Megger

DET3TA, DET3TC, DET3TD and DET4TD Earth Ground Electrode Testers

USER MANUAL

⚠ SAFETY WARNINGS

- **Safety Warnings** and **Precautions must be read** and understood before the instrument is used. They **must** be observed during use.
- **Do not** leave the instrument connected to the system under test when not in use.
- Circuit connections and exposed metalwork of an installation or equipment under test **must not** be touched.
- The instrument **must not** be operated or connected to any external system if it shows any visible signs of damage or if it has been stored for prolonged periods in unfavourable conditions.
- The instrument **must not** be operated or connected to any external system if the battery compartment or casing is open or any parts of the case (including keypad, selector switch, display window, etc.) are missing.
- The earth spikes, test leads and their terminations (including connections to the earthing system under test) **must not** be touched if an installation earth fault can arise unless adequate precautions are taken.
- The earth spikes, test leads and their terminations (including connections to the earthing system under test) **must not** be touched while the instrument is switched on.
- **Special precautions** are necessary when operating in situations where 'live' earths may be encountered: isolation switches and fuses (not supplied with this instrument) must be used.
- **Special precautions** are necessary when working near high tension systems (MV and HV): rubber gloves and shoes (not supplied with this instrument) should be worn.
- **Special precautions** are necessary when working in wet conditions or in agricultural areas: observe the local safety standards and take all necessary special precautions applicable to the particular location.
- The instrument **must** be disconnected from the earthing system under test while batteries are being changed or the fuse replaced.
- Replacement batteries and fuses **must** be of the correct type and rating.

NOTE

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

Users of this equipment and/or their employers are reminded that National Health and Safety Legislation requires them to carry out valid risk assessments of all electrical work so as to identify potential sources of electrical danger and risk of electrical injury such as inadvertent short circuits. Where the assessments show that the risk is significant then the use of fused test leads may be appropriate.

⚠ LIVE EARTH SAFETY PRECAUTIONS

It is preferable that the earth electrode to be tested is first isolated from the circuit it is protecting, so that only the earth is measured and not the complete system. When this is done, the circuits and equipment must be de-energised. If however this is not possible, the earth electrode should be duplicated so that when it is disconnected for test purposes, the other one provides the necessary circuit protection. The following safety precautions are essential when working near high tension systems where any unintentional 'live' earths may be encountered between the site earth and remote earths established for test purposes. A 'live' earth is one that carries current from the mains supply, or could do so under fault conditions.

1. All persons involved must be trained and competent in isolation and safety procedures for the system to be worked on. They must be clearly instructed not to touch the earth electrode, test spikes, test leads, or their terminations if any 'live' earths may be encountered. It is recommended that they wear appropriate rubber gloves, rubber soled shoes, and stand on a rubber mat.
2. The 'P' ('S') and 'C' ('H') terminals should be connected through a double pole isolation switch, the rating of which will cope with the maximum fault voltage and current. The isolation switch must be open whilst any personal contact is made with the remote test spikes, or the connecting leads, e.g. when changing their position.

Note: If a fault occurs while a test is being made the instrument may be damaged. Incorporating fuses at the isolation switch, rated at 100 mA, and able to cope with the maximum fault voltage will provide some protection for the instrument.

BATTERY INSTALLATION

Caution: Whenever battery cells are being fitted or replaced, there should be no connections to the instrument terminals. The cover to the battery compartment lifts off the rear of the instrument and is held in position by a single captive screw in the base of the instrument. To fit or replace battery cells, loosen the captive screw and lift away the cover. Fit new cells observing the correct polarity as indicated on the battery compartment moulding. Replace the cover and tighten the securing screw. To avoid damage by leaking electrolyte, do not leave cells fitted in an instrument which will remain unused for extended periods of time.

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Symbols used on the instrument are:


Caution: refer to accompanying notes


Equipment protected throughout by Double Insulation (Class II)


Equipment complies with current EU directives.



Equipment complies with 'C tick' requirements

INTRODUCTION

Thank you for purchasing the Megger Earth Ground Electrode Tester.

For your own safety and to get the maximum benefit from your instrument, please ensure that you read and understand the following safety warnings and instructions before attempting to use the instruments.

