ΙER
ΙUMENTS
ED

)over Kent CT17 9EN England Tel: 0304 202620 Fax: 0304 207342 Telex: 96283 Avomeg G

manufactured in the United Kingdom.
erves the right to change the specification or design without prior notice.
egistered Trade Mark of MEGGER INSTRUMENTS LIMITED.
e comma as the decimal marker to align with general European usage.
ıse design is registered.
GGER INSTRUMENTS LIMITED, 1988
Edition 2 Printed in England SL/0,2k/8T

ATIONAL company

MEGGER

MEGGER® Insulation Tester BMD3

Operating Instructions

MEGGER®

SAFETY WARNING

- ★ ***The circuit must be de-energized and isolated BEFORE connections are made for any test, (except a voltage measurement).***
- ★ ***If the high voltage warning neon illuminates when the instrument is connected do not press the 'Test' button.***
- ★ ***Do not touch the circuit during an insulation test.***
- ★ ***After insulation tests, capacitive circuits MUST be allowed to discharge BEFORE disconnecting the test leads.***
- ★ ***Test leads, including crocodile clips, must be in good order; clean and having no broken or cracked insulation.***
- ★ ***Replacement fuses MUST be of the correct type and rating.***
- ★ ***When making voltage measurements on high energy systems, it is essential that test leads with fused prods are used.***

Refer also to page 11 for further explanations and other precautions.
The warnings and precautions must be read and understood before the instrument is used. They must be observed during use.

NOTE

This instrument is only to be used by a suitably trained and competent person.

CONTENTS

WARNING

d isolated BEFORE connections are measurement).

minates when the instrument is itton.

sulation test.

:uits MUST be allowed to discharge ls.

, must be in good order; clean and ion.

:orrect type and rating.

s on high energy systems, it is essential ised.

ions and other precautions. ead and understood before the ed during use.

TE

uitably trained and competent person.

CONTENTS

GENERAL DESCRIPTION

The BMD3 is a portable, auto-ranging, insulation and continuity tester in which accurate readings are shown directly on a 3½ digit liquid crystal display.

For insulation testing there are four d.c. test voltages, 100 V, 250 V, 500 V and 1000 V derived from a d.c. to d.c. converter and the maximum resistance which can be measured is 1999 MΩ. Continuity can be measured up to 199,9 Ω with a resolution of 0,01 Ω on the lowest range. In order to minimise the effects of standing e.m.fs when continuity testing, a reverse polarity function is available. So, without altering the position of the test leads, two measurements can be made with opposite polarities of the test current and an average reading taken.

There is a rotary function/range selector switch and two push-buttons on the front panel. One push-button is latchable and acts as the instrument's on/off switch, the other is the 'Test' button which is pressed to execute an insulation or continuity test. When the selector switch is in any of the four insulation test voltage positions, the latchable push-button 'on' but the 'Test' button not pressed, the instrument acts as an a.c./d.c. voltmeter with a range of 0 – 600 V. The automatic capacitive circuit discharge facility is also effective when the switches are set like this and the instrument will monitor the decaying voltage as discharging takes place; the display then showing when it is safe to remove the test leads.

With either of the continuity ranges selected and the 'Test' button not pressed, the instrument is in a stand-by condition and no reading will be shown but an over-range indication is given.

The BMD3 is auto-ranging and gives all measurement values directly, with no multiplying factors to apply. The display also shows the units of measurement, either 'MΩ', 'Ω' or 'V' and indicates over-range (i.e. '1' is displayed only). Note that when measuring voltage the maximum value is 600 V even though the display is capable of showing up to 1999 V. When the instrument's battery needs replacing the symbol '–||–' appears on the display.

Power for the instrument and the test circuit is supplied by six 1,5 V alkaline manganese cells, IEC LR6 type. These are fitted in a compartment in the rear of the casing.

Although the instrument circuit is protected against the application of 1200 V a.c. or d.c. on the 1000 V insulation range and the voltage ranges, and 600 V a.c. or d.c. on the remaining ranges, a neon indicator is fitted on the front panel to warn of the presence of a dangerous external voltage. When this neon illuminates on no account must the 'Test' button be pressed. The neon operates whether the instrument is switched on or not and is effective whatever range is selected.

Three 4 mm recessed terminals are provided on the instrument. Those marked '+' and '–' are used for all measurements. The guard terminal, marked 'G', is used to minimise the effects of surface leakage when carrying out insulation tests. The instrument's carrying handle folds down over the terminals and so helps to retain the test leads and stop them becoming disconnected during a test.

The instrument casing is made from a strong ABS material which is robust yet very light in weight.

APPLI

The safe
equipme
It is esse
installed
voltage
interrup
testing
equipm
time, to
accumu
or breal
insulati

The BM
accord
Regula
insulat

The fo
makes
voltage
etc.

The in
requir
part 4

With either of the continuity ranges selected and the 'Test' button not pressed, the instrument is in a stand-by condition and no reading will be shown but an over-range indication is given.

The BMD3 is auto-ranging and gives all measurement values directly, with no multiplying factors to apply. The display also shows the units of measurement, either 'MΩ', 'Ω' or 'V' and indicates over-range (i.e. '1' is displayed only). Note that when measuring voltage the maximum value is 600 V even though the display is capable of showing up to 1999 V. When the instrument's battery needs replacing the symbol '⊣|–' appears on the display.

Power for the instrument and the test circuit is supplied by six 1,5 V alkaline manganese cells, IEC LR6 type. These are fitted in a compartment in the rear of the casing.

Although the instrument circuit is protected against the application of 1200 V a.c. or d.c. on the 1000 V insulation range and the voltage ranges, and 600 V a.c. or d.c. on the remaining ranges, a neon indicator is fitted on the front panel to warn of the presence of a dangerous external voltage. When this neon illuminates on no account must the 'Test' button be pressed. The neon operates whether the instrument is switched on or not and is effective whatever range is selected.

Three 4 mm recessed terminals are provided on the instrument. Those marked '+' and '–' are used for all measurements. The guard terminal, marked 'G', is used to minimise the effects of surface leakage when carrying out insulation tests. The instrument's carrying handle folds down over the terminals and so helps to retain the test leads and stop them becoming disconnected during a test.

The instrument casing is made from a strong ABS material which is robust yet very light in weight.

APPLICATIONS

The safety of electrical wiring installations and equipment depends on the condition of the insulation. It is essential to thoroughly test the insulation of newly installed wiring and equipment by subjecting it to a voltage in excess of its normal rating. In order to avoid interruptions or breakdowns it is desirable that routine testing of the insulation condition of pieces of equipment or wiring installations is made from time to time, to ensure that deterioration is not occuring. The accumulation of dirt or moisture and mechanical wear or breakage can all lead to a deterioration of the insulation.

The BMD3 is suitable for testing wiring installations in accordance with the 15th Edition IEE Wiring Regulations. It is also able to perform 1000 V d.c. insulation tests on installations when required.

The four test voltages available on the instrument makes it suitable for testing many other pieces of low voltage equipment, domestic and portable appliances etc.

The instrument has been designed to fulfil the requirements of the German VDE 0413 part 1 and part 4 specifications.

SPECIFICATION

INSULATION RANGES

Insulation Resistance	0 – 1,999 MΩ at all test voltages 19,99 MΩ at all test voltages 199,9 MΩ at all test voltages 1999 MΩ at 500 V d.c. and 1000 V d.c. test voltages Fully auto-ranging at all voltages
Rated Test Voltages d.c.	100 V 250 V 500 V 1000 V
(U_N) (min. terminal voltage at 1 mA load)	
Terminal Voltage on Open Circuit	Rated voltage +40%, −0%
Rated Current (I_N) (current at rated voltage)	1 mA minimum
Terminal Current on Short Circuit	1,2 mA nominal
Accuracy (23 °C ± 2 °C)	<500 MΩ: ±3% of reading ±2 digits 500 MΩ to 1999 MΩ: ±5% of reading ±2 digits
Temperature Coefficient	<500 MΩ: ≤30 °C, ±0,1% / °C >30 °C, ±0,25% / °C 500 MΩ to 1999 MΩ: ≤30 °C, ±0,2% / °C >30 °C, ±0,5% / °C
Interference Rejection	Within twice the normal accuracy if the noise current does not exceed 1 mA for the 1000 V range or 0,5 mA for the other ranges and is within 45 Hz to 65 Hz

CONTINUITY RANGE

Resistance	0 – 19,99 Ω and 199,9 Ω Fully auto-ranging On 'Ω+' the '+' terminal is the source of the test current On 'Ω−' the '−' terminal is the source of the test current

Terminal Voltage on Open Circuit (U_O)		4,3 V nominal, 4,0 V
Terminal Current on Short Circuit (I_K)		215 mA nominal
Accuracy (23 °C ± 2 °C)		±2% of reading ±1 terminals
Temperature Coefficient		±0,1% / °C

VOLTAGE RANGE

Range		0 – 600 V a.c./d.c. positions with the
Input Impedance		300 kΩ to 1 MΩ d
Discharge Rate		A 1 μF capacitor v 2 seconds
Accuracy		±2% of reading
Temperature Coefficient		±0,1% / °C

GENERAL

Overload Rating		600 V a.c. or d.c 1200 V a.c. or d. voltage measu
Temperature Range	operating	−5 °C to +50 °
	storage	−20 °C to +70
Humidity	operating	70% RH at 20 (for measurem
	storage	95% RH at 35

0 – 1,999 MΩ at all test voltages
19,99 MΩ at all test voltages
199,9 MΩ at all test voltages
1999 MΩ at 500 V d.c. and 1000 V d.c. test voltages
Fully auto-ranging at all voltages

100 V 250 V 500 V 1000 V

Rated voltage +40%, −0%

1 mA minimum

1,2 mA nominal

<500 MΩ: ±3% of reading ±2 digits
500 MΩ to 1999 MΩ: ±5% of reading ±2 digits

<500 MΩ: ≤30 °C, ±0,1% / °C
>30 °C, ±0,25% / °C
500 MΩ to 1999 MΩ: ≤30 °C, ±0,2% / °C
>30 °C, ±0,5% / °C

Within twice the normal accuracy if the noise current does not exceed 1 mA for the 1000 V range or 0,5 mA for the other ranges and is within 45 Hz to 65 Hz

