DET3/2, DET5/2 & DET5/2D
Digital Earth Testers

User Guide
Guide de l’utilisateur
Guía del usuario
SAFETY WARNINGS

★ The earth spikes, test leads and their terminations must not be touched if an installation earth-fault can arise, unless adequate precautions are taken.

★ When working near high tension systems rubber gloves and shoes should be worn.

★ Special precautions are necessary when ‘live’ earths may be encountered, and isolation switches and fuses are needed in this situation.

★ The terminals of the DET5/2 must be disconnected from any external circuit while its battery cells are being charged. The DET5/2D must be similarly disconnected while its battery cells are changed.

★ Before charging the DET5/2 battery ensure that the correct supply fuse is fitted and the voltage selector is set correctly.

★ Refer also to page 14 for further explanations and other precautions.

★ Warnings and Precautions must be read and understood before the instrument is used. They must be observed during use.

NOTE

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

Fig. 7 High potential spike resistance symbol 18
Fig. 8 Excessive noise interference symbol 18
Fig. 9 Over-range symbol 18
Fig. 10 Fall-of-Potential method for measuring resistance of an earth electrode 35
Fig. 11 Fall-of-Potential method using single lead to the earth electrode 36
Fig. 12 Resistance areas associated with electrode and current spike 37
Fig. 13 The 61.8% Rule method 37
Fig. 14 Connection for the Slope method 39
Fig. 15 Resistance curve from the Slope method tests 39
Fig. 16 Possible results from several Slope method tests 40
Fig. 17 “Dead” earth method 46
Fig. 18 Test spike positions for the 16th Edition IEE Wiring Regulations 47
Fig. 19 Determining ‘Touch’ and ‘Step’ potential 48
Fig. 20 Connections for resistivity testing 50
Fig. 21 Nomogram for resistivity calculations 52
Fig. 22 Continuity testing 53
Fig. 23 Block diagram of instrument circuit 54

Note:- The MEGGER® DET5/2 has been superseded by the MEGGER® DET 5/4, which has its own User Guide.

Symbols used on the instrument

Caution: Refer to accompanying notes.

Equipment complies with relevant EU Directives
GENERAL DESCRIPTION

The DET3/2, DET5/2 and DET5/2D MEGGER® Digital Earth Testers are compact instruments designed to measure earth electrode resistance, earth continuity etc. They may also make earth resistance tests which lead to the measurement of soil resistivity. The DET3/2 is powered by a hand cranked generator whereas the DET5/2 has an internal rechargeable battery, with an integral charger unit. The DET5/2D is powered from six internal, replaceable alkaline cells.

TEST METHOD

Each instrument uses the well known four-terminal method of measurement in which the resistance of the current circuit test leads does not affect the result. In the DET3/2, DET5/2 and DET5/2D the resistance of the potential circuit test leads can also be ignored because a buffer stage is incorporated to prevent the measuring circuit from loading the earth resistance under test.

A simple, latchable, push-button switch provides a three-terminal measurement by internally connecting the ‘C1’ and ‘P1’ terminal sockets together.

A reversing d.c. test current, generated electronically from a “floating” constant current source within the instrument, is passed via the ‘C1’ and ‘C2’ terminals through the earth being tested. The potential developed across the earth is compared with the current and, after filtering and phase sensitive detection, the resistance is given directly on the digital display.

The test frequency is 128 Hz and in the interests of safety the maximum test voltage at the terminals is limited to 50 V (peak) with respect to earth. Short circuit current is either 10 mA, 1 mA or 100 µA depending on the range in use.

INSTRUMENT DESIGN

The instruments are very robust and have tough cases moulded in ABS plastic. Each case is fitted with a fold-down carrying handle and four right-angled adaptors are supplied to connect the test leads to the instrument terminals. Test leads are not supplied with an instrument but form part of earth testing field accessory kits which are available as an additional option.