This user manual describes the operation and functions of the DET series of Earth Ground Electrode Testers:

DET3TA

DET3TC

DET3TD

DET4TD

GENERAL DESCRIPTION

The Megger DET family of test instruments offers a unique solution to the measurement of earth or ground electrode (rod) resistance and soil resistivity. The family has three digital variants, which support 2, 3 and 4 point (DET4TD only) testing, and one analogue version that makes provision for 2 and 3 point measurements.

The DET3TC can use an optional current clamp (ICLAMP) to measure electrode (rod) resistance without disconnection, leaving the installation earthing system intact (Attached Rod Technique, ART). The DET3TC in conjunction with the current clamp can also measure conductor current.

The DET variants have the following features:

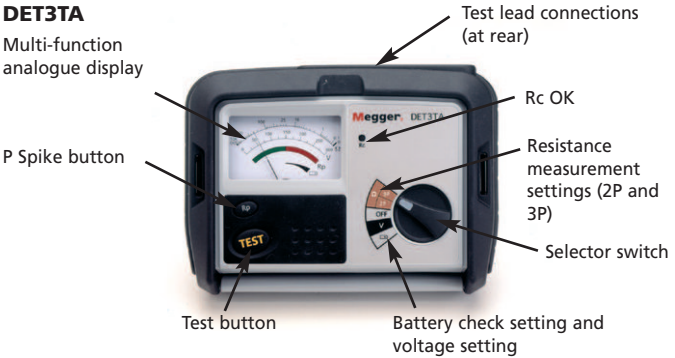
Feature	**DET3TA**	**DET3TC**	**DET3TD**	**DET4TD**
Automatic C spike check		■	■	■
Automatic P spike check		■	■	■
Manual P spike check	■			
Automatic noise check		■	■	■
Manual noise check	■			
Noise rejection (40 V pk-pk)	■	■	■	■
2-wire test	■	■	■	■
3-wire test	■	■	■	■
4-wire test				■
No disconnect testing (ART)		■		
Voltmeter (ground noise voltage measurement)	■	■	■	■

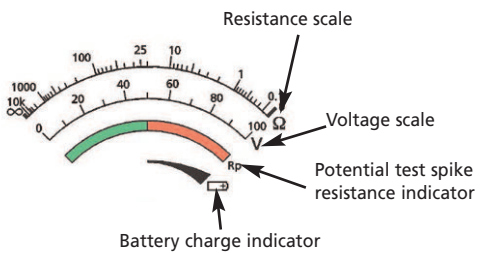
INSTRUMENT ILLUSTRATIONS

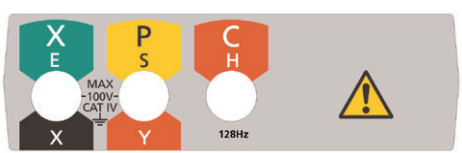
Feature	DET3TA	DET3TC	DET3TD	DET4TD
Current measurement		■		
LCD display		■	■	■
Moving coil meter	■			
IP54 rated	■	■	■	■
EN61010-1 100 V CATIV	■	■	■	■

Each instrument kit comprises instrument, test leads, test spikes, batteries and calibration certificate stored in a tough polypropylene carrying-case.

DET3TA



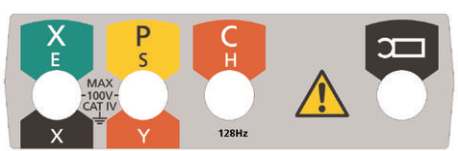




Test lead connections (at rear of instrument)

DET3TC

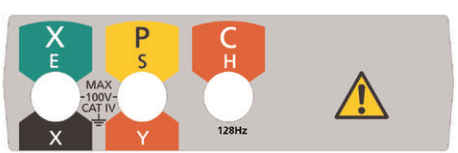




Test lead connections (at rear of instrument)

DET3TD





Test lead connections (at rear of instrument)

DET4D



Test lead connection (at rear of instrument)

Batteries

The Megger DET series instruments are supplied with batteries fitted. When batteries become exhausted, refer to the section on battery replacement.