0 – 19,99 Ω and 199,9 Ω
Fully auto-ranging
On 'Ω+' the '+' terminal is the source of the test current
On 'Ω−' the '−' terminal is the source of the test current

Terminal Voltage on Open Circuit (U_o)		4,3 V nominal, 4,0 V minimum
Terminal Current on Short Circuit (I_k)		215 mA nominal
Accuracy (23 °C ± 2 °C)		±2% of reading ±1 digit ±30 mΩ at the instrument terminals
Temperature Coefficient		±0,1% / °C
VOLTAGE RANGE		
Range		0 – 600 V a.c./d.c. (effective in the four insulation range positions with the 'Test' push-button not pressed)
Input Impedance		300 kΩ to 1 MΩ depending on input voltage
Discharge Rate		A 1 μF capacitor will discharge to a safe level in less than 2 seconds
Accuracy		±2% of reading ±1 digit for d.c. or a.c. at 45 Hz to 65 Hz
Temperature Coefficient		±0,1% / °C
GENERAL		
Overload Rating		600 V a.c. or d.c. on all ranges 1200 V a.c. or d.c. for 10 seconds on 1000 V insulation and voltage measuring ranges
Temperature Range	operating	−5 °C to +50 °C
	storage	−20 °C to +70 °C
Humidity	operating	70% RH at 20 °C, 60% RH at 35 °C and 50% RH at 40 °C (for measurements <200 MΩ)
	storage	95% RH at 35 °C

SPECIFICATION

Safety

The instrument will, in general, meet the requirements of BS 4743, IEC 348 and VDE 0411. It will satisfy the requirements of VDE 0413 parts 1 and 4. Safety Class II

Power Supply

Six 1,5 V cells IEC LR6 type (e.g. Duracell MN1500)
Battery life, 2100 operations (tested to VDE 0413 part 1)

Fuse

500 mA 440 V 32 mm x 6 mm ceramic HBC

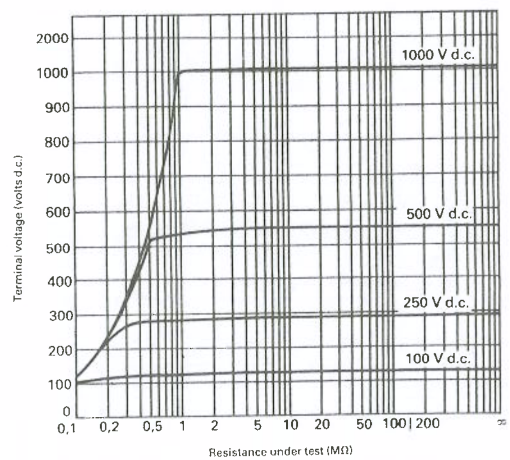
Dimensions

180 mm x 128 mm x 125 mm (7 in x 5 in x 5 in approx.)

Weight

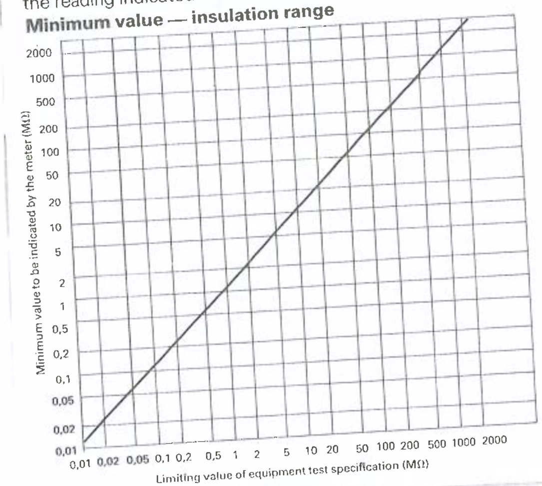
1 kg (2,2 lb)

Typical Terminal Voltage Characteristics

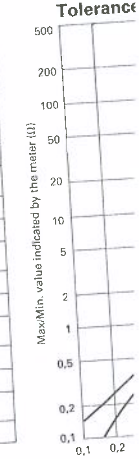


The VDE 0413 specification part 1 stipulates that these instructions should contain a diagram showing the minimum insulation resistance value which the instrument must indicate in certain conditions. An insulation or continuity test being performed on any item of equipment, would normally be carried out to a particular specification for that type of equipment. Therefore, even at the instrument's worst accuracy, the reading indicated should be such that the actual

Minimum value — insulation range



value is nev
question.
The curve b
which shal
maximum
insulation r
specificati
Another cu
shows the
Toleranc



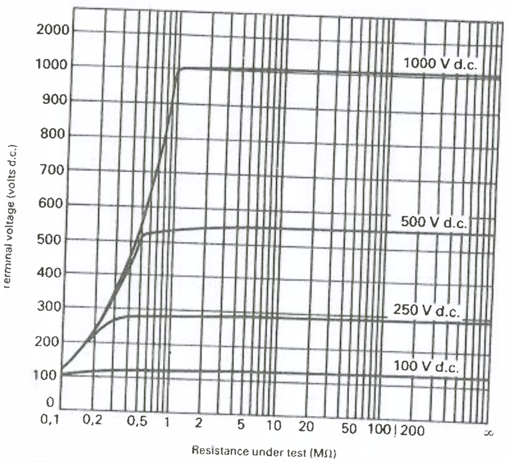
The instrument will, in general, meet the requirements of BS 4743, IEC 348 and VDE 0411. It will satisfy the requirements of VDE 0413 parts 1 and 4. Safety Class II

Six 1,5 V cells IEC LR6 type (e.g. Duracell MN1500)
Battery life, 2100 operations (tested to VDE 0413 part 1)

500 mA 440 V 32 mm x 6 mm ceramic HBC

180 mm x 128 mm x 125 mm (7 in x 5 in x 5 in approx.)

1 kg (2,2 lb)

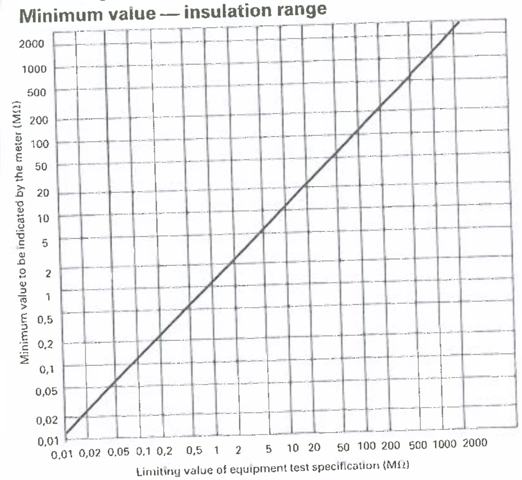


The VDE 0413 specification part 1 stipulates that these instructions should contain a diagram showing the minimum insulation resistance value which the instrument must indicate in certain conditions. An insulation or continuity test being performed on any item of equipment, would normally be carried out to a particular specification for that type of equipment. Therefore, even at the instrument's worst accuracy, the reading indicated should be such that the actual value is never below the particular specification in question.

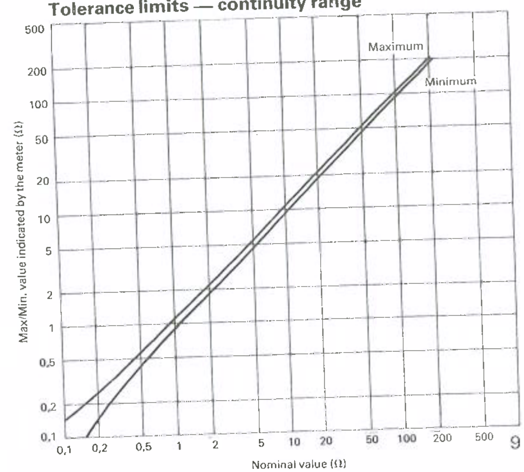
The curve below (left) shows the minimum value which shall be indicated by the instrument (at its maximum error) to ensure that the limiting value of the insulation resistance given in the relevant equipment specification is met.

Another curve is given for the continuity ranges which shows the tolerance band of measurement.

Minimum value — insulation range



Tolerance limits — continuity range



ACCESSORIES

SUPPLIED WITH THE INSTRUMENT

Test lead (black) with shrouded crocodile clips (3 supplied) — part no. 6220-295

Operating instruction book

AVAILABLE AS AN OPTIONAL EXTRA

Carrying case — part no. 6420-043

4 mm right angled adaptors (allowing the use of test leads with straight connectors)

- black — part no. 6320-176
- red — part no. 6320-177

Test leads with fused prods (440 V a.c. max. 500 mA fuse), complies with Health and Safety Executive doc. GS38

- black — part no. 6121-125
- red — part no. 6121-126

OPERATION

WARNING

1. The circuit under test must be switched off, de-energized and isolated BEFORE connections are made for insulation or continuity tests. The instrument's voltmeter function may be used to verify that the circuit is "dead". Test leads with fused prods are available and it is recommended that these be used when making voltage measurements in high energy situations. (Max. voltage of the fused leads is 440 V a.c.). The display will show a zero reading if the circuit is "dead".
2. Do not press the 'Test' button if, when the instrument is connected, the high voltage warning neon illuminates. The neon illuminates when the instrument is connected to a dangerously high voltage and that voltage must be removed before any tests are carried out. Do not change the selector switch to a different position if an external voltage is present.
3. Do not touch the circuit during an insulation test.
4. After an insulation test, capacitive circuits MUST be allowed to discharge through the instrument circuit BEFORE the test leads are disconnected. The discharging voltage is monitored by the voltmeter and is at a rate better than 2 seconds per microfarad. The test leads can be removed when the voltage has fallen to zero.
5. Do not use test leads which have damaged or broken insulation.

6.

7.

8.