All instruments have simple controls. Mounted on the front panel is a rotary range selector and two push-button switches, one for checking the potential circuit resistance prior to a measurement being made and the other for connecting the ‘C1’ and ‘P1’ terminals internally for a three-terminal measurement. The instrument’s 3½ digit liquid crystal display shows the test result and also indicates a high current circuit resistance, a high potential circuit resistance, (both
usually caused by a high test spike resistance), a
“noisy” environment within the earth making up the
test sample, and a low battery voltage in the case of
the DET5/2 and DET5/2D, or low generator cranking
speed in the case of the DET3/2. As these factors can
influence the measurement being made, noise and
the current circuit resistance are continuously
monitored during a test, while a check of the potential
circuit resistance can be made at any time. The
display shows all measurements directly in ohms with
the decimal point automatically positioned. It also
gives an over-range indication to instruct the user to
change to a higher range, and a negative sign to
show that the current and potential test leads are
reversed.

The battery powered testers both have an automatic
switch-off after 3 minutes of measurement.

These instruments have been designed to comply
with the performance specifications of BS7430
(formerly CP 1013) specification (from BSI), BS7671
(the IEE Wiring Regulations) IEC 364, NFC 15-100
French Specification and VDE 0413 Part 7 (1982)
German specification. For this reason, the terminals
are each marked in a dual way as follows:

<table>
<thead>
<tr>
<th>C1</th>
<th>P1</th>
<th>P2</th>
<th>C2</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>ES</td>
<td>S</td>
<td>H</td>
</tr>
</tbody>
</table>

Terminal C1(E) is for the Current connection to the
Earth electrode to be tested.

Terminal P1(ES) is for the Potential connection to the
Earth electrode to be tested.

Terminal P2(S) connects to the remote Potential test
spike.

Terminal C2(H) connects to the remote Current test
spike.

**DET 5/2 CHARGER POWER CORD**

If the charger power cord plug is not suitable for your
type of socket outlets, do not use an adaptor. You
should use a suitable alternative power cord, or if
necessary change the plug by cutting the cord and
fitting a suitable plug.

The colour code of the cord is:

- **Earth (Ground)**: Yellow / Green
- **Neutral**: Blue
- **Phase (Line)**: Brown

If using a fused plug, a 3 Amp fuse to BS 1362 should
be fitted.

**Note:** A plug severed from the power cord should be
destroyed, as a plug with bare conductors is
hazardous in a live socket outlet.
SPECIFICATION

Max. Potential Spike Resistance
Spike resistance that will introduce +1% error is:-

<table>
<thead>
<tr>
<th>Resistance Range</th>
<th>Resistance Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 Ω range</td>
<td>10 kΩ ± 1 kΩ</td>
</tr>
<tr>
<td>200 Ω range</td>
<td>25 kΩ ± 3 kΩ</td>
</tr>
<tr>
<td>2 kΩ and 20 kΩ ranges</td>
<td>100 kΩ ± 10 kΩ</td>
</tr>
</tbody>
</table>

(These are loop resistances, therefore the resistance under test must be subtracted from these figures).

Max. Output Voltage
50 V

Display
3½ digit LCD, maximum reading 1999

Temperature Effect
<±0.2%/°C over the temperature range -15 °C to +55 °C

Temperature Range
-15 °C to +55 °C (0 °C to +55 °C for DET5/2D)
-40 °C to +70 °C (for DET5/2D, without batteries)

Humidity
- Operating: 95% RH max. at 40 °C
- Storage: 93% RH max. at 55 °C

Flash Test
3 kV a.c.

Voltage Withstand
In the event of a system fault the instrument will withstand 240 V a.c. applied between any two terminals.

Fuses
- DET3/2, DET5/2 and DET5/2D
  - 100 mA ceramic HBC 20 mm x 5 mm IEC 127/1 (for current source protection)
  - Internal 100 mA ceramic HBC 20 mm x 5 mm IEC 127/1 (for potential circuit protection)
  - Internal 100 mA ceramic HBC 20 mm x 5 mm IEC 127/1 (for 3/4 terminal switch circuit protection)

