Megger

BM15/MJ15
Insulation Testers

USER GUIDE

CONTENTS

Before using the instrument, follow the separate instructions provided to fit either the locking or non-locking test button.

If the locking button is fitted, extra care must be taken. See page 6.

Symbols used on the instruments


Risk of electric shock.


Caution, refer to accompanying documents


Equipment protected throughout by Double Insulation (Class II)


Equipment complies with current EU Directives

⚠SAFETY WARNINGS

- **'Safety Warnings'** and **'Working with Capacitive Loads' must** be read and understood before the instrument is used. Safety precautions must be observed during use.
- The circuit under test **must** be switched off, de-energised and isolated before any test connections are made.
- Circuit connections **must not** be touched during a test.
- On completion of a test, decaying voltage across the terminals is indicated on the display. Capacitive load circuits **must** be discharged to **below 60 V** before disconnecting the test leads.
- Capacitive load circuits should be shorted with a shorting link after discharge.
- **Remove** the test leads from the instrument **before** opening the battery compartment.
- Test leads and 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.
- U.K. Safety Authorities recommend the use of fused test leads when measuring voltage on high energy systems. See '**Choice of Test Leads'.**

NOTE

The instruments must only be used by suitably trained and competent persons.

NOTE

Users of this equipment and or their employers are reminded that 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 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. See **'Choice of Test Leads'**.

GENERAL DESCRIPTION

BM15, and MJ15 testers are completely self contained instruments designed for high voltage insulation resistance testing in the maintenance and servicing of rotating plant machinery, transformers, switchgear and industrial installations.

Tests can be performed at 500 V, 1000V, 2500 V or 5000 V. Insulation measuring range is 100 kΩ to 20 GΩ and Infinity. Automatic discharge for capacitive circuits under test is provided and decaying voltage displayed.

A guard terminal can be used to minimise the effects of surface leakage when carrying out insulation resistance tests.

Tests are initiated by pressing the BM15 **'Test'** button (or by turning the MJ15 generator handle). Releasing the 'Test' button (or ceasing handle rotation) causes the instrument to default to ac/dc voltmeter mode, with a discharge resistor internally connected across the terminals. This feature will give decaying voltage indication following the testing of equipment possessing capacitance.

The moving coil meter operates a black pointer to display the readings on a single logarithmic black scale on a white scale-plate for clarity of reading. The movement is resiliently mounted for field use.

A slide - in 'Pass Band' overlay can be inserted over the display. Appropriate Pass/Fail bands can be marked on these windows with a permanent marker for 'Go / No Go' testing.

BM15 is powered by eight 1,5 V (IEC LR6) cells.

Normal power for the MJ15 is by low voltage, hand cranked, brushless a.c generator. Fitting the battery container supplied, with eight 1,5 V IEC LR6 cells gives the instrument a dual (independent) supply capability. Both instruments are fitted with a battery check range, operated by pressing the 'Test' push button. Cranking the handle too slowly (<180 RPM) results in an unstable pointer reading. Excess handle speed cannot harm the instrument as the output voltage is electronically regulated.

