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Megger[®]

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.

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Note:- The **MEGGER® DET5/2** has been superseded by the **MEGGER® DET 5/4**, which has it's own User Guide.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, latching, 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 μ A 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

GENERAL DESCRIPTION

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:

C1	P1	P2	C2
E	ES	S	H

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.

Power Supply	DET3/2	Internal hand-cranked a.c. generator (Minimum cranking speed 160 r.p.m.)
	DET 5/2	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.
Battery life		Typically 80 x 3 min tests (4 hours' continuous use). 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.
	DET5/2D	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.
Battery life		50 x 3 min tests (2½ hours' continuous use); at 0 °C, 15 x 3 min tests (45 minutes' continuous use).
Safety		The instruments meet the requirements for double insulation to IEC 1010-1 (1995), EN61010-1 (1995).
E.M.C.		In accordance with IEC61326 including Amendment No.1
Dimensions	DET3/2	210 mm x 128 mm x 125 mm (8¼ in x 5 in x 5 in approx.)
	DET5/2 and DET5/2D	180 mm x 128 mm x 125 mm (7 in x 5 in x 5 in approx.)
Weight	DET3/2	1 kg (2¼ lb approx.)
	DET5/2	1,4 kg (3 lb approx.)
	DET5/2D	0,82 kg (1¾ lb approx.)
Cleaning		Wipe disconnected instrument with a clean cloth dampened with soapy water or isopropyl alcohol (IPA).

ACCESSORIES

SUPPLIED	PART NUMBER
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User Guide	6171-524
Power cord (Battery charging DET5/2)	
Four right angled terminal adaptors	

OPTIONAL

Vinyl Carrying Case	6420 - 111
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Four Terminal Earth Testing Kit	6310 - 755
Carrying bag containing:- Club hammer, 4 x spikes 3 m (x2) cable and 30 m 50 m of cable on winders.	

Four Terminal Compact Earth Testing Kit	6210 - 161
Compact carrying bag containing:- 4 x push in spikes, 3 m, 15 m, 30 m, and 50 m of cable on cable tidy.	

Three Terminal Compact Earth Testing Kit	6210 - 160
Compact carrying bag containing:- 3 x push spikes, 3 m, 15 m and 30 m of cable on a cable tidy.	

Publications

'Getting Down to Earth'	AVTM25-TA
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U.S. OPTIONS

Standard Accessory Kit

Cat. Number

250579

Canvas case containing:-
2 x 20 in rods, leads
(25,50 &100 ft)

Deluxe Accessory Kit

250581

Padded case to hold instrument,
2 x 20 in rods, leads
(25,50 &100 ft)

Soil Resistivity Kit

250586

Padded case to hold instrument,
4 x 20 in rods and test leads
(4 x 50ft)

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

- 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.

Pics in here

Fig. 4 Low cranking speed and low battery voltage indications.

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 460 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.

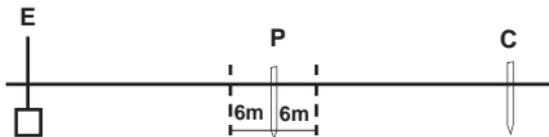


Fig.18 Test spike positions for BS7671 testing

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

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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.

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