument's maximum values for electrical safety. Measurements per DIN EN 61010-031 may only be performed in environments in accordance with measuring categories III and IV with the safety cap attached to the test probe at the end of the measurement cable.

In order to establish contact inside 4 mm jacks, the safety caps have to be removed by prying open the snap fastener with a pointed object (e.g. the other test probe).

13.5 Optional Accessories (not included)

Master Battery Pack (material no. Z502H)

8 LSD NiMH rechargeable batteries with reduced self-discharging (AA) (eneloop/Sanyo), 2000 mAh with sealed cells

Charger (material no. Z502R)

Broad-range charger for charging batteries in the measuring instrument
Input: 100 to 240 V AC, output: 16.5 V DC, 0.6 A

ISO Calibrator 1 (material no. M662A)

Calibration adapter for testing the accuracy of instruments used for measuring insulation resistance and low-resistance for test voltages of up to 1000 V (per VDE 0413, parts 1, 2, 4 and 10).

KS-C (material no. Z541F)

Cable set consisting of measurement cable and shielded high-resistance measurement cable for measurements in the $G\Omega$ range

1081 Probe (material no. GTZ3196000R0001)

Triangular probe for floor measurements per EN 1081, DIN VDE 0100-600 (standing surface insulation)

KS24 (material no. GTZ3201000R0001)

Cable set consisting of a 4 m long extension cable with a permanently attached test probe at one end and a contact protected socket at the other end, and 1 alligator clip which can be plugged onto the test probe.

Test Probe for Remote Triggering

(material no. Z550A)
Optional plug-on measurement cable with a triggering key on the test probe and an additional key for illuminating the measuring point, including shielded, plug-in connector cable.

Barcode-Profiscanner-RS232

(material no. Z502F)
Barcode scanner for RS 232 connection (laser sensor), variable barcode length, enhanced reading accuracy, with coil cable

Barcodeleser B3261

(material no. GTZ3261000R0001)
Barcode scanner for RS 232 connection (LED sensor)

SCANBASE RFID

(material no. Z751G)
RFID read/write for RS 232 port
(13.56 MHz)

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

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

* DAkkS Calibration Laboratory for Electrical Quantities D-K-15080-01-01 accredited per DIN EN ISO/IEC 17025

Accredited quantities: direct voltage, direct current value, direct current resistance, alternating voltage, alternating current value, 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.

Our DAkkS calibration laboratory is accredited by the Deutsche Akkreditierungsstelle GmbH (National accreditation body for the Federal Republic of Germany) in accordance with DIN EN ISO/IEC 17025 under registration number D-K-15080-01-01.

We offer a complete range of expertise in the field of metrology: from **test reports** and **proprietary calibration certificates** right on up to **DAkkS calibration certificates**.

Our spectrum of offerings is rounded out with free **test equipment management**.

An on-site **DAkkS 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.

15 Recalibration

The measuring tasks performed with your instrument, and the stressing it's subjected to, influence aging of its components and may result in deviation from the specified levels of accuracy.

In the case of strict measuring accuracy requirements, as well as in the event of use at construction sites with frequent stress due to transport and considerable temperature fluctuation, we recommend a relatively short calibration interval of once per year. If your instrument is used primarily in the laboratory and indoors without considerable climatic or mechanical stressing, a calibration interval of once every 2 to 3 years is sufficient as a rule.

During recalibration* at an accredited calibration laboratory (DIN EN ISO/IEC 17025), deviations from traceable standards demonstrated by your measuring instrument are documented. Ascertained deviations are used to correct displayed values during later use of the instrument.

We would be happy to perform DAkkS or factory calibration for you at our calibration laboratory. Further information is available at our website:

www.gossenmetrawatt.com (→ COMPANY → Quality and Certificates → DAkkS-Calibration Center).

Recalibration of your instrument at regular intervals is essential for the fulfillment of requirements according to quality management systems per DIN EN ISO 9001.



Note

The device should be regularly calibrated in a calibration laboratory which is certified according DIN EN ISO/IEC 17025.

* Examination of the specification, as well as adjustment, are not included in calibration. However, in the case of our own products, any required adjustment is performed and adherence to the specification is confirmed.