



MI 3211 TeraOhmHP 10 kV
MI 3215 TeraOhmHP 15 kV

Quick Guide
Ver. 1.1.1, code no. 20 753 389

Distributor:

Manufacturer:

Metrel d.o.o.
Ljubljanska cesta 77
SI-1354 Horjul
[e-mail:info@metrel.si](mailto:info@metrel.si)
<https://www.metrel.si>

DATA BACKUP AND LOSS:

It is the user's responsibility to ensure the integrity and security of the data carrier and to regularly backup and validate the integrity of backups of the data. METREL HAS NO OBLIGATION OR LIABILITY FOR ANY LOSS, ALTERATION, DESTRUCTION, DAMAGE, CORRUPTION OR RECOVERY OF USER DATA, REGARDLESS OF WHERE THE DATA IS STORED.



Mark on your equipment certifies that it meets requirements of all subjected EU regulations.



Hereby, Metrel d.o.o. declares that the MI 3211 and MI 3215 are in compliance with Directive 2014/53/EU (RED) and all other subjected EU directive. The full text of the EU declaration of conformity is available at the following internet address
<https://www.metrel.si/DoC>.



Mark on your equipment certifies that it meets requirements of all subjected UK regulations.



Hereby, Metrel d.o.o. declares that the MI 3211 and MI 3215 are in compliance with Radio Equipment Regulations 2017 and all other subjected UK regulations. The full text of the UK declaration of conformity is available at the following internet address
<https://www.metrel.si/UK-DoC>.

© Metrel d.o.o.

Published: 07/2024

No part of this publication may be reproduced or utilized in any form or by any means without permission in writing from *Metrel*.

Note:

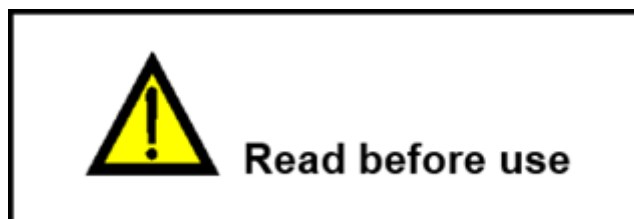
This document is not a supplement to the Instruction manual.

TABLE OF CONTENTS

1	General description.....	4
1.1	Warnings and notes.....	4
1.1.1	Safety warnings	4
1.1.2	Warnings related to batteries	5
1.1.3	Warnings related to safety of measurement functions.....	5
1.1.4	Markings on the instrument.....	6
2	Instrument description.....	7
2.1	Front panel	7
3	Instrument operation	8
3.1	General meaning of keys.....	8
3.2	General meaning of touch gestures	8
3.3	Virtual keyboard	9
3.4	Safety checks, symbols, messages	9
3.4.1	Terminal voltage monitor.....	10
3.4.2	Bar graph.....	10
3.4.3	Battery	10
3.4.4	Messages	10
4	Single tests.....	13
4.1	Single test measurements.....	13
4.1.1	Inspection	13
4.1.2	Voltage and Frequency	14
4.1.3	Insulation resistance	15
4.1.4	Diagnostic Test	17
4.1.5	Step Voltage Test.....	20
4.1.6	Withstanding Voltage Test	22
5	Maintenance.....	24
5.1	Warranty & Repairs.....	24

1 General description

1.1 Warnings and notes



1.1.1 Safety warnings

In order to reach high level of operator safety while carrying out various measurements using the instrument, as well as to keep the test equipment undamaged, it is necessary to consider the following general warnings.

- Read this instruction manual carefully, otherwise use of the instrument may be dangerous for the operator, for the instrument or for the equipment under test!
- Consider warning markings on the instrument!
- If the test equipment is used in manner not specified in this instruction manual the protection provided by the equipment may be impaired!
- Use only *Metrel* standard or optional test accessories!
- Only adequately trained and competent persons may operate the equipment.
- Do not use the instrument and accessories if any damage is noticed!
- Regularly check the instrument and accessories for correct functioning to avoid hazard that could occur from misleading results.
- Do not touch any conductive parts of equipment under test during the test, risk of electric shock!
- Consider all generally known precautions in order to avoid risk of electric shock while dealing with hazardous voltages!
- Do not use the equipment in a wet environment, around explosive gas, vapour or dust.
- Instrument servicing and calibration is allowed to be carried out only by a competent authorized person!
- In rare cases (internal fault) the test equipment can behave in an uncontrolled manner (LCD blinking, freezing, not responding to keys, etc.). In this case consider the test equipment and the test object as hazardous live and perform all safety measures to turn off (reset) the test equipment and to discharge the test object manually!
- *Metrel* Auto Sequences® are designed as guidance to tests in order to significantly reduce testing time, improve work scope and increase traceability of the tests

performed. *Metrel* assumes no responsibility for any Auto Sequence by any means. **It is the user's responsibility, to check adequacy for the purpose of use of the selected Auto Sequence.** This includes type and number of tests, sequence flow, test parameters and limits.