95
43
76
77
5
6

OPERATION

WARNING

1. The circuit under test must be switched off, de-energized and isolated BEFORE connections are made for insulation or continuity tests. The instrument's voltmeter function may be used to verify that the circuit is "dead". Test leads with fused prods are available and it is recommended that these be used when making voltage measurements in high energy situations. (Max. voltage of the fused leads is 440 V a.c.). The display will show a zero reading if the circuit is "dead".
2. Do not press the 'Test' button if, when the instrument is connected, the high voltage warning neon illuminates. The neon illuminates when the instrument is connected to a dangerously high voltage and that voltage must be removed before any tests are carried out. Do not change the selector switch to a different position if an external voltage is present.
3. Do not touch the circuit during an insulation test.
4. After an insulation test, capacitive circuits MUST be allowed to discharge through the instrument circuit BEFORE the test leads are disconnected. The discharging voltage is monitored by the voltmeter and is at a rate better than 2 seconds per microfarad. The test leads can be removed when the voltage has fallen to zero.
5. Do not use test leads which have damaged or broken insulation.
6. Replacement fuses must be of the correct type and rating, (refer to the specification).
7. The instrument should not be used in explosive or inflammable environments, although there is unlikely to be a fire hazard due to the instrument itself. However, arcing in faulty insulation, sparking caused when making or removing connections to equipment that has not been properly de-energized, or discharge of capacitance following tests, can all lead to explosion or fire hazard.
8. If it is suspected that the instrument's protection has been impaired, it must not be used but returned to the manufacturer or his agent for checking. The protection is likely to have been impaired if, for example, the instrument shows visible damage, or fails to perform the intended measurements, or has been subjected to prolonged storage under unfavourable conditions, or has been subjected to severe transport stresses.

OPERATION

PRECAUTIONS

1. If the instrument is not to be used for a long period of time it is advisable to remove the battery cells to avoid any possible damage being caused by leaking electrolyte.
2. Instruments used in dusty environments should be stripped and cleaned periodically. This should be done by a qualified instrument technician.
3. The instrument circuit contains static sensitive devices. If the casing is opened for any reason, care must be exercised in handling the printed circuit board. This should be done in accordance with DEF STAN 59-98 and BS 5783, specifications for handling electrostatic sensitive devices.
   Note:— If the casing is opened for any reason, this will automatically invalidate any warranty covering the instrument.

FITTING OR REPLACING BATTERY CELLS

The battery cells are housed in a compartment in the base of the instrument. To change the cells, ensure first that the instrument is not connected to any external circuit and is switched off, then turn the instrument over and use a screwdriver to remove the battery cover securing screw (located at one end of the base of the case). Lift off the battery compartment cover and fit or replace the cells ensuring that they are inserted with the correct polarity as marked in the case moulding. Replace the cover and secure it with its retaining screw.

DISPLAY INDICATORS

In addition to showing the measurement readings, the display also indicates the following:—

Low Battery Voltage

The low battery voltage symbol is '—|⊢' and it appears at the top left hand side of the display when the battery cells need replacing. This should be done as soon as the symbol first appears to avoid errors in the readings.

Units of Measurement

The units of the measurement, either 'MΩ', 'Ω' or 'V' appear at the right of the display as soon as the relevant function is selected.

Note:— In each of the insulation test positions 'V' appears first, and is replaced by 'MΩ' when the 'Test' button is pressed.

Over-range

The over-range indication appears if the instrument is asked to measure an insulation resistance value or continuity value above its maximum capability, i.e. above 199,9 MΩ or 1999 MΩ or 199,9 Ω according to the function selected.

The over-range indication is a '1' as the left hand digit with the rest of the display blank except for the decimal point and units of measurement.

Open Circuit Fuse

The symbol '-⊟-' appears at the bottom left hand side of the display to indicate that the instrument's fuse has ruptured. This will only occur when the terminals or test leads are open circuited, either of the continuity measuring positions is selected and the 'Test' button pressed. The facility is incorporated as a means of automatically checking the validity of the continuity range fuse. When the test leads are not open circuit a random, constantly changing reading is given if the fuse is open circuit.

Stand-by Indication

With the selector switch in one of the continuity positions but the 'Test' button not pressed, the instrument is in the stand-by mode. The display indicates this by showing a '1' as the left hand digit with the remainder of the display completely blank.

High Voltage Warning

The high voltage warning is not a function of the liquid crystal display. It is provided by a neon light situated just above the display itself. The neon will always illuminate, whether the instrument is on or off (and no matter what range is selected), except when actually insulation testing, if a voltage greater than approximately 60 V is present across the instrument's terminals. Thus a warning of a dangerous external high voltage is given whether this is from a "live" supply or from a capacitance charged up during an insulation test.

long period
tery cells
ised by

its should
nis should
nician.
ensitive
reason, care
ed circuit
ce with
ations for
s.
reason, this
ny warranty

LS

nent in the
ls, ensure
to any
urn the
remove the
ne end of
ompartment
that they are
d in the
ure it with

DISPLAY INDICATORS

In addition to showing the measurement readings, the display also indicates the following:—

Low Battery Voltage

The low battery voltage symbol is '—|⊢' and it appears at the top left hand side of the display when the battery cells need replacing. This should be done as soon as the symbol first appears to avoid errors in the readings.

Units of Measurement

The units of the measurement, either 'MΩ', 'Ω' or 'V' appear at the right of the display as soon as the relevant function is selected.

Note:— In each of the insulation test positions 'V' appears first, and is replaced by 'MΩ' when the 'Test' button is pressed.

Over-range

The over-range indication appears if the instrument is asked to measure an insulation resistance value or continuity value above its maximum capability, i.e. above 199,9 MΩ or 1999 MΩ or 199,9 Ω according to the function selected.

The over-range indication is a '1' as the left hand digit with the rest of the display blank except for the decimal point and units of measurement.

Open Circuit Fuse

The symbol '-⊟-' appears at the bottom left hand side of the display to indicate that the instrument's fuse has ruptured. This will only occur when the terminals or test leads are open circuited, either of the continuity measuring positions is selected and the 'Test' button pressed. The facility is incorporated as a means of automatically checking the validity of the continuity range fuse. When the test leads are not open circuit a random, constantly changing reading is given if the fuse is open circuit.

Stand-by Indication

With the selector switch in one of the continuity positions but the 'Test' button not pressed, the instrument is in the stand-by mode. The display indicates this by showing a '1' as the left hand digit with the remainder of the display completely blank.

High Voltage Warning

The high voltage warning is not a function of the liquid crystal display. It is provided by a neon light situated just above the display itself. The neon will always illuminate, whether the instrument is on or off (and no matter what range is selected), except when actually insulation testing, if a voltage greater than approximately 60 V is present across the instrument's terminals. Thus a warning of a dangerous external high voltage is given whether this is from a "live" supply or from a capacitance charged up during an insulation test.

PRELIMINARY CHECKS

To establish that there is no leakage within the instrument itself, select the '1 kV/MΩ' position and, with nothing connected to the terminals, press the on/off button to switch on and then press and hold down the 'Test' button. The display should show the over-range indication. If the display gives a reading, be it erratic or stable, this indicates a fault in the instrument.

Inspect the test leads to see that they have no cracked or broken insulation and that they are clean and free from oil and grease. Connect a lead to the '+' terminal and another to the '−' terminal of the instrument. Ensure that the test lead clips are not touching anything and press the 'Test' button again. The display should indicate over-range as before, showing that no leakage is being caused by the test leads. (Twisting the test leads together provides a more stringent test for leakage, but is somewhat unrealistic).

Connect the test lead clips together and press the 'Test' button again. The result should be a zero reading. This checks that the test leads do not possess a high resistance or are open circuit.

OPERATION

Turn the selector switch to either 'Ω+' or 'Ω–', open circuit the test leads and press the 'Test' button. Ensure that the open circuit fuse symbol does not appear. If it does the instrument's fuse must be replaced.

Note:— The instrument is calibrated to read zero ohms at the terminals on the continuity ranges. This means that the test lead resistance will always be included in any measurement made. The lead resistance itself will have to be deducted from the measured value to obtain the true value.

REPLACING A FUSE

The continuity range fuse is located in a screw type holder in the base of the instrument case. To change a fuse ensure that the instrument is disconnected from any external circuit, then use a screwdriver to remove the fuseholder cap containing the fuse. Replace the fuse and then fit and secure the cap back in the holder.

Note:— The fuse MUST be of the correct type and rating, see the "Specification".

INSULATION TESTING

After connecting the test leads to the instrument and carrying out the Preliminary Checks as detailed on page 13, set the selector switch to the insulation testing voltage required.

Having isolated the circuit to be tested connect the test leads as follows:—

(a) For insulation tests to earth:—
Connect the '+' test lead to earth, frame of the equipment or cable sheath as appropriate for the item being tested. Connect the '–' test lead to that part of the circuit to be tested, e.g. the core of a cable.

(b) For insulation tests between cables:—
Connect a test lead to the core of each of the cables.

Note:— If the item to be tested is not de-energized, the display will show the voltage present, and the high voltage warning neon will illuminate, as soon as both test leads have been connected to the circuit. DO NOT press the 'Test' button until the voltage has been removed i.e. until the voltmeter reads zero.

Switch the instrument on and press and hold the 'Test' button. The insulation resistance will be indicated on the display.

If a capacitive circuit is tested the displayed reading will initially be near zero and then increase gradually to its final steady value as the capacitance is charged up to the output voltage of the instrument.

Capacitive circuits automatically discharge through the instrument when the 'Test' button is released. The discharging voltage will be shown on the display. Wait a few moments for the voltage to fall to zero before disconnecting the test leads.

If several successive over-range indications are obtained, connect the two farther ends of the test leads together and carry out another check of the leads. A zero reading should result which confirms that the leads are not disconnected or broken and therefore the insulation resistance readings are correct.

CONTINUITY TESTING

With the leads connected to the instrument, and having tested them as described in the Preliminary Checks, set the selector switch to the 'Ω+' position. With the circuit under test isolated, connect the leads across the appropriate points. Press the 'Test' button and note the resistance reading as indicated on the display.

Note:— The resistance of the test leads is included in the reading, therefore their own resistance should be measured and deducted from the displayed value to give the true value.

If necessary repeat the continuity test with the selector switch set to the 'Ω–' position. The effects of any stray e.m.fs. in the circuit under test may then be negated by taking the average of the two readings.