Warning: Do not switch the instrument on with the battery cover removed.

Inspection

Before each use of the instrument, visually inspect the instrument case, test leads, spikes and connectors to confirm that their condition is good, with no damaged or broken insulation.

Instrument output voltage selection

The maximum output voltage of the instrument is nominally 50 V. Should it prove necessary in particular circumstances, it is possible to set the output voltage 25 V. The procedure for changing the output voltage is as follows:

1. Press and hold the TEST button and switch instrument ON to the V setting on the selector switch.
2. The LCD display will indicate 'tst' (DET3TC, DET3TD and DET4TD).
3. Release TEST button. The maximum output test voltage will be displayed, either '50 V' or '25 V'.
4. To toggle between the maximum output test voltages, press the TEST button.
5. Switch off instrument when the desired maximum test voltage is displayed.

Auto power down

To extend battery life the instrument will automatically switch off six minutes after the last operation.

The instrument can be switched off manually by selecting the 'OFF' setting on the selector switch and then switched on as normal.

Display symbols (DET3TC, DET3TD, DET4TD)


Warning Triangle

Fuse Blown


Battery Indicator (not DET3TA).

>100V Indicates that the ground noise voltage exceeds the instrument measurement capability.

Rp OK Potential spike (P Spike) resistance is within range for accurate measurement.

Rp Hi Potential spike (P Spike) resistance exceeds range for accurate measurement.

Rc OK Current spike (C Spike) resistance is within range for accurate measurement.

Rc Hi Current spike (C Spike) resistance exceeds range for accurate measurement.

Noise OK Ground noise voltage is within range for accurate measurement (<40 Vpk-pk).

Noise Hi Ground noise voltage exceeds range for accurate measurement (>40 Vpk-pk).

Display symbols (DET3TA)



Current spike (C Spike) resistance is within range for accurate measurement.



Instrument is performing measurement checks.

REPLACING BATTERIES AND FUSES

Batteries

Battery type: 8 x LR6 (AA), 1.5 V Alkaline, or 8 x 1.2 V NiCAD, or 8 x 1.2V NiMH

The battery condition is continuously displayed by the bar-graph type symbol (DET3TC, DET3TD and DET4TD) or by switching to the battery setting and pressing the TEST button (DET3TA).

Figure 1 shows the progression of the battery indicator (for the DET3TC, DET3TD and DET4TD) which gives a qualitative status of the battery charge condition.



Fully charged battery



75% charged battery



50% charged battery



25% charged battery



Some testing still possible but battery may fail at any time



Symbol flashes when there is not enough charge to do a test and the instrument will turn itself off

Figure 1: Battery life indication (DET3TC, DET3TD, DET4TD)

Note: Fully charged NiMH or NiCAD rechargeable batteries show a lower charge than alkaline batteries, and may not give much warning before becoming exhausted

To replace batteries

Warning: Do not operate instrument with the battery cover removed.

1. To avoid the possibility of electric shock, switch instrument 'OFF' and disconnect the instrument from any electrical circuits.
2. The rear cover must not be opened if the test leads are connected.
3. To avoid the possibility of electric shock, do not press the test button or touch the fuse when changing batteries.
4. To remove the rear cover, release the screw at the bottom of the cover and lift the cover upwards.
5. Remove the dead cells.
6. Refit new batteries observing the correct polarity as marked on the battery compartment.
7. Replace the instrument back cover and secure by tightening the retaining screw.

Warning: - Incorrect battery cell polarity can cause electrolyte leakage, resulting in damage to the instrument. If the battery condition indicator does not show a full charge when battery cells are new, a cell may be reversed.

Note: Battery cells should not be left in an instrument that may remain unused for extended periods.

Fuse

Fuse type: 500 mA (F), HBC, 50 kA, 600 V (32 x 6 mm)

Blown fuse symbol: ⊟ (DET3TD, DET3TC and DET4TD)

Only one fuse is contained within the instrument, and is user-replaceable.

When the fuse ruptures, symbol will show and testing is inhibited.

To replace the fuse

Warning: Do not operate instrument with the battery cover removed.