- **It is the user's responsibility to ensure that automated tests using Blackbox commands, and custom-made Auto Sequences are safe and comply with all safety regulations.**

1.1.2 Warnings related to batteries

- The instrument contains a Li-ion battery that is not user-replaceable and can only be replaced by authorized service personnel.
- When disposing of electronic devices containing Li-ion batteries, ensure proper recycling according to local regulations.

1.1.3 Warnings related to safety of measurement functions

WARNING

Capacitive objects may be charged to a high voltage during the measurement.

Risk of electric shock!

Always consider precautions against electric shock!

MI 3211

Voltage measurements may be performed on energized objects, up to 600 V CAT IV.

MI 3215

Voltage measurements may be performed on energized objects, up to 1000 V CAT IV.

Working with the instrument – safety precautions for insulation tests

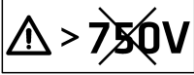
Make sure that the tested object is disconnected (mains voltage disconnected) and de-energized before connecting the test leads and starting the measurement
Always connect accessories to the test equipment and to the test object before starting the test. Do not touch test leads or crocodile clips during measurement.

Handling with capacitive loads

Note that a charge above 45 μC (for example 1 kV on 40 nF, 10 kV on 4 nF, or 15 kV on 3 nF) are hazardous live!

	Never touch the measured object during the testing until it is totally discharged, automatically and manually! In case of a capacitive test object, automatic discharge of the object may not be done immediately after finishing the measurement. Because of dielectric absorption, capacitive test objects (capacitors, cables, transformers, etc.) must be shorted out after the measuring process is completed.
Insulation resistance	Conditions for starting the test in regard to external voltage on test terminals): U < 50V: test will start normally MI 3215: U = 50 V to 1000 V: test will start, noise icon will lit. Results may be impaired. U > 1000 V: test will not start, noise icon will lit. MI 3211: U = 50 V to 600 V: test will start, noise icon will lit. Results may be impaired. U > 600 V: test will not start, noise icon will lit.
Burn mode	Normal breakdown mode is disabled. The test will proceed even in case of insulation breakdown. Test may damage the insulation. This enables the location of a failure to be detected with various methods (visual, geophone, acoustic, etc.)

1.1.4 Markings on the instrument

	Read the Instruction manual with special care to safety operation«. The symbol requires an action!
	Hazardous voltage is present on test terminals
	Do not use the equipment on energized distribution system with voltages higher than 750 V.
	Instrument is protected by reinforced insulation.
	Mark on your equipment certifies that it meets requirements of all subjected EU regulations.
	Mark on your equipment certifies that it meets requirements of all subjected EU regulations.
	This equipment should be recycled as electronic waste.

2 Instrument description

2.1 Front panel



1	Colour TFT display with touch screen
2	LED hazard indicator (high voltage warning)
3	Keypad
4	(+) Rx test terminal
5	(G) Guard terminal
6	(-) Rx test terminal
7	Mains supply input
8	Serial port
9	USB communication port

3 Instrument operation

The instrument can be manipulated via a keypad or touch screen.

3.1 General meaning of keys



Cursor keys are used to:

- select appropriate option;
- Left, right, up, down;
- In some functions: page up, page down.



Enter key is used to

- confirm selected option;



Run key is used to:

- start measurement if pressed and held for 3 s;
- stop measurement.



Escape, On/Off key is used to:

- return to previous menu without changes;
- abort / stop measurements
- switch On / Off the instrument;
- hard switch off (by hardware) the instrument if pressed and held for 5 s.



Option key is used to:

- expand column in control panel;
- Show detailed view of options.

3.2 General meaning of touch gestures



Tap (briefly touch surface with fingertip) is used to:

- Select appropriate option.
- Confirm selected option.
- Start and stop measurements.

	Swipe (press, move, lift) up/ down is used to: • Scroll content in same level. • Navigate between views in same level.
long 	Long press (touch surface with fingertip for at least 1 s) is used to: • Select additional keys (virtual keyboard).
	Tap Escape icon is used to: • Return to previous menu without changes. • Abort / stop measurements.

3.3 Virtual keyboard



Note

- If Backspace is held for 2 s, all characters will be selected.
- Set English, Greek, Russian, Hebrew character set: eng, GR, RU, HEB.

Hint

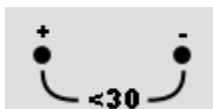
Long press on some keys opens additional keys.

3.4 Safety checks, symbols, messages

At start up and during operation the instrument performs various safety checks to ensure safety and to prevent any damage. If a safety check fails, an appropriate warning message will be displayed, and safety measures will be taken.