VOLTAGE MEA

The voltage mea
effective when a
'Test' button no
the 'On' positio
are connected t
present will be i
is given that the
energized.

The instrument
with a 0 – 600 V
discharging volt
following an ins
power cable. It
to zero and the
test leads.

—', open
ton.
es not
be

zero
uity
d
n any
tance
the
alue.

ew type
o change a
cted from
o remove
lace the
the

pe and

ment and
iled on
lation

Having isolated the circuit to be tested connect the test leads as follows:—

(a) For insulation tests to earth:—
Connect the '+' test lead to earth, frame of the equipment or cable sheath as appropriate for the item being tested. Connect the '—' test lead to that part of the circuit to be tested, e.g. the core of a cable.

(b) For insulation tests between cables:—
Connect a test lead to the core of each of the cables.

Note:— If the item to be tested is not de-energized, the display will show the voltage present, and the high voltage warning neon will illuminate, as soon as both test leads have been connected to the circuit. DO NOT press the 'Test' button until the voltage has been removed i.e. until the voltmeter reads zero.

Switch the instrument on and press and hold the 'Test' button. The insulation resistance will be indicated on the display.

If a capacitive circuit is tested the displayed reading will initially be near zero and then increase gradually to its final steady value as the capacitance is charged up to the output voltage of the instrument.

Capacitive circuits automatically discharge through the instrument when the 'Test' button is released. The discharging voltage will be shown on the display. Wait a few moments for the voltage to fall to zero before disconnecting the test leads.

If several successive over-range indications are obtained, connect the two farther ends of the test leads together and carry out another check of the leads. A zero reading should result which confirms that the leads are not disconnected or broken and therefore the insulation resistance readings are correct.

CONTINUITY TESTING

With the leads connected to the instrument, and having tested them as described in the Preliminary Checks, set the selector switch to the 'Ω+' position. With the circuit under test isolated, connect the leads across the appropriate points. Press the 'Test' button and note the resistance reading as indicated on the display.

Note:— The resistance of the test leads is included in the reading, therefore their own resistance should be measured and deducted from the displayed value to give the true value.

If necessary repeat the continuity test with the selector switch set to the 'Ω—' position. The effects of any stray e.m.fs. in the circuit under test may then be negated by taking the average of the two readings.

VOLTAGE MEASUREMENT

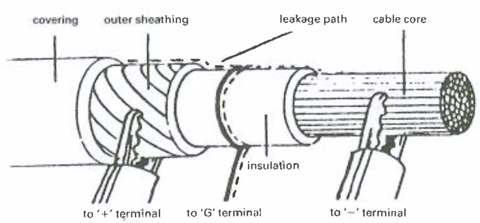
The voltage measuring function of the instrument is effective when an insulation range is selected, the 'Test' button not pressed and the 'On/Off' button in the 'On' position. Therefore, as soon as the test leads are connected to the item under test, any voltage present will be immediately shown. Thus an indication is given that the item has not been completely de-energized.

The instrument may be used directly as a voltmeter with a 0 – 600 V a.c. or d.c. range. It also monitors the discharging voltage when the 'Test' button is released following an insulation test on a capacitive item, e.g. a power cable. It shows when the voltage has decayed to zero and therefore when it is safe to remove the test leads.

OPERATION

GUARD TERMINAL

The guard terminal 'G' is provided to minimise the effects of surface leakage currents on the resistance readings when carrying out insulation tests. During cable testing, for example, a leakage path may exist between the bared conductor and the external sheathing due to dirt or moisture contamination. Where this possibly exists, particularly when testing at higher voltages, a bare conductor may be bound tightly around the insulation and connected by the third test lead to the guard terminal as indicated in the diagram below.



Error When Guard is Used

The percentage error when the guard is used is given by:—

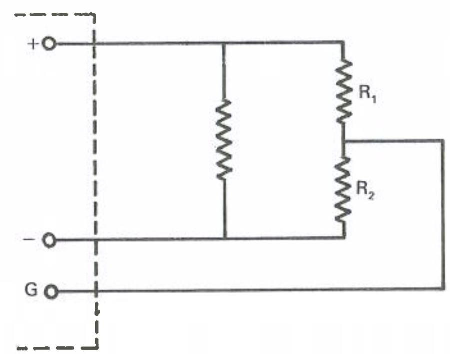
$$\% \text{ Error} = \frac{R_x}{5\,R_1\,R_2} \quad \text{provided } R_1 \text{ and } R_2 \text{ are} >> 2\ k\Omega$$

where in the diagram below

R_x = the unknown resistance being measured (MΩ)

R_1 = the leakage resistance of '+' terminal to 'G' terminal (MΩ)

R_2 = the leakage resistance of '–' terminal to 'G' terminal (MΩ)



MODE D'EMPLOI

AVERTISSEMENTS

1. Le circuit à vérifier doit être mis hors tension et isolé avant de réaliser des liaisons pour des mesures d'isolement ou de continuité. La fonction voltmètre de l'appareil peut être utilisée pour vérifier que le circuit est hors tension. Il est recommandé d'utiliser des cordons avec pointes munies de fusibles pour effectuer des mesures de tension sur des circuits pouvant présenter une énergie importante (la tension max des cordons est 440 C.Alt.). L'affichage indiquera zéro si le circuit est hors tension.
2. Ne pas enfoncer le bouton 'Test' si, lorsque l'appareil étant relié à une structure, la lampe néon indicatrice de présence de haute tension s'allume. Le néon s'allume en cas de présence de haute tension dangereuse. Cette tension doit être supprimée avant de réaliser tout essai. Ne pas changer la position du commutateur de sélection en présence de tension externe.
3. Ne pas toucher le circuit pendant une mesure d'isolement.
4. Après une mesure d'isolement, il faut attendre que le circuit se décharge dans l'appareil avant de débrancher les cordons. La tension de décharge est contrôlée par le voltmètre. Le temps de décharge est inférieur à 2 secondes

pa
zér
5. Ne
dé
6. Le
m
sp
7. L'
er
bi
ui
p
m
s
c
c
e
8. S
c
r
l

DESIRABILITY OF INSULATION TESTING

The safety of electrical installations and apparatus depends on the condition of the insulation. It is essential that this is thoroughly checked when new equipment is installed, whilst being subjected to a voltage high enough to break through any mechanical flaws arising from manufacture or installation.

It is also desirable, in order to avoid interruptions or breakdowns, that tests on the condition of the installation and equipment are made from time to time to ensure that deterioration is not occurring because of the accumulation of dirt or damp, or caused by mechanical factors of wear or breakage.

In every case the insulation resistance can be measured very simply by using the MEGGER® Tester.

In dealing with faults in electrical equipment, the location of a circuit discontinuity will often reveal the site of a breakdown in insulation which is often responsible for the final fault. By using the instrument's 'Ω' function, circuit and earth continuity can be tested and any unsatisfactory joints or contacts can be measured, traced and corrected.

PREVENTIVE MAINTENANCE

It is good practice to make regular tests of the insulation resistance of all large machinery and thus detect any incipient faults. When the tests are entered in the logbook a considerable variation between test results will be noted.

It is therefore important to test under similar conditions each time and to note the current weather status.

Damp weather — or damp conditions of use or storage — can cause large reductions in insulation resistance. Drying out by heat or by running for a period, should give a more consistent and appropriate insulation resistance value.

A counter effect to that above occurs because the insulation resistance of the varnishes used in the construction of machine windings becomes lower when hot than when cold. Thus for constant comparisons the temperature of the machine under test should also be noted.

The best plan is regularly to make the time for testing a machine as soon as possible after it has been shut down. The insulation resistance is then likely to be at its lowest operational value. This then would become the figure which would show any continuing mechanical depreciation or potential insulation breakdown.

If the machine stands idle in humid conditions a worse picture might well apply but this would normally be assumed to be safe during the running up to temperature, provided that the resistance at working temperature remained unchanged.

For fractional horse power generators and motors, the British Standard Specification No. 170 states that the insulation resistance should not be less than 1 MΩ when tested at 500 V.

TESTING MOTORS AND GENERATORS

1. Disconnect the equipment from the supply by opening the main switch and removing the main fuses.
2. Join together BOTH terminals on the motor side of the double pole main switch.
3. With a contactor operated starter where all the lines to the motor are disconnected at 'off' it is necessary to make tests to earth on both the incoming and outgoing terminals of the starter.
4. Connect the '+' test lead to earth using the frame of the motor.
5. Using the '–' test lead measure the resistance of each part of the circuit in the usual way. If the value is unsatisfactory then separate tests in starter, motor and cables must be carried out to locate the defect.
6. If the motor itself is suspect, disconnect its supply cables and with one lead connected to the frame carry out the following tests:
7. Test with the armature and field windings connected together.
8. Test with the brushes lifted from contact with the commutator.
9. Test on the armature only, section by section.
10. If all resistances are low the fault can usually be remedied by complete and careful cleaning of the machine. Equipment that has been in service for a period can accumulate metallic, or other conducting, dust especially when mixed with oil

from
depo

TESTING
IEE Wirir

Extracts f
Installatic
appertain
below.

Continui

Regulati
continuity
conducto
Appendix

Continui

Regulati
separatel
and corre
conducto
for equipc

Appendi
Continuit

Method 1
The contii
including

conditions each time and to note the current weather status.

Damp weather — or damp conditions of use or storage — can cause large reductions in insulation resistance. Drying out by heat or by running for a period, should give a more consistent and appropriate insulation resistance value.

A counter effect to that above occurs because the insulation resistance of the varnishes used in the construction of machine windings becomes lower when hot than when cold. Thus for constant comparisons the temperature of the machine under test should also be noted.

The best plan is regularly to make the time for testing a machine as soon as possible after it has been shut down. The insulation resistance is then likely to be at its lowest operational value. This then would become the figure which would show any continuing mechanical depreciation or potential insulation breakdown.

If the machine stands idle in humid conditions a worse picture might well apply but this would normally be assumed to be safe during the running up to temperature, provided that the resistance at working temperature remained unchanged.

For fractional horse power generators and motors, the British Standard Specification No. 170 states that the insulation resistance should not be less than 1 MΩ when tested at 500 V.