1. To avoid the possibility of electric shock, switch instrument 'OFF' and disconnect the instrument from any electrical circuits.
2. The rear cover must not be opened if the test leads are connected.
3. To avoid the possibility of electric shock, do not press the test button when replacing the fuse.
4. To remove the rear cover, release the screw at the bottom of the cover and lift the cover upwards.
5. Disconnect the battery circuit before accessing the fuse.
6. Remove fuse and replace it with of fuse of the same characteristics.
7. Replace the instrument back cover and secure by tightening the retaining screw.

MEGGER'S 'DOWN TO EARTH' PUBLICATION

The following descriptions of tests are a set of instructions for the sole purpose of the proper use of these instruments by competent persons. Where there is doubt about a particular application, reference should be made to the advice and guidance contained within the publication 'Down to Earth', available from Megger.

DESCRIPTION OF TESTS FOR MODELS DET3TC, DET3TD DET4TD

Battery

Before proceeding with measurements, ensure that the charge condition of the batteries is sufficient to undertake the intended measurements. The charge status is given in the bar-graph, as shown in Figure 1, which is continually shown on the LCD when the instrument is switched on.

Measurement of ground noise voltage (DET3TC, DET3TD and DET4TD)

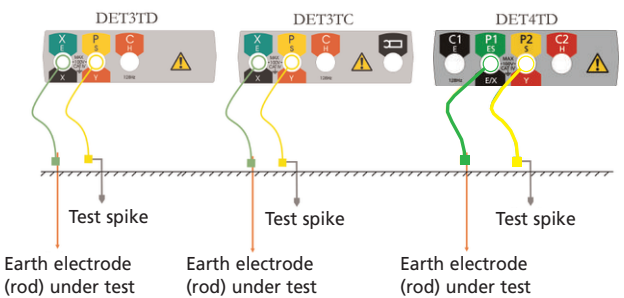


Figure 2: Connections for measuring ground noise voltage and two-terminal resistance.

To measure the ground noise voltage:

1. With the selector switch set to the 'OFF' position, connect the instrument as shown in Figure 2.
2. Set the selector switch to the ground noise voltage setting marked 'V'.
3. The ground noise voltage reading will be displayed on the LCD display as shown in Figure 3.



Figure 3: Ground noise voltage reading

Two-terminal resistance measurement (DET3TC, DET3TD, DET4TD)

1. With the selector switch in the 'OFF' position connect the instrument as shown in Figure 2, but connected to the part of the installation you wish to test
2. Set the selector switch to the 3 point resistance measurement setting marked '3P'.
3. Press and release the TEST button [by pressing and holding the TEST button, the resistance measurement will be continually updated and displayed].
4. A resistance reading will be displayed on the LCD display as shown in Figure 4.

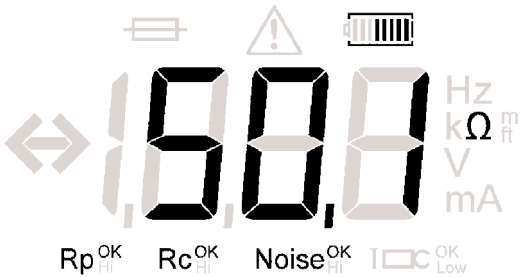


Figure 4: Two point resistance reading

Note: The test voltage used to make resistance measurements is a.c. and because of this may not suitable for continuity testing in accordance with local regulations.

Three-terminal ground rod resistance measurement (DET3TC, DET3TD, DET4TD)

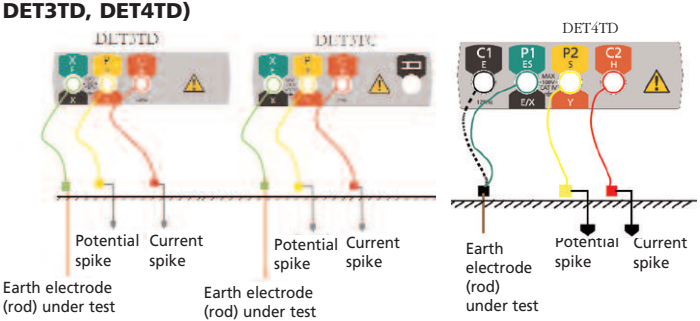


Figure 5: Connections for measuring three-terminal ground rod resistance

1. With the selector switch in the 'OFF' position, connect the instrument as shown in Figure 5.
2. Set the selector switch to the 3 point resistance measurement setting marked '4P'.
3. Press and release the TEST button [by pressing and holding the TEST button, the resistance measurement will be continually updated and displayed].
4. The instrument will then check for ground noise, the parameters of the current and voltage circuits and the integrity of the fuse.
5. A resistance reading will be displayed on the LCD display, as shown in Figure 6.