  - DET 5/2 Charger Cord
    - DET5/2 only
    - Fused plug (when applicable) 3 A fuse to BS 1362.
  - DET 5/2 Charger Cord
    - DET5/2 only
    - 50 mA ceramic HBC 20 mm x 5 mm IEC 127/1 for 240 V a.c. supply, 100 mA ceramic HBC 20 mm x 5 mm IEC 127/1 for 120 V a.c. supply (for circuit protection during battery charging).
    - Internal 1 A ceramic HBC 20 mm x 5 mm IEC 127/1 (for battery protection)
<table>
<thead>
<tr>
<th><strong>Power Supply</strong></th>
<th>DET3/2</th>
<th>Internal hand-cranked a.c. generator (Minimum cranking speed 160 r.p.m.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DET 5/2</td>
<td></td>
<td>Internal rechargeable sealed lead acid cells 12 V, 0,8 Ah capacity. Battery voltage range over which basic accuracy is maintained, 10,0 V to 13,5 V.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Battery charging time, 10 hours max. (from completely exhausted). Charging supply required, 200 V to 255 V a.c. or 100 V to 130 V a.c. 50 Hz/60 Hz.</td>
</tr>
<tr>
<td>DET5/2D</td>
<td></td>
<td>6 x 1,5 V alkaline battery cells IEC LR6 type. Battery voltage range over which basic accuracy is maintained, 6 V to 10 V.</td>
</tr>
<tr>
<td><strong>Battery life</strong></td>
<td>DET5/2D</td>
<td>50 x 3 min tests (2½ hours’ continuous use); at 0 °C, 15 x 3 min tests (45 minutes’ continuous use).</td>
</tr>
<tr>
<td><strong>E.M.C.</strong></td>
<td></td>
<td>In accordance with IEC61326 including Amendment No.1</td>
</tr>
<tr>
<td><strong>Dimensions</strong></td>
<td>DET3/2</td>
<td>210 mm x 128 mm x 125 mm (8¼ in x 5 in x 5 in approx.)</td>
</tr>
<tr>
<td>DET5/2 and DET5/2D</td>
<td></td>
<td>180 mm x 128 mm x 125 mm (7 in x 5 in x 5 in approx.)</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>DET3/2</td>
<td>1 kg (2¼ lb approx.)</td>
</tr>
<tr>
<td>DET5/2</td>
<td></td>
<td>1,4 kg (3 lb approx.)</td>
</tr>
<tr>
<td>DET5/2D</td>
<td></td>
<td>0,82 kg (1¾ lb approx.)</td>
</tr>
<tr>
<td><strong>Cleaning</strong></td>
<td></td>
<td>Wipe disconnected instrument with a clean cloth dampened with soapy water or isopropyl alcohol (IPA).</td>
</tr>
</tbody>
</table>
## ACCESSORIES

<table>
<thead>
<tr>
<th>SUPPLIED</th>
<th>PART NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>User Guide</strong></td>
<td>6171-524</td>
</tr>
<tr>
<td><strong>Power cord</strong> (Battery charging DET5/2)</td>
<td></td>
</tr>
<tr>
<td>Four right angled terminal adaptors</td>
<td></td>
</tr>
<tr>
<td><strong>OPTIONAL</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Vinyl Carrying Case</strong></td>
<td>6420 - 111</td>
</tr>
<tr>
<td><strong>Four Terminal Earth Testing Kit</strong></td>
<td>6310 - 755</td>
</tr>
<tr>
<td>Carrying bag containing:</td>
<td></td>
</tr>
<tr>
<td>Club hammer, 4 x spikes</td>
<td></td>
</tr>
<tr>
<td>3 m (x2) cable and 30 m</td>
<td></td>
</tr>
<tr>
<td>50 m of cable on winders.</td>
<td></td>
</tr>
<tr>
<td><strong>Four Terminal Compact Earth Testing Kit</strong></td>
<td>6210 - 161</td>
</tr>
<tr>
<td>Compact carrying bag containing:</td>
<td></td>
</tr>
<tr>
<td>4 x push in spikes, 3 m, 15 m, 30 m</td>
<td></td>
</tr>
<tr>
<td>and 50 m of cable on cable tidy.</td>
<td></td>
</tr>
<tr>
<td><strong>Three Terminal Compact Earth Testing Kit</strong></td>
<td>6210 - 160</td>
</tr>
<tr>
<td>Compact carrying bag containing:</td>
<td></td>
</tr>
<tr>
<td>3 x push spikes, 3 m, 15 m</td>
<td></td>
</tr>
<tr>
<td>and 30 m of cable on a cable tidy.</td>
<td></td>
</tr>
<tr>
<td><strong>Publications</strong></td>
<td></td>
</tr>
<tr>
<td>‘Getting Down to Earth’</td>
<td>AVTM25-TA</td>
</tr>
</tbody>
</table>