TESTING MOTORS AND GENERATORS

1. Disconnect the equipment from the supply by opening the main switch and removing the main fuses.
2. Join together BOTH terminals on the motor side of the double pole main switch.
3. With a contactor operated starter where all the lines to the motor are disconnected at 'off' it is necessary to make tests to earth on both the incoming and outgoing terminals of the starter.
4. Connect the '+' test lead to earth using the frame of the motor.
5. Using the '−' test lead measure the resistance of each part of the circuit in the usual way. If the value is unsatisfactory then separate tests in starter, motor and cables must be carried out to locate the defect.
6. If the motor itself is suspect, disconnect its supply cables and with one lead connected to the frame carry out the following tests:
7. Test with the armature and field windings connected together.
8. Test with the brushes lifted from contact with the commutator.
9. Test on the armature only, section by section.
10. If all resistances are low the fault can usually be remedied by complete and careful cleaning of the machine. Equipment that has been in service for a period can accumulate metallic, or other conducting, dust especially when mixed with oil from bearings etc. The leakage paths from such deposits are eliminated by thorough cleaning.

TESTING WIRING INSTALLATIONS IN BUILDINGS

IEE Wiring Regulations

Extracts from the British IEE Regulations for Electrical Installations in Buildings (15th. Edition), where they appertain to Insulation and Continuity tests, are given below.

Continuity of ring final circuit conductors

Regulation 613-2. A test shall be made to verify the continuity of all conductors (including the protective conductor) of every ring final circuit (see Item 2 of Appendix 15).

Continuity of protective conductors

Regulation 613-3. Every protective conductor shall be separately tested to verify that it is electrically sound and correctly connected. This test shall include all conductors and any extraneous conductive parts used for equipotential bonding (see Item 3 of Appendix 15).

Appendix 15 Item 2.
Continuity of ring final circuit conductors

Method 1
The continuity of each conductor of the ring circuit, including the protective conductor, is measured

between the two ends of the conductor before completion of the ring. The resistance values are noted.

After connection of the two ends of each conductor to complete the ring, the resistance is measured between the corresponding distribution board terminal and the appropriate terminal or contact at the outlet nearest to the midpoint of the ring, using a suitable test lead. The resistance value is noted and the resistance value of the test lead is deducted from this. The resulting value should be approximately one quarter of the corresponding value obtained before completion of the ring.

Method 2
The continuity of each conductor of the ring circuit, including the protective conductor, is measured between the two ends of the conductor before completion of the ring. The resistance values are noted. After completion of the ring, the various conductors of the circuit are all bridged together at the point nearest to the midpoint of the ring. The resistance is then measured between the phase and neutral terminal at the origin of the circuit in the distribution board, when the value obtained should be approximately one half of the value for either the phase or the neutral conductor before completion of the ring.

Where the protective conductor is in the form of a ring, the resistance is then measured between the phase and earth terminals at the origin of the circuit. The value obtained should be the sum of one quarter of the value originally obtained for the phase conductor and one quarter of the value originally obtained for the protective conductor.

Appendix 15 Item 3.
Continuity of protective conductors and equipotential bonding

The initial tests to be applied to protective conductors are intended to verify that the conductors are electrically sound and correctly connected, before the installation is energized and before any other tests involving these conductors are made. The test is made with a voltage not exceeding 50 V a.c. or d.c. and at a current approaching 1,5 times the design current of the circuit under test, except that the current need not exceed 25 A. For a.c. the current shall be at the frequency of the supply. If a d.c. test is used, it is to be verified by inspection throughout the length of the protective conductor that no inductor is incorporated. Where the protective conductor is not steel conduit or other steel enclosure the requirement concerning the test current does not apply and a d.c. ohmmeter may be used. It is often more convenient if a hand generator or other portable device is used rather than a transformer fed from the supply, as in this event the live conductors of the various circuits, whilst disconnected from the supply, may be connected for purpose of test to the consumer's earthing terminal and the test can be made between the phase conductor and the protective conductor at each individual point, such as a socket outlet.

Insulation resistance

Regulation 613-5. The tests described in Regulations 613-6 to 613-8 shall be made before the installation is permanently connected to the supply. For these tests large installations may be divided into groups of outlets, each containing not less than 50 outlets. For the purpose of this regulation the term 'outlet' includes every point and every switch except that a socket outlet, appliance or luminaire incorporating a switch is regarded as one outlet. A d.c. voltage not less than twice the normal voltage of the circuit concerned (r.m.s. value for an a.c. supply) shall be applied for the measurement of insulation resistance, provided that the test voltage need not exceed 500 V d.c. for installations rated up to 500 V, or 1000 V d.c. for installations rated above 500 V up to 1000 V.

Regulation 613-6. When measured with all fuse links in place, all switches (including, if practicable, the main switch) closed and, except for TN-C systems, all poles or phases of the wiring electrically connected together, the insulation resistance to Earth shall be not less than 1 megohm.

Regulatio
conductors
supply and
other phas
not less th
that all par
shall be re
be discon
lamps or o
removal o
using equi
controllin
open. Par
presence
installatio
they are n

Regulati
for the te
and the e
required
protectiv
between
parts of t
and shall
appropri
there is r
resistanc

Note:—

ring, the resistance is then measured between the phase and earth terminals at the origin of the circuit. The value obtained should be the sum of one quarter of the value originally obtained for the phase conductor and one quarter of the value originally obtained for the protective conductor.

Appendix 15 Item 3.
Continuity of protective conductors and equipotential bonding

The initial tests to be applied to protective conductors are intended to verify that the conductors are electrically sound and correctly connected, before the installation is energized and before any other tests involving these conductors are made. The test is made with a voltage not exceeding 50 V a.c. or d.c. and at a current approaching 1,5 times the design current of the circuit under test, except that the current need not exceed 25 A. For a.c. the current shall be at the frequency of the supply. If a d.c. test is used, it is to be verified by inspection throughout the length of the protective conductor that no inductor is incorporated. Where the protective conductor is not steel conduit or other steel enclosure the requirement concerning the test current does not apply and a d.c. ohmmeter may be used. It is often more convenient if a hand generator or other portable device is used rather than a transformer fed from the supply, as in this event the live conductors of the various circuits, whilst disconnected from the supply, may be connected for purpose of test to the consumer's earthing terminal and the test can be made between the phase conductor and the protective conductor at each individual point, such as a socket outlet.

Insulation resistance

Regulation 613-5. The tests described in Regulations 613-6 to 613-8 shall be made before the installation is permanently connected to the supply. For these tests large installations may be divided into groups of outlets, each containing not less than 50 outlets. For the purpose of this regulation the term 'outlet' includes every point and every switch except that a socket outlet, appliance or luminaire incorporating a switch is regarded as one outlet. A d.c. voltage not less than twice the normal voltage of the circuit concerned (r.m.s. value for an a.c. supply) shall be applied for the measurement of insulation resistance, provided that the test voltage need not exceed 500 V d.c. for installations rated up to 500 V, or 1000 V d.c. for installations rated above 500 V up to 1000 V.

Regulation 613-6. When measured with all fuse links in place, all switches (including, if practicable, the main switch) closed and, except for TN-C systems, all poles or phases of the wiring electrically connected together, the insulation resistance to Earth shall be not less than 1 megohm.

Regulation 613-7. When measured between all the conductors connected to any one phase or pole of the supply and, in turn, all conductors connected to each other phase or pole, the insulation resistance shall be not less than 1 megohm. Wherever practicable, so that all parts of the wiring may be tested, all lamps shall be removed and all current-using equipment shall be disconnected and all local switches controlling lamps or other equipment shall be closed. Where the removal of lamps and/or the disconnection of current-using equipment is impracticable, the local switches controlling such lamps and/or equipment shall be open. Particular attention shall be given to the presence of electronic devices connected in the installation and such devices shall be isolated so that they are not damaged by the test voltage.

Regulation 613-8. Where equipment is disconnected for the tests prescribed in Regulations 613-6 and 613-7, and the equipment has exposed conductive parts required by these Regulations to be connected to protective conductors, the insulation resistance between the exposed conductive parts and all live parts of the equipment shall be measured separately and shall comply with the requirements of the appropriate British Standard for the equipment. If there is no appropriate British Standard the insulation resistance shall be not less than 0,5 megohm.

Note:— Earth continuity conductors are also subject to earth fault loop impedance tests —

Regulation 613-15.
Residual Current Circuit Breakers incorporated into installations are subject to tests — Regulation 613-16.
Earth electrodes included in installations are subject to tests — Regulation 613-4.
Recommended MEGGER® testers for these purposes are LT5, CBT2 and DET3.

SETTING-UP PROCEDURE

The basic setting-up procedure for the BMD3 Insulation Tester is detailed below. It is however important that only a qualified technician, who is aware of the hazards involved when dealing with a circuit which produces high voltages, be employed to service the instrument.

The instrument has internal capacitors which may retain charge under fault conditions. These become exposed when the instrument casing is opened up.

Note:— (i) Opening the casing will automatically invalidate any warranty covering the instrument unless carried out by the manufacturer or one of his approved agents (see page 23).
(ii) Fit new battery cells before commencing the setting-up procedure.
(iii) The instrument circuit contains static sensitive devices.

1. Up-range setting
Select the '1 kV MΩ' range. Set the potentiometer R81 fully clockwise (viewed from the front of the instrument). Connect a 180 MΩ resistor (able to withstand 1 kV) to the '+' and '–' terminals. Press the 'Test' button and the display should show 180,0. Adjust R81 until the reading changes up-range to about 180.

2. Voltage function setting
Select the '1 kV MΩ' range. Connect a source of 600 V d.c. to the '+' and '–' terminals. Without pressing the

SETTING-UP PROCEDURE

'Test' button adjust R82 until a reading of 600 is obtained. Reverse the polarity of the supply and check that the reading is 600 ± 4 digits. Check that on each test voltage range the reading is within ± 5 digits at 300 V d.c. and within ± 9 digits at 600 V d.c. and 600 V a.c. at 50 Hz.