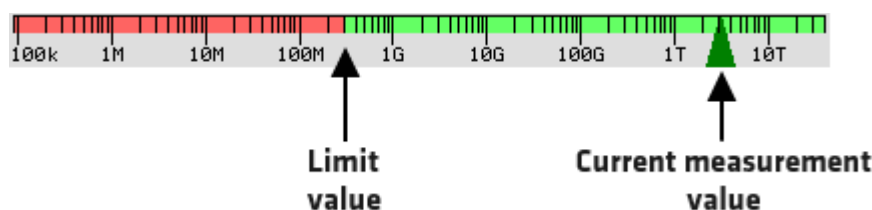
3.4.1 Terminal voltage monitor

The terminal voltage monitor displays true RMS voltage conditions on the test terminals for voltages >30 V. If terminal voltage >50 V is detected, noise icon is displayed, LED hazard indicator is blinking and warning sound is on (if enabled).



3.4.2 Bar graph

In some measurement functions, the current resistance measurement value is indicated in the logarithmic scale bar graph. When a measurement limit is selected, it splits the bar graph into red (fail) area (left of the limit value) and green (pass) area (right of the limit value).



3.4.3 Battery

The battery indication indicates the charge condition of battery and connection of external charger.



Battery capacity indication.



Low battery. Recharge the battery cells.



Battery is full.



Battery fault indication.



Charging in progress.

3.4.4 Messages

In the message field warnings and messages are displayed.

Warning! Low battery level detected. Charge the instrument. OK	Low battery level is detected. The measurement is aborted.
Notification Voltage breakdown detected. Possible fault in the insulation. OK	Voltage breakdown is detected. The measurement immediately ends.
Warning! The voltage or current noise at the test terminals exceeds the permitted level. Immediate action is required! OK	The voltage or current noise at the test terminals exceeds the permitted level. Immediate action is needed! Check the reason and safely remove the test leads from the voltage source.
 Filter not steady Hint: Filter is in a transient state. OK	Filter (Average) is in transient state and needs additional samples.
 Calibration Hint: Internal calibration in progress. Please wait. OK	Instrument is in self-calibration mode. This is performed automatically after the instrument is powered-on and lasts a few seconds. Measurement is not allowed to start.
Error Reset the instrument! Code: 1 OK	Self-calibration error is detected. The measurement is aborted.

	Conditions on the input terminals allow starting the measurement; consider other displayed warnings and messages.
	Conditions on the input terminals do not allow starting the measurement, consider displayed warnings and messages.
	Stop the measurement.
	Warning! High voltage is applied to the test terminals. Limit [> 50 Vrms on test terminals].
	A high voltage is / will be present on the instrument output! (Withstanding test voltage, Insulation test voltage or mains voltage).
	High electrical noise was detected during measurement. Results may be impaired.
	Measurement is running, consider displayed warnings.
	Burn mode active.
	Filter (Average) is in transient state and needs additional samples.
	Instrument is in self-calibration mode.
	Test passed. Result is inside predefined limits.
	Test failed. Result is out of predefined limits.
	Bluetooth communication active.

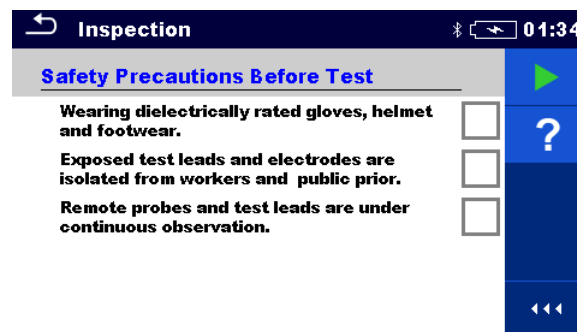
Hint

For some icons more information is displayed if  on icon.