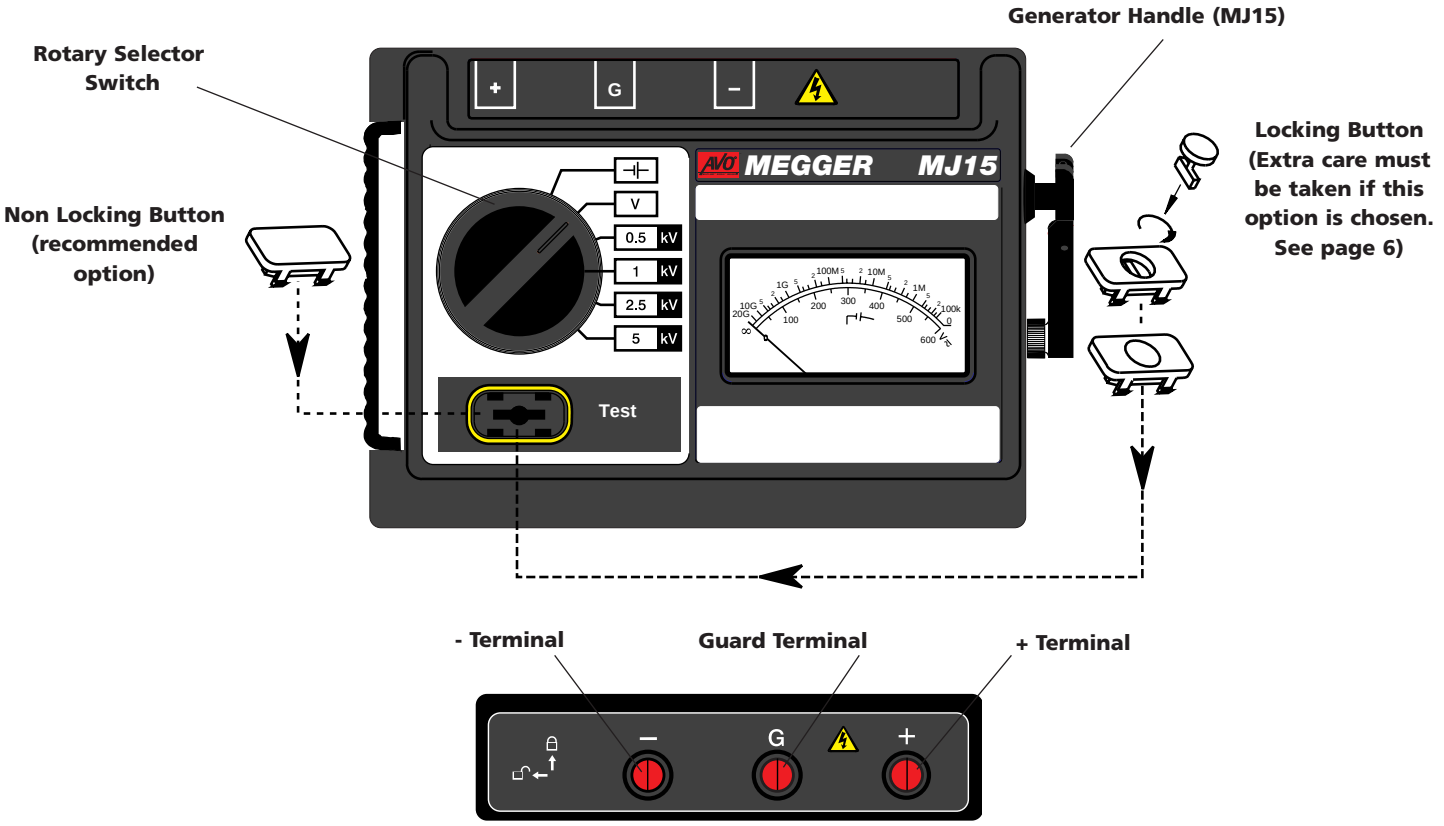
The case is robust, yet light-weight, made from a flame retardant ABS, with a polycarbonate display window. Mounted on top of the case is a 6 position, rotary, range selection switch and a **'Test'** push button.

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.

Design safety features include:

- External voltage, a.c. or d.c., 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.



TO INSERT TERMINAL PLUGS, PUSH IN - TO RELEASE, TWIST A QUARTER TURN AND PULL OUT

WORKING SAFELY WITH CAPACITIVE LOADS

⚠

Circuit connections and the instrument terminals may become hazardous when connected to Capacitive loads.

1. These instruments are designed to safely charge and discharge capacitive loads up to 5 µF. To safeguard against malfunction however, you are advised to take your own precautions when working with capacitive loads. Remember that when charged, even low value capacitors can be fatal on contact .
2. Extra care must be taken if the locking Test button is selected.
3. Circuit connections must not be touched when testing.

Do not forget to release a locked Test button and discharge any capacitance before touching the item under test or disconnecting the test leads.

4. Care must be taken to prevent capacitive circuits becoming disconnected during a test, leaving the circuit in a charged state.
5. On completion of a test, the instrument indicates circuit decaying voltage. Do not disconnect test leads until the load capacitance has discharged to below 60 V.
6. The voltmeter and automatic discharge feature of the instruments should be regarded as additional safety features and not a substitute for normal safe working practice.
7. If any part of the instrument is damaged, it should not be used, but returned to the manufacturer or an approved service organization for repair.

PRELIMINARY CHECKS

Preliminary Performance Checks

The instrument will operate in any position, but best results are achieved when the instrument is face up, on a firm level surface. This is particularly true for hand cranked units to obtain a crank speed of >180 rev/min.

1) If battery cells are fitted, switch to **Battery Check** range and press the 'Test' push button. Confirm that the pointer settles within the battery symbol portion of the scale.

2) With the test leads disconnected, set the rotary selector switch to the appropriate insulation range, press and hold down the **'Test'** button, (or turn the generator handle). The meter pointer should move up the scale briefly and then return to the '∞' (infinity) position on the scale. This establishes that there is no leakage through the instrument itself.

3) Check that the test leads and crocodile clips are in good order, clean and with no broken or cracked insulation. Connect two of the test leads to the '+' and '-' terminals and ensure that their clips are not touching anything.

4) Press the **'Test'** button again (or turn the generator handle) and observe the meter pointer. The pointer should rest over the '∞' position on the scale. If it does not, the test leads may be faulty and should be inspected more closely for damage. Replace them if necessary.

