Megger

BM80/2 Series

Multi-Voltage Insulation and Continuity Tester

User Guide

Guide de l'utilisateur

Gebrauchsanleitung

Guía del usuario

Contents

SAFETY WARNINGS

- Safety Warnings and Precautions must be read and understood before the instrument is used. They must be observed during use.
- The circuit under test must be de-energized and isolated before connections are made except for voltage measurement.
- Circuit connections must not be touched during a test.
- After insulation tests, capacitive circuits must be allowed to discharge before disconnecting the test leads.
- The Live Circuit Warning and Automatic Discharge are additional safety features and should not be regarded as a substitute for normal safe working practice.
- Replacement fuses must be of the correct type and rating.
- Test leads, including crocodile clips, must be in good order, clean and have no broken or cracked insulation.
- U.K. Safety Authorities recommend the use of fused test leads when measuring voltage on high energy systems.

NOTE

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

Notes

BEFORE USING THE INSTRUMENT, follow the separate instructions provided to fit either the locking or non-locking test button. Megger Limited recommend the fitting of the non-locking test button. Hands free operation is provided on all ranges except the insulation ranges. If the locking button is fitted, extra care must be taken.

Symbols used on the instrument:

Risk of electric shock.

Refer to User Guide.

Equipment protected throughout by Double Insulation (Class II).

Equipment complies with current EU Directives.

NOTE

Users of this equipment and or their employers are reminded that Health and Safety Legislation require 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 from inadvertent short circuits. Where the assessments show that the risk is significant then the use of fused test leads constructed in accordance with the HSE guidance note GS38 'Electrical Test Equipment for use by Electricians' should be used.Users of this equipment and or their employers are reminded that Health and Safety Legislation require 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 from inadvertent short circuits. Where the assessments show that the risk is significant then the use of fused test leads constructed in accordance with the HSE guidance note GS38 'Electrical Test Equipment for use by Electricians' should be used.

General Description

The ***BM80/2 Series*** instruments are battery powered Insulation and Continuity testers, with a measurement capability from 0,01 Ω Continuity to 200 GΩ Insulation.

Offering multi-voltage facilities, the instruments take full advantage of microprocessor technology and feature a large liquid crystal display combining digital and analogue readings. The analogue display has the benefit of indicating trends and fluctuations in readings, while the digital readout gives direct accurate results.

The ***BM80/2 Series*** instruments have the unique option of either a locking or non-locking button which is user selected. The chosen test button is easily pushed into the instrument casing without the use of a tool. The procedure for inserting the test button is provided on the separate instruction sheet included with the test buttons.

A customized connector on the top of the instrument enables the optional Megger ***SP****6F* Switched probe to be used for two handed probe operation.

The TEST button is used to initiate the insulation tests, for operating the null facility and for adjusting the auto shut-off time. Grey markings on the range label denotes when the use of the TEST button is necessary. All other tests (Voltage, Continuity and Resistance) have the advantage of hands free operation and are activated when the probes make contact.

The 250 V, 500 V and 1000 V ranges can be used to test electrical installations in compliance with BS7671 (16th Edition IEE Wiring Regulations) IEC364 and HD384, since each range has a 1 mA minimum test current at the minimum pass values of insulation specified in these documents. The 100 V range is ideal for testing telecommunications equipment which would be damaged by higher voltages. The 50 V range is useful for testing sensitive equipment, such as electronic components, and computer peripherals.

Available as an optional accessory, the Megger ***DLB*** Downloading Base can be fitted for realtime downloading of measured test

results to a Palmtop, Laptop or Personal computer via an RS232 serial lead. The optional miniature clip-on current transducer ***MCC10*** enables the instrument to measure a.c. currents from 1 A to 10 A.

Instrument power is supplied by six 1,5 V alkaline battery cells, which are constantly monitored. When battery power is nearly exhausted, the  symbol appears on the display. Remaining battery life can be monitored at any time using the battery check switch position. This is beneficial before going on-site, to ensure enough battery power for the day's work.

Designed to IEC1010-1 the ***BM80/2 Series*** are protected against connection to a 440 V Category III supply. The instruments have a basic accuracy of ± 2% at 20 °C.

The instruments are waterproof and dustproof to IP54. This helps maintain accuracy and ensures maximum reliability in harsh environments.

The circuit under test must be completely de-energized and isolated before test connections are made.

Testing is automatically inhibited if.....

- An external voltage >55 V is present when switched to any Insulation position above 50 V.
- An external voltage >25 V is present on all other ranges (excluding Voltmeter position).

The external voltage is indicated on the display and the bleeper sounds intermittently.