4 Single tests

4.1 Single test measurements

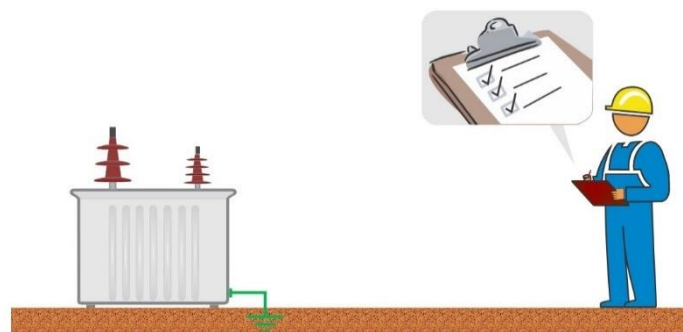
4.1.1 Inspection



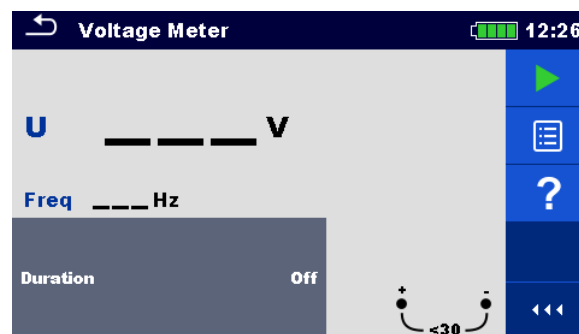
Test results / sub-results

- ☒ Pass
- ☒ Fail
- ☐ Checked

Test circuit



4.1.2 Voltage and Frequency



Test results / sub-results

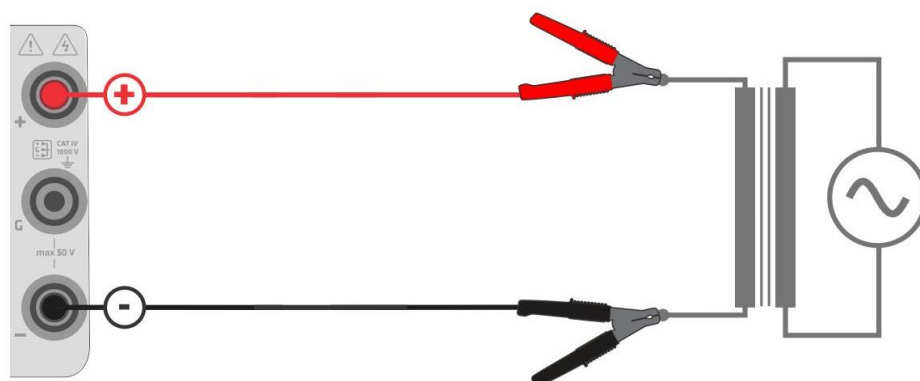
U Voltage (True RMS)

Freq Frequency (dominant frequency)

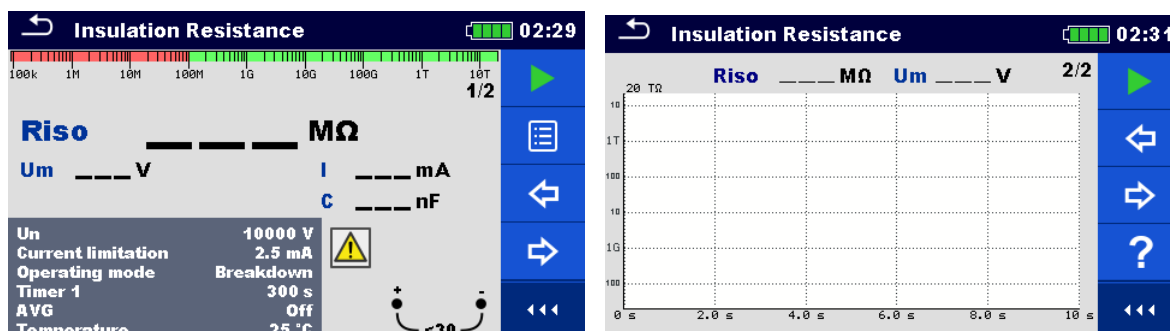
Test parameters

Duration	Duration: [Off, Custom, 2 s ... 30 s]
----------	---------------------------------------

Test circuits



4.1.3 Insulation resistance



Test results / sub-results

Riso	Insulation resistance
Um	Measured voltage
I	Measured current
C	Capacitance (displayed after measurement)
Time	Elapsed time (displayed during measurement)
Start	Delayed start [3, 2, 1]

Test parameters

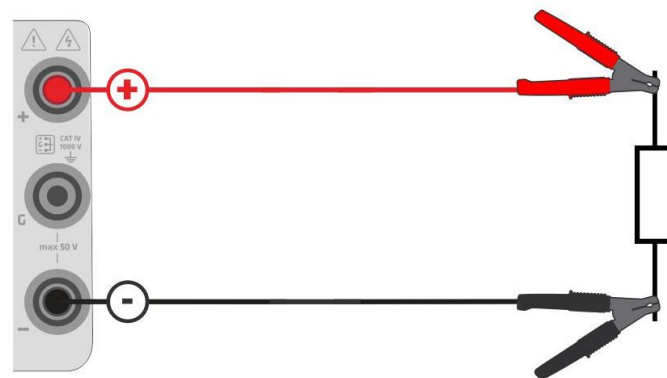
Un	Test voltage [50 V ... 10000 V]*, [50 V ... 15000 V]**
Current limitation	Current capability: Mains supply [0.5 mA ... 4.0 mA] Battery supply [0.5 mA ... 2.5 mA] Burn mode [0.5 mA, 1.0 mA]
Operating mode	[Breakdown, Burn] Breakdown: measurement ends if test current suddenly exceeds the limit value Burn mode: measurement doesn't stop if test current suddenly exceeds the limit value
Timer 1	Test duration [Custom, 5 s ... 600 s]
AVG	Averaging factor (moving average) [Off, 5 ... 200]
Temperature	[Off, Custom] Test object temperature (informative value)

