Megger

BM5200
5 kV Digital Insulation Tester

USER MANUAL

CONTENTS

⚠ SAFETY WARNINGS

Safety warning must be observed during use:

- The circuit under test **must** be switched off, deenergised, isolated and checked to be safe before insulation test connections are made. Make sure the circuit is not reenergised whilst the instrument is connected.
- Circuit connections **must not** be touched during an insulation test.
- After completing a test, capacitive circuits **must** be completely discharged before disconnecting the test leads. **Capacitive charges can be lethal.**
- Tested items should be firmly shorted out with a shorting link, after discharge, until required for use. This is to guard against any stored dielectric absorption charge subsequently being released thereby raising the voltage to potentially dangerous levels.
- The voltage indicator and automatic discharge features should be regarded as additional safety features and not a substitute for normal safe working practice.
- It is rare, but in certain circumstances, breakdown of the circuit under test may cause the instrument to terminate the test in an uncontrolled manner, possibly causing a loss of display while the circuit remains energised. In this event, the unit **must** be turned off and the circuit discharged manually.
- Test leads, including crocodile clips, **must** be in good order, clean and with no broken or cracked insulation.
- The instrument **should not** be used if any part of it is damaged.
- Insulation testing in wet weather conditions might be hazardous. It is recommended that this instrument is not used in these circumstances. If this is unavoidable, the user **must** take all necessary precautions.
- This instrument is not intrinsically safe and **must** not be used in hazardous atmospheres.
- If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
- Rechargeable batteries **should not** be used on this instrument.

NOTE

THE INSTRUMENT MUST ONLY BE USED BY SUITABLY TRAINED AND COMPETENT PERSONS.

Users of this equipment and/or their employers are reminded that National Health and Safety Legislation requires them to carry out valid risk assessments of all electrical work so as to identify potential sources of electrical danger and risk of electrical injury such as inadvertent short circuits. Where the assessments show that the risk is significant then the use of fused test leads may be appropriate.

Symbols used on this instrument

 Caution: refer to accompanying notes

 Caution: risk of electric shock

 Class II double insulated instrument

 Do not dispose of in the waste stream

Equipment complies with current Australian C-Tick directives

 Battery

Terms used in this manual
The word must is used to indicate that the instructions following should be followed under all circumstances. Failure to follow these instructions could result in damage to the instrument and / or a hazard to the operator.

The word '**should**' is used to indicate that the instructions indicate best practice.

Cleaning
Disconnect the instrument and wipe it with a clean cloth slightly damped with soapy water or Isopropyl alcohol (IPA).

General description

BM5200 insulation tester has a digital and analogue arc display designed for high voltage insulation resistance testing in the maintenance and servicing of cables, rotating plant machinery, transformers, switchgear and industrial installations.

DC insulation tests are performed at 250 V, 500 V, 1000 V, 2500 V and 5000 V. Insulation resistance measuring range is 100 kΩ to 1000 GΩ. Automatic discharge for capacitive circuits under test is provided and decaying voltage displayed.

The guard terminal can be used to minimise the effects of surface leakage and hence erroneous measurements when carrying out insulation resistance tests.

Insulation resistance test modes

Three insulation resistance (IR) test modes are provided, (InS, PI, t) and selected from any insulation range by pressing the left arrow key depicting PI-t.

In insulation resistance test mode (InS) tests are initiated by pressing and holding down the TEST button for two seconds. Once an insulation test has initiated it will terminate on the next press of the TEST button. The reading is held on screen until TEST is pressed again or another range is selected.

A Polarisation Index (PI) mode performs a ratiometric test that calculates the ratio of insulation resistance at ten minutes to insulation resistance at one minute.

The timer (t) mode facilitates a single fixed duration IR test based on the set time interval t.

Automatic discharge

For capacitive test objects the instrument will automatically discharge through an internal resistor and indicate voltage across the terminals in the range 25 V to 600 V with higher voltages indicated by '>600 V'. This feature will give decaying voltage indication following the testing of equipment possessing capacitance. When the voltage indicator no longer shows it is safe for the user to disconnect the test leads.

Lead set

Three recessed sockets are provided, and marked '+', '-' and 'G'. These have safety covers which open when the plugs are inserted. When inserted into the sockets, the shrouded test lead plugs lock into position. They are released by twisting the plug a quarter turn and pulling out.

For this reason, only the test leads supplied or suitable Megger replacement ones should be used.

Instrument power

The BM5200 is powered by eight 1.5 V IEC LR6/AA alkaline cells. Rechargeable batteries **should not** be used on this instrument.