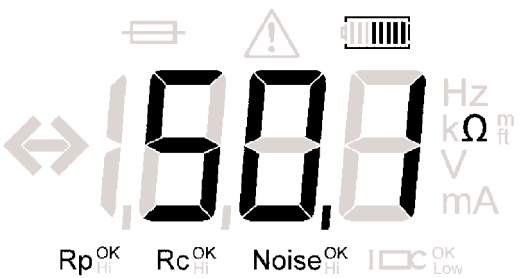


Figure 6: Three point resistance and four point resistivity reading

Four-terminal ground rod resistance measurement (DET4TD)

In circumstances where the lead resistance could introduce unacceptable levels of error, the effect can be removed from the measured resistance using the method below.

1. With the selector switch in the 'OFF' position, connect the instrument as shown in Figure 5, with the lead shown dotted connecting terminal 'C1' to the earth electrode (rod) under test.
2. Set the selector switch to the 4 point resistance measurement setting marked '4P'.
3. Press and release the TEST button [by pressing and holding the TEST button, the resistance measurement will be continually updated and displayed].
4. The instrument will then check for ground noise, the parameters of the current and voltage circuits and the integrity of the fuse.
5. After a short period, a resistance measurement reading is displayed.
6. A resistance reading will be displayed on the LCD display, as shown in Figure 6.

Ground resistance measurement (DET4TD)

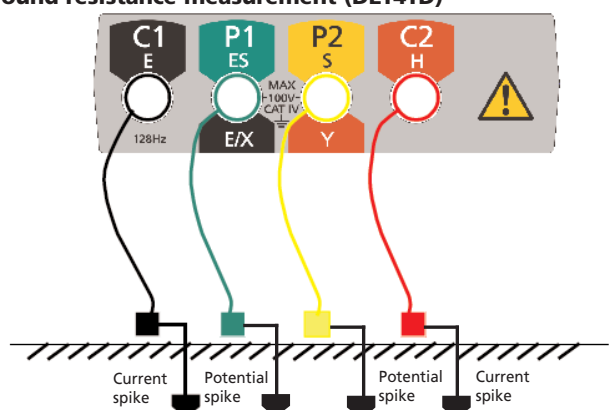


Figure 7: Connections for measuring four-terminal soil resistance

1. With the selector switch in the ‘OFF’ position, connect the instrument as shown in Figure 7.
2. Set the selector switch to the 4 point resistance measurement setting marked ‘4P’.
3. Press and release the TEST button [by pressing and holding the TEST button, the resistance measurement will be continually updated and displayed].
4. The instrument will then check for ground noise, the parameters of the current and voltage circuits and the integrity of the fuse
5. A resistance reading will be displayed on the LCD display, as shown in Figure 6.

Calibrating the instrument to the ICLAMP (DET3TC)

Before proceeding with any measurement using the ICLAMP, it is essential to calibrate the instrument to the particular ICLAMP using the following procedure. This calibration should be repeated periodically.

1. With the selector switch in the ‘OFF’ position, connect ICLAMP to instrument.
2. Press and hold the TEST button and switch instrument ON to the ‘A’ setting on the selector switch.
3. Release TEST button,
4. Connect terminals ‘X’ and ‘C’ on the instrument together with the lead provided with the ICLAMP.
5. Press and hold down the TEST button until a ‘0’ reading is obtained on the instrument display.
6. Close clamp around the lead connecting the ‘X’ and ‘C’ terminals.
7. Press and hold the TEST button until a ‘100’ reading is obtained.
8. The instrument is now calibrated to the particular ICLAMP.
9. Switch the instrument to the OFF position.