*MI 3211, **MI 3215

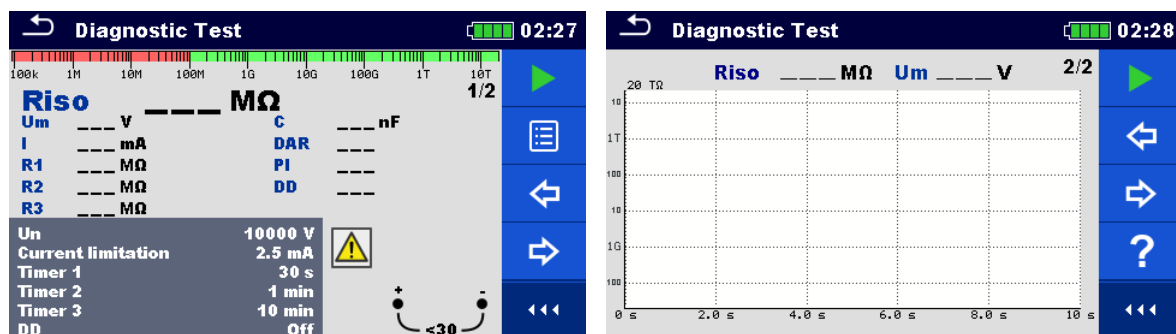
Test limits

Limit	Low Limit Riso: [Off, Custom, 100 kΩ ... 100 GΩ]
-------	--

Test circuits



4.1.4 Diagnostic Test



Test results / sub-results

Riso	Insulation resistance
Um	Measured voltage
I	Measured current
R1	Resistance at timer 1
R2	Resistance at timer 2
R3	Resistance at timer 3
C	Capacitance (displayed after measurement)
DAR	Dielectric absorption ratio
PI	Polarization index
DD	Dielectric discharge
Time	Elapsed time (displayed during measurement)
Start	Delayed start [3, 2, 1]

Test parameters

Un	Test voltage [50 V ... 10000 V]*, [50 V ... 15000 V]**
Current limitation	Current capability: Mains supply [0.5 mA ... 4.0 mA] Battery supply [0.5 mA ... 2.5 mA]
Timer 1	Test duration [Custom, 5 s ... 600 s]
Timer 2	Test duration [Custom, 1 min ... 100 min]
Timer 3	Test duration [Custom, 1 min ... 100 min]
DD	Dielectric discharge test [Off, On]
AVG	Averaging factor (moving average) [Off, 5 ... 200]
Temperature	[Off, Custom]

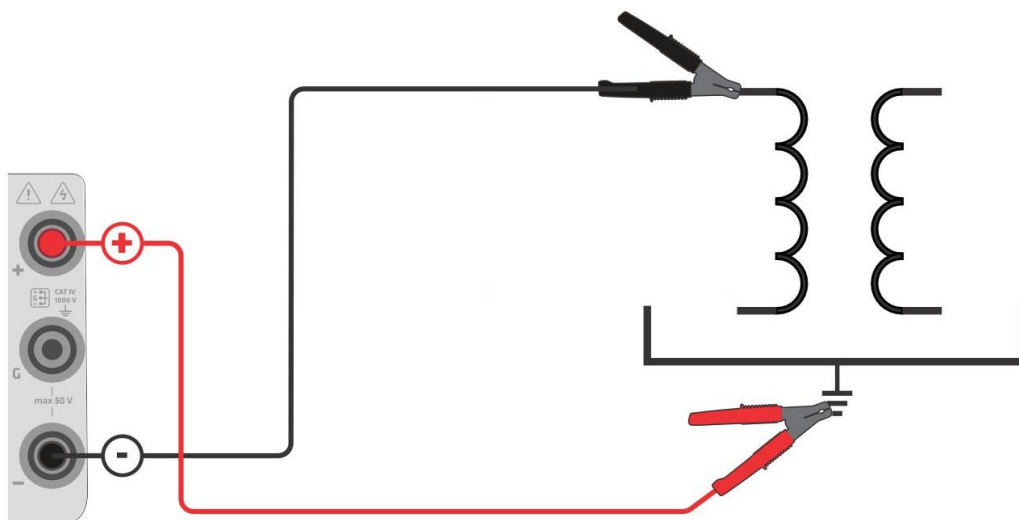
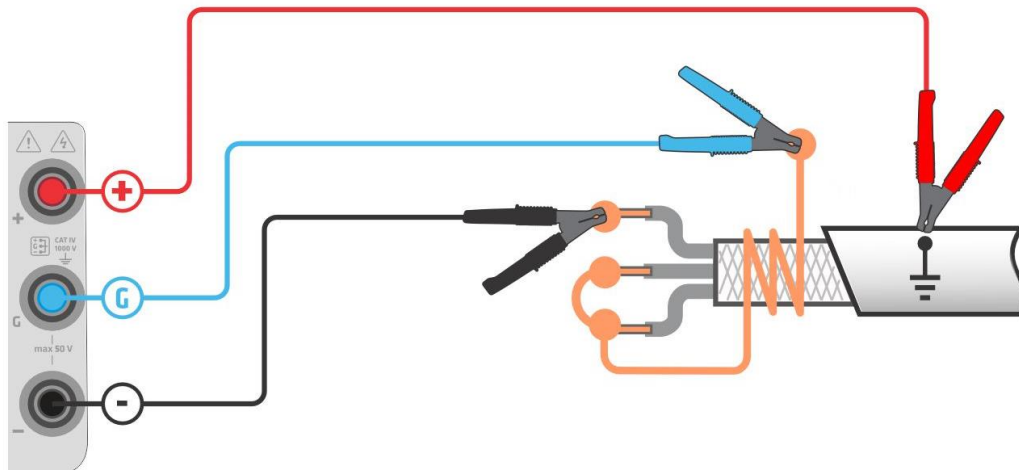
Test object temperature (informative value)