### U.S. OPTIONS

<table>
<thead>
<tr>
<th>Cat. Number</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standard Accessory Kit</strong> 250579</td>
</tr>
<tr>
<td>Canvas case containing:</td>
</tr>
<tr>
<td>2 x 20 in rods, leads</td>
</tr>
<tr>
<td>(25, 50 &amp; 100 ft)</td>
</tr>
<tr>
<td><strong>Deluxe Accessory Kit</strong> 250581</td>
</tr>
<tr>
<td>Padded case to hold instrument,</td>
</tr>
<tr>
<td>2 x 20 in rods, leads</td>
</tr>
<tr>
<td>(25, 50 &amp; 100 ft)</td>
</tr>
<tr>
<td><strong>Soil Resistivity Kit</strong> 250586</td>
</tr>
<tr>
<td>Padded case to hold instrument,</td>
</tr>
<tr>
<td>4 x 20 in rods and test leads</td>
</tr>
<tr>
<td>(4 x 50 ft)</td>
</tr>
</tbody>
</table>
OPERATION

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

2. It is advisable that, when working with the DET5/2 instrument, the battery is fully charged before embarking upon a test sequence. It can be extremely inconvenient if the battery voltage becomes too low while a field test is in progress. Similarly, with the DET5/2D new battery should always be available.

DISPLAY SYMBOLS
The 3½ digit l.c.d. shows the reading directly and the operator can simply refer to the range switch position for the units of measurement. The instrument's display symbols can also help the operator make certain that the reading is valid. The meaning of each display symbol is given in the following paragraphs.

Low Generator Cranking Speed (DET3/2)
If the generator handle on the DET3/2 is turned too slowly such that there is insufficient output for a test to be performed properly, an arrow ‘←’ appears on the left of the display pointing at the 'Rev/Min Lo’ mark on the graphics panel. Any reading on the display should be ignored and the generator turned faster until the arrow disappears before a measured value is accepted.

Low Battery Voltage (DET5/2 and DET5/2D)
Similarly on the DET5/2 and DET5/2D, if the battery voltage is too low the arrow on the left of the display will appear pointing at the ‘Lo’ mark on the graphics panel. In this case the batteries hold only enough power for possibly one or two more measurements and must be recharged (DET5/2) or replaced (DET5/2D) before further tests are undertaken.

Reverse Polarity
When the potential test leads are reversed with respect to the current test leads, the reading on the
SETTING-UP THE TEST SPIKES ETC.

For earth electrode testing and for earth resistivity surveying, the instrument’s test leads are connected to spikes hammered into the ground. The way the connections are made depends on the type of test being undertaken and the details of these are given in the next section, ‘Measuring Techniques’.

Test spikes and long test leads are necessary for all types of earth testing and the Earth Testing Field Accessory Kits (available as an option) contain the basic equipment.

Recommended test spikes are 13 mm square, or diameter 46.0 mm long and made of mild steel. These can be driven to a depth of 300 mm with rapid blows from a 1 kg hammer. The size of the cable suitable for use as test leads is not critical but, it should be reasonably flexible and MUST be insulated. At least 100 m length will be needed and a cable size of about 104/0.1 mm is suitable.

When connections are made to the instrument the right angled adaptors should be used. These are supplied with the instrument and they have screw terminals to take hook or spade connectors, bare wires, or 4 mm plugs.

BASIC TEST PROCEDURE

Four Terminal Measurement

After the test spikes have been set-up and connected to the instrument for the type of test to be carried out (refer to ‘Measuring Techniques’), proceed as follows:

1. Select the measuring range required. Choose the lowest range if it is uncertain which is correct; this may produce the over-range symbol when the instrument is operated, if so switch to the next range.

2. Turn the generator handle at 120 r.p.m. (minimum) for the DET3/2.
   Note:— The DET5/2 and DET5/2D energize the test circuit as soon as the range is selected.

3. Check that the display shows no adverse test conditions, i.e. that the high current circuit resistance and excessive noise symbols are not showing. Also check that the low battery voltage symbol (DET5/2 and DET5/2D) or low cranking speed symbol (DET3/2) is not illuminated.