Measuring ground current with the ICLAMP (DET3TC)

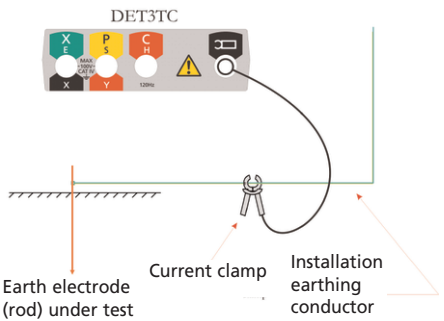


Figure 8: Connections for measuring current using the current clamp

1. With the selector switch in the ‘OFF’ position, connect the instrument, as shown in Figure 8 and close the ICLAMP around the earthing conductor under test.
2. Turn the selector switch to the current measuring setting marked ‘A’.
3. The instrument will display a measured current value, as shown in Figure 9.

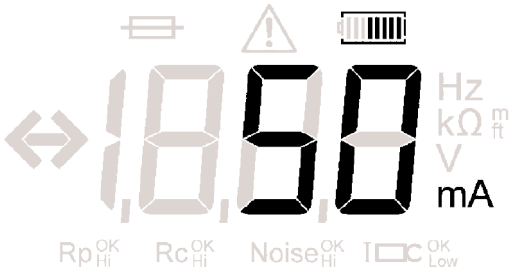


Figure 9: Current reading using the current clamp

Attached Rod Technique (ART) (DET3TC)

It is possible to use this instrument to measure the resistance of a ground rod without disconnecting it from the rest of the system, thereby allowing normal operations within the installation to continue uninterrupted. This technique is known as the 'Attached Rod Technique' (ART). Where the means of grounding comprises multiple rods, this technique also allows individual measurement of each rod.

Measuring ground resistance with the ICLAMP using ART (DET3TC)

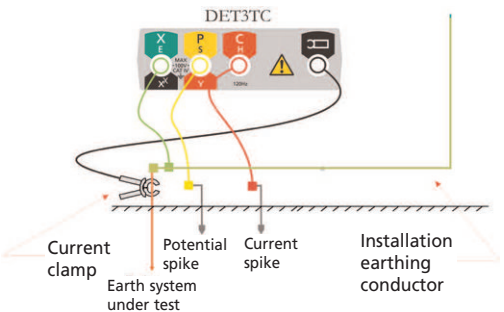


Figure 10: Connection for measuring three-terminal ground rod resistance

1. With the selector switch in the 'OFF' position, connect the instrument, as shown in Figure 10 and close the ICLAMP around the earthing conductor under test.
2. Set the selector switch to the setting marked '3P ⊏C '.
3. Press and release the TEST button [by pressing and holding the TEST button, the resistance measurement will be continually updated and displayed].

4. The instrument will then check for ground noise voltage, the parameters of the current and voltage circuits and the integrity of the fuse.
5. A resistance measurement reading is displayed as shown in Figure 11.

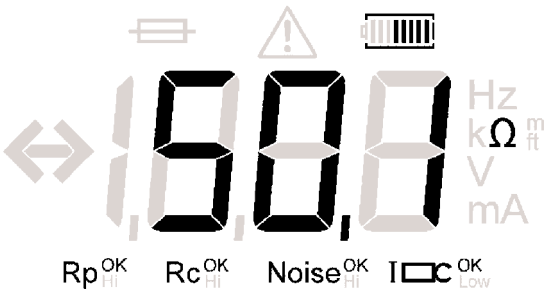


Figure 11: Three point resistance reading using ART

Battery-life reading (DET3TA)

1.Set the selector switch to

2. Press and hold the TEST button.
3. The battery life will be indicated in the analogue display on the scale marked with the , as shown in Figure 12.
4. Release TEST button.