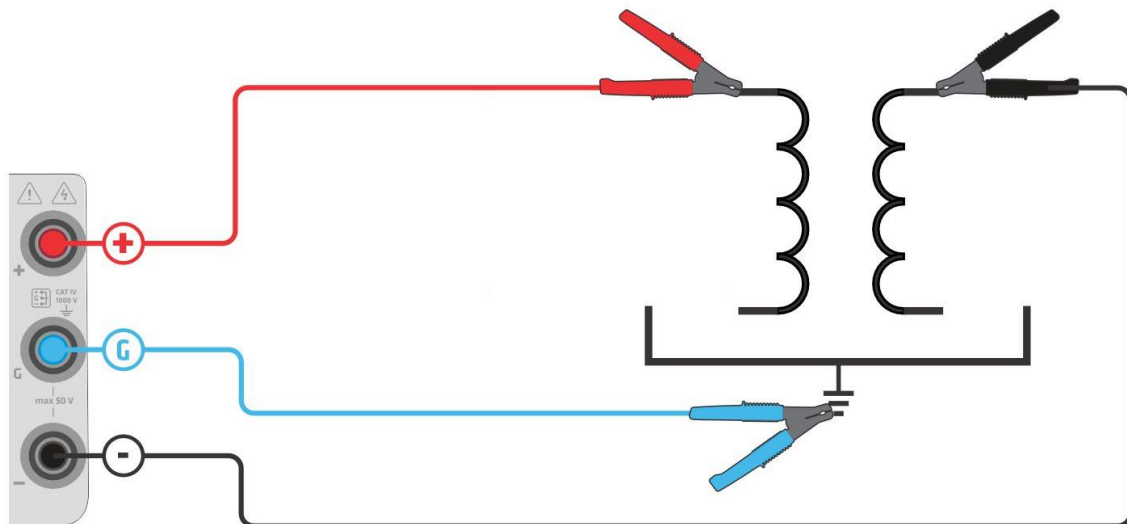
*MI 3211, **MI 3215

Test limits

Limit Low Limit Riso: [Off, Custom, 100 k Ω ... 100 G Ω]

Test circuits





Note

Calculated results:

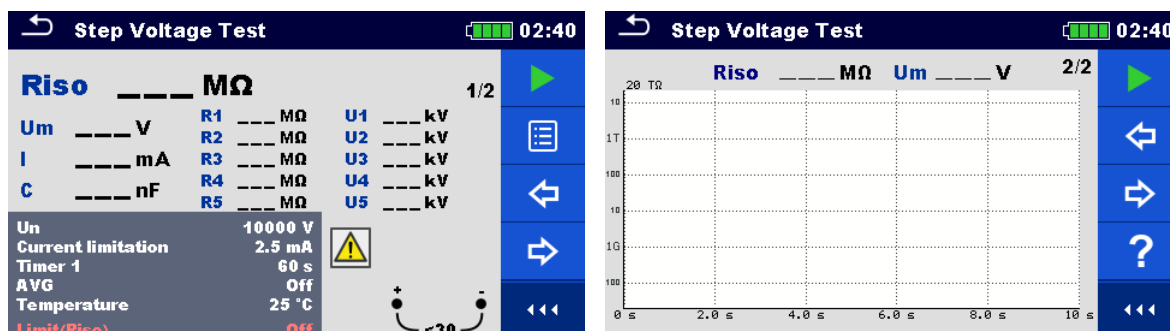
- $PI = R3/R2$
- $DAR = R2/R1$
- $DD = I_{dis}/(U * C)$