3. Insulation ranges
By connecting suitable resistors to the '+' and '–' terminals, check that on each test voltage range the readings are within the accuracy shown in the specification. The reading when the terminals are short circuited should be checked, other suitable resistor values might be 1,5 MΩ, 15 MΩ, 150 MΩ and 1500 MΩ. Ensure that the resistors used can withstand the voltage applied to them and that their value tolerance is very small compared with the instrument's accuracy.

4. Output characteristics
Using a high impedance voltmeter (1 GΩ min.) check that the open circuit voltage on each test voltage range is within the specified accuracy. Check that at 1 kV test voltage and 1 MΩ load the terminal voltage is 1000 V min., similarly at 500 V test voltage and 500 kΩ load the terminal voltage is 500 V min., at 250 V test voltage and 250 kΩ load the terminal voltage is 250 V min. and at 100 V test voltage and 100 kΩ load the terminal voltage is 100 V min. Check also that, for each test voltage, with the terminals short circuited the short circuit current is 1,2 mA ± 10%.

5. Continu
By connect
terminals, c
and 'Ω–' ra
specificatic
short circui
resistor val
the resisto
with the in
the voltage
and the cu
± 10 mA.

6. Ω stand
Select the
pressed th
units or de

7. Fuse sy
Select the
terminals c
check that

8. Low ba
Replace th
low batter
display wh
nominal va

9. Guard t
Select the
between t
'–' termin
ohmmete

ıbject to

:ions are

'or these

The basic setting-up procedure for the BMD3 Insulation Tester is detailed below. It is however important that only a qualified technician, who is aware of the hazards involved when dealing with a circuit which produces high voltages, be employed to service the instrument.

The instrument has internal capacitors which may retain charge under fault conditions. These become exposed when the instrument casing is opened up.

Note:— (i) Opening the casing will automatically invalidate any warranty covering the instrument unless carried out by the manufacturer or one of his approved agents (see page 23).
(ii) Fit new battery cells before commencing the setting-up procedure.
(iii) The instrument circuit contains static sensitive devices.

1. Up-range setting
Select the '1 kV MΩ' range. Set the potentiometer R81 fully clockwise (viewed from the front of the instrument). Connect a 180 MΩ resistor (able to withstand 1 kV) to the '+' and '−' terminals. Press the 'Test' button and the display should show 180,0. Adjust R81 until the reading changes up-range to about 180.

2. Voltage function setting
Select the '1 kV MΩ' range. Connect a source of 600 V d.c. to the '+' and '−' terminals. Without pressing the

SETTING-UP PROCEDURE

'Test' button adjust R82 until a reading of 600 is obtained. Reverse the polarity of the supply and check that the reading is 600 ± 4 digits. Check that on each test voltage range the reading is within ± 5 digits at 300 V d.c. and within ± 9 digits at 600 V d.c. and 600 V a.c. at 50 Hz.

3. Insulation ranges
By connecting suitable resistors to the '+' and '−' terminals, check that on each test voltage range the readings are within the accuracy shown in the specification. The reading when the terminals are short circuited should be checked, other suitable resistor values might be 1,5 MΩ, 15 MΩ, 150 MΩ and 1500 MΩ. Ensure that the resistors used can withstand the voltage applied to them and that their value tolerance is very small compared with the instrument's accuracy.

4. Output characteristics
Using a high impedance voltmeter (1 GΩ min.) check that the open circuit voltage on each test voltage range is within the specified accuracy. Check that at 1 kV test voltage and 1 MΩ load the terminal voltage is 1000 V min., similarly at 500 V test voltage and 500 kΩ load the terminal voltage is 500 V min., at 250 V test voltage and 250 kΩ load the terminal voltage is 250 V min. and at 100 V test voltage and 100 kΩ load the terminal voltage is 100 V min. Check also that, for each test voltage, with the terminals short circuited the short circuit current is 1,2 mA ± 10%.

5. Continuity ranges
By connecting suitable resistors to the '+' and '−' terminals, check that the readings on both the 'Ω+' and 'Ω−' ranges are within the accuracy shown in the specification. The reading when the terminals are short circuited should be checked, other suitable resistor values might be 10 Ω and 100 Ω. Ensure that the resistor value tolerance is small in comparison with the instrument's accuracy. On these two ranges the voltage on open circuit should be 4,3 V ± 0,3 V and the current on short circuit should be 215 mA ± 10 mA.

6. Ω standby
Select the 'Ω+' range. With the 'Test' button not pressed the display should indicate over-range with no units or decimal point.

7. Fuse symbol
Select the 'Ω+' range and remove the fuse. With the terminals open circuit press the 'Test' button and check that the fuse symbol appears on the display.

8. Low battery
Replace the battery cells with a d.c. power supply. The low battery voltage symbol should appear on the display when the supply voltage is reduced from its nominal value of 9 V to 6,5 V ± 0,3 V.

9. Guard terminal
Select the '100 V MΩ' range. Connect an ohmmeter between the '−' and 'G' terminals (positive lead to the '−' terminal). With the instrument switched on the ohmmeter should read 1,58 kΩ to 2,42 kΩ.

INSTRUMENT REPAIRS AND SPARE PARTS

The manufacturer's service and spare parts organisation for MEGGER® instruments:—

MEGGER INSTRUMENTS LIMITED,
Archcliffe Road,
Dover,
Kent CT17 9EN,
England.
Tel: Dover (0304) 202620
Fax: Dover (0304) 207342
Telex: 96283 Avomeg G

Approved Repair Companies
A number of independent instrument repair companies in the U.K. have been approved for repair work on most MEGGER® instruments, using genuine MEGGER® spare parts. Their names and addresses are listed in the Warranty Card supplied with each new instrument.

Overseas
Instrument owners outside Great Britain should consult the Appointed Distributor/Agent for their country regarding spare parts and repair facilities. The Distributor/Agent will advise on the best course of action to take.

If returning the instrument to Britain for repair, it should be sent, freight pre-paid, to the address shown opposite. A copy of the Invoice and of the Packing Note should be sent simultaneously by airmail to expedite clearance through the U.K. Customs.

A repair estimate showing freight return and other charges will be submitted to the sender, if required, before work on the instrument commences.

NEW MEGGER® INSTRUMENTS ARE GUARANTEED FOR 12 MONTHS FROM THE DATE OF PURCHASE BY THE USER.

COMPONENTS LIST

Main p.c.b.

R1	Resistor	432 kΩ±1%	0,25 W
R2	Resistor	100 kΩ±1%	0,25 W
R3	Resistor	33 kΩ±1%	0,25 W
R4	Resistor	2,1 kΩ±1%	0,25 W
R5	Resistor	10 kΩ±5%	500 V
R6	Resistor	10 kΩ	1 kV
R7	Resistor	9 MΩ±0,1%	1 kV
R8	Resistor	1 MΩ±1%	0,25 W
R9	Resistor	220 kΩ±5%	0,5 W
R10	Resistor	220 kΩ±5%	0,5 W
R11	Resistor	1 MΩ±5%	0,5 W
R12	Resistor	390 kΩ±5%	1 W
R13	Resistor	100 kΩ±1%	0,25 W
R14	Resistor	82 MΩ±10%	1 kV
R15	Resistor	1 MΩ±1%	0,25 W
R16	Resistor	1,167 MΩ±0,25%	1 kV
R17	Resistor	4,7 Ω±5%	2,5 W
R18	Resistor	432 Ω±1%	0,25 W
R19	———		
R20	Resistor	100 kΩ±1%	0,25 W
R21	Resistor	100 kΩ±1%	0,25 W
R22	Resistor	100 kΩ±1%	0,25 W
R23	Resistor	120 kΩ±1%	0,25 W
R24	Resistor	300 kΩ±1%	0,25 W
R25	Resistor	470 Ω±1%	0,25 W
R26	Resistor	100 kΩ±1%	0,25 W
R27	Resistor	1 kΩ±1%	0,25 W
R28	Resistor	10 kΩ±0,25%	0,25 W

R29 Resisto
R30 Resisto
R31 Resisto
R32 Resisto
R33 Resisto
R34 Resisto
R35 Resisto
R36 Resisto
R37 Resisto

RN1 Resist
RN2 Resist
RN3 Resist
RN4 Resist

C1 Capac
C2 Capac
C3 Capac
C4 Capac
C5 Capac
C6 Capac
C7 Capac
C8 Capac
C9 Capac
C10 Capac
C11 Capac
C12 Capac

; AND SPARE PARTS

re parts
ents:—

),

t repair
proved for repair
ts, using genuine
and addresses
ed with each new

Overseas

Instrument owners outside Great Britain should consult the Appointed Distributor/Agent for their country regarding spare parts and repair facilities. The Distributor/Agent will advise on the best course of action to take.

If returning the instrument to Britain for repair, it should be sent, freight pre-paid, to the address shown opposite. A copy of the Invoice and of the Packing Note should be sent simultaneously by airmail to expedite clearance through the U.K. Customs.

A repair estimate showing freight return and other charges will be submitted to the sender, if required, before work on the instrument commences.

NEW MEGGER® INSTRUMENTS ARE GUARANTEED FOR 12 MONTHS FROM THE DATE OF PURCHASE BY THE USER.

COMPONENTS LIST

Main p.c.b.