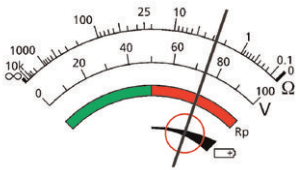


Figure 12: Analogue display indicating remaining battery life

Ground noise voltage measurement (DET3TA)

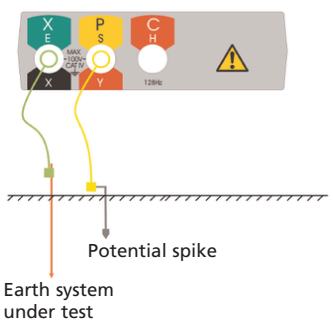


Figure 13: Connections for measuring ground noise voltage and two-terminal resistance

1. With the selector switch set to the ‘OFF’ position, connect the instrument as shown in Figure 13.
2. Set the selector switch to the ground noise voltage setting marked ‘V’.
3. A voltage reading will be indicated on the analogue display, as shown in Figure 14.



Figure 14: Analogue display indicating ground noise voltage measurement

Two-terminal resistance measurement (DET3TA)

1. With the selector switch in the ‘OFF’ position, connect the instrument as shown in Figure 13, but connected to the part of the installation you are testing.
2. Set the selector switch to the 2 point resistance measurement setting marked ‘2P’.
3. The ground noise voltage is indicated on the analogue display
4. If the ground noise voltage is within acceptable limits, press and hold down the TEST button.
5. The instrument will then check for ground noise voltage, the parameters of the current and voltage circuits and the integrity of the fuse during which time the Rc LED will flash.
6. A resistance reading will be indicated on the analogue display, as shown in Figure 15.
7. Release TEST button.



Figure 15: Resistance reading between ‘X’ and ‘Y’ terminals

Three-terminal resistance measurement (DET3TA)

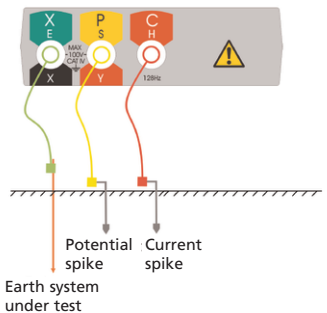


Figure 16: Connections for measuring three-terminal ground rod resistance

1. With the selector switch in the ‘OFF’ position, connect the instrument as shown in Figure 16.
2. Set the selector switch to the 3 point resistance measurement setting marked ‘3P’.
3. The ground noise voltage is indicated on the analogue display.
4. If the ground noise voltage is within acceptable limits, push and hold

down the ‘P Spike’ button.

5. A P Spike resistance reading will be indicated on the analogue display.
6. If the P Spike resistance is within acceptable limits as shown in Figure 17a (within the Green region on the Rp scale), release the ’Spike’ button.

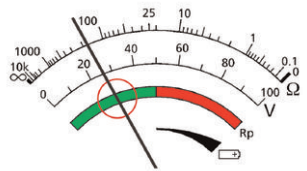


Figure 17a: P Spike OK (in green zone)

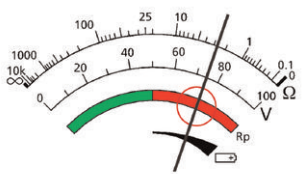


Figure 17b: P Spike **NOT** OK (in red zone)

7. Press and hold down the TEST button.
8. The instrument will then check for ground noise voltage, the parameters of the current and voltage circuits and the integrity of the fuse during which time the Rc LED will flash.
9. If the Rc LED fails to illuminate solidly and the needle does not move, this may indicate that the fuse has blown or that the current probe circuit (C Spike) resistance is out of limits.
10. Continuous illumination of the Rc LED indicates that the resistance of the current circuit is within limits.
11. A resistance reading will be indicated on the analogue display, as shown in Figure 15.
12. On completion of measurement, release the TEST button.

PREVENTIVE INSTRUMENT MAINTENANCE

1. The DET series instruments require very little maintenance.
2. Test leads should be checked before use to ensure there is no damage.
3. Ensure batteries are removed if left unused for extended periods.
4. When necessary, the instrument can be cleaned with a damp cloth.
5. Do not use alcohol-based cleaners, as these may leave a residue.

TECHNICAL SPECIFICATION

General Specification

Only values with tolerances or limits are guaranteed data. Values without tolerances are for information only.