⚠ Voltage Testing on High Energy Systems
Use extreme care when using or measuring voltages above 30 V, particularly in high energy systems. Fused test leads are available as optional accessories. These are strongly recommended for use when making voltage tests. (GS38 H.S.E document).

Auto-shut Off
To conserve battery life, Auto-shut Off (preceded by a series of bleeps) operates after 12 minutes of instrument inactivity in all insulation test switch positions, and after 5 minutes of instrument inactivity in all other switch positions. If desired, the 5 minute shut-off can be changed to 60 minutes (non insulation test switch positions). To do this, first perform a battery check, then press the TEST button twice to show (➔60).

If an insulation test, or OFF is subsequently selected, the shut-off time reverts to the default times. It is therefore not possible to generate dangerous voltages for more than 12 minutes, even with a locking test button.

To restore operation after Auto-shut Off, select OFF followed by the required switch position.

Note: Auto-shut Off has a small power consumption and it is recommended that the instrument is switched to OFF when not in use. This is particularly important at the end of the working day, since no battery power is used in the OFF position.

Insulation Tests (MΩ)
Insulation tests operate only when the TEST button is pressed. (See the separate instructions for fitting the TEST button). These tests produce high voltages at the terminals and are initiated when the TEST button is pressed. When the TEST button is released, the reading will be held for a few seconds, the item under test will automatically be discharged, and the capacitive charge decay shown on the Live Circuit Warning voltmeter.

When the 1 kV range has been selected (***BM80/2*** & ***BM82/2*** only) and the TEST button pressed, there will be a safety delay of 3 seconds and '1000 V' will flash before the test voltage is applied. This delay only occurs as a warning the first time that the button is pressed after the range has been selected. The delay will not occur on subsequent tests.

1. Set the selector switch to the test voltage required.
2. Connect the test leads, first to the instrument, and then to the isolated item under test.
3. Press the TEST button to activate the test voltage.
4. Release the TEST button at the end of the test. The reading will hold for a few seconds.
5. Any capacitive circuits charged during a test will automatically discharge. If significant voltage remains the voltage warning will occur.
6. Remove the test leads only when no voltage is indicated.

Polarization Index Testing
Polarization Index (PI) is the term applied to the Dielectric Absorption Ratio when resistance values are measured after 1 minute and again after 10 minutes. Polarization Index is then the resistance value after 10 minutes divided by the resistance value after 1 minute. The test can be run at any voltage.

More detailed information on PI Testing and value assessment can be found in Megger Limited publications listed in the Accessories page.

Continuity Testing (Ω)
(***BM80/2*** & ***BM81/2*** only)
The continuity tests are activated when the probes make contact. The test operates without the need to press the TEST button. When the test leads are removed the reading will hold for a few seconds and then reset.
This range is not suitable for diode testing since the automatic contact detector will not be activated when connected to a diode. The kΩ range can be used for diode testing.

1. Set the selector switch to Ω.
2. Connect the test leads. The pointer will appear when connection to <10 MΩ is made.
3. The test will activate automatically.
4. After the test probes are disconnected, the reading will be held for a few seconds.

Continuity Bleeper (
(***BM80/2*** & ***BM81/2*** only)
The continuity bleeper sounds continuously when less than 5 Ω is detected. Short bleeps will sound for resistances lower than a few kΩ and above 5 Ω. If contact to less than 5 Ω is maintained for five seconds, the bleeper stops, and the display shows the measured resistance.

1. Set the selector switch to  .
2. Connect the test leads.

Zeroing of Test Lead Resistance
(***BM80/2*** & ***BM81/2*** only)
The resistance of the test leads can be nulled on the continuity ranges. To zero the resistance (up to 9,99 Ω), short the test leads together, wait for a stable reading, and press the TEST button. The symbol will appear to indicate the zero has been adjusted.

1. Select either Continuity range.
2. Short the test leads across a known good conductor.
3. When the reading has stabilized, press the TEST button. A short 'bleep' will sound and the zero offset symbol will appear.
4. To release the zero offset press the test button again or switch the instrument off.

Resistance Tests (kΩ)
This is a low voltage (5 V) low current (20 µA) test for sensitive electronic equipment. It operates in the same way as the continuity ranges. This range can be used for diode testing.

1. Set the selector switch to kΩ.
2. Connect the test leads.
3. The test will activate automatically.

Voltage Tests (V)
The measured a.c. or d.c. voltage is indicated on the display. The analogue scale display can be toggled between the default range of 0 to 500 V (1 V resolution) or the 1 to 50 V (0,1 V resolution) range by pressing the TEST button. When a.c. volts are detected the ~ symbol will appear next to the 'V'. The presence of negative d.c. is indicated by '-dc' on the display, but no reading is given.