Instrument safety

Design safety features include:

- External voltage indication, AC or DC displayed.
- Load automatically discharged at the end of a test, and decaying voltage displayed.
- Test leads can lock into the case to prevent accidental disconnection.

Preparations for use

1. Unpack the shipping box and locate the BM5200 instrument, carry case, test leads, batteries, quick start and user guides.
2. Ensure that the main range switch is in the OFF position.
3. Locate the battery compartment and open it using a PZ2 pozidrive screwdriver.
4. Remove the battery module and insert the eight 1.5 VLR6/AA alkaline cells ensuring correct orientation according to polarity.
5. Connect the battery module to the battery lead ensuring correct polarity.
6. Replace battery module and battery cover into the case and replace the two screws tightening by hand only.
7. As an initial check, without any leads connected, switch the instrument on by turning the main range switch to any position other than OFF. Ensure that the instrument display responds. Switch off the instrument. If the instrument display does not respond return t to step 2, repeat the process and check all eight battery orientations are correct.
8. If the instrument still fails to respond use a voltmeter to check battery module voltage which should be 12 V assuming all cells are at their rated 1.5 V.

Operating instructions

Instrument controls and indicators

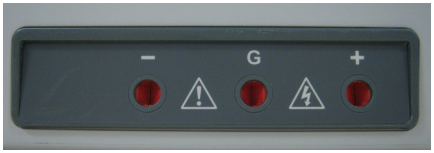
1. Backlit LCD display with analogue arc and dual 3-digit display.
2. Backlight on/off switch
3. Four arrow buttons, PI-t function on left arrow button
4. Main range switch Setup functions plus AC and DC voltmeter (25 V to 600 V)
5. Main range switch with DC insulation tests at 250 V, 500 V, 1000 V, 2500 V and 5000 V.
6. TEST button to initiate and terminate insulation tests
7. Warning High Voltage (HV) indicator

Before switching on the BM5200 the test leads should be connected to the instrument.

There are three test terminals marked +, - and G. These terminals are designed to accept only the test leads supplied. Shutters across the terminals prevent accidental ingress of dirt and other objects. Test lead plugs interlock with the shutters and are released by rotating the test lead plug a quarter turn.

After testing the charge present on the terminals due to internal capacitance is fully discharged within 10 seconds of completion of the test. You should be aware that it will take longer to discharge external reactive loads.

The BM5200 is turned on by rotating the main range switch to insulation test, voltage test or setup function.

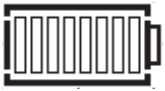


The rear panel indicates polarity of test sockets and -, + and G (Guard). The negative (-) terminal is at 0 V and positive (+) terminal is at test voltage (up to 5000 V DC).

The battery level indicator is located at the top right of the display and contains four pairs of segments depicting charge level.

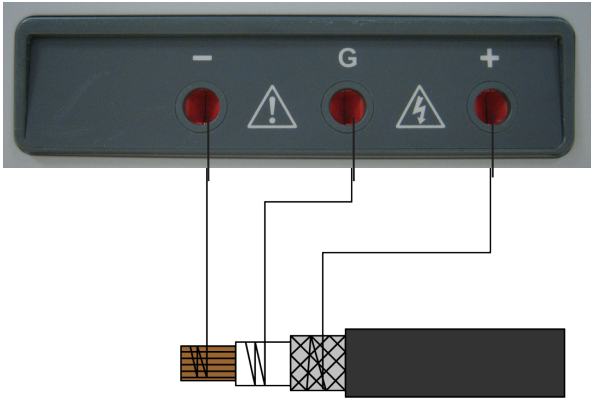
Battery level indication of 50% of battery life.

Battery level indication of a flat battery.



Use of guard terminal (G)

For basic insulation resistance tests where there is little possibility of surface leakage affecting the measurement, it is not necessary to use the guard terminal i.e. if the insulator is clean and there are unlikely to be any adverse current paths. However in cable testing for example, there may be surface leakage paths across the insulation between the bare cable and the external sheathing due to the presence of moisture or dirt. To obtain an accurate measurement, particularly at high testing voltages, a bare wire may be bound tightly around the insulation and connected via the third test lead to the guard terminal 'G'.



As illustrated in the diagram, the guard terminal is at the same potential as the negative terminal. Since the leakage resistance is effectively in parallel with the resistance to be measured, the use of the guard causes the current flowing through surface leakage to be diverted from the measuring circuit. The instrument therefore reads the leakage of the insulator, ignoring leakage across its surface.