5) Connect the test lead clips together, press the '**Test'** button (or turn the generator handle) and observe the meter pointer. The meter should read '0Ω'. If it indicates infinity or a high resistance value the leads may be open circuit and should be inspected further. Replace them if necessary. (Shorting the leads together and obtaining a '0 Ω' reading also indicates that the instrument is working).

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 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.

Voltage measurement

When switched to the **'V'** position, the instrument measures up to 600 V a.c. to the specified accuracy of the instrument. DC voltage is also indicated on the display, but not to the specified accuracy. When not testing (i.e. in standby mode) and connected to a live circuit, the instruments default to voltmeter (0 to 600 Volts a.c. or d.c.) irrespective of the rotary switch position. Any voltage present will immediately be shown. Thus indication is given that the item has not been completely de-energized. The instrument also monitors circuit discharge when the **'Test'** button is released following an insulation test on a capacitive item, e.g. a long cable.

Insulation Testing

After connecting the test leads to the instrument and carrying out the Preliminary Performance Checks:

1) Set the selector switch to the required test voltage. Connect the test leads to the isolated circuit to be tested, as follows:-

   (a) For insulation tests to earth (ground):- Connect either test lead to earth (ground) or the frame of the equipment,and the other lead to that part of the circuit to be tested.

   b) For insulation tests between wires:- Connect a lead to the core of each of the wires.

2) Press the **'Test'** button (or turn the generator handle).

3) The meter pointer will indicate the value of insulation resistance on the Ω scale.

If a capacitive circuit is tested, the pointer will initially deflect towards 0 Ω and then gradually rise to its final steady value as the capacitance is charged up to the output voltage of the tester.

If several successive readings of ∞ (infinity) are obtained, connect the two farthest ends of the test leads together and carry out a check on the leads. A 0Ω reading should result which double checks that the leads are not disconnected or broken and therefore, the insulation resistance readings are correct.

Capacitive circuits automatically discharge through the tester when the 'Test' button is released. Decaying discharge voltage will be indicated on the voltage scale. Wait a few moments for the voltage to decay to below 60 V before disconnecting the test leads.

Do not forget to release a locked Test button, and discharge any capacitance before touching the item under test, or disconnecting the test leads.

Choice of Test Leads

BM15/MJ15 are supplied with three unfused leads terminated in crocodile clips. These are the best leads to use for insulation tests on non-live circuits. The crocodile clips ensure that any capacitive load remains connected until it is automatically discharged at the end of a test.

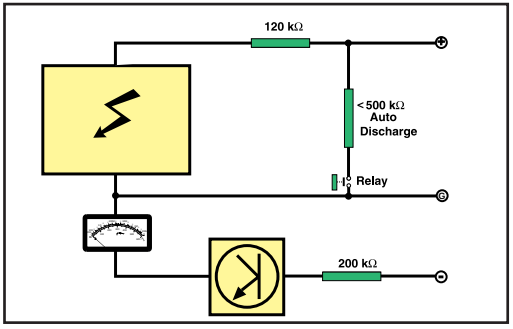
GS 38 (UK Safety Authority Guidance Note) advises the use of fused test prods if the instrument is to be used for making voltage measurements on live, high energy circuits. These leads are available as an optional extra. See **'Accessories'**.

Fused prods must not be used for insulation testing. If the fuse should rupture, or the prods lose contact during a test, the system under test would remain charged **without any apparent evidence of danger!**

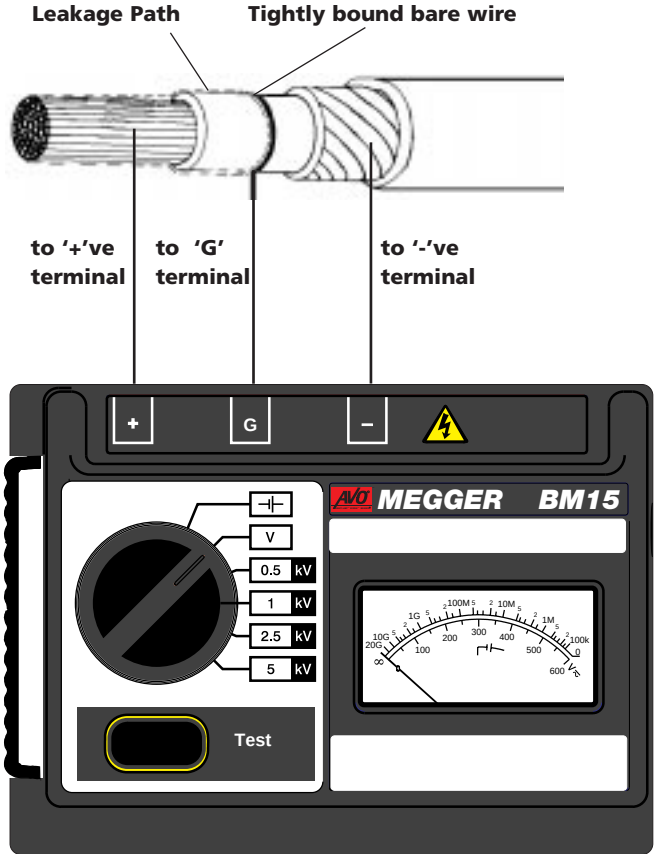
Using the Guard terminal (G)