If the voltmeter operation is in question, test the voltmeter on a known source.

1. Set the selector switch to V.
2. Connect the test leads.
3. After a short settle time,the reading will be displayed automatically.

Live Circuit Warning
When more than 25 V is applied to the terminals, the instrument defaults to a voltmeter on all switch positions except OFF and Battery Check. In addition, the audible bleeper will sound on all switch positions except OFF and V. All selected tests will be inhibited except for Insulation tests of 100 V and above, which will remain available until the voltage exceeds 55 V.

Note: If the 500 mA fuse has ruptured, the voltmeter will continue to operate for voltages greater than 100 V at 50 Hz.

Battery Check

The instrument will automatically indicate a battery low condition by the display of .

To monitor the battery power level, select the Battery Check position. The instrument will then measure the battery voltage under a simulated load. This value will be displayed. The analogue arc represents the remaining battery life. A full arc is equivalent to about 9 V and when the arc is at its minimum the battery voltage will be about 6 V.

Battery Replacement

When the low battery symbol  appears, the cells are nearly exhausted and should be replaced as soon as possible. Use Alkaline cells IEC LR6 (AA) only. To install or replace the cells, disconnect the test leads, switch the instrument to OFF and loosen the captive screws on the base of the instrument, holding the battery compartment cover in place. Remove the cover and lift out the cells. Ensure that the replacement cells are fitted with the correct polarity in accordance with the label in the battery compartment. Replace and re-secure the battery compartment cover. Remove the cells if the instrument is not going to be used for an extended period of time.

Fuse Checking and Replacement

To check the instrument fuse, switch to an insulation range and press the TEST button. The symbol  will appear if the fuse is ruptured.

N.B. the voltmeter will continue to operate for voltages greater than 100 V at 50 Hz.

To replace the fuse, disconnect the test leads, switch the instrument OFF and loosen the captive screws holding the battery compartment cover in place. Use only a 500 mA (F) 440 V, 32 mm x 6 mm ceramic use of high breaking capacity HBC 10 kA min. Glass fuses **MUST NOT** be fitted. Remove the cover and replace the fuse. Replace and re-secure the battery compartment cover.

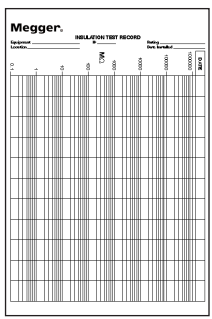
Preventive Maintenance

The proverb ‘A stitch in time saves nine’ inspired the title of an Megger Limited booklet on insulation testing, as it neatly sums up the benefits of preventative maintenance. The savings come in financial terms from costly repairs, lost production, lost profits and in human terms, from lives saved in the event of dangerous electrical faults.

Regular insulation testing of electrical equipment can help to detect deteriorating insulation. The effects which cause insulation to deteriorate include mechanical damage, vibration, excessive heat or cold, dirt, oil, moisture and localized voltage stresses - all of which can arise on most industrial or utility equipment.

Insulation tests are sometimes used in isolation as absolute measures of the quality of the insulation. This is most appropriate when equipment is being installed and checked for compliance with a specified ‘Pass’ level. For operational equipment the key factors are trends in the insulation readings.

It is therefore important that records of insulation readings are kept, relating to each piece of equipment or ‘Asset’ in your testing regime. Megger Limited supplies test record cards to assist with such record keeping. There are also a number of influences on the insulation readings - temperature, humidity and surface leakage for example and a range of test techniques have been developed to help with the interpretation of your insulation tests.



Test Record Example

Insulation Testing Concepts

Insulation resistance can be considered by applying Ohm's Law. The measured resistance is determined from the applied voltage divided by the resultant current,

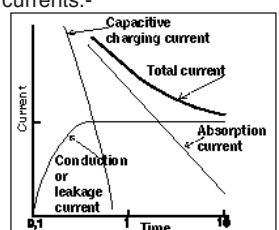
$$R = \frac{V}{I}$$

There are two further important factors to be considered. These are:

(i) the nature of the current through and/or over the insulation, and:

(ii) the length of time for which the test voltage is applied. These two factors are linked.

The total current that flows is made up of three separate currents:-



1) Capacitance charging current. This current is initially high and drops as the insulation becomes charged up to the applied voltage.

2) Absorption current. This current is also initially high but drops at a much slower rate than the charging current.

3) Conduction or Leakage current.This is a small steady current that can be sub-divided into two:-

(a) A current flowing along conduction paths through the insulation material.