I_{dis} Discharging current after 1 minute in nA

U Test voltage in Volts

C Capacitance of test object in μF

4.1.5 Step Voltage Test



Test results / sub-results

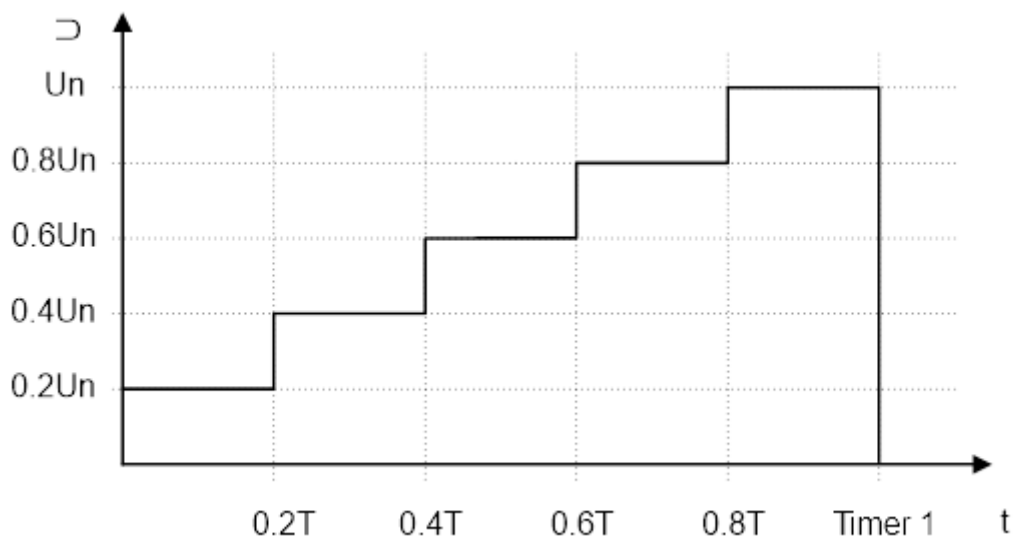
Riso	Insulation resistance
Um	Measured voltage
I	Measured current
C	Capacitance (displayed after measurement)
R1	Insulation resistance at U1
R2	Insulation resistance at U2
R3	Insulation resistance at U3
R4	Insulation resistance at U4
R5	Insulation resistance at U5
U1	Voltage step 1
U2	Voltage step 2
U3	Voltage step 3
U4	Voltage step 4
U5	Voltage step 5
Time	Elapsed time (displayed during measurement)
Start	Delayed start [3, 2, 1]

Test parameters

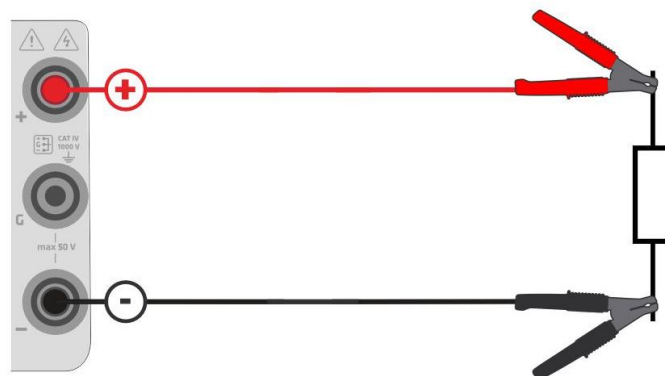
Un	Test voltage [50 V ... 10000 V]*, [50 V ... 15000 V]**
Current limitation	Current capability: Mains supply [0.5 mA ... 4.0 mA] Battery supply [0.5 mA ... 2.5 mA]
Timer 1	Test duration [Custom, 30 s ... 600 s]
AVG	Averaging factor (moving average) [Off, 5 ... 200]

Temperature	[Off, Custom] Test object temperature (informative value)
*MI 3211, **MI 3215	
Test limits	
Limit	Low Limit Riso: [Off, Custom, 100 kΩ ... 100 GΩ]