For basic insulation tests and where there is little possibility of surface leakage affecting the measurement, it is unnecessary to use the guard terminal (if the insulator is clean and there are unlikely to be any adverse current paths). However in cable testing, 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. Where it is required to remove the effect of this leakage, 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'**.

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.



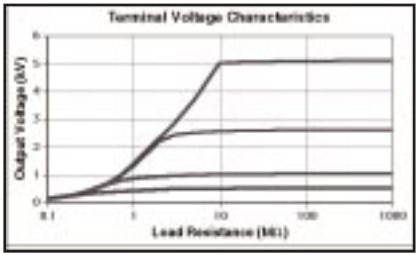
OPERATION BLOCK DIAGRAM



SPECIFICATION

Insulation

Range:	100 kΩ to 20 GΩ (also 0 Ω and ∞)
Test Voltages (d.c.):	500 V, 1000 V, 2500 V & 5000 V
Test Voltage Accuracy:	±5% of nominal test voltages on 20 MΩ load
Test Voltage Stability:	<±1% (180 r.p.m. to 240 r.p.m. MJ15)
Insulation Accuracy (at 0 - 30˚C):	±2,5% of scale
Short Circuit Current:	1,5 mA ± 0,5 mA
Maximum capacitance of load:	5 µF
Interference Rejection:	1 mA rms at 50 to 60 Hz
Discharge Resistor:	<500 kΩ



Voltage

Range:	0 to 600 V a.c.	indication of d.c.
Accuracy:	± 2,5% f.s.d.(with rotary switch in the V position)	± d.c. unspecified

General

Overload rating:		720 V a.c. or d.c.
Scale Length:		72 mm (96˚)
Power Supply:	BM15	8 x LR6 (AA alkaline or rechargeable) cells
	MJ15	Low voltage brushless Generator or 8 x LR6 (AA alkaline) cell battery
Battery life:		Typically 2000 five second tests at 5 kV on 100 MΩ load
Battery Indicator:		Loaded battery test

Safety:		Meets the safety requirements for double insulation to IEC 1010-1 (1995) EN61010 (1995) to installation Category III***, 300 Volts phase to earth (ground) or 600 Volts Category I*
Non replaceable Fuse:		1 Amp, 250 V, HBC type (F) (20 mm x 5 mm) to IEC 127/1 This fuse protects the instrument against any faults occurring when using rechargable batteries.
E.M.C:		In accordance with IEC 61326 including amendment No.1
Temperature Range:		
Operating:		0˚C to 30˚C (32˚F to 86˚F) at full specification
Operating:		-20˚C† to 50˚C (-4˚F to 122˚F) to temperature coefficient ±0,1% / ˚C
Storage:		-25˚C to 65˚C (-13˚F to 149˚F)
Humidity:		90% RH maximum at 40˚C (104˚F)
Dimensions:		220 mm x 160 mm x 115 mm (8,9 in x 6,3 in x 4,5 in)
Weight:	BM15	Approx 1.2 kg
	MJ15	Approx 1,6 kg, or 1,8 kg with battery holder and cells.
Cleaning:		Wipe the disconnected instrument with a clean cloth dampened with soapy water or Isopropyl Alcohol (IPA)

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

*Relates to transient overvoltage likely to be found in special equipment or parts of equipment, telecommunication, electronic etc.

† Note: MJ15 will operate as normal by generator at full temperature range
BM15 will require new healthy battery cells to operate as normal at -20˚C

ACCESSORIES

SUPPLIED WITH THE INSTRUMENT	PART NUMBER
User Guide	6172-209
Battery of 8 x 1,5 V LR6 (AA Alkaline) cells	
3 x 3 m HV leads	8101-181
Test Record Card (5 supplied)	6172-111 (U.S. 210949)
Carrying case with lead storage	6420-117
Slide in Pass Band overlay (5 supplied)	6121-401

AVAILABLE AS AN OPTIONAL EXTRA	
5 kV Fused Prod Set	6320-240
5 kV Calibration Box - CB101	6311-077
Test Record Card (Pack of 20)	6111-216

PUBLICATIONS	
'A Stitch In Time'	AVTM21-P8B
'Lowdown on HV d.c. Testing'	AVTM22P-1