(b) A current flowing along conduction paths over the surface of the insulation material.

As the total current depends upon the time for which the voltage is applied, Ohm's Law theoretically applies at infinite time. The charging current falls relatively rapidly as the equipment under test becomes charged up. The actual length of time depends upon the size and capacitance of the item under test.

Larger items with more capacitance will take

longer e.g. long supply cables. The absorption current decreases relatively slowly compared with the charging current. In essence it depends upon the nature of the insulation material.

The conduction or leakage current builds up quickly to a steady value and then remains constant for a particular applied voltage under stable conditions. It is this current that is affected by moisture, dirt etc. and the degree to which it flows bears a direct relation to the quality of the insulation, and consequently to the value of the insulation resistance measured. An increase in the leakage current is a pointer to possible future problems.

Specification

All quoted accuracies are at +20 °C.

Insulation

	Range	Full Scale	Accuracy
(***BM80/2*** & ***BM82/2*** only)	1000 V	200 GΩ	± 2% ± 2 digits ± 0,2% per GΩ
	500 V	100 GΩ	± 2% ± 2 digits ± 0,4% per GΩ
	250 V	50 GΩ	± 2% ± 2 digits ± 0,8% per GΩ
	100 V	20 GΩ	± 2% ± 2 digits ± 2,0% per GΩ
	50 V	10 GΩ	± 2% ± 2 digits ± 4,0% per GΩ

Notes:

All ranges measure from 0,00 MΩ upwards.

0 - 10 GΩ on analogue scale on all ranges.

Test voltage accuracy:	+15% maximum on open circuit
(250 V and 1000 V)	- 0% minimum on 1 mA load
(50 V and 100 V)	- 0% minimum on 250 kΩ load

Short circuit current: < 2 mA

Continuity (***BM80/2*** & ***BM81/2*** only)

Measurement:	0,01 Ω to 99,9 Ω (0 to 50 Ω on analogue scale)
Accuracy:	± 2% ± 2 digits
Open circuit voltage:	5 V ± 1 V
Test current:	205 mA ± 5 mA (0 - 10 Ω)
Zero offset at probe tips:	0,10 Ω typical
Lead resistance zeroing:	Up to 9,99 Ω
Bleeper:	Operates at less than 5 Ω (approx).

Resistance

Measurement:	0,1 kΩ to 100 kΩ (0 to 10 MΩ on analogue scale)
Accuracy:	± 3% ± 2 digits
Open circuit voltage:	5 V ±1 V
Short circuit current:	20 µA ± 5 µA

Voltage

Analogue Scale	Measurement	Accuracy(>1 V)
0 to 500 V Range	0 to 450 V d.c. or a.c. (50/60 Hz)	± 1% ±2 digit
	450 to 600 V d.c. or a.c. (50/60 Hz)	± 1% ±2 digit
	0 to 450 V 400 Hz a.c.	± 5% ±2 digits
0 to 50 V Range	0 to 50,0 V d.c. or a.c. (50/60 Hz)	± 2% ±2 digits

Default Voltmeter

Operates at >25 volts a.c. or d.c. on any range except OFF and Battery check. Reverse polarity d.c. will cause '-dc' to appear in the display.

Safety Protection

The instruments meet the requirements for double insulation to IEC 1010-1 (1995), EN 61010-1 (1995) to Category III**, 300 Volts phase to earth (ground) and 440 Volts phase to phase, without the need for separately fused test leads. If required, fused test leads are available as an optional accessory.

E.M.C.

In accordance with IEC 61326 including amendment No.1

Interference

Error caused by 50/60 Hz hum:

Insulation ranges (100 kΩ to ∞)	<10% error with 100 µA rms.
Continuity range (0,2 Ω to 50 Ω)	<3% error with 1 V rms.