Polarisation index (PI)

Polarisation Index (PI) test performs a ratio metric test that calculates the ratio of insulation resistance at ten minutes, $IR_{10\ min}$ to insulation resistance at one minute, IR_{1min}. This test provides a simple indication of insulation polarisation when subjected to high voltage DC. A high PI value indicates a high degree of insulation polarisation and therefore good insulation condition. Generally the PI value should be two or above.

Polarisation occurs at different rates ranging from minutes to several hours which led the IEEE to create a ratiometric PI test. The IEEE standard 43-2000, "Recommended Practice for Testing Insulation Resistance of Rotating Machinery," limits the use of PI test on winding systems to those with IR_{1min} being less than 5000 MΩ.

Timed insulation resistance

The timed IR test is a test that automatically terminates after a user adjustable time (t). Users can select SETUP on the range switch and adjust timer (t) using up and down arrow buttons to set the desired time followed by a single press of the PI-t (left arrow) button. Default time (t) is set at one minute because IR1min is frequently referred to in international standards.

Preventative maintenance

No user serviceable parts

There are no user serviceable parts in the BM5200 except for the batteries.

If an instrument's protection has been impaired it should not be used, but sent for repair by suitably trained and qualified personnel. The protection is likely to be impaired if for example, it shows visible damage, fails to perform the intended measurements, has been subjected to prolonged storage under unfavourable conditions, or has been subjected to severe transport stresses.

Battery replacement

⚠ **WARNING**

The battery contacts are not isolated from the test leads. Remove the test leads from the instrument before opening the battery compartment.

The cells are housed in a battery compartment in the base of the instrument. To change the cells, use a PZ2 pozidrive screwdriver to remove the battery cover securing screws and lift off the battery compartment cover. Observing the correct polarity as marked on the battery housing, install 8 replacement IEC LR6 (AA) cells. Replace and secure the battery compartment cover on completion.

Technical specifications

The following specifications apply at 20 °C unless otherwise stated:

Electrical specifications

Insulation range	0.1 MΩ to 1 TΩ
Nominal test voltages	250 V, 500 V, 1000 V, 2500 V, 5000 V
Terminal voltage accuracy	0 to +5% of nominal test voltage
Insulation accuracy	Up to 1 GΩ: All ranges ±5% ±2 digits Over 1 GΩ: 5000 V ±5% ±0.04% per GΩ 2500 V ±5% ±0.08% per GΩ 1000 V ±5% ±0.2% per GΩ 500 V ±5% ±0.4% per GΩ 250 V ±5% ±0.8% per GΩ
Short circuit current	1.4 mA ± 0.5 mA
Maximum load capacitance	5 μF
Voltmeter accuracy (DC or AC)	3% ±3 V
Frequency measurement	45 Hz to 65 Hz
Frequency accuracy	±2 Hz
Voltage range (DC or AC)	25 to 600 V AC or DC
Power supply Battery life	8 x LR6/AA batteries 5 hours @ 5 kV into 100 MΩ with AA Alkaline LR6
Guard	2% error guarding 5 MΩ leakage on 100 MΩ load

Environmental specifications

Operating temperature range	-20 °C to +55 °C
Operating humidity	90% RH, 0 °C - 40 °C 70% RH, 40 °C - 55 °C
Storage temperature	-30 °C to +65 °C
Insulation protection	IP40
Maximum Altitude	2000 m

Service error with stated environmental limits is twice intrinsic error

Safety protection

Insulation CAT III 600 V - applicable standard IEC 61010-1:2001

Measurement Category III is applicable to test and measuring circuits connected to the distribution part of the building's low-voltage mains installation. This part of the installation is expected to have a minimum of two levels of over-current protective devices between the transformer and possible connecting points.

EMC

The product conforms to IEC 61326-1:2005

Dimensions (W x H x D)	220 mm x 115 mm x 163 mm
Weight	1.45 kg

Repair and warranty

If the protection of an instrument has been impaired if should not be used, and be sent for repair by a suitably trained and qualified personnel. The protection is likely to be impaired if, for example, the instrument shows visable damage, fails to perform the intended measurements, has been subjected to prolonged storage under unfavourable conditions, or has been exposed to severe transport stresses.

New instruments are Guaranteed for 1 Year from the date of purchase by the User.

Note: Any unauthorised prior repair or adjustment will automatically invalidate the warranty.

This product contains no repairable parts and if defective it should be returned to your supplier in its original packaging or packed so that it is protected from damage during transit.