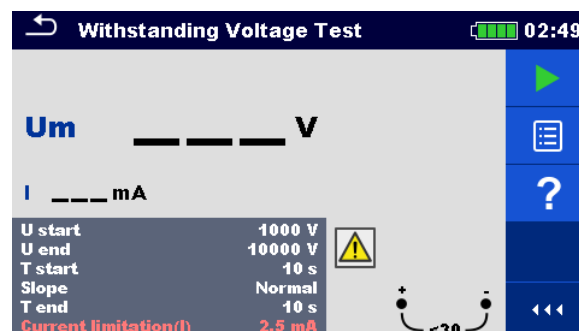
Testing voltage



Test circuits



4.1.6 Withstanding Voltage Test



Test results / sub-results

Um	Measured voltage
I	Measured current

Test parameters

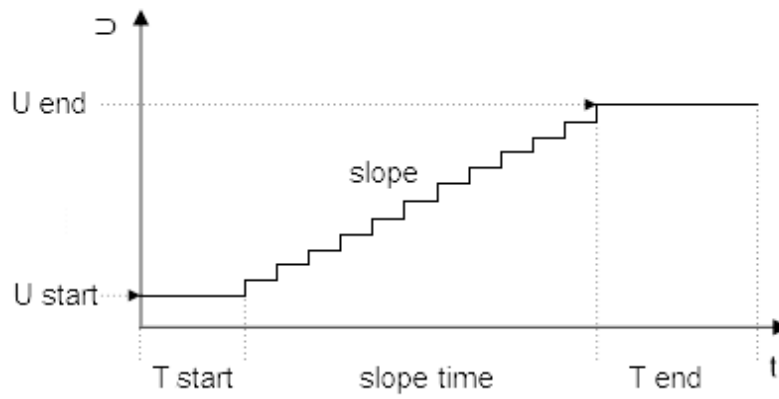
U start	Start test voltage [50 V ... 10000 V]*, [50 V ... 15000 V]**
U end	End test voltage [50 V ... 10000 V]*, [50 V ... 15000 V]**
T start	Test duration at U start [Custom, 5 s ... 60 s]
Slope	Slope [Slow, Normal, Fast] • Slow (500 V/min) • Normal (1000 V/min) • Fast (2000 V/min)
T end	Test duration at U end [Custom, 5 s ... 60 s]

*MI 3211, **MI 3215

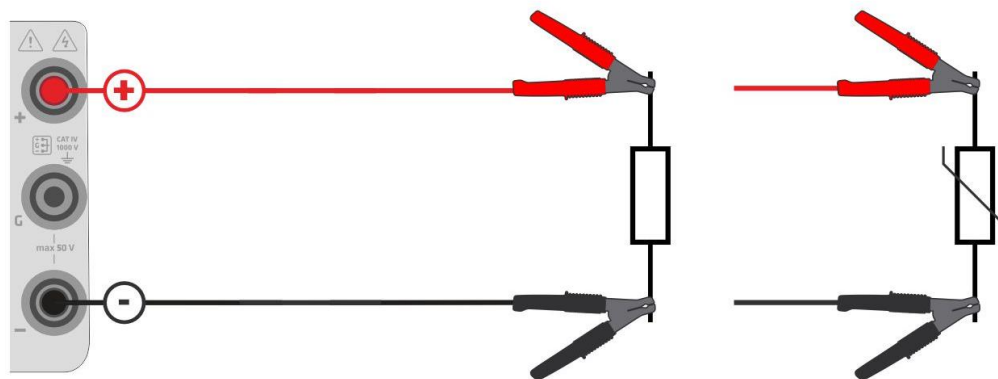
Test limits

Current limitation	Current limitation: Mains supply [0.5 mA ... 4.0 mA] Battery supply [0.5 mA ... 2.5 mA]
--------------------	---

Testing voltage



Test circuits



5 Maintenance

5.1 Warranty & Repairs

Any potentially defective items should be returned to Metrel accompanied by information regarding the faults that was incurred. It is recommended that any defective equipment is sent back to Metrel via the Partner Distributor from which the product was purchased.

All defective products will be replaced or repaired within policy period. For these items, a full refund will only be issued if a sufficient replacement is not available. Any shipping / return shipping costs are not refundable.

Metrel shall not be held liable for any loss or damage resulting from the use or performance of the products. In no event shall Metrel be liable to the customer or its customers for any special, indirect, incidental, exemplary or punitive damages resulting from loss of use, interruption of business or loss of profits, even if Metrel has been advised of the possibility of such damages.

If the customer's unit is out of warranty but needs repairs, a quote for repair will be provided via the Partner Distributor through which the instrument was sent in.

Notes

- Any unauthorized repair or calibration of the instrument will infringe the product's warranty.
- All sales are subject to Metrel Standard Terms and Conditions. Metrel reserves the right to change the conditions at any time. Any typographical, clerical or other error or omission in any sales literature, quotation, price list, acceptance of offer, invoice or other documentation or information issued by Metrel shall be subject to correction without any liability on the part of the customer.
- Specifications and designs of goods are subject to change by Metrel at any time without notice to the customer. Metrel reserves the right to make any changes in the specification of goods which are required to conform with any applicable statutory or EC requirements or, where goods are to be supplied to Metrel specification, which do not materially affect their quality or performance.
- If a condition was found to be invalid or void it would not affect the overall validity of the remainder of the conditions;
- Metrel are excluded from liability for any delays or failure to comply, where the reason is beyond Metrel control;

No order which has been accepted by Metrel may be cancelled by the customer except with the agreement in writing of Metrel and on terms that the customer shall indemnify Metrel in full against all loss (including loss of profit), costs (including the cost of all labour and materials used), damages, charges and expenses incurred by Metrel as a result of cancellation. The minimum charge for such cancellation will be 25 % of the total value of the goods ordered.

METREL d.o.o.
Ljubljanska cesta 77
SI-1354 Horjul
Slovenia
Phone: +386 (0)1 75 58 200
Fax: +386 (0)1 75 49 226
Email: info@metrel.si