Temperature effects

Temperature coefficient	<0,1% per °C up to 1 GΩ
	<0,1% per °C per GΩ above 1 GΩ

Environmental Conditions

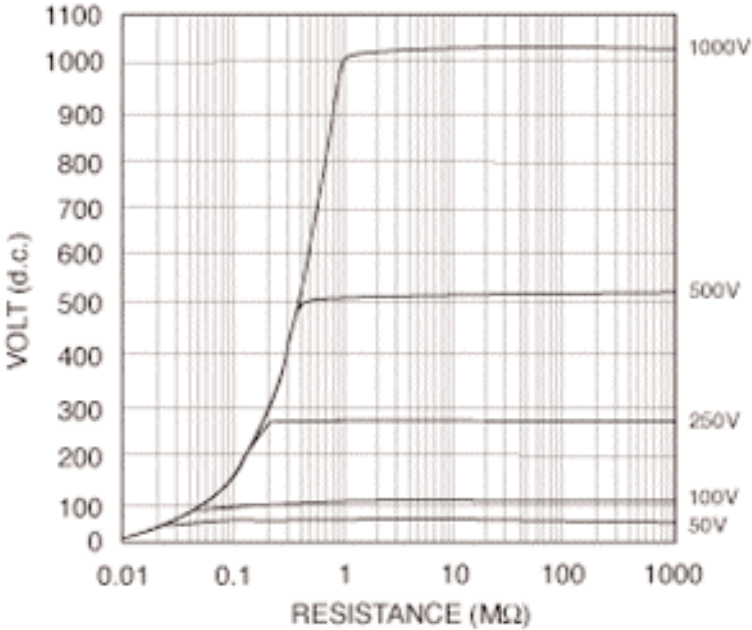
Operating range	-20 to +40 °C
Operating humidity	90% RH at 40 °C max.
Storage temperature range	-25 to +65 °C
Calibration Temperature	+20 °C
Maximum altitude	2000 m
Dust and water protection	IP54

Specification

Fuse	Use only a 500 mA (F) 440 V 32 x 6 mm ceramic fuse of high breaking capacity HBC 10 kA minimum. Glass fuses **MUST NOT** be fitted
Power Supply	Six LR6 Alkaline Cells Zinc carbon cells are not recommended
Dimensions	220 x 92 x 50 mm
Weight	625g
Cleaning	Wipe with a clean cloth dampened with soapy water or Isopropyl Alcohol (IPA).

**Relates to transient overvoltage likely to be found in fixed installation wiring.

Typical Terminal Voltage Characteristics



(BM80/2 & BM82/2 only)

Accessories

Supplied:	Part Number
Test lead set	6220-437
Test-&-carry case	6420-112
User Guide	6172-188
Optional:	
Fused lead set, FPK8	6111-218
Zip-up carrying case	6420-132
Download Base DLB2	6420-602
Switch Test Probe SP6F	6220-836
Miniature A.C. Current Transducer MCC10	6111-290
Test Record Cards (Pack of 20)	6111-216

Publications

‘A Stitch in Time’	AVTM21-P8B

Repair and Warranty

The instrument circuit contains static sensitive devices, and care must be taken in handling the printed circuit board. If the protection of an instrument has been impaired it should not be used, and be sent for repair by suitably trained and qualified personnel. The protection is likely to be impaired if, for example, the instrument shows visible 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 unauthorized prior repair or adjustment will automatically invalidate the Warranty.

Instrument Repair and Spare Parts

For service requirements for Megger Instruments contact:-

Megger LImited
Archcliffe Road
Dover
Kent CT17 9EN — Tel: +44 (0) 1304 502243
England — Fax: +44 (0) 1304 207342

OR

Megger
Valley Forge Corporate Center
2621 Van Buren Avenue
Norristown, PA 19403 — Tel: +1 (610) 676-8500
U.S.A. — Fax: +1 (610) 676-8625

or an approved repair company.

Approved Repair Companies

A number of independent instrument repair companies have been approved for repair work on most Megger instruments, using genuine Megger spare parts. Consult the Appointed Distributor / Agent regarding spare parts, repair facilities and advice on the best course of action to take.

Returning an Instrument for Repair

If returning an instrument to the manufacturer for repair, it should be sent freight pre-paid to the appropriate address. A copy of the Invoice and of the packing note should be sent simultaneously by airmail to expedite clearance through Customs. A repair estimate showing freight return and other charges will be submitted to the sender, if required, before work on the instrument commences.

Megger®

Megger Limited
Archcliffe Road Dover
Kent CT17 9EN ENGLAND
T +44 (0)1 304 502101
F +44 (0)1 304 207342

Megger
4271 Bronze Way, Dallas,
TX 75237-1019 USA
T +1 800 723 2861
T +1 214 333 3201
F +1 214 331 7399

Megger
Z.A. Du Buisson de la Couldre
23 rue Eugène Henaff
78190 TRAPPES France
T +33 (0)1 30.16.08.90
F +33 (0)1 34.61.23.77

OTHER TECHNICAL SALES OFFICES
Toronto CANADA, Sydney AUSTRALIA, Madrid SPAIN, Mumbai INDIA, and the Kingdom of BAHRAIN.

Megger products are distributed in 146 countries worldwide.

This instrument is manufactured in the United Kingdom.
The company reserves the right to change the specification or design without prior notice.

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