

# Insulation & Continuity Testers

## MEGGER® BM400/2 Series

### User Guide

www.MeterCenter.com

(800) 230-6008



#### 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 (*BM400/2*, *BM401/2* and *BM403/2* only).
- ★ 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 default voltmeter and automatic discharge are additional safety features and **should not** be regarded as a substitute for normal safe working practice.
- ★ Test leads and crocodile clips, **must** be in good order, clean, with no broken or cracked insulation.
- ★ Replacement fuses **must** be of the correct type and rating. See '**Specification**'.
- ★ U.K. Safety Authorities recommend the use of fused test leads when measuring voltage on high energy systems.

#### NOTE

THE INSTRUMENTS MUST ONLY BE USED BY SUITABLY TRAINED AND COMPETENT PERSONS

**Before using the instrument**, follow the separate instructions provided to fit either the locking or non-locking test button. AVO **INTERNATIONAL** 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 instruments are:



Caution, risk of electric shock



Caution, refer to accompanying documents



Equipment protected throughout by Double Insulation (Class II)



Equipment complies with current EU Directives.

## GENERAL DESCRIPTION

The *BM400/2* Series instruments are battery powered Insulation and Continuity testers, with a measurement capability from 0,01 Continuity to 999 M 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.

A customized connector on the top of the instrument enables the optional *Megger SP1* Switched probe to be used for two handed probe operation. Available as an optional extra, the *Megger DLB* Downloading Base can be fitted for realtime downloading of measured test results to a 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, with a resolution of 0,1 A.

Designed to IEC1010-1 the *BM400/2* Series are protected against connection to a 440 V Category III supply. The instruments have a basic accuracy of  $\pm 2\%$  at 20 °C. The instruments are waterproof and dustproof to IP54. This helps maintain accuracy and ensures maximum reliability in harsh environments.

## OPERATION



**Refer to Safety Warnings before using the instrument**

**Testing is automatically inhibited if:**

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

The external voltage is indicated on the display (flashing 'V' on the *BM402/2* & *BM404/2*) and the bleeper sounds intermittently.

### 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 ( $\rightarrow 60$ ).

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 (M )

Insulation tests operate only when the **TEST** button is pressed. Grey labelling denotes where it is necessary to press the test button. To prevent damage to the instrument from accidental connection to a 'live' circuit, the test button **must not** be pressed (or locked down) before connecting to the item under test.

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. Take the reading.
4. Release the **TEST** button at the end of the test. The reading will hold for a few seconds.
5. Capacitive circuits charged during a test will automatically discharge. The Live Circuit Warning is displayed if significant voltage remains.
6. Remove the test leads only when no voltage is indicated.

**Note:** There is a safety delay of 3 seconds on the first operation on the '**1000 V**' range, each time the range is selected.

### Automatic Discharge

When the test button is released after an insulation test, a 250 k resistor is automatically switched across the terminals to discharge the item under test. Any voltage present will be indicated on the display so that the discharge can be monitored (except on the *BM402/2* and *BM404/2*, which will display a flashing 'V'.)

### Polarization Index Testing (PI)

All insulation ranges can be used for PI testing. PI is the resistance value after 10 minutes divided by the resistance value after 1 minute. More detailed information on PI Testing and value assessment can be found in **AVO International** publications listed in the Accessories.


## CONTINUITY TESTING( )

Continuity tests are activated when the probes make contact. The test operates without the need to press the **TEST** button. This range is not suitable for diode testing .

1. Set the selector switch to .
2. Connect the test leads. The pointer will appear when connection to  $<10\text{ M}$  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()

The Continuity beeper sounds continuously when less than 5 is detected. Short beeps will sound for resistances lower than a few k and above 5 . If contact to less than 5 is maintained for five seconds, the beeper stops, and the display shows the measured resistance.

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


## RESISTANCE TESTS (k )

This is a low voltage (5 V) low current (20  $\mu\text{A}$ ) 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 k .
2. Connect the test leads.
3. The test will activate automatically.

## Zeroing of Test Lead Resistance

The resistance of the test leads can be nulled on the Continuity ranges (up to 9,99 ).

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 beep will sound and  will appear.
4. To cancel the zero offset press the test button again or switch **OFF**.

## VOLTAGE TESTS (V) (Except *BM402/2* & *BM404/2*)

The measured a.c. or d.c. voltage is indicated on the display. Pressing the **TEST** button will toggle the analogue scale display between the default of 0 to 500 V (1 V resolution) and 1 to 50 V (0,1 V resolution). 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 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 bleeper will sound on all switch positions except **OFF** and **V**. All selected tests will be inhibited except for Insulation tests, which will remain available until the voltage exceeds 55 V.

**Note:** The *BM402/2* & *BM404/2* which do not have a voltage range, will beep and display a flashing 'V'. Testing is inhibited.


## BATTERY CHECK ( )

To measure and display the battery voltage under simulated load conditions, select battery check. The analogue arc represents the remaining battery life. If an external voltage  $>\pm 1$  V is detected, the display will flash and the bleeper will sound.

## Battery Replacement

When the low battery symbol  appears, the cells are nearly exhausted and should be replaced as soon as possible. To install or replace the cells, disconnect the test leads, switch the instrument to **OFF** and loosen the captive screws 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.

**Note:** 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. Remove the cover and replace the fuse of the correct type and rating. Replace and re-secure the battery compartment cover.