Resistance Measurement

Range: 0.01 Ω to 2,000 Ω

Accuracy: 2% ±3 digits (DET3TC, DET3TD, DET4TD)

2.5% of scale length (DET3TA)

Voltage Measurement

Range: 0 V to 100 V

Accuracy: 2% ±3 digits (DET3TC, DET3TD, DET4TD)

2.5% of scale length (DET3TA)

Current measurement (DET3TC only):

Range: 0.5 mA to 19.9 A

Accuracy: 5% ±3 digits

Temperature and Humidity

Operating Range: -15ºC to +55ºC

Storage Range: -40ºC to +70ºC

Environmental Protection: IP54

Safety

Meets the requirements of EN61010-1 100V CAT IV between terminal pairs.

EMC

In accordance with IEC61326 including amendment No.1

Power Supply

Dry cell: 8 x LR6 (AA), 1.5 V Alkaline

Rechargeable: 8 x 1.2V NiCAD, or 8 x 1.2V NiMH

Battery life: Approx. 700 consecutive tests

Fuses

500 mA (F), HBC, 50 kA, 600 V (32 x 6 mm)

Weight and Dimensions

Weight: 1kg (all units)

Dimensions: 203 x 148 x 78 mm (all units)

The instrument contains static sensitive devices, and care must be taken in handling the printed circuit board. If an instrument's protection has been impaired it should not be used, but sent for repair by suitably trained and qualified personnel. The protection is likely to be impaired if for example; it shows visible damage; fails to perform the intended measurements; has been subjected to prolonged storage under unfavourable conditions, or has been subjected to severe transport stresses.

NEW INSTRUMENTS ARE GUARANTEED FOR 3 YEARS 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	or	Megger
Archcliffe Road		Valley Forge Corporate Centre
Dover		2621 Van Buren Avenue
Kent CT17 9EN		Norristown PA 19403
England.		U.S.A.
Tel: +44 (0) 1304 502 243		Tel: +1 610 676 8579
Fax: +44 (0) 1304 207 342		Fax: +1 610 676 8625

or an approved repair company.

Returning an Instrument for Repair

If it is necessary to return an instrument for repair, a returns Authorisation number must first be obtained by contacting one of the addresses shown. You will be asked to provide key information, such as the instrument serial number and fault reported when the number is issued. This will enable the Service Department to prepare in advance for the receipt of your instrument, and to provide the best possible service to you.

The Returns Authorisation number should be clearly marked on the outside of the product packaging, and on any related correspondence. The instrument should be sent, freight paid to the appropriate address. If appropriate a copy of the original purchase invoice and of the packing note, should be sent simultaneously by airmail to expedite clearance through customs.

For instruments requiring repair outside the warranty period a repair estimate will be submitted to the sender, if required, before work on the instrument commences.

Approved Repair Companies

A number of independent instrument repair companies have been authorised for repair work on most Megger instruments, using genuine Megger spare parts. A list of approved companies is available from the UK address shown on this page. Spare parts are also available.

Megger

Megger Limited
Archcliffe Road, Dover
Kent CT17 9EN England
T +44 (0)1 304 502101
F +44 (0)1 304 207342
E uksales@megger.com

Megger
4271 Bronze Way, Dallas,
Texas 75237-1019 USA
T +1 800 723 2861 (USA ONLY)
T +1 214 333 3201
F +1 214 331 7399
E ussales@megger.com

Megger
Z.A. Du Buisson de la Couldre
23 rue Eugène Henaff
78190 TRAPPES France
T +33 (0)1 30.16.08.90
F +33 (0)1 34.61.23.77
E infos@megger.com

Megger Pty Limited
Unit 26 9 Hudson Avenue
Castle Hill
Sydney NSW 2125 Australia
T +61 (0)2 9659 2005
F +61 (0)2 9659 2201
E ausales@megger.com

Megger Limited
110 Milner Avenue Unit 1
Scarborough Ontario M1S 3R2
Canada
T +1 416 298 9688 (Canada only)
T +1 416 298 6770
F +1 416 298 0848
E casales@megger.com

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

Part No. DET3TA_DET3TC_DET3TD_DET4TD V02 1205
www.megger.com