4. Press the ‘Test Rp’ push-button to check the potential spike resistance. The high potential circuit resistance symbol should not appear. Release the push-button.

5. If all the conditions for a test are satisfactory the reading given on the display may be accepted as the earth resistance. If any of the display symbols, (except reverse polarity), illuminate, the cause of
OPERATION

the adverse condition must be removed before
the reading can be accepted.

Three Terminal Measurement
The basic test procedure is the same as for the Four
Terminal Measurement except that the latchable
push-button marked ‘C1 - P1’ (‘E - ES’) should be
pressed and left in its down position. Only one
connection is then required from the ‘C1’ (‘E’) terminal
to the electrode under test. For greatest accuracy this
connection should be made with a short lead.

BATTERY CHARGING (DET5/2)
The battery should be charged as soon as the low
battery indicator appears on the display. If the display
remains blank when the instrument is switched on, it
may be that the battery has become completely
exhausted. In this case charge the battery fully before
performing any tests.

Note:— It is unwise to allow the battery to become
completely exhausted for fear of causing it
damage.

Before connecting to the mains supply ensure that the
correctly rated fuse is fitted and that the voltage
adjuster is set to the right value for the supply to be
used. For a 240 V a.c. supply the fuse should be
50 mA and for a 120 V a.c. supply the fuse should be
100 mA. (Type and size of the fuses are given in the
Specification). The mains supply fuse is located in the
holder which is part of the recessed input plug on the
side of the case. Simply slide the holder out to reveal
two fuses, the inner one is the working fuse; the
outer one is a spare fuse. The voltage adjuster is
located on the bottom of the casing. Use a
screwdriver to turn the appropriate voltage mark to
the indicating arrow.

When the fuse and voltage selector are correctly set,
plug the mains supply lead into a suitable socket
outlet and switch on. An l.e.d. light on the front panel
marked ‘CHARGE’ will illuminate to show that the
instrument is connected to a mains supply. Leave the
battery to charge for 10 hours approximately.

Caution:— Do not leave the test leads connected to
the terminals while the instrument is being
supplied with mains power.

FITTING OR REPLACING BATTERY CELLS
(DET5/2D)

Caution:— Use only battery cells of the correct type
(see the Specification). Whenever the
battery cells are being fitted or replaced
there should be no connections to the
instrument terminals.
BS7671 (16th Edition wiring regulations) requirements
Regulation 713-11 of BS7671 specifies that the resistance of earth electrodes must be measured. The accompanying Guidance Notes describe a method of test that is very similar to the Fall-of-Potential method. If the maximum deviation from the average of the three readings is better than 5% then the average can be taken as the earth electrode resistance. If the deviation exceeds 5% then the current spike should be moved further away from the electrodes and the tests repeated.

Fig.18 Test spike positions for BS7671 testing

OTHER METHODS
There are other methods of earth electrode testing among which are the Four Potential, Intersecting Curves and Star Delta methods. Megger Limited have produced a book entitled ‘A Simple Guide to Earth Testing’ (Part Number 6171-230) which explains all these test methods and gives other helpful information about earth testing. It is available from the instrument manufacturer or one of their approved distributors.
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 3 Year from the Date of Purchase by the User.

Note: Any unauthorized prior repair or adjustment will automatically invalidate the Warranty.

Instrument Repair and Spare Parts
For service requirements for MEGGER® Instruments contact

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

or Megger
Valley Forge Corporate Center
2621 Van Buren Avenue
PA 19403
U.S.A.
Tel: +1 (610) 676 8579
Fax: +1 (610) 676-8625

or an approved repair company.

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

Returning an Instrument for Repair
If returning an instrument to the manufacturer for repair, it should be sent, freight pre-paid, to the appropriate address. A copy of the Invoice and of the packing note should be sent simultaneously by airmail to expedite clearance through Customs. A repair estimate showing freight return and other charges will be submitted to the sender, if required, before work on the instrument commences.
OTHER TECHNICAL SALES OFFICES
Toronto CANADA, Sydney AUSTRALIA, Madrid SPAIN, Mumbai INDIA, and the Kingdom of BAHRAIN.

Megger products are distributed in 146 countries worldwide.

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

Megger is a registered trademark

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