## SPECIFICATION

### INSULATION RANGES

|                              | <u>BM400/2</u><br><u>BM402/2</u> | <u>BM401/2</u><br><u>BM404/2</u> | <u>BM403/2</u>         |
|------------------------------|----------------------------------|----------------------------------|------------------------|
| Nominal test Voltage (d.c.): | 500 V<br>1000 V                  | 500 V                            | 250 V, 500 V<br>1000 V |

**Measuring Range:** 0,01M to 999 M on all ranges (0 to 10 G on analogue scale)

**Terminal Voltage (d.c.):** +15% maximum on open circuit.

**Short Circuit Current:** < 2 mA

**Test Current on Load:** 1 mA at min. pass values of insulation specified in BS7671, HD384 and IEC 364, 2 mA max.

**Accuracy (at 20 °C):** ± 2%, ± 2 digits

### CONTINUITY RANGES

**Measuring Range:** 0,01 to 99,9 (0 to 50 on analogue scale)

**Open Circuit Voltage:** 5 V, ±1 V

**Short Circuit Current:** 205 mA, ± 5 mA

**Accuracy (at 20 °C):** 1 to 9,99 : ± 2%, ± 2 digits  
10 to 99,9 : ± 5%

**Zero Offset Adjust:** 0 to 9,99

**Continuity Beeper:** Operates at less than 5

**RESISTANCE RANGE** (can be used for diode testing)

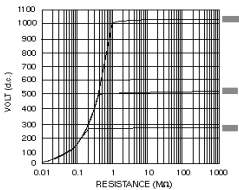
**Measuring Range:** 0,1k to 100 k (0 to 10 M on analogue scale)

**Open Circuit Voltage:** 5 V, ± 1V

**Short Circuit Current:** 20 µA, ± 5 µA

**Accuracy (at 20 °C):** ± 5% ± 2 digits

### TYPICAL TERMINAL VOLTAGE CHARACTERISTICS



### VOLTAGE RANGE

| <u>Analogue Scale</u> | <u>Measurement Scale</u>              | <u>Accuracy(above 1 V)</u> |
|-----------------------|---------------------------------------|----------------------------|
| 0 to 500 V            | 0 to 450 V d.c. or a.c. (50/60 Hz)    | ± 1% ± 2 digits            |
|                       | 450 to 600 V d.c. or a.c.(50/60 Hz)   | ± 2% ± 2 digits            |
|                       | 0 to 450 V 400 Hz a.c.                | ± 5% ± 2 digits            |
| 1,0 to 50 V           | 1,0 to 50,0 V d.c. or a.c. (50/60 Hz) | ± 2% ± 3 digits            |

### SAFETY

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, 440 Volts phase to phase, without the need for separately fused test leads. If required, fused test leads are available as an optional accessory. The *BM402/2* and *BM404/2* do not incorporate a voltage range and must **not** be intentionally connected to live circuits. \*Relates to transient overvoltage likely to be found in fixed installation wiring.

**FUSE** 500 mA (F) 440 V, 32 x 6 mm Ceramic  
HBC 10 kA minimum.

**E.M.C.** The instruments meet EN 50081-1 and  
EN 50082-1 (1992).

#### **POWER SUPPLY**

**Battery Type:** 6 x 1,5 V Alkaline cells IEC LR6 type only.

**Battery Life:** Typically 3000, 5 second operations, at 1 kV.

#### **ENVIRONMENTAL CONDITIONS**

**Altitude:** Up to 2000 m

**Pollution degree:** 2

**Operating Range:** -20 to +40 °C

**Operating Humidity:** 90% R.H. at 40 °C max.

**Storage Range:** -25 to +65 °C

**Temperature Coefficient:** <0,1% per °C on all ranges

**WEIGHT** 625g

**DIMENSIONS** 220 mm x 92 mm x 55 mm

**CLEANING** Wipe with a clean cloth dampened with  
soapy water or Isopropyl Alcohol (IPA).

#### **ACCESSORIES**

| <b>Supplied:</b>     | <b>Part Number</b> |
|----------------------|--------------------|
| User Guide           | 6172-189           |
| Test lead set        | 6220-437           |
| Zip-up carrying case | 6420-090           |

|   |          |
|---|----------|
| <b>Optional:</b>  |          |
| Fixed prod  | 5210-350 |
| Fused lead set, <b>FPK8</b>                             | 6111-218 |
| Test & carry case                                       | 6420-112 |
| Download Base <b>DLB</b>                                | 220-603  |
| Switch Probe <b>SP1</b>                                 | 6220-606 |
| Miniature Clip on A.C. Current Transformer <b>MCC10</b> | 6111-290 |
| Test Record Card (pack of 20)                           | 6111-216 |

#### **Publications**

'A Stitch in Time' AVTM21-P8B

#### **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.

## 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*<sup>®</sup> Instruments contact :

##### **AVO INTERNATIONAL**

or

##### **MeterCenter**

Archcliffe Road  
Dover  
Kent, CT17 9EN  
England

825 W. Queen Creek Rd., Suite 2118  
Chandler, AZ 85248  
U.S.A.  
Sales@MeterCenter.com

Tel: +44 (0) 1304 502243

Fax: +44 (0) 1304 207342

Tel: +1 (480) 659-8351

Fax: +1 (480) 659-8361

or an approved repair company.

#### **Approved Repair Companies**

A number of independent instrument repair companies have been approved for repair work on most *MEGGER*<sup>®</sup> instruments, using genuine *MEGGER*<sup>®</sup> 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.