R1	Resistor	432 kΩ±1%	0,25 W	
R2	Resistor	100 kΩ±1%	0,25 W	
R3	Resistor	33 kΩ±1%	0,25 W	
R4	Resistor	2,1 kΩ±1%	0,25 W	
R5	Resistor	10 kΩ±5%	500 V	
R6	Resistor	10 kΩ	1 kV	
R7	Resistor	9 MΩ±0,1%	1 kV	
R8	Resistor	1 MΩ±1%	0,25 W	
R9	Resistor	220 kΩ±5%	0,5 W	
R10	Resistor	220 kΩ±5%	0,5 W	
R11	Resistor	1 MΩ±5%	0,5 W	
R12	Resistor	390 kΩ±5%	1 W	
R13	Resistor	100 kΩ±1%	0,25 W	
R14	Resistor	82 MΩ±10%	1 kV	
R15	Resistor	1 MΩ±1%	0,25 W	
R16	Resistor	1,167 MΩ±0,25%	1 kV	
R17	Resistor	4,7 Ω±5%	2,5 W	
R18	Resistor	432 Ω±1%	0,25 W	
R19	———			
R20	Resistor	100 kΩ±1%	0,25 W	
R21	Resistor	100 kΩ±1%	0,25 W	
R22	Resistor	100 kΩ±1%	0,25 W	
R23	Resistor	120 kΩ±1%	0,25 W	
R24	Resistor	300 kΩ±1%	0,25 W	
R25	Resistor	470 Ω±1%	0,25 W	
R26	Resistor	100 kΩ±1%	0,25 W	
R27	Resistor	1 kΩ±1%	0,25 W	
R28	Resistor	10 kΩ±0,25%	0,25 W	
R29	Resistor	90 kΩ±0,25%	0,25 W	
R30	Resistor	26,7 kΩ±0,25%	0,25 W	
R31	Resistor	10 Ω±0,25%	0,5 W	
R32	Resistor	1 kΩ	1 kV	
R33	Resistor	1 kΩ±5%	1 W	
R34	Resistor	100 kΩ±1%	0,25 W	
R35	Resistor	100 kΩ±1%	0,25 W	
R36	Resistor	1 MΩ±1%	0,25 W	
R37	Resistor	100 kΩ±1%	0,25 W	
RN1	Resistor network	part no. 6280-254		
RN2	Resistor network	part no. 6180-316		
RN3	Resistor network	part no. 6180-317		
RN4	Resistor network	part no. 6180-318		
C1	Capacitor	4,7 μF	40 V	electrolytic
C2	Capacitor	470 pF		
C3	Capacitor	100 μF	10 V	electrolytic
C4	Capacitor	0,01 μF	1 kV	
C5	Capacitor	0,1 μF	1 kV	
C6	Capacitor	0,1 μF	160 V	
C7	Capacitor	47 nF		
C8	Capacitor	1 μF		
C9	Capacitor	1 μF		
C10	Capacitor	10 μF		electrolytic
C11	Capacitor	470 μF	16 V	electrolytic
C12	Capacitor	0,47 μF		

D1	Zener diode	ICL8069
D2	Zener diode	BZX79C27V
D3	Diode	1N4148
D4	Diode	BA159
D5	Diode	BA159
D6	Diode	1N4148
D7	Diode	1N4148
D8	Diode	BZV48C6V8
D9	Diode	BZV48C6V8
D10	Diode	1N4148
D11	Diode	1N4007
D12	to D16 Diodes	1N4148
TR1	Transistor	VN0300M
IC1	Integrated circuit	ICL7611
IC2	Integrated circuit	TLC27M2CP
IC3	to IC7 Integrated circuits	CMOS4052
IC8	Integrated circuit	TLC27M2CP
IC9	Integrated circuit	LM317T
N1	Neon	
N2	Neon	
T1	Transformer	part no. 6231-220
TFH1	Thick film hybrid	part no. 6180-203

RL1 Relay 6 V

FS1 Fuse 500 mA 440 V ceramic
FS2 Fuse 3,15 A ceramic

B1 Battery 6 x 1,5 V cells IEC LR6

Display p.c.b.

R50 Resistor	10 kΩ±1%	0,25 W
R51 to R64 Resistors	100 kΩ±1%	0,25 W
R65 Link		
R66 Resistor	180 kΩ±1%	0,25 W
R67 to R70 Resistors	100 kΩ±1%	0,25 W
R71 Resistor	82,5 kΩ±1%	0,25 W
R72 to R77 Resistors	100 kΩ±1%	0,25 W
R78 Resistor	1 MΩ±1%	0,25 W
R79 Resistor	1 MΩ±1%	0,25 W
R80 Resistor	1 kΩ±1%	0,25 W
R81 Potentiometer	1 kΩ	
R82 Potentiometer	1 kΩ	
R83 Resistor	15 kΩ±1%	0,25 W
R84 Resistor	53,6 kΩ±1%	0,25 W
R85 Resistor	1,2 kΩ±1%	0,25 W
R86 Resistor	24 kΩ±1%	0,25 W

COMPONENTS LIST

C20 Capacitor	0,1 μF
C21 Capacitor	0,1 μF
C22 Capacitor	220 pF
C23 Capacitor	220 pF
C24 Capacitor	2,2 nF
C25 Capacitor	2,2 nF
C26 Capacitor	47 pF
C27 Capacitor	0,47 μF
C28 Capacitor	0,1 μF
C29 Capacitor	1 μF
C30 Capacitor	0,47 μF
C31 Capacitor	0,47 μF
C32 Capacitor	0,47 μF
C33 Capacitor	220 nF
C34 Capacitor	470 pF

D20 to D25 Diodes	1N4148
D26 Diode	1N3595
D27 Diode	1N3595
D28 Diode	1N4148
D29 Diode	1N4148
TR10 Transistor	BD437
TR11 Transistor	BC213

IC12 Integrat
IC13 Integrat
IC14 Integrat
IC15 Integrat
IC16 Integrat
IC17 Integrat
IC18 Integrat
IC19 Integrat
IC20 Integrat
IC21 Integrat
IC22 Integrat

LCD Liquid C

SW2 Switch
SW3 Switch

L8069
ZX79C27V
N4148
A159
A159
N4148
N4148
ZV48C6V8
ZV48C6V8
N4148
N4007
N4148

N0300M

L7611
.C27M2CP
MOS4052
.C27M2CP
M317T

rt no. 6231-220

rt no. 6180-203

RL1	Relay 6 V
FS1	Fuse 500 mA 440 V ceramic
FS2	Fuse 3,15 A ceramic
B1	Battery 6 x 1,5 V cells IEC LR6

Display p.c.b.

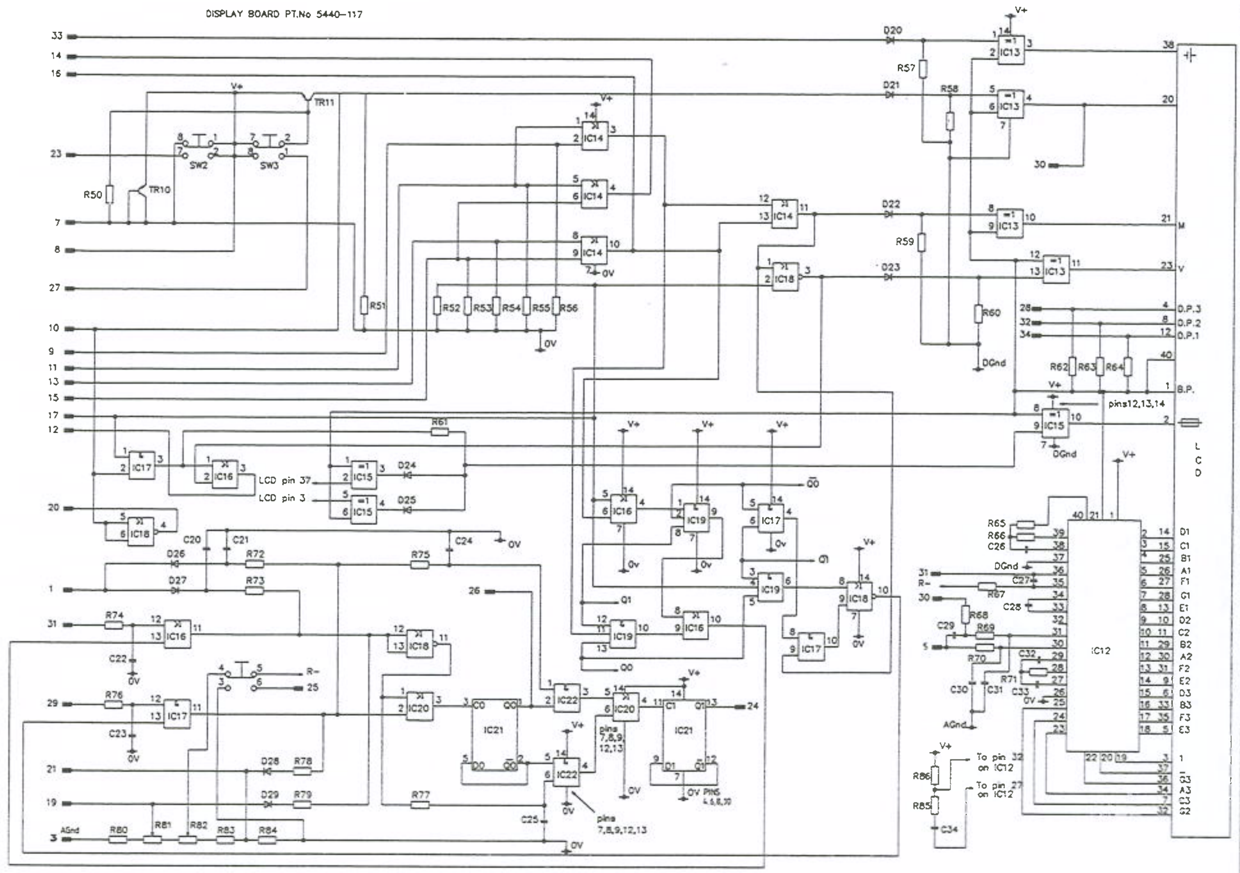
R50	Resistor	10 kΩ ± 1%	0,25 W
R51 to R64	Resistors	100 kΩ ± 1%	0,25 W
R65	Link		
R66	Resistor	180 kΩ ± 1%	0,25 W
R67 to R70	Resistors	100 kΩ ± 1%	0,25 W
R71	Resistor	82,5 kΩ ± 1%	0,25 W
R72 to R77	Resistors	100 kΩ ± 1%	0,25 W
R78	Resistor	1 MΩ ± 1%	0,25 W
R79	Resistor	1 MΩ ± 1%	0,25 W
R80	Resistor	1 kΩ ± 1%	0,25 W
R81	Potentiometer	1 kΩ	
R82	Potentiometer	1 kΩ	
R83	Resistor	15 kΩ ± 1%	0,25 W
R84	Resistor	53,6 kΩ ± 1%	0,25 W
R85	Resistor	1,2 kΩ ± 1%	0,25 W
R86	Resistor	24 kΩ ± 1%	0,25 W

COMPONENTS LIST

C20	Capacitor	0,1 μF
C21	Capacitor	0,1 μF
C22	Capacitor	220 pF
C23	Capacitor	220 pF
C24	Capacitor	2,2 nF
C25	Capacitor	2,2 nF
C26	Capacitor	47 pF
C27	Capacitor	0,47 μF
C28	Capacitor	0,1 μF
C29	Capacitor	1 μF
C30	Capacitor	0,47 μF
C31	Capacitor	0,47 μF
C32	Capacitor	0,47 μF
C33	Capacitor	220 nF
C34	Capacitor	470 pF
D20 to D25	Diodes	1N4148
D26	Diode	1N3595
D27	Diode	1N3595
D28	Diode	1N4148
D29	Diode	1N4148
TR10	Transistor	BD437
TR11	Transistor	BC213

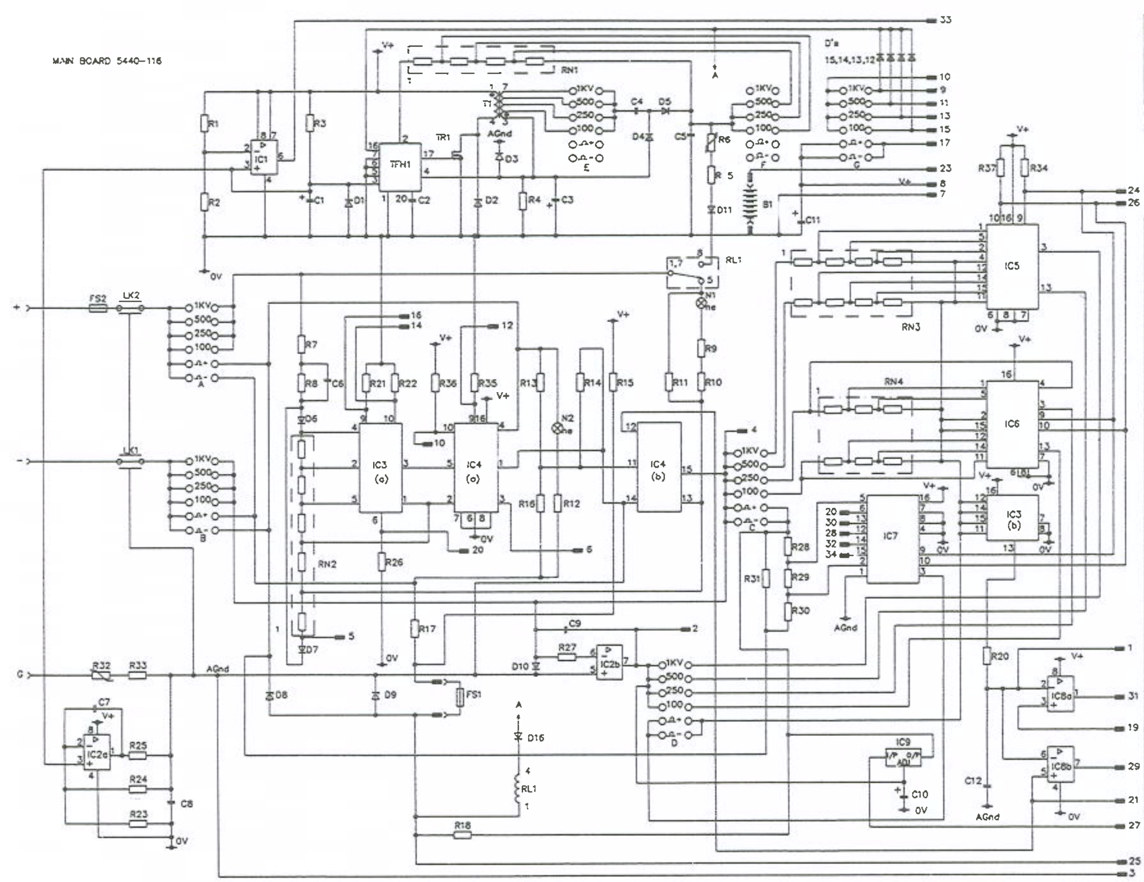
IC12	Integrated circuit	A/D ICL7106CPL
IC13	Integrated circuit	MC14070BCP
IC14	Integrated circuit	MC14071BCP
IC15	Integrated circuit	MC14070BCP
IC16	Integrated circuit	MC14071BCP
IC17	Integrated circuit	MC14081CP
IC18	Integrated circuit	MC14001BCP
IC19	Integrated circuit	MC14073CP
IC20	Integrated circuit	MC14071BCP
IC21	Integrated circuit	MC14013BCP
IC22	Integrated circuit	MC14081CP
LCD	Liquid Crystal Display	part no. 6480-027
SW2	Switch	part no. 25975-042
SW3	Switch	part no. 25975-043

CIRCUIT DIAGRAMS



DISPLAY BOARD PT.No 5440-117

REF	DESCRIPTION
C20	0,1uF
C21	0,1uF
C22	220pF
C23	220pF
C24	2n2
C25	2n2
C26	47pF
C27	0,47uF
C28	0,1uF
C29	1uF
C30	0,47uF
C31	0,47uF
C32	0,47uF
C33	220nF
C34	470pF
D20	1N4148
D21	1N4148
D22	1N4148
D23	1N4148
D24	1N4148
D25	1N4148
D26	1N3595
D27	1N3595
D28	1N4148
D29	1N4148
IC12	A/D ICL7106CPL
IC13	MC14070BCP
IC14	MC14071BCP
IC15	MC14070BCP
IC16	MC14071BCP
IC17	MC14081CP
IC18	MC14001BCP
IC19	MC14073CP
IC20	MC14071BCP
IC21	MC14013BCP
IC22	MC14081CP
R50	10K/1/0,25W
R51	100K/1/0,25W
R52	100K/1/0,25W
R53	100K/1/0,25W
R54	100K/1/0,25W
R55	100K/1/0,25W
R56	100K/1/0,25W
R57	100K/1/0,25W
R58	100K/1/0,25W
R59	100K/1/0,25W
R60	100K/1/0,25W
R61	100K/1/0,25W
R62	100K/1/0,25W
R63	100K/1/0,25W
R64	100K/1/0,25W
R65	LINK 25925-004
R66	180K/1/0,25W
R67	100K/1/0,25W
R68	100K/1/0,25W
R69	100K/1/0,25W
R70	100K/1/0,25W
R71	82K5/1/0,25W
R72	100K/1/0,25W
R73	100K/1/0,25W
R74	100K/1/0,25W
R75	100K/1/0,25W
R76	100K/1/0,25W
R77	100K/1/0,25W
R78	1M/1/0,25W
R79	1M/1/0,25W
R80	1K/1/0,25W
R81	POT 1K
R82	POT 1K
R83	15K/1/0,25W
R84	53K6/1/0,25W
R85	1K2/1/0,25W
R86	24K/1/0,25W
SW2	25975-042
SW3	25975-043
TR10	BD437
TR11	BC213
LCD	6480-027



MAIN BOARD 5440-116

REF	DESCRIPTION	REF	DESCRIPTION
C1	4,7uF/40V	R1	432K/1/0,25W
C2	470pF	R2	100K/1/0,25W
C3	100uF/10V	R3	33K/1/0,25W
C4	0,01uF/1KV	R4	2K1/1/0,25W
C5	0,1uF/1KV	R5	10K/5/500V
C6	0,1uF/160V	R6	10K/1KV
C7	47nF	R7	9M/0,1/1KV
C8	1uF	R8	1M/1/0,25W
C9	1uF	R9	220K/5/0,5W
C10	10uF	R10	220K/5/0,5W
C11	470uF/16V	R11	1M/5/0,5W
C12	0,47uF	R12	390K/5/1W
		R13	100K/1/0,25W
		R14	82M/10/1KV
B1	6xECLR6	R15	1M/1/0,25W
		R16	1M167/0,25/1KV
		R17	4,7R/5/2,5W
		R18	432R/1/0,25W
		R19	
D1	ICL8069	R20	100K/1/0,25W
D2	BZX79C27	R21	100K/1/0,25W
D3	1N4148	R22	100K/1/0,25W
D4	BA159	R23	120K/1/0,25W
D5	BA159	R24	300K/1/0,25W
D6	1N4148	R25	470R/1/0,25W
D7	1N4148	R26	100K/1/0,25W
D8	BZV48C6V8	R27	1K/1/0,25W
D9	BZV48C6V8	R28	10K/0,25/0,25W
D10	1N4148	R29	90K/0,25/0,25W
D11	1N4007	R30	26K7/0,25/0,25W
D12	1N4148	R31	10R/0,25/0,5W
D13	1N4148	R32	1K/1KV
D14	1N4148	R33	1K/5/1W
D15	1N4148	R34	100K/1/0,25W
D16	1N4148	R35	100K/1/0,25W
		R36	1M/1/0,25W
		R37	100K/1/0,25W
IC1	ICL7611	RN1	6280-254
IC2	TLC27M2CP	RN2	6180-316
IC3	CMOS4052	RN3	6180-317
IC4	CMOS4052	RN4	6180-318
IC5	CMOS4052		
IC6	CMOS4052		
IC7	CMOS4052		
IC8	TLC27M2CP		
IC9	LM317T		
N1	NEON		
N2	NEON		
FS1	500mV/440V CERAMIC		
FS2	3,15A CERAMIC		
T1	6231-220		
TFH1	6180-203		
TR1	VN0300M		
RL1	RELAY 6V		

MEGGER INSTRUMENTS LIMITED

Archcliffe Road Dover Kent CT17 9EN England Tel: 0304 202620 Fax: 0304 207342 Telex: 96283 Avomeg G

This instrument is manufactured in the United Kingdom.
The company reserves the right to change the specification or design without prior notice.
MEGGER is the registered Trade Mark of MEGGER INSTRUMENTS LIMITED.
This data uses the comma as the decimal marker to align with general European usage.
The instrument case design is registered.
Copyright © MEGGER INSTRUMENTS LIMITED, 1988
Part No 6171-338 Edition 2 Printed in England SL/0,2k/8T

An AVO INTERNATIONAL company

MEGGER